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Matthias Schemmel
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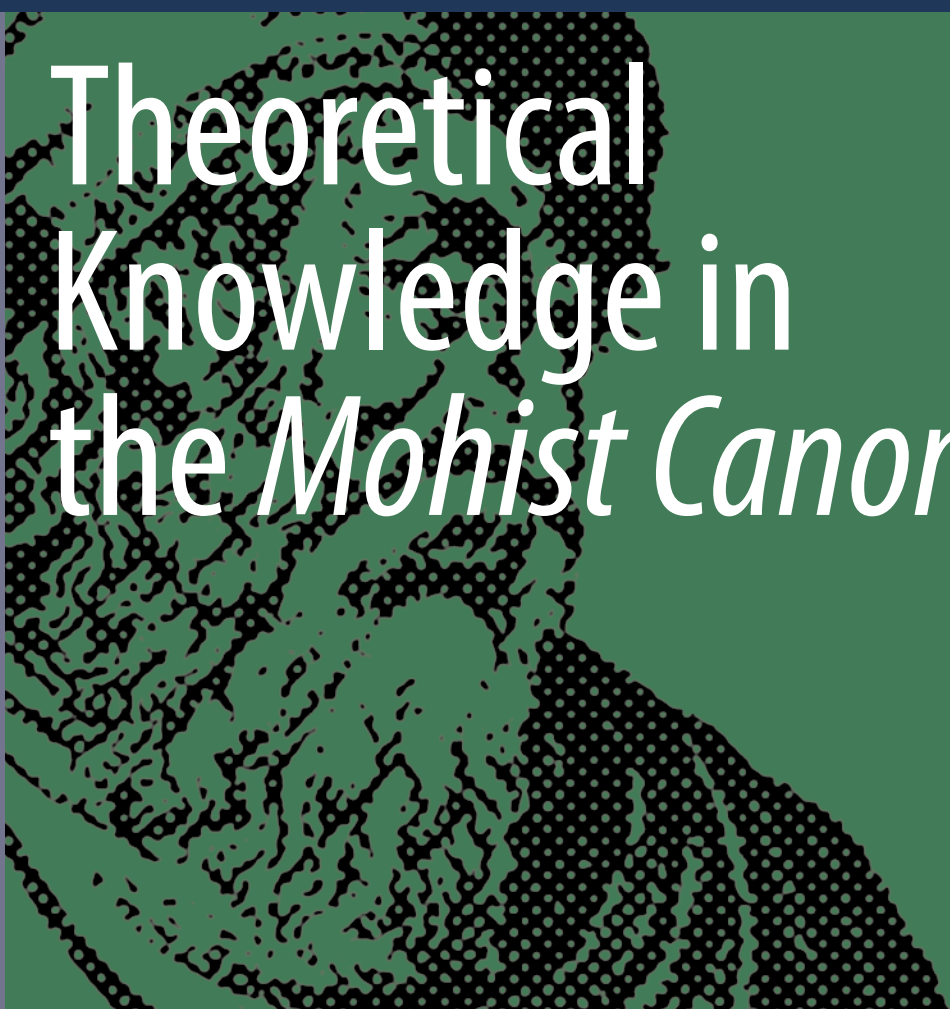
Theoretical Knowledge in the *Mohist Canon*



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Theoretical Knowledge in the *Mohist Canon*

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Preface

How many times in human history has theoretical science emerged? A very common assumption is that this happened only once, in Greek antiquity, and that all later occurrences of theoretical science can, to a greater or to a lesser degree, be traced back to these Greek origins. In this book we present and discuss a source from ancient China that we think gives evidence to the contrary: A large portion of the so-called *Mohist Canon*, we argue, documents the rise of a theoretical tradition reflecting on natural and technological knowledge independent from the roughly contemporaneous parallel developments in Greece. The analysis of this source should therefore, by way of comparison, also allow us to address questions of structural necessity and cultural-historical contingency in the formation of theoretical science. By analyzing this particular Chinese source, we therefore hope to contribute to a deeper understanding of the development of theoretical science in general, viewed as an integral part of a global, long-term history of knowledge.

To argue for such parallel development of theoretical science in ancient Greece and China, and to further use this parallelism to identify similarities and differences between the two traditions, it is required, first and foremost, to clarify the criteria on which the parallelism is established and all comparisons are based. We begin our introduction (Chap. 1) with a discussion of these criteria and a brief outline of the approach to a historical theory of knowledge on which they are founded. We then proceed to the discussion of the text and its tradition, starting from the text's socio-cultural origins and ending with its reception in modern times. We point to the philological difficulties arising from the text's confused transmission and close the introductory chapter with an overview of the structure of the text.

We begin our overall interpretation of the text (Chap. 2) with an exposition of the text's theoretical character, which is implied by its structure, and then discuss the ways the text reflects on different domains of pre-scientific knowledge pertaining to concepts such as spatial and corporeal extension, duration, motion,

measurement, model, image, and weight. This includes what has sometimes been referred to as Mohist geometry, mechanics, and optics. We compare these reflections to other historical instances of theoretical thinking, mostly from ancient Greek science and philosophy, where we think that such comparison leads to a more perceptive understanding of the text and its place in a long-term, global history of knowledge. We conclude the chapter with considerations, following from our textual analysis and intercultural comparisons, on the role of different knowledge traditions, practical and intellectual, in the rise of theoretical science.

This overall interpretation is based on the 68 selected sections of the *Mohist Canon,* whose text, translation, and commentary is presented in Chap. 3. The topics of the sections range from epistemological foundations via the consideration of logical, set-related, and spatio-temporal conditions of knowing to themes in optics and mechanics. In Chap. 4, we present text, translation, and commentary for 12 further sections that may be understood to constitute a lexical appendix to the Mohists' definitions.

The book project grew out of joint work of its two authors with Jürgen Renn and Peter Damerow in the context of the research project *The Relation of Practical Experience and Conceptual Structures in the Emergence of Science: Mental Models in the History of Mechanics* pursued in Department I at the Max Planck Institute for the History of Science in Berlin. At that time, we began to re-evaluate the Mohist passages on mechanics on the background of what we knew about the history of mechanics in Europe and Islamicate societies. A particular focus lay on the relation between practical and theoretical knowledge in the development of mechanics as a science, and on the role of language as a means of knowledge representation (Boltz 2006; Renn and Schemmel 2006). In the framework of the Berlin project cluster *TOPOI—The formation and transformation of space and knowledge in ancient civilizations*, in the context of which one of us headed a project on the long-term development of spatial concepts, we extended the set of passages we treated to include those on concepts of space, time, and matter (Boltz and Schemmel 2016), but also on optics and on concepts of knowledge.

We would particularly like to thank Jürgen Renn for his continued support of this book project.

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Bibliography

Boltz, William G. 2006. Mechanics in the '*Mohist Canon*': Preliminary Textual Questions. In *Studies on Ancient Chinese Scientific and Technical Texts: Proceedings of the 3rd ISACBRST*, ed. Hans Ulrich Vogel, Christine Moll-Murata, and Gao Xuan, 32–40. Zhengzhou: Daxiang chubanshe.

Boltz, William G., and Matthias Schemmel. 2016. Theoretical Reflections on Elementary Actions and Instrumental Practices: The Example of the '*Mohist Canon*'. In *Spatial Thinking and External Representation: Towards a Historical Epistemology of Space*, ed. Matthias Schemmel, 121–144. Berlin: Edition Open Access.

Renn, Jürgen, and Matthias Schemmel. 2006. Mechanics in the '*Mohist Canon*' and Its European Counterparts. In *Studies on Ancient Chinese Scientific and Technical Texts: Proceedings of the 3rd ISACBRST*, ed. Hans Ulrich Vogel, Christine Moll-Murata, and Gao Xuan, 24–31. Zhengzhou: Daxiang chubanshe.

Contents

Chapter 1
Introduction to the *Mohist Canon*

Abstract We briefly introduce the approach to a historical theory of knowledge that underlies our comparison of the *Mohist Canon* to other historical sources. Next, we discuss the text and its tradition, starting from their socio-cultural origins and ending with their reception in modern times. In this context we provide a translation of Liang Qichao's preface to his interpretative work on the *Mohist Canon* from 1921. Finally, we outline the philological difficulties arising from the text's confused transmission and give an overview of the structure of the text.

1.1 The *Mohist Canon* and Historical Epistemology

Anyone undertaking a long-term historical study of any particular field of human activity is confronted with the difficulty that the contents and boundaries of that field are inevitably fluid and change over time. The historical study of science is no exception to this. Is it possible to conceptualize science broadly enough to include what has traditionally been considered science and at the same time narrowly enough to exclude practices and activities that we today deem unscientific? Earlier forms of science may include elements that are later recognized as not science at all. Astrology and alchemy, for example, still prominently figured in early modern science, but are now not generally regarded as science, but rather seen as pseudo-sciences. And different strands of traditional practices and thinking that may not have originally been deemed scientific *sensu stricto* may at some point merge with each other, taking on a new form that can then be considered properly scientific, *e.g.*, the merger of practical mathematics with natural philosophy in early modern Europe, resulting in modern exact science. In the end any answer to the question of what historical human activity and knowledge are to be considered scientific depends on how science is defined, *i.e.*, what characteristics of science are deemed essential.[1] If the discovery and systematic, often quantitative, treatment of

[1] The following argument was made in Damerow and Lefèvre 1981, 9; for a further discussion of how to discern scientific knowledge in history, see Damerow and Lefèvre 1996, 395 ff. The question if there was science in antiquity is also discussed in Lloyd 2004, 12.

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regularities in nature is deemed to be that criterion, science begins in such early civilizations as in the Near East, Asia, and Mesoamerica. If systematic argumentation about such regularities and theoretical proofs are deemed to be that criterion, ancient Greece is most prominently considered the historical place where science emerged. If the empirical foundation of knowledge by systematic experimentation is considered the vital criterion, then science only begins in early modern times.

A pragmatic approach to delineating the field of a science for historical study would be to follow the connected currents of traditions that have led to its modern manifestation and consider everything that contributed to these currents to be of relevance to the history of that science. But when a historical tradition, however significant at a certain time in a certain context, did not become a part of a developmental trajectory that led to some aspect of modern science we are denied this pragmatic approach. In particular when we discuss the emergence of a specific type of science in ancient China and compare it to the independent emergence of such a type of science in ancient Greece, as we will endeavor to do here, we have to recognize this difficulty and to be conscious of what exactly to compare. In defining this type of science we have to be careful to distinguish what constitutes in its historical manifestations a necessary feature, *i.e.*, what truly motivates us to identify the historical activity as science, and what are contingencies of the specific historical manifestations. Failing to make such a distinction either renders the comparison impossible, because no two cultural activities that have developed independently will ever be identical; or it may lead to privileging the manifestation in one culture over that in the other, the first being taken as a standard, and the second subordinated to it, analyzed and judged by how it matches the features of that first standard. Earlier analyses of ancient Chinese science and in particular of the *Mohist Canon*—the text whose analysis and interpretation lies at the center of this book—show that scholars have not infrequently fallen into this trap and have tended to this kind of biased judgment, consciously or unconsciously taking western science as the default standard and subordinating judgments about Chinese science to that.

Even Joseph Needham (1900–1995), whose high esteem for Chinese science is readily apparent in his pioneering work on science and civilization in China, discusses Chinese scientific achievements by using Western traditions as the standard reference point, as if only one historical pathway to truth were available. Statements such as the following abound in his work: "if continued [the lines along which the Mohist thought] could have developed into a geometrical system of Euclidean type." (Needham 1959, 94); "[section B 62 of the *Mohist Canon*[2]] seems to show the Mohists moving in the direction of the 'gravitas secundum situm' of Jordanus Nemorarius (+13th) and Leonardo, who both considered spheres or circles moving on inclined planes" (Needham 1962, 58–59). "The most important thing about this excerpt on the lever and balance [section B 25b of the *Mohist Canon*] is that it shows that the Mohists must have been essentially in possession of the whole theory

[2] For an explanation of our section numbering convention see the last section of this Introduction (*Structure and transmission of the text*).

of equilibria as stated by Archimedes" (Needham 1962, 23). Needham somehow assumes that those aspects of Western science that he cannot find expressed in the Mohist text were all the same familiar to the Mohists, or might have been an inevitable consequence of future developments that in fact did not happen. At one place he even goes so far as to speculate about missing parts of the Mohist corpus: "[…] if more of the physics of the Mohist school had been preserved, we should have found in it some discussion of trajectories, the effect of gravity, and so on" (Needham 1962, 58). He then proceeds to console himself over the absence of any concept comparable to the western notion of 'impetus' in the *Mohist Canon* by pointing out the similar absence of two other concepts that he considers detrimental in the western tradition: "If the Mohists had no technical term corresponding to impetus, at least they did not suffer from the concept of 'natural place' or the awkward idea of antiperistasis" (Needham 1962, 58).

Such short-circuiting of the Mohist achievements in their own right when comparing them with Western science blinds us to the possibility of seeing real alternatives to the Western tradition. The Mohists may well provide us with a case that qualifies as exact science, but does not lead to or imply the science of a Euclid, Archimedes, Jordanus, Galileo, or Newton. We have to recognize that alternatives to the historical development of Western science are possible, and that there are cultural activities that may qualify as science but do not presuppose any particular historical pathway. We can turn the problem of defining science in order to compare different traditions around, into one of studying different traditions in order to learn what science is. After formulating criteria to identify intellectual and social activities that suggest the possibility of the emergence of scientific thinking, comparison of the different traditions will show which aspects of those activities are cross-cultural and which are contingent on specific cultural and historical contexts. This should provide some insight into the emergence and epistemology of scientific thinking and its relation to the history of knowledge generally.

It has been asked, for instance, if there are

> decisive reasons that the form of 'exact science' must first have emerged in the specific field of mathematics, in other words, if it is to be ascribed exclusively to particular circumstances of Greek antiquity, and in this way to chance, that it was mathematics where this form of science first emerged, or if there were systematic reasons for this?[3]

The question entails the relation of mathematics to the other sciences, but also to the specific form of mathematics that developed in Greek antiquity, *viz.*, deductive geometry. Is the Greek invention of deductive geometry and its influence on other fields of knowledge the only possible historical way for science in an exact form to arise? Similar questions can be asked concerning the relations between various fields of knowledge and their specific manifestations in ancient societies. Given the

[3] "Gibt es zwingende Gründe, daß der Typus der 'exakten Wissenschaft' zuerst in der Einzelwissenschaft Mathematik in Erscheinung treten mußte; m.a.W., ist es nur besonderen Unständen der griechischen Antike und in diesem Sinne Zufällen zuzuschreiben, daß es die Mathematik war, in der jener Wissenschaftstypus erstmalig in Erscheinung trat, oder hat das systematische Gründe?" (Lefèvre 1979, 298).

fact that early Greek science is preceded and accompanied by cosmological speculation, what role do such traditions play in shaping the early development of science generally? And furthermore given the idea that a controlled use of language is characteristic of Western scientific thought, what are the consequences of certain fields of linguistically represented knowledge having become the object of systematic reflection while others did not? Such questions can best be addressed when real historical alternatives are available. Looking beyond a single tradition may well give rise to further interesting questions of this type. It is in this spirit that we will analyze what has been termed Mohist science.[4]

As we shall see, Mohist science reveals a genuinely alternative view of the world, a view that is neither identical to, nor a deficient or aberrant version of, anything known from Western traditions. It is also distinct from what came to be known as Chinese natural philosophy, in particular as that involves concepts such as *yīn* 陰 and *yáng* 陽 notions of natural polarity or complementarity and *wǔ xíng* 五行, the Five Agental Processes. Mohist science is an alternative kind of rationalization of aspects of the perceived world, natural and technical. In its rationality and its adherence to observation it may clearly be ranked among the historical origins of science, notwithstanding its later demise and neglect. It therefore appears to represent a highly suitable case for addressing the questions raised above about the origins of science, their historical contingencies and their possible systematic aspects.

To identify the common core of the ancient Greek and Chinese activities to be compared, we point to their goals and to the types of knowledge they involve as a consequence of these goals. More specifically, we are here concerned with the origins of *theoretical* science. We can speak of theoretical science whenever the goal of a certain social activity does not primarily consist in the fulfillment of some practical task, no matter how much knowledge it involves, but rather in the reflective occupation with knowledge itself.[5] Such theoretical reflection is no matter of course. While it may be spontaneously pursued by individuals, as a collective endeavor it only develops under specific societal conditions that promote and sustain it. It is therefore by no means the case that "we must accept that every culture has a science" (Selin 1997, xv).[6] On the contrary the development of theoretical science seems to be the exception rather than the rule in pre-modern societies. It therefore becomes worth asking what exactly are the conditions under which such theoretical reflections prosper. Here again cross-cultural comparisons may help to distinguish

[4] The British sinologist A. C. Graham was one of the first modern scholars to recognize the so-called "later" Mohist material as 'science' and he was certainly the first to treat it in great detail from this perspective on a textually reliable basis. See Graham 1978, 53–58 *et passim*. We have relied on Graham's work, especially Graham 1978, unstintingly in our own work here.

[5] This is consistent with the idea that "[w]e may speak of science if the goal of a certain social activity consists in elaborating the potentials of the material tools of mental labor, which are otherwise used in the planning of work, apart from such goals [and] solely for the purpose of gaining knowledge about the possible outcome" (Damerow and Lefèvre 1996, 398).

[6] To be sure, Selin's claim arises from loosely defining science as "a way of defining, controlling, and predicting events in the natural world" (Selin 1997, xv).

necessary preconditions from accidental circumstances. Furthermore, they may reveal how the concrete form and content of early theoretical science is shaped by the contexts from which it emerges.

Any systematic reflection on knowledge necessarily involves some sort of external, *i.e.* non-mental, representation that can be reproduced, manipulated, and changed, and that thus may serve as a medium of reflection. External representations of knowledge rely on the material means available in a given society at a given time, particularly including the material tools of mental labor. These may include language in spoken and in written form, non-linguistic written and otherwise recorded symbols (such as knots in a quipu), drawings, diagrams, and maps, but also actions, instruments and mechanical tools. For the case of the later Mohists, language in its written form is the only medium of reflection available to us. To what extent, if any, there was an allied use of spoken language in this connection is not known. By the same token, ancient Greek philosophy is only available to us through written, transmitted, texts. Nevertheless, the possibility of basing theoretical traditions solely on the oral use of language combined with a strong tradition of memorization is shown by the example of the ancient Indian grammarians.[7]

Comparison with Greek mathematics further raises the question of the role of drawings and drawing instruments in Mohist science. As in the Greek case, no drawings are preserved from antiquity, but in the Mohist case, unlike the Greek, it is questionable if drawings ever existed. To be sure, in reading some of the Mohist passages one would appreciate a drawing to clarify the situation or arrangement in question, but with one or two possible exceptions no geometrical construction in the *Mohist Canon* is so complicated as to require an accompanying diagram to be comprehensible. Nothing in the text itself refers to or hints at the use of drawings, so it is unlikely that drawings were ever an integral part of the work. This marks a clear difference to texts from the Euclidean tradition, in which drawings played a central role in the argument.[8] This may be understood as a consequence of how the knowledge reflected upon was represented differently in the two traditions. There are references to such things as drawing instruments, measuring instruments and astronomical instruments in the Mohist text, and even a definition of the circle (section A 58) referring to the compass and strikingly similar to the definition found in Euclid's *Elements*. Nonetheless, in contrast to Euclid's *Elements*, the Mohist text does not systematically reflect upon the figures that can be drawn with straight edge and compass.

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[7] While the extent to which writing was involved in ancient Indian theoretical traditions has been a matter of controversy, Richard Salomon (1995, 278), in reviewing works of Oskar von Hinüber and Harry Falk, concludes that "the already discredited skepticism about the possibility of oral composition and preservation of the Veda, Panini's grammar, etc." has "effectively [been] put to rest." On the oral tradition in ancient India, see further Scharfe 2002, 8–37.

[8] This applies to the ancient formulations of Euclidean geometry, not to modern axiomatic ones, which can do without figures. See, for instance, Damerow (2007, 28), who points out that the "duality of constructions and proofs in Euclid's *Elements* indicates that figures still served here as first-order representations complementing the deductive second-order representation in written language."

Alongside the means of representation, the kinds of knowledge reflected upon shape the resulting theoretical science. We will distinguish two types of knowledge, *viz*., elementary and instrumental knowledge. *Elementary knowledge* is ontogenetically acquired in the process of building up sensorimotor intelligence. Due to the similar biological constitution of all human beings and to the similar basic physical properties of their environments, irrespective of culture, large parts of this type of knowledge can be assumed to be universal. This knowledge contains, for instance, the following kinds of primary perceptual structures:[9]

- a basic dichotomy of extended, generally impenetrable bodies and more or less empty spaces between them; this includes the three-dimensionality of bodies and spaces as well as the tangibility of bodies;
- a dichotomy between moving bodies and bodies at rest, against which motion can be perceived;
- a distinct sense of the vertical direction, which stems from the experience of bodies falling downwards or pressing against what supports them from below, including experiences of one's own body;
- a basic mental structure arising from human experience in pushing or pulling objects: the harder one pushes or pulls, the greater the effect; this includes the idea that where there is motion there must be a mover.

How these mental structures arise is a matter of developmental psychology, while their universality is investigated in studies of primate cognition and in cross-cultural psychology. The structures of elementary knowledge as exemplified above are not reflected upon in the realm of elementary knowledge itself where they only underlie action and perception and, as a rule, remain unconscious.

Instrumental knowledge is acquired through the handling of cultural artifacts and instruments, often learned through joint action and frequently accompanied by speech. Often this is part of expert traditions and is acquired only by certain groups of individuals within a society. While instrumental knowledge usually builds upon universal elementary knowledge structures, it clearly depends on the artifacts available in a given culture and varies with the concrete practices this culture has developed. Examples of structures of instrumental knowledge are:

- the additive structure of length, implicit in the handling of measuring rods and ropes in societies where practices of spatial measurement such as surveying have developed;
- concepts of circle and of right-angledness implicit in the handling of the geometrical compass and the carpenter's square, for instance in the context of architectural construction;
- the variation of shadows depending on the spatial arrangement of light source, shadow-casting object and surface the shadow is cast on, for instance when gnomons are used in the contexts of calendrical and astronomical practices;

[9] For a discussion of these elementary structures of knowledge, see Schemmel 2016, 9–20.

- the notion that weight and force can be compensated by distance from a fulcrum, an experience that can be made in any society with instruments that make use of the lever principle, such as levers, shoulder poles, or balances with unequal arms.

As was the case with their elementary counterparts, the structures of instrumental knowledge need not be explicitly formulated. The use of a lever, for instance, need not be the practical application of a theoretically conceived lever principle. The knowledge is partly embodied in the instruments and is socially communicated, typically by example and by joint action, in order to be handed down, but it remains closely linked to the concrete practices in the context of which it arises, and may in many cases become intuitive through repetition.

The external representation of elementary and instrumental knowledge, primarily by means of language and instruments, enables the exploration of these means of representation and the reflection on the structures inherent in these types of knowledge. The historical emergence of theoretical science means that institutions arise within which such exploration and reflection is systematically pursued and the corresponding practices and results are handed down. As a consequence a new systematic type of knowledge, which we refer to as *theoretical*, comes about. This is what happened in ancient Greece, and, as the Later Mohist corpus testifies to, also in China in the Warring States (Zhan guo 戰國) period, roughly the fifth through the third centuries B.C.E. In the following we will sketch the historical background for the emergence of this theoretical knowledge in China and delineate its later fate in Chinese intellectual history, before we give a more detailed overview of the text itself.

1.2 The Text and Its Tradition: Background

Traditional Chinese bibliographic practice from the early mediaeval period on has been to divide all written works by genre into four large classes, *jīng* 經 "Classics", *shǐ* 史 "Histories", *zǐ* 子 "Masters", and *jí* 集 "Anthologies", known collectively as the *sì bù* 四部 "The Fourfold Categories".[10] The third of these, *zǐ bù* 子部, the Masters category, has often been called "philosophy" in western surveys and studies of pre-modern Chinese literature because this is the category in which we find most of the texts that are associated with what in Western terms is thought of as traditional or classical Chinese philosophy. The *Mozi* 墨子 is included in this category

[10] A *sì bù* 'fourfold' classification scheme is first attested in the *Xin Bu* 新簿, compiled by the Western Jin scholar Xun Xu 荀勖 (d. 289). This work is no longer extant, but from a descriptive summary of the work preserved in the *Sui shu* 隋書, "Jing ji zhi" 經籍志 (*History of the Sui Dynasty*, "Bibliographic Record") it seems that Xun Xu did not use the names *jīng* 經, *shǐ* 史, *zǐ* 子 and *jí* 集, but rather simply the first four of the traditional set of ten "counting terms", *viz.*, *jiǎ* 甲, *yǐ* 乙, *bǐng* 丙 and *dīng* 丁, *i.e.*, A, B, C and D. All the same he recognized the *zǐ bù* 子部 Masters texts as a specific textual genre and placed them in the second (*yǐ* 乙) category. See Zuo Yuhe 2004, 53.

as are other well-known works from the pre-imperial classical age of Chinese literature, such as the *Zhuangzi* 莊子, the *Laozi* 老子, the *Xunzi* 荀子, the *Liezi* 列子, the *Sunzi* 孫子, the *Gongsun Longzi* 公孫龍子 and the *Guanzi* 管子, to name only a few, all of them roughly dating from the Warring States period and one way or another thought of generally as "philosophy."[11] The texts from this period in the *zi bu* Masters category are typically not rigorously analyzed or argued, as might be expected on the basis of the Western understanding of the generic designation 'philosophy', as much as they are dialogic accounts of didactic, often socially moralistic, exchanges between rulers and ministers or they are belletristic records of anecdotal teachings, chiefly social or political in content either explicitly or by implication, of a named Master and his often unnamed disciples.[12] There are, to be sure, many texts that deal with such things as *tiān* 天 'heaven' and *gǔi shén* 鬼神 'ghosts and spirits', which at first glance seem to fall into a category of religious beliefs rather than one of didactic social or political concern. But the context in many, perhaps most, of these passages is with the proper understanding of 'heaven', 'ghosts and spirits', &c. in order that they may best accord with the exigencies of the social and political environment. The concern is not with any kind of abstract noetic sense of religion or of philosophy as a rational search for truth or for the objective basis of knowledge.[13]

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[11] The early textual history of nearly all of these works is complicated and in many respects unknown. More often than not the texts themselves in their transmitted, received form are composites rather than compilations from the hand of a single author. All the same, most of them are reliably taken to be from the pre-imperial period, that is, the period before the unification of the Chinese states into an empire by the state of Qin in 221 B.C.E., or from the early Han (second and first centuries B.C.E.)

[12] Such famous texts as the *Analects* of Confucius (*Lun yu* 論語) and the *Mencius* (*Mengzi* 孟子), which to be sure are conventionally considered philosophy in the same broad sense as those others mentioned here, are in fact not found in the *zǐ bù* Masters category, but are instead included in the *jīng bù* Classics category because of the revered status they enjoy from their traditional association with Confucius.

[13] On the general question of the nature of early Chinese 'philosophy', or—phrased somewhat more dramatically,—whether there even is such a thing as Chinese philosophy, see Defoort 2001. Much like the debated applicability of the label 'science' to pre-modern practices and thinking, the extent to which the term 'philosophy' is applicable to the large body of *zǐ bù* 子部 texts depends on how the term is defined. Many of these texts would not rise to the level of philosophy when the term is understood as Kant would have it: Wissenschaft von den letzten Zwecken der menschlichen Vernunft "the science of the ultimate purposes of human reason." (Cited and rendered slightly differently in Behr 2018, 143, where the page reference to Kant should be 23, not 25.) Wolfgang Behr points out that in the Western classical tradition one of the commonest ways to validate truth claims in connection with philosophical arguments or propositions is "via the principle of non-contradiction, first *explicitly* formulated in Plato's *Republic* … and in Aristotle's *Metaphysics*." (Behr 2018, 150–51) He then proceeds to show the germs of a "principle of non-contradiction," couched especially in the counterpart Chinese term 誖 *bèi* 'self-refutation, self-contradiction', which he analyzes morphologically in an exceedingly intriguing way. This term *bèi* 'self-refutation, self-contradiction' underlies a number of brief passages that are included in the Later Mohist textual corpus and occurs to a limited extent in a few other passages from roughly contemporaneous texts, *e.g.*, the *Lüshi chunqiu*, the *Xunzi*, the *Hanshi waizhuan*, that are somewhat more narrative in

If history is recognized as distinct from pre-history by the invention of writing and the first appearance of written documents, Chinese history begins around 1200 B.C.E. with written texts incised chiefly on turtle plastrons, on animal bones (usually the scapulae of oxen), and cast in ceremonial bronze vessels. In the aggregate these inscription materials constitute the earliest known Chinese texts and are the earliest known direct evidence for the Chinese writing system and language. The political context is that of the late Shang 商 state, called sometimes the Yin 殷. The plastron and bone texts are primarily divinatory in content, recording the ancestral divination practices of the Shang royal house and other powerful lineage groups, from the time of king Wu Ding 武丁 *ca*. 1200 B.C.E. to the end of the Shang state in 1045 B.C.E., when the Shang was conquered by the Zhou 周.[14] The bronze inscription texts are chiefly commemorative or ceremonial paeans directed to the ancestors. As important as the Shang is for its claim to having the earliest Chinese texts and thereby affording us the earliest evidence of Chinese writing and of the Chinese language, and thus to being identified as the beginning of Chinese history, it is really to the following Zhou state that we must look for the origins of most of the ritual and ceremonial practices, religious beliefs, political and social institutions, intellectual discourses, texts and traditions, – the things in other words that in the aggregate we associate with the culture of "Classical China."

For about two centuries after the Zhou conquest of the Shang in the mid-eleventh century B.C.E. Chinese society was characterized by political institutions and authority rigidly determined by lineage relations within the ruling house. The Zhou are seen to revere a religious entity known as *Tian* 天 'The Overhead, Sky, Heaven', a religious figure or deity unattested in extant Shang inscription material and therefore probably unknown in the Shang and generally regarded as something particular

style than the Later Mohist text. (*op. cit*., 158–67) In view of this, Behr remarks "[g]iven this background, one marvels less at the seeming historical exceptionality of the confident manipulation of 'self-refutation' in the Later Mohists canons." (*op. cit*., 163) In his discussion of the Later Mohist use of this term 詩 *bèi* A. C. Graham defines it as 'self-falsifying, illogical'. (Graham 1978, 199–200) Graham does not analyze the morphological structure of the word as Behr does, but both Graham and Behr see the term as central to a form of argument that meets the demands of a rigorous definition of 'philosophy' in a way that traditional didactic accounts of social and political morality and ethics do not.

[14] Ken-ichi Takashima, "Shāng 商 Chinese, Textual Sources and Decipherment", in: *Encyclopedia of Chinese Language and Linguistics*, General Editor Rint Sybesma. Consulted online on 09 July 2017. Many traditional historical records purport to give the history of the Shang for periods prior to the time of king Wu Ding, but this is *sensu stricto* not history but legend; there are no contemporaneous texts extant for any time prior to that of king Wu Ding, *ca*. 1200 B.C.E. This is all the more so *mutatis mutandis* for those still later records that describe what is said to be the still earlier Xia 夏 dynasty. Western terminology has traditionally called these historical (and prehistorical) periods 'dynasties', on analogy with the better known history of ancient Egypt and the Egyptian dynasties. To be sure, the literal sense of 'dynasty' as a succession of rulers from the same lineage applies to the Shang and, up to a point, the Zhou. But the grandeur associated with the Egyptian dynasties does not characterize these early Chinese states.

to the Zhou.[15] For want of written records we cannot know whether *Tian* was a Zhou religious concept prior to the conquest of the Shang or not. But it is reasonable to suppose that it was; there is no evidence that it was a belief inherited from the Shang, and it is unlikely to have been created out of whole cloth just with the Zhou conquest. In any case early Zhou bronze inscriptions refer to the Zhou king as *Tian zi* 天子 the 'Son of Heaven'. The particularly Zhou concept of *Tian* 'Heaven' and the identification of the Zhou king as the *Tian zi* 'Son of Heaven' seem to have become fused with ancestral sacrifice practices and ceremonies inherited from the Shang.[16] As was the case with the earlier Shang, the Zhou king was seen as the pre-eminent medium for communication with the ancestors. Within about a century after the Zhou conquest of the Shang the role of *Tian* 'Heaven' seems to have become central to early Zhou political and religious institutions; we find not just *Tian zi* the 'Son of Heaven', but also *Tian xia* 天下 the 'Subcelestial Realm' designating the whole known world, *Tian di* 天地 the complementarity of 'Heaven and Earth' and most importantly *Tian ming* 天命 the 'Mandate of Heaven', the term reflecting the claim that Heaven has shown favor on the Zhou, passing its Mandate (*mìng* 命) from the Shang to the Zhou, and thereby justifying the Zhou overthrow of the Shang and legitimizing Zhou rule.[17] As a consequence the Zhou state enjoyed

[15] As a religious concept *Tian* is sometimes said to be anthropomorphic (*e.g.*, Li Feng 2013, 143.) There is no primary textual evidence for this understanding; the claim seems to be based entirely on an impressionistic "pictographic" interpretation of the earliest bronze inscription forms of the character for the word *tiān* 'overhead, sky, heaven', *viz.*  , which to be sure does "look like" a human figure. But the characters of the Chinese writing system, like graphs of writing systems generally, convey meaning by writing words, not by drawing pictures. And the word in question is *tiān* < ***llhin**, which means basically 'overhead, sky'. To the extent that the graph reflects this basic meaning in any way other than simply standing for the word, it may be that the enlarged head of the humanoid figure is intended to suggest the ***word*** *tiān* 'overhead'. The Han period dictionary *Shuowen jiezi* glosses *tiān* 'sky, heaven, overhead' paronomasitcally as *diān* < ***ttin** 顛 'overhead' rather than in any way that would reflect a religious sense. The two words *tiān* < ***llhin** 'overhead, sky' and *diān* < ***ttin** 'overhead' are likely cognate, and the initial consonants of the two OC pronunciations ***llhin** and ***ttin** are probably related in some way not yet fully explicable and closer to each other than the reconstructed forms given here would suggest.

[16] A religious entity known as *Shang Di* 上帝 was the supreme Shang religious figure, generally understood as the Shang counterpart to the Zhou *Tian* 'Heaven'. Sarah Allan has proposed that *Shang Di* of the Shang period should be seen as "the spirit of the pole star" and that "*Tian* – the sky – was the location of the (*sic*) Shang Di…" The Zhou *Tian* was understood as the locus for all celestial bodies, the pole star being a kind of *primus inter pares* among heavenly phenomena. In her view the relation between the Shang *Di* and the Zhou *Tian* was not one of the latter supplanting the former, but was a hierarchical relation, *Shang Di* coming to be subsumed as one of the celestial constituents of *Tian*. See Allan 2007, 1–46, citations here from page 2. Note that the 'Shang' of *Shang Di* is not the same word or name as the 'Shang' of the Shang state.

[17] Strictly speaking we are not justified in claiming that all of these aspects of *Tian* 'heaven' appear "within about a century" of the Zhou conquest of the Shang, because to a very great extent this understanding of early Zhou history is based on transmitted texts largely of a later time. For this early period few, if any, transmitted texts can be shown with certainty to be contemporaneous with the period that they describe. Some may have had an origin in the Western Zhou and thus may have

during this early period a kind of *pax caeles*, a fundamental sense of legitimacy, authority and security granted and guaranteed ultimately by Heaven.

By the early decades of the eighth century B.C.E. this agreeable state of affairs had broken down. There now was a sense that the *pax caeles* had come to an end. Heaven seems to have withdrawn its Mandate and is no longer looking with favor on the Zhou state or protectively over Zhou society. The Zhou king and Zhou people now feel alienated from what had been earlier regarded as a secure relation with a benign and compassionate Heaven. Such phenomena as a major earthquake in 782 and aggressive incursions by alien people from the north and west into the Zhou domain at about the same time are seen as signs that Heaven had distanced itself from the Zhou ruling house and withdrawn its favor and its Mandate to rule. There is an account, taken traditionally as factual history, that around 779 the Zhou king, named You, displaced his legitimate queen and the heir she brought him, preferring instead a great beauty of mysterious and unnatural birth and of melancholy temperament named Bao Si and the son she bore him. This kind of disregard for the sanctity of the Zhou house and the proprieties of legitimate hereditary rule aggravated a growing social malaise and was thought to have contributed to the perception of great displeasure on the part of Heaven.[18]

The early classic of poetry, known as the *Shijing* (translated variously as "Book of Songs," "Book of Poetry" or "Book of Odes" among other possibilities), one of the pre-eminent works of early Chinese literature, includes many poems registering a high measure of praise and reverence for the early Zhou state and its rulers and heroes, including both the historical and the legendary. But the same venerated *Shijing* classic also includes poems that reveal a dramatic degree of alienation from Heaven. Poem 192, for example, includes these lines:

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some imperfect claim to contemporaneity with the period in question, even if altered, corrupted and edited in the course of transmission. But even here the claim is weak, and for many other texts we must acknowledge that they are compositions from a later time, sometimes much later. The only irrefutably contemporaneous texts, and thus credible as primary sources, are bronze inscriptions, preferably ones on bronze vessels that have been excavated under controlled circumstances. While these occasionally mention *Tian zi*, the 'Son of Heaven', referring to the Zhou king, the role of *Tian* 'heaven' is overall much less prominent in these inscription sources than in the transmitted literature. Beyond that, bronze inscriptions are inherent, tangible features of bronze vessels, that is, of material artifacts, and their meaning has to be seen first in that context. They are not simply texts that have survived thanks to being cast on a durable medium and that can be abstracted and fit insouciantly into a literary or political history. Note in particular Falkenhausen: "I consider the inscriptions … part of the archaeological record, relevant not because they can be linked to other written evidence concerning Western Zhou history, but because they can help us comprehend more fully the objects they are inscribed on, as well as those objects' excavation context" (Falkenhausen 2006, 31; see also Li Feng 2008, 11–20). On the considerably different picture that the archaeological record gives from what we see in the transmitted literature generally, see Falkenhausen 2006 *passim*, esp. 10–19.

[18] It is hard not to see the traditional understanding of *Tian* here and in connection with *Tian ming* 'the Mandate of Heaven' as an anthropomorphic figure.

> When father and mother bore me, why was I caused to suffer so. … The grief of my heart is ever increasing. … The people are now in peril; they look upon Heaven as uncaring. … There is no one whom Heaven does not oppress. … The august God on High,—whom does he hate so? … The majestic House of Zhou,—Bao Si has destroyed it.[19]

In the immediately preceding poem, number 191, we find the following:

> "Heaven has sent a plague down upon us,
> Death and destruction are everywhere.
> The people's words are full of spite,
> Why does no one stop this sadness?
> … Mighty Heaven, now unkind,
> Do not oppress our people so.
> … Mighty Heaven now inconstant,
> Brings down on us this hardship;
> Mighty Heaven now uncaring,
> Brings down on us this great pain.
> … Now inconstant is mighty Heaven,
> Disorder is forever on the land …[20]

And in the following poem, number 193, we find these lines:

> On the first day of the month the sun was eclipsed; we found it ominous. … The moon was eclipsed, now the sun is eclipsed; this prefigures calamity. … Thunder booms, lightening flashes, things are not peaceful. … Rivers overflow, mountain tops collapse, high river banks become valleys, deep valleys become hills, … why has nobody brought an end to these disorders?

Eclipses, the actual celestial mechanics of which were of course not understood, and these other kinds of natural disasters as set out here are inevitably associated with a displeased Heaven. And in 194 we find this:

> The grand and great Heaven no longer extends its grace; it sends down famine and death, strikes at and destroys the states in all four directions. Great Heaven is now terrifying. We are all together made to suffer. … The House of Zhou is destroyed.[21]

Another series includes such laments as this:

> … we have no house, no home
> Because of the Xian-yun.[22]

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[19] The reference to "God on High" is to *Shang Di*, the pre-eminent religious figure of the Shang state. This is the kind of textual reference that suggests the Zhou belief in *Tian* 'Heaven' was in some way fused with the religious beliefs or customs of the Shang. See in this regard Allan 2007.

[20] Ode 191; translation by Joseph R. Allen in Waley and Allen 1996, 165–66.

[21] *Shijing* odes 192, 193, 194; translations adapted from Karlgren 1950.

[22] Xian-yun is the name by which an aggressive, presumably non-Zhou group of people is known historically. They are recorded as having lived in an area to the northwest of the Zhou heartland and to have made repeated incursions into Zhou territory. Whether they are ethnically, *i.e.*, linguistically, Chinese or, as is often assumed, non-Chinese, is impossible to determine on the basis of extant evidence. In simple terms they are referred to as 'barbarians', but this label has the same imprecision here as it does in most usages elsewhere. All it means is that the Xian-yun did not share in the Zhou cultural and institutional traditions and were not subordinate to Zhou rule. Historical facts of Xian-yun aggression against the Zhou are drawn from contemporaneous bronze vessel inscriptions. See Li Feng 2006, 141–92.

We cannot rest or bide
Because of the Xian-yun.
… our hearts are sad,
Our sad hearts burn,
We are hungry and thirsty,
But our campaign is not over,
… We cannot rest or bide,
Our sad hearts are very bitter;
… The march before us is long,
We are thirsty and hungry,
Our hearts are stricken with sorrow,
But no one listens to our plaint.[23]

And ode 195 opens as follows:

Foreboding Heaven is a cruel affliction,
Spreading out over the lands below.
Plans and counsels are twisted and vile;
When will we ever see their end?[24]

Ode 258 laments the terrible consequences of prolonged drought, laid at the feet of an uncaring Heaven:

Vast is that River of Stars,
Shining and turning in the sky.
The king cries out, "But alas,
What blame do your find with us?"
Heaven rains down death and disorder,
Hunger and famine year after year.
There is no spirit not praised,
No victim who is begrudged them,
Token and tally are all expended;
How can none of them hear our plea?
…
We have been unceasing in our prayers,
…
To Heaven, to earth, offerings and burials;
There is no spirit who is not worshipped.
Still, … God on High does not come near.
Ruin and destruction on earth below;
Why does this all fall to us now?[25]

The poem continues for another half a dozen stanzas of lamentations in the same vein.

Clearly, there is a strong literary representation here of a despair that the Zhou rulers and the Zhou people seem to have felt in the mid-eighth century in the face of what they saw as a dramatic alienation from Heaven. This is what A. C. Graham has called "the breakdown of the world order decreed by heaven," and our

[23] Ode 167; translation by Joseph R. Allen in Waley and Allen 1996, 139–40.

[24] Ode 195; translation by Joseph R. Allen in Waley and Allen 1996, 174.

[25] Ode 258; translation by Joseph R. Allen in Waley and Allen 1996, 270.

understanding of it is based virtually entirely on transmitted literary texts, none of which can claim primary-source status.[26] All the same, there can be little doubt that such a religious disruption of the confident relation the state had enjoyed with Heaven in the past must have occurred in some form at about this time, perhaps having arisen a century or so earlier and extending over more than a century later in its effect.[27]

The archaeological record, in contrast to the literary, can claim "primary-source status" for this early period to the extent that the evidence is contemporaneous with the events in question, not having suffered changes or corruption in the course of any transmission. There is a considerable variety of archaeological material available for the Western Zhou, but for studying such cultural aspects as beliefs, ancestral sacrifices, concepts of political authority &c., the most important archaeological evidence consists principally of bronze vessels. And that evidence shows what Lothar von Falkenhausen has called a "decisive transformation" of Shang and early Western Zhou ancestral sacrifices and practices at about this time. He calls this the Western Zhou "Ritual Reform" and identifies three specific features of this transformation.[28] (i) There was a marked shift in ritual vessel types away from wine vessels, which had been prominent in the Shang and early Western Zhou and were central to wine-infused ancestral sacrifice practices, to bronze vessels used for meat and grain and other kinds of food consumption. This is seen as a sign of the changing nature of ancestral sacrifice, from what Falkenhausen, borrowing Nietzsche's Hellenistically-inspired terms, calls a shift from "dionysian" to "apollonian" practices. The former were characterized by "dynamic, even frenzied movement," the latter by "far more formalized ceremonies … in which it was the paraphernalia themselves, and their orderly display, that commanded the principal attention of the participants." (Falkenhausen 2006, 48) (ii) Bronze vessels began to appear in what can be called "standard sets" the size and nature of which can be correlated with

[26] See A.C. Graham 1989, 8.

[27] Mark Lewis avers that these odes, referring to ode 258 in particular, do not indicate a "theological revolution" or an "intellectual rupture," but rather suggest the "presence of a space in the intellectual field … wherein it was possible to question the virtue of Heaven or its active response to human actions, and to proclaim personal innocence – or even superiority – in the face of failure or suffering." (Lewis 1999b, 153) In making this comment Lewis is aligning the sense of these odes with his suggestions for the emergence of an "individual poetic voice" in the *Shijing* generally. (*ibid*) To be sure, such sophisticated labels as "theological revolutions" and "intellectual ruptures" do not apply to these poems, but Lewis's perspective on this aspect of them seems a matter of degree and focus in comparison with Graham's and does not ultimately impugn them as evidence for the kind of breach with Heaven that Graham identifies.

[28] What von Falkenhausen calls the Zhou "Ritual Reform" has been termed the "Ritual Revolution" by Jessica Rawson, who was the first to recognize the importance of the differences between Shang and early Western Zhou bronze vessels, – vessel types and decor and vessel distribution and arrangement in tombs both, – and the corresponding evidence from the mid-Western Zhou and later, and to suggest how this indicates a major shift in the nature of Zhou ancestral sacrifices (Rawson 1999, 433–40; Falkenhausen 2006, 52). For a discussion of the same development from an art historical perspective, showing especially the changes in the way ceremonial bronzes were shaped and decorated, see Thote 2003.

elite rank according to established sumptuary rules. (iii) New vessel types appear, with a decoration that is singularly unadorned and plain, very unlike the richly ornate decor of the earlier Western Zhou and even earlier Shang vessels. Falkenhausen describes these as "simple and humble," and he interprets this shift in decor as reflecting a "desire to reform the spirit of ritual by reducing its complexity and linking it with everyday activities." (Falkenhausen 2006, 50) He concludes this by saying that "These late Western Zhou changes in the spirit and performance of ancestral sacrifices must have constituted, in the collective consciousness of their time, a major break with earlier practices." (Falkenhausen 2006, 50).

1.3 The Text and Its Tradition: Reactions to the Breakdown of World Order

This dramatic shift in late Western Zhou attitude and practice toward the ancestral cult and attendant sacrifices, documented by unambiguous primary archaeological evidence, in tandem with the apparent "alienation from Heaven" evidence that we find revealed in the early transmitted literary tradition provide a full, two-part picture,—the excavated archaeological and the transmitted literary,—behind Graham's reference to "the breakdown of the world order decreed by heaven." There were initially two major reactions to this in the following centuries. The first, and certainly the more enduring, was what Graham calls the "conservative" reaction of Confucius (traditionally, 551–479 B.C.E.) (Graham 1989, 9). It was conservative not because Confucius and his disciples wanted to restore the former spiritual solemnity and ceremonial grandeur of the Shang and early Western Zhou ancestral cult to their pristine ancient form, but because these "first generation Confucians" were intent on maintaining a deep respect for tradition and on preserving the revered status of the ancestral cult, while at the same time extending and adapting the central moral and ethical tenets of these ancient traditions to matters of the immediate societal and political realm.[29]

[29] The label 'Confucian', though pervasive in western studies and writings about China, scholarly and popular both, is generally quite ill-suited to giving an accurate understanding of the religious, social or philosophical picture of pre-modern China. Very little of what is called 'Confucian' actually has any meaningful link to Confucius. We will use the term 'Confucian' in this work in a very limited way, referring specifically only to those things that are directly related to what we know of Confucius, chiefly from the *Lunyu* 論語 (*Analects of Confucius*), and from the roughly contemporaneous primary historical text sources such as the *Zuo zhuan* 左傳. So our "first generation Confucians" (including textually attested immediate disciples, which group may include those a generation removed from Confucius's own time) are those individuals starting with Confucius himself, directly involved with the initial shaping of the religious, philosophical and social reaction to the "breakdown of world order." Any extension of this use, *e.g.*, in phrases such as "Confucians" or "Confucianism" or in phrases that use "Confucian" as a modifier, would be meaningful only when it can be shown to have a first-order, consequential relation to Confucius and his immediate circle of disciples. Even then, the term "Confucian," and especially the term "Confucianism," is

The second reaction Graham calls the "radical" reaction of the Mohists, radical because it advocated rejecting the entire edifice of early Zhou ceremonial traditions concerned with the ancestral cult and related elitist matters, and dismissing the Confucian effort to preserve these traditions and practices in whatever modified or refocused shape they might take, except when they may be directed to immediate, practical social good.[30] (Graham 1989, 33) The Mohists turned their attention exclusively toward the practical issues and problems of the real world and the everyman. Traditions, beliefs and practices of the past were important only to the extent that they served the practical needs of the present. To be sure, the Mohists did not reject or deny the importance of Heaven outright, but instead of maintaining a solicitous reverence as the Confucians did, the Mohist saw Heaven as a kind of objective guide or model for correct behavior, rewarding the good and bringing misfortune to the bad.[31]

In the early years of the Western Zhou social status was hereditary, and political authority rested in the hands of hereditary aristocratic clans who wielded suzerainty over major cities and over the territory that those cities were able to oversee and control. At first the cities were ruled by extended family members of the Zhou nobility who maintained at least in the early period a strong formal allegiance to the central Zhou court. The lineage bonds that held these cities and their ruling families together became over time increasingly attenuated. Rivalry and competition among evolving cadet lineages increased, leading to the fragmentation of what had earlier been integral territories and to the widespread weakening of political authority. As these junior lineages gradually gained in both military strength and institutional independence they gave rise to new territorial states, which in turn opened a wide

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better avoided, thus conforming to Chinese practice, which never uses Confucius's name this way. The conventional Chinese term for the so-called "Confucian" school is Ru 儒 (*jiā* 家 'school'). Thus the English terms ought properly to be Ruist ("Confucian") and Ruism ("Confucianism").

[30] In the same way that the overly casual use of the term 'Confucian' as a label for an ostensible "school of thought" or "philosophy" (or worse yet, "religion") gives a false impression about the relation between Confucius himself and the conservative tradition that follows in his wake, so also the use of the term 'Mohist' is meaningful only when it refers to the traditionally recognized figure of Mozi (whether there was historically such a person or not) and to the anonymous compilers of the *Mozi* text. In the most precise sense 'Mohist' refers to the writings we find preserved in the transmitted work we know as the *Mozi*. Beyond that, the claim that there was a "Mohist school of thought or philosophy," what in Han texts is called *mò jiā* 墨家, is as dubious for the Warring States period as comparable claims for other presumed "schools of thought." It is likely that this conception of Warring States period 'philosophy' as categorizable into a relatively small number of "schools" is an anachronistic Han period *post factum* invention, arising probably from Han efforts to systematize and codify the texts that they inherited from their pre-imperial forebears. See Smith 2003, Brindley 2009 and Meyer 2012, 33. Meyer in particular gives a clear statement why this notion of "schools" (what are termed *jiā* 家 traditionally) is pernicious: "The problem of using such labels is that they suggest an intellectual consistency that is difficult to justify and, worse, may in fact distort historical reality." (Meyer *loc. cit.*)

[31] This point is well explained by Chris Fraser in his contribution on "Mohism" in the online *Stanford Encyclopedia of Philosophy*, in the section titled "Justification and the Role of Heaven" (Fraser 2015). See also the discussion at A 70, on *fǎ* 法 'models' *infra*.

door to growing numbers of state-dependent administrative officials. By the sixth century B.C.E. the old social and political order that had taken shape four centuries earlier under the martial and political dominance of the early Western Zhou court had broken down, and the individual aristocratic families now ruling over largely independent states paid allegiance to the Zhou king only in hollow formality, not with any significant measure of sincere deference or genuine respect.

The emergence of numerous quasi-independent states, some great, some small, some powerful, some less so, was, not surprisingly, accompanied by endemic inter-state rivalries, political intrigue and persistent military tension and conflict, sometimes open, more often implicitly threatening, clandestine and subtle. It was precisely this context that brought about the emergence of the "first generation Confucians," calling for a renewed respect toward the central features of traditional ceremony and statesmanship on the one hand and a recognition of the need to deal effectively with the political exigencies of the real world on the other. To the extent that the ruling class in this increasingly volatile social setting was still constituted of descendants of the old nobility, a part of the conservative Confucian message was to recognize the moral and social demands attendant on people belonging to this elite hereditary class and to adhere to the expected codes of proper behavior, even in the face of diminished personal circumstances. The radical reaction of the Mohists on the other hand was to call for a complete abandoning of elitist tradition and hereditary privilege and for a refusal to accept what was perceived as the social injustices that those traditions and privileges entailed.

Political success, even basic survival, in this atmosphere came to depend on a significant measure of demonstrable military prowess combined with crafty and cunning political suasion. The former called for a class of adroit military leaders and, fundamentally, a society capable of maintaining agricultural productivity and population stability, if not growth. The latter led to a social class of educated and adept political and military advisers, skilled in one or another of these areas, who served the courts of the various states and who came often to compete with one another for recognition and status, either as a part of inter-state maneuvering or as advocates for competing policies in a given situation or circumstance. As the numbers of these advocate-advisers grew, their importance increased both at court and within state administrations. They became increasingly specialized in one or another area and skilled in the art of verbal disputation and persuasion. Some became prominent for the vigor of their arguments or the successes of their doctrines, or both.[32]

Out of this literate social milieu a wide variety of teachings arose representing the diverse political, social, military and economic doctrines that were advocated and circulated from state to state and court to court. What began as advice for the effective, and sometimes morally correct, governing of a state, from

[32] The presentation here is *per force* exceedingly brief. There are innumerable specialized studies and comprehensive descriptions of this period of early Chinese history. Among the best in English are the works of Mark Edward Lewis, from the very effectively concise picture that he draws in the *Cambridge History of Ancient China* (Lewis 1999a) to his fuller studies, *Sanctioned Violence* (Lewis 1990) and *Writing and Authority in Early China* (Lewis 1999b).

adviser-advocates closely associated with one court or another, especially the courts of powerful states, grew in time to become less state-centered and more abstract in doctrinal and philosophical slant and content, while the individuals associated with such teachings at the same time often retained the authority and status that characterized the old state adviser-advocates. Written materials were comparatively rare; they were costly and difficult to produce, and not easily replicated or circulated. Teachings were likelier to have been conveyed and spread orally than in written form, and this naturally led to the identification of named "teachers" or "masters," each with his group of largely unnamed "followers", "students" or "disciples." It is traditionally thought that writings, when they did appear, were often produced by the students, or disciples and followers of a particular master or teacher, sometimes more than a single generation removed from the master himself. As the teachings took written form they typically came to be known simply by a master's name, reflecting that master's doctrinal legacy. Whether the master in question was responsible for the body of teachings that came to be perpetuated under his name or not, or even whether or not he can be historically documented as having existed at all, is less important than the status that he enjoyed and the respect that he had accrued as an acknowledged master. The named master then became a function of the prevailing attitude toward what constitutes acceptable socio-political and philosophical (broadly understood) discourse (Lewis 1999a, b, 53–97).

Distinctive of many of the works that are included in the *zi bu* Masters category of texts, and in fact the basis for this bibliographic label in the first place, is the fact that the names of these texts often appear to be proper names for individuals to which the suffix *-zǐ* 子 has been appended, a term that in its lexical origin means simply 'offspring, child'. These are the names of the masters around whom bodies of texts accrued and took shape and who serve as the nominal authorities validating the teachings of those texts. The association of this commanding, authoritative status of the names of the texts with a concern for ethical or social morality that the texts often reflect sometimes leads to the mistaken identification of a *zǐ* 'Master' as a 'philosopher'. But neither the word *zǐ* nor the suffix *-zǐ* ever had anything to do with philosophy. In fact the suffix *-zǐ* in Chinese proper names functioned in origin pretty much like the suffix *-son* in English names such as Johnson, Peterson, Davidson, &c., or as the *O′* in Irish names, the *Mac-* in Scottish names, the *-ides* in Greek names, the *-vic(h)* in Slavic names, or the prefix *Fitz-* (< *fils de*), or even the aristocratic titles *Hidalgo* (< *hijo de algo*), *Thane* (also *Thegn*, originally 'freeman', cognate with Gk. τέκνον 'child') and even English *Childe*. In all of these cases the original intent was to affirm clan lineage affiliation, often aristocratic or noble, by explicitly indicating that someone was the 'offspring' of someone "with a name," *i.e.*, of noble line. In pre-imperial China it was as important to register in one's name the fact of aristocratic birth and lineage as it was anywhere else in the pre-modern world, and this is the basic function of the Chinese suffix *-zǐ*. Belonging to the aristocratic class gave males the possibility of entry into the world of letters and, ultimately, the court. As a consequence of this the works of the *zi bu* Masters category consist chiefly in the writings of that social class and reflect their concerns, diverse

as they may have been.[33] They are not as much philosophy in a classical western sense as they are belletristic essays on questions of proper social and political behavior, sometimes practical, sometimes idealistic, according to the mores and perspectives of the members of the ruling class of the time. Differing perspectives on such questions led to an intellectual environment characterized by frequent debate and extensive disputation, sometimes formal, sometimes indirect.

The chief concern of a large number of these *zi bu* "Masters" writings from the Warring States period centers on the proper role of man in a secular society. What Graham identified as the breakdown of world order as it had earlier been decreed by a protective, benign Heaven came also to include a breakdown of the old so-called "feudal" order that had served at least in principal, sometimes in fact, as a framework for social and political stability since the founding of the Western Zhou in 1045 B.C.E., more than half a millennium earlier.[34] The sense of a breech between Heaven and earth and a loss of the reliable underpinnings of a traditional stable society that had been centered on ceremony and ritual directed toward Heaven and the ancestors led to a focus now shifted to secular matters. The task now was to discern man's proper role in the social and political world, to reduce the growing tendency toward social and political strife and disarray, and to find a way to re-establish a stable secular world order. Beginning with Confucius this entailed at the same time honoring the traditional ceremonies and the traditional reverence due the ancestors and the past. More than a century and a half after Confucius, in the works first of Mencius (late fourth-century B.C.E.), later of Xunzi (mid-third-century B.C.E.), we find an explicit return to the question of man's relation to Heaven, extended now to include for the first time in pre-imperial Chinese thought debates on human nature. These concerns are not a call for the restoration of the old beliefs or of the sacrificial ritual practices of Western Zhou antiquity, but, however abstract they may appear, still are typically interwoven with concrete questions of social and political ethics, morality and the proper behavior of rulers and individuals in a secular context, the goal of which was societal stability.[35]

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[33] Many of the transmitted texts included in this category are known by titles that appear to be based on personal names with the *-zǐ* suffix, but that in fact are unlikely to represent actual, historical persons. They seem to be popular epithets, such as *Zhuangzi* 莊子 'the Stern One' and *Laozi* 老子 'the Old One', that have taken on a superficial proper-name form based on the *zi* suffix and the *zi bu* category. In some cases the name of the text includes the *-zǐ* suffix, but the name of the person in question is not attested with this suffix, *e.g.*, the *Hanfeizi* 韓非子 as a text, but only the name Han Fei (without the *zi*) is attested as a person.

[34] We write *"feudal"* with scare quotes here because the social and political structures and institutions were not in any way feudal as that term is properly used in regard to European history. It is conventional to describe pre-imperial Chinese society as 'feudal', but it is also misleading, if not simply wrong. See Li Feng 2003.

[35] For a well-informed survey of this material from the perspective of traditional Chinese scholarship see Hsiao Kung-ch'üan 1979: part I. For an analytically and interpretively much more innovative approach see Graham 1989: parts I, II, & III.

1.4 The Text and Its Tradition: The Mohists

The *Mozi* 墨子, reflecting the "radical" reaction to the breech between Heaven and earth, is conventionally recognized as the first primary textual counterpart to the "conservative" reaction registered in the *Analects* of Confucius, though in content the *Mozi* text makes no direct reference to the *Analects* text itself and, with the exception of the dialogic chapters (46–51), is of a very different style. It is understood as a record promoting a social doctrine generally characterized as anti-elitist, pragmatic, rational and to some extent egalitarian, and it falls into the bibliographic *zi bu* Masters category in respect of both its name and its content. It is in its core parts chiefly a statement about a desire for practical, useful social and political policies on the part of the ruling authorities and by the same token about the pernicious, if not enervating, consequences of holding tenaciously to old, traditional beliefs and ceremonies, now deemed obsolete and irrelevant. And, as with other texts in this category from this period, the name of the text, ending with the suffix *-zǐ*, is traditionally taken to be the name of the author of the text.[36] For the *Mozi*, as for many other *zi*-named texts of this period, this is a very uncertain presumption. There may have been a real person named Mozi, whose full name is said to have been Mo Di 墨翟, and who is sometimes given the dates *ca*. 479–381 B.C.E., making his birth year close to Confucius's death year, and making him nearly a centenarian when he is said to have died. There is very little solid historical documentation for this traditional belief. There is also an alternative view that the term *mozi*, which could be understood simply as 'the black one(s)' or 'dark one(s)', is not a proper name at all, but a descriptive epithet used in reference to the presumed swarthy appearances of the allegedly "working class" compilers of this text, who are often said to have been carpenters, craftsmen or even convicts.[37] In either case the implied character of the ostensible compiler of the text seems at odds with the general presumption that those names ending in the suffix *-zǐ* are members of the nobility and with the further presumption that written texts only emerged from an elite, learned stratum of society. How this is to be explained remains unclear.

The received *Mozi* text has 53 chapters. According to the Chinese bibliographical tradition the work is said to have had originally 71; this means that at some point(s) in its transmission after the Han period the text has lost 18 chapters. What is usually regarded as the core part of the work, that is, the part that gives the text its most widely recognized philosophical and political nature, consists of 32 chapters of the extant 53. These are the narrative essays that present arguments surrounding a set of ten basic doctrinal theses associated with Mohist social philosophy. Each argument is dealt with three times, in three different chapters. This is usually taken as

[36] In many cases the names were given to the texts by later editors in the belief that they were using the name of the author of the text in question, though authorship in the pre-imperial period is very much a matter of tradition, very little of demonstrable fact.

[37] We might, then, call Mozi by the name von Schwartz or Swartzchilde, or more classically, Melanides.

suggesting that within the Mohist "school" there were three competing perspectives on the argument in question; each perspective coming to be represented in one of the three pertinent chapters.[38] Not all of the chapters for all ten of the theses are extent *in toto*; some seem to exist only in fragmentary or digest form and some are not extant at all.[39] The ten core theses and their original triads of chapters are:

1. *Shang xian*	尚賢	"Exalting worthiness"	Chapters 08–10,
2. *Shang tong*	尚同	"Exalting conformity"	Chapters 11–13,
3. *Jian ai*	兼愛	"All-inclusive caring"	Chapters 14–16,
4. *Fei gong*	非攻	"In opposition to aggression"	Chapters 17–19,
5. *Jie yong*	節用	"Moderating expenditures"	Chapters 20–22,
6. *Jie zang*	節葬	"Moderating funerals"	Chapters 23–25,
7. *Tian zhi*	天志	"The inclination of heaven"	Chapters 26–28,
8. *Ming gui*	明鬼	"Getting a clear idea about ghosts"	Chapters 29–31,
9. *Fei yue*	非樂	"In opposition to ritual music"	Chapters 32–34,
10. *Fei ming*	非命	"In opposition to notions of fate"	Chapters 35–37.

In addition to these ten theses, chapters 38 and 39 are called *Fei ru* 非儒, usually referred to somewhat uncritically as "In opposition to Confucians" or "Rejecting Confucians." The word *rú* 儒 in this pair of chapters (only the second of which is extant) is conventionally taken as referring to the doctrines associated with Confucius and called, in modern Western terminology, "Confucianism." If in fact there had been such a doctrine or "school of thought" in the pre-imperial age, the proper term *more sinico* should be "Ruism," not "Confucianism," since the Chinese tradition never uses the name Kong(fu)zi 孔(夫)子 'Confucius' explicitly to designate a "school of thought", as mentioned in footnote 29. In fact it is now recognized that the term *rú* was not used to refer to any particular doctrine *per se*, nor was it used to refer to the adherents of any particular doctrine, certainly not advocates only of the teachings of Confucius. The meaning and use of the term is not completely clear, partly because it seems to change over time. By the Han dynasty it had come to refer to, among other things, a class of scholars of ancient texts whom we might call 'classicists'. At the same time it was used to refer to government officials and, finally, to "Confucians" as that label was used in the Han period.[40] Prior to that it seems to have denoted a class of people concerned with ritual and ceremonies in

[38] Some recent scholarship suggests the possibility that the difference among the three versions of each of the core chapters is chronological rather than doctrinal. Defoort and Standaert 2013, 10–19.

[39] See Graham 1993, 336–37.

[40] See Nylan 1999, 18–19 and Anne Cheng 2001, 102, who cites and discusses Nylan 1999. For an extended discussion of how the term *rú* was used see Jensen 1997, 153–215; esp. 163–68. Jensen examines the way the word *rú* was appropriated by Matteo Ricci and the Jesuits in their effort to admit themselves into the revered tradition associated with Confucius and his immediate disciples and at the same time to admit Confucius and his followers into "the realm of the knowable, a realm accented by the visible presence of the holy. As the order of the literati, *ru* were made brethren of Ricci's beloved Society of Jesus in also being a sect and in effect symbolically christened" (Jensen 1997, 92).

some sense, and this might easily have overlapped with disciples of Confucius and adherents of Confucius's teachings. The earliest texts to use the word in any sense are the *Lun yu* itself (*Analects of Confucius*) and the *Mozi*.[41] The one extant *Fei ru* chapter is more explicitly directed at what are seen as the excesses of the conservative "Ruists" than are the other core parts of the *Mozi*. It displays the same argumentative, sometimes mildly caustic, confrontational style as the preceding 30 chapters and is often regarded as of a piece with those.[42]

In their conservative way the Ruists at this time are the masters of ritual and ceremony, things that the Mohists deemed largely useless and arid. The following excerpt from chapter 39 should give an idea of the attitude and style of the Mohist's anti-Ruist rhetoric.

> The Ruists exaggerate ceremonies of ritual and music in order to drive people to excess. They will prolong mourning periods and contrive laments in order to hoodwink the relatives of the deceased. They will claim Fate as a pretext and indulge poverty, yet they live high and mighty. They turn their backs on the basics, abandon responsibilities and plunge forward in idleness and indolence. They are avaricious toward food and drink and irresponsible toward productive efforts … They stuff their cheeks like hamsters, gaze upon things in a stupor like a billy-goat and rise up on their haunches like a bloated wild-pig. When a proper gentleman ridicules him the Ruist responds angrily, "useless fellow, what do you know about being a good Ruist?" … They will beg for grains until the crops are in, then it will be grand funeral ceremonies that they will pursue. With kids and kin all in tow they will be able to get their fill of food and drink. In the end, officiating at a few funeral ceremonies would suffice to put them in good shape … when there is a funeral in a wealthy household, the Ruist is then greatly delighted. He will exclaim with glee, "here is the next key to our food and clothing."

The received text of the *Mozi* in addition to this 30 or 32 chapter core part consists of four other parts, *viz*., seven initial epitomic chapters on diverse aspects of personal behavior (chapters 1–7), six chapters of didactic dialogues (chapters 46–51; these come closest to matching the style of the *Analects*), 20 on the techniques of military engineering and defensive warfare (chapters 52–71) and finally six chapters that have often been called 'scientific' or 'logical' or 'dialectical' and that deal with what may be understood as matters of optics, mechanics, geometry, logic and ethics (chapters 40–45).[43] These six are in many ways the most atypical parts of the whole *Mozi* text, not to mention the most challenging to understand. All the same, they share the same general character of much of the rest of the *Mozi* in showing a concern with and attention to aspects of the immediate world as opposed to philosophical, religious or ceremonial predispositions toward the ancestors or traditions of the past. Specifically, these six chapters consist of

chapter 40: *Jing* (part A) 經上 "Canons" (part A)
chapter 41: *Jing* (part B) 經下 "Canons" (part B)

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[41] See Zufferey 2003, 144.

[42] Some recent scholarship dates the *Fei ru* chapter to a time somewhat later than that of the so-called "core" chapters and suggests that its style makes it more similar to the later "dialogues" chapters than to the "core." See Defoort and Standaert 2013, 5.

[43] Using these terms to characterize the contents of these chapters runs the risk of inadvertently giving a misleading idea about the nature of the text. In our translations, analyses and discussions we will generally use terms more directly reflective of the actual text.

chapter 42: *Jing shuo* (part A) 經說上 "Explanations" (part A)
chapter 43: *Jing shuo* (part B) 經說下 "Explanations" (part B)
chapter 44: *Da qu* 大取 "The Major option"
chapter 45: *Xiao qu* 小取 "The Minor option"

These six so-called dialectical chapters in the aggregate are often called the "Later Mohist" texts or the Mohist "dialectical chapters", in the Chinese tradition they are called the *Mobian* 墨辯, because they are thought to reflect the kind of discriminating arguments (辯 *biàn*) associated with systematic, logical thinking. They are called 'later' texts because of an assumption that this kind of thinking generally appears in the textual record later than much of the other political and social discourse, though this is only an assumption. While it may be correct, there is no hard empirical evidence to support the claim. With the possible exception of some of the passages that are identified as 'sophist', the particular kind of thinking that these chapters illustrate does not appear anywhere else in the early received tradition either before or after the fourth century B.C.E. A.C. Graham has argued that these chapters show the kind of rigorous thinking that was demanded by the intensity and sophistication of the prevailing Warring States period debates and arguments (Graham 1978, 19–25). At the same time these are the chapters that lead to a claim that the *Mozi* is an early scientific text. The first four, the "Canons" and the "Explanations" chapters, collectively referred to as the *Mohist Canon*, are the ones with which the present study is concerned.

Irrespective of the uncertain historicity of an individual named Mozi, the text that has been transmitted from the Warring States period is almost certainly a composite work, an amalgamation of textual pieces from an indeterminate number of hands. To be sure, many of these pieces focus themselves on the same or related social and political questions, and are in that sense homogeneous. Much of the *Mozi* is distinctive in comparison with other contemporaneous *zi bu* Masters texts in that its arguments are based on appeals to reason or what can be considered from a Mohist perspective "common sense" rather than on claims of authority or precedent derived from the sage figures and legendary rulers of antiquity. In many respects the doctrines expressed in the text recognize the traditional distinction between nobles and commoners, between an aristocratic class and a plebeian class, as incompatible with a stable, orderly society. There is a marked current of egalitarianism apparent in the core theses. Even in its central ethico-philosophical parts the *Mozi* is a text constructed primarily along the lines of rational argument and debate from a practical, quotidian perspective and is not based on any highly regarded tradition or on appeals to the wisdom, humane ethics and benign rule of the heroes of the past. To the extent that they deal with matters of the real world, especially its physical and technological aspects, the "Canons" and the "Explanations" chapters, distinctive in content and format as they are in comparison with the rest of the work, often seem nevertheless to be dispositionally aligned with the so-called philosophical parts of the *Mozi*. For example, one of the best known socio-political doctrines of the *Mozi* associated with the text's explicit rejection of outmoded, conservative practices and ceremonies of the past, and its implicit advocacy of an egalitarian ideal is that called *jiān ài* 兼愛 "all-inclusive caring" (more popularly translated and known as "universal

love," chapters 14–16). The doctrine advocates a kind of equal respect and concern for all people in a society or community irrespective of hereditary status of aristocratic pedigree. The gist is set out succinctly in the following lines from chapter 14:

> 若使天下兼相愛， 國與國不相攻， 家與家不相亂， 盜賊無有， 君臣父子皆能孝慈, 若此則天下治。
>
> Suppose that throughout the Subcelestial Realm everyone cared for one another, states would not attack one another, family estates would not bring about disorder to one another, brigands and thieves would not exist, lords and vassals and fathers and sons would in all cases show appropriate filial and paternal affection,—if things were like this, then the Subcelestial Realm would enjoy good order.

Compare this with the concrete references in the Explanation parts of sections B 74–75, sections that are primarily concerned with theoretical questions about sets:

> Being two, we know their number. So, in asking "How do we know someone's caring fondly for (*ài* 愛) people accounts for them exhaustively," some have been left out from this question. If one is exhaustive in asking about people, then being exhaustive in caring fondly for (*ài* 愛) those about whom one has asked follows. (B 74)
>
> and
>
> It is like "when knowing their number, then knowing that the caring fondly (*ài* 愛) exhaustively accounts for them presents no difficulty." (B 75)[44]

Although the word *ài* 愛 occurs in these passages without the modifier *jiān* 兼, the sections clearly relate to a discussion about *jiān ài* 兼愛 'comprehensively caring fondly for', because they explicitly address the question: is it possible to show care to the set of all people or not?

1.5 The Text and Its Tradition: Modern Reception

In the last years of the Qing dynasty (1644–1911) and the first years of the Republic of China intellectuals and literary scholars in China became concerned with the implications of the seemingly marked disparity between the rudimentary level of scientific and technological knowledge in China and the considerably more advanced level of such knowledge in the West. This apparent disparity provoked a strong reaction in some quarters, leading to determined and insistent efforts to show that China was not after all as scientifically backward or uninformed as it might at first appear.[45] The six dialectical chapters of the *Mozi* are often invoked to show that

[44] The translation here has been modified slightly from the more formal one we have given in Chap. 3 of this study. The word *ài* 愛 occurs in these passages without the modifier *jiān* 兼, and we translate it as 'to care fondly for'. Its actual semantic scope extends from a somewhat disinterested, but responsible, sense of 'looking after' to a passionate 'caring deeply for' at the other end of the scale.

[45] For a thorough study of this early twentieth century phenomenon in China and its intellectual precursors see Kurtz 2011.

China was already able to express sophisticated and complex mechanical, optical, geometric and logical propositions and explanations as early as the fourth century B.C.E. Benjamin Elman points out, for example, that from 1886 through 1894 about 25% of the essay topics selected for the *Shanghai Polytechnic Prize Essay Competition* dealt with the sciences, chiefly with the relation between traditional Chinese learning and Western science. In particular, in the Spring of 1894 we find this essay contest theme: "Itemize and demonstrate … that the *Jing shang* and *[Jing]shuo shang* [Canons, part A and Explanations, part A, *i.e.*, chapters 40 and 42] from the *Mozi* had already raised the Western principles of calendrical studies, optics, and mechanics."[46] Intense concern with the chronological priority of Chinese science over Western continued into the twentieth century. This concern took both nationalistic and genuinely scientific focuses.

Liang Qichao 梁啟超 (1873–1929) stands out prominently among early Republican intellectuals as particularly concerned with the political and social importance of introducing Western scientific learning into China (Elman 2005, 341 and *passim*, Kurtz 2011, 313–18). Liang was both a traditionally trained scholar of classical Chinese texts and history and a major political figure in the early years of the Republic. He served the new Republic as Minister of Justice in 1913 and as Minister of Finance in 1917 (Hsü 1959, 1–2). At the same time he shared in the desire to find a basis in early Chinese texts to demonstrate that in some sense what we see as modern western scientific thinking was already present in the classical Chinese tradition (Kurtz 2011, 319–27). To this end he produced a carefully detailed textual study of the *Jing* and *Jing shuo* chapters of the *Mozi*, which he called *Mojing jiaoshi* 墨經校釋, published in 1923. In his Preface to this work Liang sets out explicitly his view of the extent to which the Later Mohist texts reflect a kind of scientific thinking comparable to that in the modern West. We include a translation of the Preface here.[47] Liang Qichao exemplifies a perception of the relation between Chinese and European knowledge traditions that shaped until recently the reception of the *Mohist Canon* throughout modern times from its first reconsideration in the late eighteenth century after a millennium and a half of studied disinterest.[48] With our work we propose a reassessment of this relation that tries to appreciate the Mohist text in its own right, resisting the lure of the conventional comparative model that has prevailed in recent decades assessing the evidence for early Chinese science against the history of western science as a default standard.

[46] See Elman 2005, 340, 433. We have modified the theme wording slightly from what Elman has given, in order to conform to the terminology that we use here. In fact the optics and mechanics sections that this essay theme appears to refer to would be found in the *Jing xia* and *Jingshuo xia* chapters (41 and 43), not in chapters 40 and 42.

[47] This translation was done by W. Boltz and the late Judith M. Boltz jointly. Madeleine Dong (University of Washington, Seattle) gave us very welcome assistance in understanding Liang Qichao's likely meaning in several places. The original Chinese text of this Preface is given in the Textual Appendix.

[48] For an in-depth study of Liang Qichao as a historian, see Levenson 1967.

Liang Qichao's "Preface" to the *Mojing jiaoshi*《墨經校釋》
梁啟超自序

Were we to search among our country's wealth of ancient texts for something that, though far removed in time from the present, shows nevertheless a close match to what we call in the modern world a "scientific spirit," we would need look no further than the *Mojing* 墨經. The two chief subjects that Mozi's teaching promoted are said to be *ai* 愛 'caring for others' and *zhi* 智 'knowledge'. What Mozi spoke of, and what the disciples recounted, in the various chapters such as "Tian zhi" 天志 ("The Inclination of Heaven"), "Shang tong" 尚同 ("Exalting Conformity"), and "Jian ai" 兼愛 ("All-inclusive Caring"), is 90% concerned with the first of these two teachings, that of *ai* 愛 'caring for others'. By contrast, the materials dealing with the second teaching, *zhi* 智 'knowledge', consist of the two "Jing" 經 chapters, no more than half written by Mozi himself, together with the two "Jing shuo" 經說 chapters, which arose as Mohist disciples across the land recited every aspect of their Master's teaching, sometimes recounting what they had heard, sometimes incorporating their own opinions.

The text itself does not have more than 6000 words and consists of 179 individual entries. It analyzes in great detail and sets out with great clarity the basic wherewithal of knowing and understanding, including the origins of knowing and understanding, how knowing and understanding are pulled forth from deep recesses and put to use, and finally how one arrives at truth or falls into error. In consequence we can make use of it to distinguish between *míng* 名 'name' and *shí* 實 'object' and to come to grips with *shì lǐ* 事理 'logical reasoning'.[49] Each time the text remarks on a single notion its observations are in every case sharply discerning and profound. This puts it in marked contrast to the vulgar sophistry that has prevailed for the last two millennia, such that we may recognize it as matching in many respects comparable discoveries of western scholars in the modern age. It takes up questions of mathematics, geometry, optics, and mechanics, revealing heretofore hidden secrets in these areas.

As I have commented, the *Mojing* is one of the oldest books of logic (*míng xué* 名學) in the world. Logic (*luó jí* 邏輯) in the west starts from Aristotle, as much as a century later than Mozi, and has evolved through numerous reshapings in every generation since, becoming grander and more illustrious with each step, to the point where now scholars of all kinds rely on it to great advantage. The *Mojing*, by contrast, after the demise of the Qin-Han empire, fell into a period of prolonged oblivion. Once its study had come to an end,

[49] [Boltz and Schemmel footnote:] The distinction between *míng* 名 'name' and *shí* 實 'object' was a widespread and frequently invoked theme in Warring States period debates, becoming in the Han period a central part of an incipient "linguistic philosophy." See Suter 2017, esp. sections 4 & 5; Graham 1978, 196–99; 1989, 137–41, 147–55.

scholars became uncritically inclined to place equal merit on all sorts of vacuous, obscure, superficial, dubious and discredited theories, such that the mental blindness and intellectual impoverishment of ostensibly learned circles has, to our great dismay, reached an extreme in the present day.

Of later scholars who took up the study of this material, it was only in the Jin 晉 period (265–420) that a certain Lu Sheng 魯勝 (fl. 291) seems to have brought together into a single compilation the four separate sections, "Jing" (*shàng* and *xià*) and "Jing shuo" (*shàng* and *xià*). He called this compilation the *Mobian* 墨辯 and prepared a commentary (*zhu* 注) for it. Lu Sheng's preface (*xu* 序) to this work is preserved in the "Yin yi zhuan" 隱逸傳 ("Accounts of Recluses and Hermits") of the *Jin shu* 晉書 (ch. 94, comp. *ca*. 647). The commentary itself would seem to have been lost for a long time; it is not registered even in the "Jing ji zhi" 經籍志 ("Book Catalogue") of the *Sui shu* 隋書 (chs. 32–35, comp. *ca*. 636).

The *Mozi* text in general is famously difficult to read, and these four sections are particularly so. [There are eight specific sources of difficulty:]

1. The original text was written in two horizontal panels, one above the other (*pang hang* 旁行), but was copied in the course of transmission as if it were written to be read directly from top to bottom. Modern editions reflect this; lines are thus jumbled and mixed and are difficult to put back into proper order.
2. The matching "Jing" and "Shuo" lines are separated from each other, such that there is no way to re-connect them except by determining for yourself where they may have originally been linked to each other.
3. The proper order for reading the items and passages has become completely mixed up, so that which goes with which is off by a 1000 miles.
4. Because the text is so concise, when it has erroneous or missing characters, there is nothing in the tone of its language from which to draw forth any clues for sorting out the correct meaning.
5. The wordings of commentaries and exegetic notes have sometimes become inadvertently incorporated into the primary text, and it is now difficult to distinguish these interpolations from the original text.
6. As it has been handed down, the text was copied and recopied generation after generation, sometimes with forced explanations, sometimes with the loss of characters or with nonsensical changes, so that in the course of its transmission what were errors early on have spawned still more errors.
7. Ancient commentaries and exegeses have all been lost, so there is nothing on which we can rely for confirmation of the correct understanding.
8. The meaning of the text is especially abstruse and at the same time has a sense markedly different from the usual scholastic understandings of the age, so that taking up old, traditional assumptions to make sense of it inevitably leads one to misunderstandings and confusion.

Now in the present day no one any longer knows enough to place any importance on this scholarship. Anyone who tries to work with it will come up against these eight difficulties. Thus this work has been like a brilliant pearl dropped into the dust, a rare orchid cast into the weeds, such that for countless centuries no one has given it as much as a backwards glance.

During the Qianlong (1736–1795) and Jiaqing (1796–1820) reign periods of the Qing dynasty textual criticism flourished as a scholarly enterprise. The eighteenth century classical scholars Wang Zhong 汪中 (1745–1794) and Bi Yuan 畢沅 (1730–1797) both prepared collations and commentaries for the *Mozi* text, with Bi Yuan's edition becoming fairly widely circulated at the time. The works that were compiled by father and son, Wang Niansun 王念孫 (1744–1832) and Wang Yinzhi 王引之 (1766–1834), as well as by Yu Yue 俞樾 (1821–1907), all provided collations and exegetic notes, and thus the *Mozi* text became from then on gradually less incomprehensible. Only when Zhang Huiyan 張惠言 (1761–1802) compiled the *Mozi jing shuo jie* 墨子經說解, did the *Mojing* sections begin to receive particular attention.

Two scholars from my own hometown, the late Zou Boqi 鄒伯奇 (1819–1869) and Chen Li 陳澧 (1810–1882), often cited western scholarship to elucidate passages in the *Mojing* text, and scholars gradually became ever more astonished by the riches concealed in this work. All the same, while there have been discoveries of individual meanings section by section, still we have not yet gotten even one or 2% of the total sense of the text. Sun Yirang 孫詒讓 (1848–1908) compiled the *Mozi jiangu* 墨子間詁 in which he attempted to analyze more or less all of the doubtful and intractable passages in the whole work. In spite of his assiduous effort in just these four chapters alone, there were notably few places where he was able to come up with good explanations. As for his text critical studies in particular, the parts that he was clear about and able to get right did not reach even to the half-way mark.

Such difficulties at the outset are in principle taken as a given. For some years now European scholarship has been funneling into China, and scholars have relied on this new knowledge to re-consider old areas of study, increasingly coming to realize that the meaning contained in this 6000-word text is exceptionally far-reaching and nearly unbounded in its scope. For example, the works compiled by Zhang Binglin 張炳麟 (1868–[1936]) and Hu Shi 胡適 (1891–[1962]) have both, by building on the accomplishments of their predecessors, been able to adduce new facts, bringing a new respect to the text and advancing its study overall.

I for my part have had a great fondness for the *Mozi* since my youth and for 20 years now have been supplementing the critical exegeses of this text with a lot of marginal notes. Before I ever managed to put my notes into any orderly shape, they fell into a state of disarray or went missing altogether. This winter while at Qinghua Yuan 清華園 I lectured on the history of China's traditional literature. When the term was over I took advantage of my free time to have

another look into those old drafts. I was able to set them in order and come up with a fairly voluminous work that I have called *Mojing jiaoshi* 墨經校釋. Probably more than half the time I have taken exception to the theories of Bi Yuan, Zhang Huiyan and Sun Yirang. Nevertheless, were it not for the hard work and diligence of those worthy scholars who have preceded me, how could I ever have been able to note down anything about this work? To be sure, we recognize that the enterprise of scholarship is not anything that can be achieved by a single person in a single generation. Rather, it rests without question on being able to continue the work of one's predecessors. Those respectable men of letters, diligent as they were in regard to their predecessors, and in all cases venerable figures of their age, were broadly learned and exacting in their deliberations. All the same there still remain any number of textual passages for which correct exegeses are yet to be settled and that await the considered scrutiny of later scholars. How else would such a poorly informed and inept bloke such as I dare trust himself to take on this work? If even 40% or 50% of this *jiaoshi* 'critical exegesis' that I have produced is able to be confirmed by the work of future scholars, then I would regard my efforts as richly rewarded.

Lu Sheng in the Preface to his *Mobian* says: "Draw on the *shuo* 'explanation' to get to the *jing* 'canon'; each item will be found to be attached to its respective passage. In doubtful cases, leave it out." I have taken this advice to come up with a meaningful ordering. If we do not take into consideration Lu Sheng's endeavor, would we be able to follow by even one or two footsteps in his tracks?

Lunar New Year's Eve (07 February) 1921.

1.6 Structure and Transmission of the Text

As mentioned above, this study deals with four of the six chapters of the *Mozi* that collectively are often known as the *Mohist Canon*. These four chapters are, specifically, numbers 40–41, titled *Jing* (A & B) 經 (上 & 下), translated as "Canons" and numbers 42–43, titled *Jing shuo* (A & B) 經說 (上 & 下), translated as "Explanations" (*sc*., of the Canons). These, together with chapters 44 and 45 (*Da qu* 大取 and *Xiao qu* 小取, usually translated "Greater, resp. Lesser, Pick"), are regarded as the "logical" or "scientific" parts of the *Mozi*, called *Mobian* 墨辯 in the Chinese tradition. The word *biàn* 辯 'argue' in this title is often taken to suggest a dialectical style, though argumentative or disputatious modes are rarely expressed openly and are mostly at best implicit.

Chapter 40 consists of Canons numbered A 1–A 98, and chapter 41 consists of Canons B 1–B 82.[50] Chapter 42 consists of Explanations A 1–A 98, and chapter 43 consists of Explanations B 1–B 82. There appears to have been one Explanation for each Canon, though in a few cases the Explanation is missing and presumed to have once existed but now is no longer extant. The numbering scheme used here reflects A. C. Graham's editing of the text. Basing himself on earlier work of Bi Yuan 畢沅 (1730–1797) and Liang Qichao, among others, Graham has recognized that the order of the Explanations is very likely original and has accordingly re-ordered the Canons such that the numbering of the Canons matches the numbering of their corresponding Explanations (Graham 1978).

The textual history of the *Mozi* prior to its printing in the Ming Taoist Canon (*Daozang* 道藏) of 1445 is very poorly known, and the received text is notoriously corrupted. The *Daozang* printing of the *Mozi* is generally considered the closest thing to an *editio princeps* extant, in spite of its late date relative to the actual compilation of the text (Graham 1993). This is the version that will be used here, with textual emendations noted as necessary. The "Later Mohist" sections of the text, our focus in the present work, are no exception to the generally corrupted nature of the whole *Mozi* text. In particular the sequence of sections in the received text of the *Jing* "Canon" chapters (40 and 41) is very confused. At some point early in its transmission the text was apparently written in two separate, horizontally divided "panels" across the page, one panel on top and one on the bottom of a single sheet (probably paper, conceivably silk or even bound bamboo slips). It would seem that the intention was to read all of the sections, *i.e.*, canons, of the upper panel *in toto* across before moving to the sections of the lower panel. At some point the text was apparently copied by a scribe who did not recognize this "upper panel—lower panel" arrangement, and simply copied the sections of the text from top to bottom of the whole page, thus inter-weaving the early Canons with the later ones in a confusing shuffle. Individual sections were generally kept textually intact, but the order was corrupted from what must have originally been (top panel:) 1, 2, 3 … 47, 48, 49//(bottom panel:) 50, 51, 52 … 96, 97, 98 to 1, 50, 2, 51, 3, 52 … and so on.

The text of the *Jing shuo* "Explanation" chapters (42 and 43) was apparently not written in such an unusual way and was thus spared from suffering any similar textually disruptive fate. It appears instead to preserve the original section sequence. In a preliminary section of his *Mojing jiaoshi* 墨經校釋, called "Du Mojing yuji" 讀墨經餘記 ("Supplementary notes on reading the *Mojing*"), Liang Qichao recognized that the "head" character of each Explanation was not an integral part of the Explanation statement itself, but instead served simply as a kind of "key word" marker referring to the corresponding Canon, thus providing a link for matching each of the Explanations with its proper Canon (Liang Qichao 1923,

[50] The section numbering scheme used here follows that set out in Graham 1978. In citing the text below, lines marked "C" ('Canon') are always the *Jing* 經 portions of the text from chapters 40 and 41, and lines marked "E" ('Explanation') are the corresponding *Jing shuo* 經說 portions from chapters 42 and 43.

8). The relation between the two parts, Canon and Explanation, seems generally to be what the labels would suggest, *viz*., a kind of canonical definition or proposition, rarely more than a single line, accompanied by an explanation or example which may be anywhere from a few words to several lines long. It is not at all clear, at least to us, why the text was structured with the Canons in separate chapters from the Explanations. And it will quickly become apparent that the notion of 'explanation' is not always as straightforward and useful as we might hope. The brief sketch given here of the nature of the received text and the corruption that it seems to have suffered does not begin to exhaust the extent of textual challenges that this work presents. The comments in the present work regarding textual history and textual corruption and emendation are largely based on A.C. Graham's thorough summary of the pertinent Qing and twentieth-century scholarship, laid out as a part of his own extensive, text-critical study of the work (Graham 1978, 73–110).[51]

The textual emendations that we make, often based on Graham's work, are generally of two kinds, (i) straightforward corrections of what we take to be erroneous characters, *i.e*., characters standing as we see it for incorrect words, and (ii) replacing unconventional, obscure or unattested characters with standard ones when the word intended is not in doubt. Instances of the first category are usually the result of confusion between similar graphs. Those of the second kind are typical of the transmitted *Mozi* overall, a text that is well known for its numerous non-standard characters (relative to the received writing system from the Han period on) generally. As examples of the first kind, at one point in sections A 43 and A 60 the received text writes 但, which is emended in both cases on the basis of intelligibility to 俱; in A 48 the received text writes 庫, which is emended to 運, again on the basis of intelligibility. Both of these can be seen as likely arising from the fact of graphic similarity. As examples of the second, we find in section B 28 the character 剃, conventionally standing for the word *tì* 'to shave off fur or hair', but here used for the word *tī* 'ladder', conventionally written 梯; in the same section we have the word *qū* 'to bend or bow down' (conventionally written 屈) written 軀.

The Mohist text does not explicitly introduce a meta-terminology distinguishing different types of canon, but from a careful scrutiny of the text itself a division into two categories becomes clear. Canons A 1 to A 87 are all about delineating the meaning of terms and may therefore be referred to as 'definitions', and canons A 88 to B 82 usually contain a statement to be explained. Most of these end with the phrase 說在… 'the explanation lies with …'. These are referred to as 'propositions'. The relation between chapters, which are an objective feature of the text, and

[51] No serious research on this text can proceed without taking Graham's scholarship as one of the central starting points, and to be sure that is the case for the work presented here. All the same, the translations and interpretations of specific sections that we give may differ on occasion from Graham's understanding or proposals.

the definitions and propositions, which are identified on the basis of content and formal structure, is as follows:

- Chapter 40 (*jing A* 經上) includes the canon part of sections A 1 to A 98. Of these, A 1 to A 75 are substantive definitions of terms, A 76 to A 87 are definitions limited to different meanings and usages of the words in question, and A 88 to A 98 are propositions.
- Chapter 41 (*jing B* 經下) includes the canon part of sections B 1 to B 82. These are all propositions.
- Chapter 42 (*jing shuo A* 經說上) includes the explanation part of sections A 1 to A 98. Of these, A 1 to A 87 are definitions and A 88 to A 98 are propositions.[52]
- Chapter 43 (*jing shuo B* 經說下) includes the explanation part of sections B 1 to B 82. These are all propositions.

The only significant difference between the A set of Canons and the B set is that all of the B set, save one, end with the summing-up formulaic phrase *shuo zai* X (說 在 X) "the explanation lies with X," and none of the A set has such a line. With respect to the distinction between 'definition' and 'proposition' this means that no definition has the phrase *shuo zai* X and that all propositions have it except those in chapter 40, *i.e.*, A 88-A 98. The X in this phrase is typically a single word or a short phrase that is contained or implied in the corresponding Explanation, and which in the majority of cases the Explanation seems to elaborate on. In some cases it appears to be no more than an illustrative example. We will refer to this X term as the 'cross-reference term' of the section. In view of the fact that the Explanation sometimes elaborates on the cross-reference term, it is possible that the *shuo* 說 of the *shuo zai* X phrase is intended to be understood in connection with the *shuo* 說 of the *jing shuo* 經說 "Explanation" given for each canon, but there is no explicit indication of this.

Graham (1978, 30 and 229–230) proposes to match sequences of definitions with sequences of propositions exhaustively, in an effort to establish a systematic relation between definitions and propositions. In the table here we illustrate Graham's proposed matching, putting sequences of definitions in the left half opposite sequences of propositions on the right half, without committing ourselves to such an interpretation. While the association of particular definitions with particular propositions is obvious in the case of the sections on spatial extent, duration, and motion, it is less so in the case of what Graham calls "the sciences," *i.e.*, definitions on corporeal extension on one side and the propositions on shadows and mirror images and on the vertical tendency of weights on the other. The sequences of sections discussed in this book are printed in bold face.

[52] Because the distinction between definition and proposition is determined on the basis of the canons, it follows that the explanations here and in chapter 43 will conform to this same distinction.

A 1–6: Reflections on reasoning and knowing	A 88–B 12: Procedures for consistent description
A 7–39*: Conduct and government **A 21: Force**	
A 40–51: Spatial extent, duration, and motion	**B 13–16: Spatial extent, duration, and motion**
A 52–69: Corporeal extension	**B 17–24: Shadows and mirror images** **B 25a–29: Vertical tendency of weights**B 30, 31: Problems in economics
A 70–87*: Disputation, terminological distinctions **A 70, 71: Model and criterion** **A 76–87: Terminological distinctions**	B 32–82*: Problems in disputation **B 52, 53, 60–65, 73–75: Propositions related to spatial extent, duration, motion, ironic appearances, modular correspondences and sets**

An asterisk (*) indicates a broken sequence.

Our selection of passages from the Later Mohist corpus for translation and analysis is governed by our interest in the emergence and development of theoretical knowledge and scientific thinking. We are interested in the theoretical knowledge that results from reflections on elementary and practical knowledge about the physical environment, *i.e*., knowledge that stems from experiences within the natural environment and from the handling of cultural, in particular technological, artifacts. Therefore we have selected passages dealing with space, time and motion, materiality, and mechanical and optical devices and arrangements. We have additionally selected the six opening sections of the *Mohist Canon*, dealing with knowledge and related fundamental concepts, since they show the Mohist's attempt to differentiate types of knowledge on the basis of varying conditions. This illustrates the systematicity and the reflected character of the Later Mohist enterprise.

Summing up, we have selected the following 68 sections from the *Mohist Canon* for close study, given here with section numbers following Graham 1978, but with our own descriptive rubric headings:[53]

- A 1–6: *Epistemological foundations*;
- A 21: *Definition of Force*;
- A 40–51: *Spatial and temporal contingency and inevitability;*
- A 52–69: *Corporeal extension ("Geometry")*;
- A 70, 71: *Model and duplicate*;
- B 13–16: *Spatial and temporal contingency and inevitability—Reprise*;
- B 17–24: *Shadows and mirror images ("Optics")*;
- B 25a–29: *Vertical tendency of weights ("Mechanics")*;
- B 52, 53: *Mechanical and temporal bases for judgments*;
- B 60–65: *Spatial and temporal paradoxes, and spatiotemporal and modular correspondences*;
- B 73–75: *Sets of indeterminate or unknown extent*.

[53] A section usually consists of a Canon proper and a coordinated Explanation. In parenthesis we have included A. C. Graham's designation of the sequences of sections (Graham 1978, 229–230).

Additionally, we have included a lexical appendix of 12 sections:

– A 76–87: *Terminological distinctions.*

It becomes clear even from this list that the ordering and grouping of sections appear to be deliberately done by the original compilers of the text. The position of a section within the text therefore often provides useful information on the section's meaning, as we will see throughout our work.

There are about 90 further sections in the *Mohist Canon*, depending on what is considered an integral part of the text, that we have not included in our selection. They are about such things as ethics, economics, sophistry and logic, and government. The fact that we have not included these sections in our selection of translated and interpreted passages does not mean that we do not take them into account in our overall discussion when pertinent. They constitute the closest, immediate context of the selected passages and cannot be ignored when it comes to understanding what the Later Mohists' endeavor was all about. While it would be desirable ideally to include them in a full retranslation of the Later Mohist corpus, the leading questions of this book call for, it seems to us, a more focused approach.

Let us finally present two tree diagrams (Figs. 1.1 and 1.2) showing a hierarchical grouping of sections, linking the sections translated and commented on in the Chap. 3 (on the right-hand side) to their overall topic represented in shaded boxes (on the left-hand side). The topics in the shaded boxes also serve as the section headings of the Chap. 3. The tree diagrams, one for the definitions, the other for the propositions, further testify to the highly structured design of the text, a topic to which we will return in the next chapter.

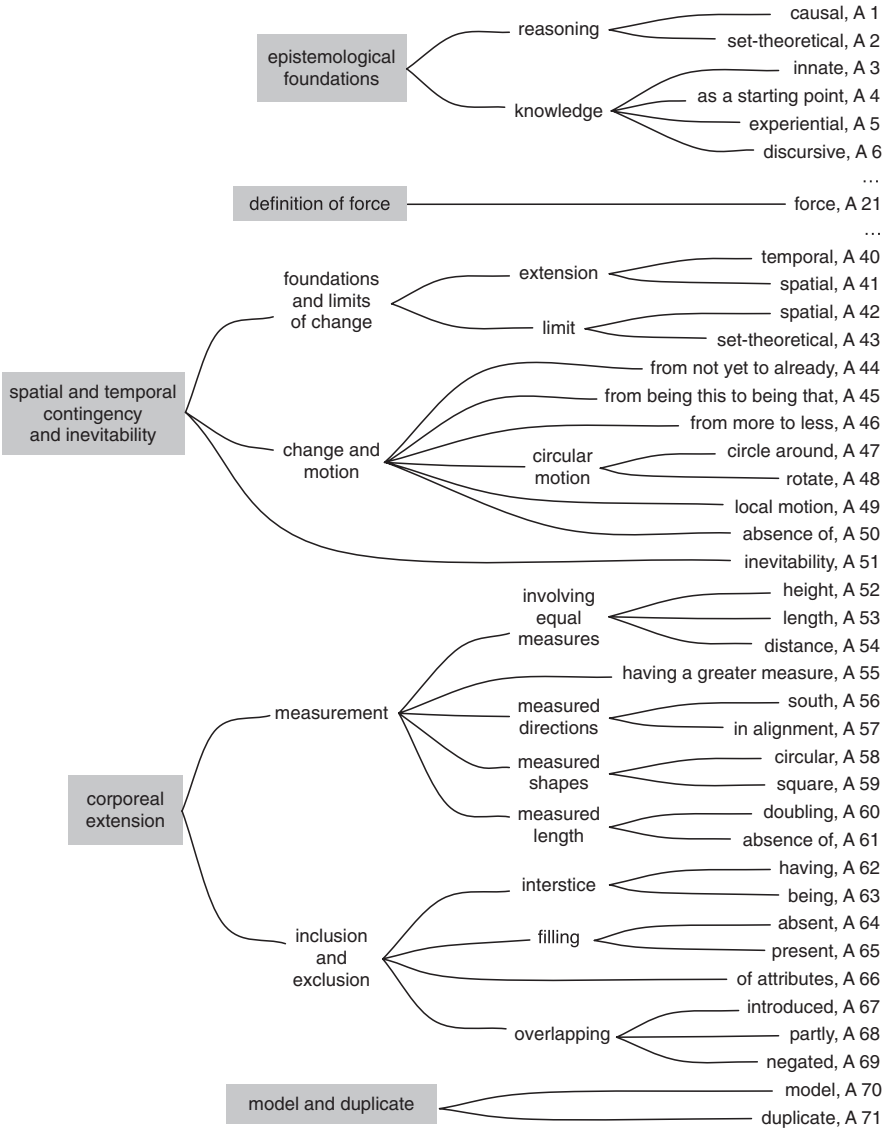

Fig. 1.1 Hierarchical tree chunking the definitions discussed in the following chapters

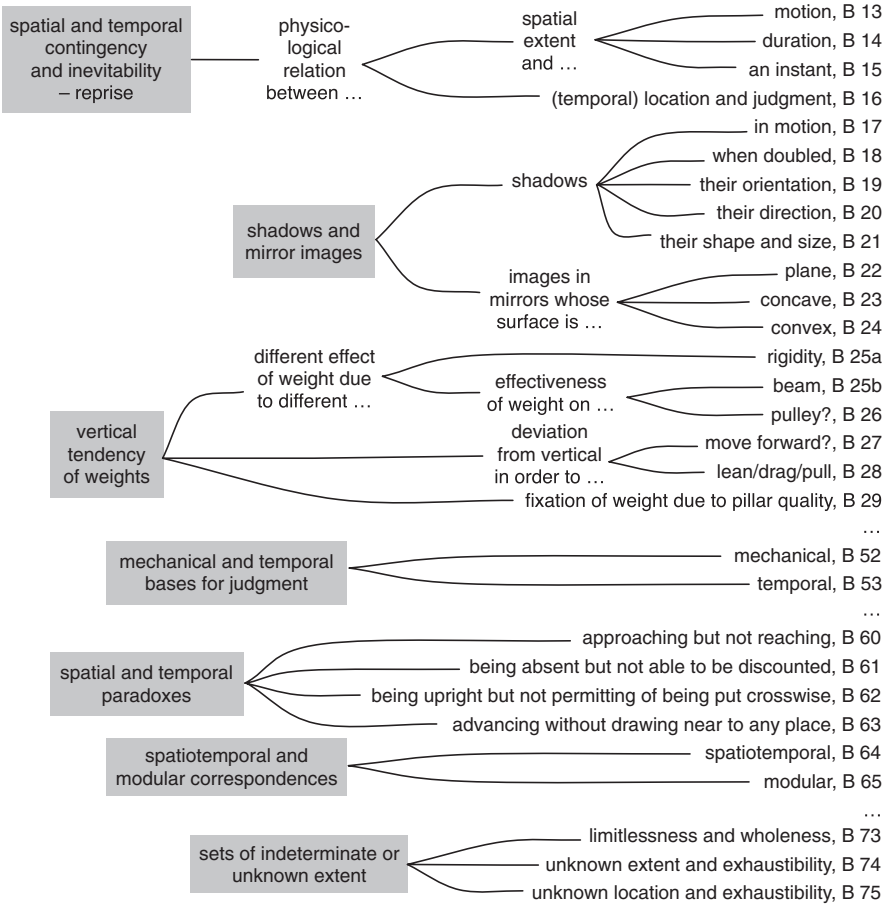

Fig. 1.2 Hierarchical tree chunking the propositions discussed in the following chapters

Chapter 2
The *Mohist Canon* and Alternative Origins of Theoretical Science

Abstract Proceeding from the theoretical considerations presented in Chap. 1, the chapter provides an overall interpretation of the scientific sections of the *Mohist Canon*, which are presented in Chap. 3. We start with a discussion of the theoretical character of the text as it ensues from textual structures. We then discuss the ways the text reflects on different domains of pre-scientific knowledge pertaining to concepts such as spatial and corporeal extension, duration, motion, measurement, model, image and weight, thereby including what has sometimes been referred to as Mohist geometry, mechanics and optics. We compare these reflections to other historical instances of theoretical thinking, mostly from ancient Greek science and philosophy. We conclude the chapter with considerations, following from our textual analysis and intercultural comparisons, on the place of Mohist science in a long-term, global history of knowledge and what it tells us about structural necessities and historical contingencies in the rise of theoretical science.

In the Introduction we have argued that the selected parts of the *Mohist Canon* presented in this book document a particular type of theoretical thinking, that they represent rationalizations of aspects of the perceived world, natural and technical, that bespeak an origin of theoretical science that can be seen as an alternative to and independent of the widely recognized Greek case. In this interpretative chapter we will substantiate this claim by a comprehensive analysis of Mohist science based on the translations and discussions of the sections of the *Mohist Canon* that we set out in Chap. 3 and on the structure of the text overall. In particular, we will make use of comparisons between the Chinese and the Greek case in order to address the question of cross-cultural commonalities and historical and cultural contingencies in the origin of theoretical science. The *Mohist Canon* can be understood as reflecting this kind of theoretical thinking in two complementary ways, through the hierarchically structured nature of the text itself and through the knowledge evident in the sequences of individual sections as they are presented in this work. Our analysis of these two features of the *Mohist Canon* taken together suggests an origin of theoretical science different from and entirely independent of what we know from the classical West.

M. Schemmel, W. G. Boltz, *Theoretical Knowledge in the* Mohist Canon,
Archimedes 63, https://doi.org/10.1007/978-3-031-08797-4_2

2.1 Structure and Theoretical Character of the Scientific Sections in the *Mohist Canon*

The most obvious structural feature of the *Mohist Canon*, as we have sketched in the Introduction, is the division into Canons proper and matching Explanations. The Canons either provide a definition or state a proposition. Sections A1 to A 75 comprise the definitions; sections A 88 to B 82 comprise the propositions. All definitions start with a *definiendum* of one or two characters in length, followed by a short *definiens,* sometimes as short as a single character, and end with the particle *yě* 也. Sections A 76 to A 87 constitute a kind of "lexical appendix" to the definitions, exemplifying not just the different meanings of words with more than one usage, but also drawing attention to the semantic scope of words that play a central role in the whole Later Mohist enterprise (see Graham 1978, 323–336). They may thus be counted to belong to the group of definitions, but because their content is chiefly lexical, not scientific, we have not included the sections in the main part of our study, but dealt with them separately in the Lexical Appendix (Chap. 4).

The prominent role of definitions in the text is a clear indication of its theoretical character. The attempt to delineate meaning is an act of reflection on the meaning of the terms. Even though modern deductive systems such as Hilbert's axiomatic formulation of Euclidean geometry completely dispense with explicit definitions, still we may argue that definitions are the most crucial ingredient in the emergence of deductive thinking seen in ancient texts (Lefèvre 1979, 301). While at first sight the presence of proofs may seem more crucial to the emergence of deductivity than that of definitions, to be part of a deductive system, proofs have to be closed, *i.e*., they have to be anchored in statements that are also part of the deductive system and that are not themselves amenable to proof. This closure is thus achieved by definitions, and, when present, axioms or postulates.[1]

The Explanations, which match the Canons, are a structural element of the text that further underlines its theoretical character. One function of the Explanations is to introduce conceptual distinctions beyond those stated in the Canons. For example, in B 25a the Canon says simply "Bearing but not being deformed." The Explanation expands on this and explains the different behavior of beams and ropes under a weight (*zhòng* 重) by introducing the concept of *jí* 極 'rigidity', thus refining the conceptual tools to describe the varying effects of a weight (極勝重也 "the rigidity prevails over the weight"). There are particularly interesting cases where the new concept is expressed as the negative mode of a term already defined and becomes an independent technical term. For example, Canon A 44 始 says: "*shǐ* 'beginning' pertains to time." The explanation recapitulates the association of 'time' with 'duration' seen already in A 40 久 and introduces further the distinction between 'duration' and 'lacking duration' 無久. Up to now the term 'lacking duration' has not been introduced in the text. Here it is used as a concept in its own right,

[1] The importance of anchoring scientific proof in non-demonstrable premises is emphasized in Aristotle's *Posterior Analytics*, 72b; Aristotle 1989, 37–41.

not merely as the absence of duration. The last line of the explanation, "The 'beginning' corresponds to [the case of] not having duration," (始當無久) shows this clearly. The importance of the concept 'lacking duration' is further highlighted by its use in A 50 止 discussing motion and rest in relation to 'duration' and 'lacking duration', and its use in B 15 as the concept that when paired with 'spatial extent' is of the 'hard-and-white' type (無久與宇堅白 "The relation between 'being without duration' and 'spatial extent' is of the hard-and-white type"). A parallel case occurs in the definition of 'having a limit' A 42 窮 where the Explanation introduces the term 'lacking a limit' 無窮, which is then further used as a concept in B 61, where it refers to the temporal limitlessness of the fact of something having happened (有之而不可去 "having had it, then it cannot be disposed of"), and in B 73 which argues that the elements of unbounded sets can be exhausted (無窮不害兼 "being without limits is not detrimental to being a composite whole").

Very often the Explanation provides an elaboration on the statement of the Canon. For instance, the Canon of A 46 損 defines *sǔn* 'lessening' as "partially removing." The Explanation then elaborates on what 'partially' means by stating that "to be 'partial' is to be an element (*tǐ* 體) of a composite whole (*jiān* 兼)," thereby making the section a part of a systematic concern with sets. It further identifies what remains, after having had some elements removed, as the 'lessened' object. It therefore makes clear that the partialness in question pertains as much to what remains as to what is removed. The Canon A 51 必 defines *bì* 'being inevitable' straightforwardly as "being unstoppable." The Explanation introduces logical inevitability with the example of the pair 'elder brother/younger brother', thus showing a further understanding, to wit, the existence of an elder brother logically means there is a younger brother (*more sinico*). Secondly, it sets out the complementary pair of either 'being this' or 'not being this' as a case of the inevitability that arises from the law of the excluded middle. Later in the text, *bì* 必 is further used in relation to empirical inevitability. In B 25b, for example, it says that if you add a weight to one side of a beam, that side will inevitably drop down (必垂).

For propositions the Explanation often expands on the cross-reference term (the X of the *shuō zài* 說在 X summing up phrase of the Canon). Thus, the Canon of B 64 reads: "Traveling a long distance takes a long time. The explanation lies with 'earlier and later'"(行脩以久, 說在先後). The Explanation then explicitly expands on the meaning of 'earlier and later' by stating that the pair of terms has to do with temporal duration, and that "when people travel a long distance they inevitably take a long time" (民行脩, 必以久也).

In the sections on optics and mechanics (B 17–29) the Explanation often provides an exposition of the physical arrangement and behavior involved, but typically fails to describe in detail the apparatus that accounts for these things. The Canon of B 19, for example, states somewhat vaguely that a shadow will turn upside down at some point in conjunction with which it elongates. The Explanation lays out a specific arrangement referring to light emanating "like arrows shot from a bow" (入煦若射) and casting shadows above or below, depending on where it enters. It then identifies the point at which the shadow turns upside down, but does not include any

information on the physical set-up that produces this effect, leaving the description overall somewhat wanting.

Graham (1989, 138) speculates that the Canons were learned by heart while the Explanations "were probably jotted down from teachers' oral explanations" of the Canons. While this must remain a speculation, it is undeniable that the division into Canons and Explanations shows a systematicity that clearly underlines the theoretical character of the text. Because the Explanations elaborate, differentiate and substantiate the statements in the Canons, they deepen and widen the conceptual network and scope of Mohist science, which in many cases would remain obscure if we had to rely on the Canons alone. The language of the Explanations remains as succinct and as formal as that of the Canons proper. There are no extant texts known from the Warring States period with language that can readily be recognized as "jottings," that is, as informal notes casually appended to a text. It is difficult to see how the Explanations could have arisen in their present form simply as teachers' notes "jotted down" to serve a passing didactic or disputational purpose. If Graham is right about their origin, then what we have in the text is likely to be a very much revised form of those jottings. And to the extent that revision implies reconsideration and re-thinking, the Explanations would represent a kind of concise analytical commentary.

The definitions provide a basis for consistent use of words in reasoning. The defined terms often but not necessarily figure in the propositions. The Mohists seem to have thought of establishing definitions as a virtue in itself. The fact that about half of all sections are definitions indicates that they are not merely preparatory with respect to the propositions, but constitute a contribution to the later Mohist dialectical endeavor in their own right. If the whole text is understood as providing a basis for consistent reasoning, the definitions form an important part of this. That they are also of use in the propositions formulated in the text is a consequence of and evidence for their overall import.

The propositional sections chosen here for translation display some of the terms defined in the first half of the canons, namely *gù* 故 'basis' (A 1), *tǐ* 體 'element' (A 2), *zhī* 知 'knowing' (A 5), lì 力 'force', *jiǔ* 久 'enduring' (A 40), *yǔ* 宇 'spatial extent' (A 41), *qióng* 窮 'reaching a limit' (A 42), *jìn* 盡 'to be exhaustive' (A 43), *yùn* 運 'rotating' (A 48), *zhǐ* 止 'remaining fixed' (A 50), *bì* 必 'being inevitable' (A 51), *zhōng* 中 'center' (A 54), *zhí* 直 'to be straight' (A 57), *duān* 端 'end-point' (A 61), *yíng* 盈 'filled out' (A 65), *jiān bái* 堅白 'hard-and-white' (A 66) and *fǎ* 法 'model' (A 70). In some cases, the propositions offer further considerations on terms defined in the first half of the text, *e.g.*, in B 13, where the term *yǔ* 宇 'spatial extent', already defined in A 41, is elaborated on by use of the terms *xí* 徙 'shifting about' (宇或徙 "'spatial extent', [allows for] a shifting about somewhere") and *zhǎng* 長 'expand', (說在長 "the explanation lies with 'expanding'"), neither of which has been defined but that recur in a number of other sections. Sometimes the elaboration involves explicitly relating these terms to further defined terms, *e.g.,* in B 14 where *yǔ* 宇 'spatial extent', *jiǔ* 久 'duration' and *jiān bái* 堅白 'hard-and-white' are all used in conjunction with one another: 宇久不堅白 "(The relation between) 'spatial extent' and 'temporal duration' is not of the hard-and-white type."

B 15 immediately following uses the same technical terms in very much the same way in connection with *wú jiǔ* 無久 'being without duration', which is itself established as a technical term in A 44 as we have mentioned above.

Besides these few cases in which the understanding of some defined terms is directly elaborated on, the propositions mainly introduce new topics. In this, they may clarify the relation between terms not previously defined, *e.g.*, B 26, which contrasts *qiè* 挈 'pulling up' and *shōu* 收 'letting down':

C: 挈與收反 …
C: Pulling something up in conjunction with letting something gradually down are the reverse of each other. …

E: … 挈: 長重者下, 短輕者上。上者愈得, 下者愈亡。繩直, 權重相若, 則止矣。收:上者愈喪, 下者愈得。上者權重盡, 則遂。
E: … Pulling something up: The long and heavy is below, the short and light is above. The more the one above gains, the more the one below loses. When the cord hangs straight and the effectiveness and the weight match each other, then it would remain fixed. Letting something down gradually: The more the one above loses, the more the one below gains. If the effectiveness and the weight of the one above are exhausted, it drops.

As the text is handed down to us there is no formal proof of any proposition anchored solely in the definitions, and there probably never was. At the same time there are central technical terms used to explain phenomena described in the propositions that are not found in the definitions. Examples are *quán* 權 'effectiveness' (B 25b and B 26) or *jí* 極 'rigidity' (B 25a). There are also defined terms that are not made use of in the propositions, *e.g.*, *lú* 櫨 'king-post' (A 64). But defined terms are used in propositions, in some places so systematically, that the respective Explanation comes close to formal proof. The Explanation of B 73: 無窮不害兼 "being without limits is not detrimental to being a composite whole," is probably the best example. Both the Canon and the Explanation explicitly include the formal feature of claiming a statement and its negation with no possibility of a third option (*tertium non datur*). At the same time the explanation of B 73 also includes an explicit rebuttal to the ostensible *tertium-non-datur* claim that had been made. The argument is expressed in terms previously defined in the text, *viz.*, *qióng* 窮 'reaching a limit' (A 42), *jìn* 盡 'to be exhaustive' (A 43), *zhī* 智 [*sic*] 'knowing by direct contact' (A 5, 知), *yíng* 盈 'filled out' (A 65), and *bì* 必 'inevitable' (A 51). In particular, the use of the word *bì* 必 'inevitable' is consistent with the definition in A 51, indicating logical necessity. Additionally, the first part of the Explanation presents a claim, using the term *bèi* 誖 'self-contradictory, fallacious', intending to refute a Mohist tenet, a claim that is then successfully rebutted by the Mohist. As we mentioned in the Introduction (fn. 13), the use of the term *bèi* 誖 suggests a philosophical, or logical rigor not often found in other texts from this period.

Among Graham's proposed matchings of sequences of definitions with sequences of propositions (Graham 1978, 30 and 229–30), the set of propositions B 13–16 paired with definitions A 40–51 seems to show the clearest relation between

definition and proposition generally. Propositions B 13–16 follow closely the topic of the co-ordinated definitions on spatial and temporal contingency and inevitability seen in A 40–51. B 16 in particular introduces a distinguishing criterion related to time by which a statement is true in one case and false in another, thus fitting the topic of temporal contingency neatly. Although the propositions B 17–29 do not directly build upon the terms defined in A 52–69, Graham, all the same, argues for a match between these two parts of the text. The category under which both of these sets of definitions and propositions are subsumed he calls "explaining objects (the sciences)" (Graham 1978, 30). He labels the definitions A 52–69 "geometry" and the set of propositions B 17–29 "problems in optics [and] mechanics" (Graham 1978, 230).[2] Although these passages all deal with situations in the material world that in many cases come about through the use of instruments, Graham's matching is imperfect and not without some question in that the definitions relate to instruments of measurement and construction (measuring rod, compass, carpenters' square, gnomon), but the propositions deal with optical instruments and arrangements (pin hole, flat, convex and concave mirrors, and possible shadow theaters) or material arrangements with ropes, beams, and stones, involving mechanical devices such as levers and probably pulleys.

In view of the above it is clear that the *Mohist Canon* is not a fully-fledged deductive text. While there clearly are the rudiments of deductive argumentation, unlike in most parts of Euclid's *Elements* or in Archimedes' *On the Equilibrium of Planes*, there is no strict deductive buildup here. This absence should not be allowed to suggest that the text does not in fact have a genuinely solid theoretical structure. The separation of the text into definitions and propositions is only the first of a hierarchical structure of subdivisions that reaches down to the level of pairs of sections. (See the hierarchical tree of topics in the Introduction; Figs. 1.1 and 1.2.) The ordering, grouping and sequencing of sections renders the *Mohist Canon* a very finely structured text, even if this structure is only very partially a deductive one. By way of ordering, grouping and sequencing, definitions and propositions are put in thematic contexts, their similarities and distinctions are highlighted, and novel relations established that otherwise would have likely gone unnoticed. First of all, the overall ordering of the groups of sections appears not to be random. These are what we identified as thematic sequences in the Introduction and according to which we grouped our translations and discussions, beginning with *Epistemological foundations* and ending with *Sets of indeterminate or unknown extent*. That the discussion of spatial extension and duration as general terms precedes that on the corporeal aspects of extension, for instance, is likely to be a deliberate choice, because the former is a reflection of intuitive knowledge, while the latter reflects on the knowledge obtained in the use of certain instruments, a development that builds upon intuitive knowledge. By the same token, the placement of the fundamental epistemological definitions at the very beginning of the entire work seems to be

[2] Graham 1978 includes sections B 30 and B 31 ("economics") in the sciences section of propositions. We have omitted this part of his label.

deliberate, given the obvious overall concern with the basis for knowledge and its relation to rigorous reasoning.

Thematic sequences of sections can be further subdivided. The first five of the optical sections (B 17–21) are on shadows, the last three (B 22–24) on mirror images. 'Shadows' and 'mirror images' are both designated by the same character 景 (which may have been read [in modern pronunciation] *yǐng* or *jǐng* depending on which meaning was intended; the writing system is ambiguous in this respect), formally grouping all eight optical sections together. Similarly, the first six sections on epistemological foundations can be seen to fall into two subgroups, A 1 故 *gù* 'basis' and A 2 體 *tǐ* 'element' deal with basic structures in reasoning, and the following four, A 3 知 *zhī* 'knowing', A 4 慮 *lǜ* 'thinking', A 5 知 *zhī* '(acquired-) knowing', and A 6 恕 *zhì* 'wisdom', describe types of knowing. Sections A 44–50 all deal with change; sections A 47–50 deal in particular with motion as change of place or position, and with rest as the absence of motion. Subdivisions can be identified down to the level of pairs of contrasting or parallel sections. Temporal and spatial extensions, for example, are defined in precisely parallel language, A 40: 久, 彌異時也 "*jiǔ* 'enduring' is spanning different times," A 41: 宇, 彌異所也 "*yǔ* 'spatial extent' is spanning different places." In the same way it seems not to be a coincidence that A 47 and A 48 occur in sequence, the first defining revolving and the second defining cyclical rotating, A 47: 儇, 稆秖也 "*xuán* 'circling around' is coiling and curving," A 48: 運, 易也 "*yùn* 'rotating' is switching from one to another."[3] Graham points out that the two Canons A 47 and A 48 "make a pair with contrasted definitions" and that "phonologically" 運 *yùn* < ***N-q**$^{\mathrm{w}}$**ins** 'rotate' is related to 圓/員 *yuán* < ***G**$^{\mathrm{w}}$**ren** 'round' (Graham 1978, 297, using earlier OC reconstructions). To these two we can add the A 48 word 儇 (旋/還) *xuán* < ***s-g**$^{\mathrm{w}}$**en** 'circling around'. In the everyday language of Warring States period texts 儇/旋/還 *xuán* means 'revolve, circle, turn or whirl around' and 運 *yùn* means 'rotate, spin', as *e.g.,* of a potter's wheel (*cf.* 均/鈞 *jūn* < ***q**$^{\mathrm{w}}$**in** 'potter's wheel'). It seems that the juxtaposition of these two sections here, in view of the explicit sense of 'switching' expressed by the definition 運, 易也 in A 48, is intended to bring the difference between these two kinds of circular motion sharply into focus, 'revolving and curving around' on the one hand *vs.* 'rotating about an axis or in a fixed cycle' on the other.[4]

Often the overall succession of sections proceeds through different aspects or levels of abstraction and varies a certain theme accordingly. Thus, the theme of

[3] The text of the Canon of A 47 is reconstructed and speculative, see the discussion in the textual notes to A 47.

[4] If the three words 運 *yùn* < ***N-q**$^{\mathrm{w}}$**ins** 'rotate', 圓/員 *yuán* < ***G**$^{\mathrm{w}}$**ren** 'round' and 儇/旋/還 *xuán* < ***s-g**$^{\mathrm{w}}$**en** 'circling around' are in fact related, we then have a "word family" characterized by a phonological archetype {labio-velar or uvular initial, **–in** ~ **–en** rime}. Whether the words are cognates or morphologically derived from an underlying word root is difficult to say, but we can recognize that the word family itself includes many more members, *e.g.*, 淵 *yuān* < ***??**$^{\mathrm{w}}$**in** 'whirlpool', 渾 *hún* < ***N-qq**$^{\mathrm{w}}$**ən** ~ 混 *hùn* < ***N-qq**$^{\mathrm{w}}$**əns** 'roiling, swirling', 圍 *wéi* < ***G**$^{\mathrm{w}}$**əj** 'to encircle', 衛 *wèi* < ***G**$^{\mathrm{w}}$**əjs** 'to circumambulate, circle around, revolve' and 回 *húi* < ***GG**$^{\mathrm{w}}$**əj** 'return'.

change is varied from A 44 through A 51. Change is regarded first with respect to something beginning, emphasizing its punctual character (A 44 始當無久 "The 'beginning' corresponds to [the case of] not having duration"), then with respect to the features of something being transformed (A 45 化徵易也 "'transforming' is when the set of identifying features switches from one to another"), and next with respect to the amount in something being lessened (A 46 損偏去也 "'lessening' is partially removing"). Sections A 47–50 treat change in place or position, as mentioned above. Finally, the sequence turns to the logical realm, discussing inevitability (A 51 必). From this last move it becomes clear that the discussion of change is to be understood as an exploration of what may vary over time and space, while certain inferences are inevitable and therefore apply invariably. Since every section contributes to the immediate context of a sequence, a single section can bring into focus an unexpected connotation for a whole series of sections, as happens with the section on 'inevitability' readjusting the meaning of the whole sequence on space, time, motion and change (A 40–51).

One feature of the ordering of definitions that does play into the deductive aspect of the text is that when defined terms are used in the definition of another term, they are, as a rule, defined *before* such use. Among the sections selected for translation the only violations of this rule, in fact, pertain to defined terms used in the Explanation of a definition, but never in the Canon. Thus, *duān* 端 'end-point', defined in A 61, is used in the Explanations of A 1 故, A 2 體 and A 60 倍 (and by conjecture in that of A 55 厚), but not in their Canons; *dòng* 動 'moving' defined in A 49 and *zhǐ* 止 'remaining fixed' defined in A 50 are used in A 43 盡, but only in the Explanation. Use of a previously defined term in a later definition, by contrast, occurs 25 times in the selected sections, and in 12 of these cases the term is used in the Canon. In some cases we see clear instances of a systematic progression of definitions. Thus, *jìn* 盡 'to be exhaustive', defined in A 43, is used in the definition of *tóng cháng* 同長 'of the same length' (A 53): "'of the same length' means that by being laid straight (next to each other) each exhausts the other" (同長, 以正相盡也). This in turn is used as the definition of *zhōng* 中 'center' (A 54): "'center' implies being of the same length" (中, 同長也), *i.e.*, being of the same length from a common starting point. The pair A 53 and A 54 are then the basis for the definition of *yuán* 圓 'circle' in A 58: "'circle' implies being of the same length from a single center"(圓, 一中同長也).

If we allow ourselves to interpret the first two sections (A 1 故 and A 2 體) as an indication of the Later Mohists' reflection on their own methods, we could say that the first implies establishing a basis by defining certain terms and formulating conditions under which something may come about, and then, on this basis, being able to argue for further definitions and propositions, as is the case generally in deductive reasoning. This is consistent with the idea of a *gù* 'basis' as "what must be the case before something will be achieved" (A 1 故). The second section, by contrast, emphasizes the holistic aspect of knowledge, "*tǐ* 'element' is a part of a composite whole" (A 2 體). Each Canon can be viewed as an element in a larger set, and sets of Canons can be viewed as elements in even larger sets, thus reflecting the hierarchical grouping of sections in the text. These two sections taken in tandem may

suggest alternative, but not necessarily mutually exclusive, approaches to structuring knowledge; A 1 reflects a form of argument based on premises and precedents, A2 reflects reasoning on the basis of compositional relations.

All these relations among the sections reveal a complex network of interrelated concepts. This network character of the text turns words taken from everyday language or from the more specific language of particular practices into theoretical terms.[5] While the terms inherit part of their meaning from their original everyday use and practical contexts, the meaning is modified by being detached from concrete action and being relocated within the conceptual structure making up Later Mohist theoretical thought. Theoretical demands such as consistency, comprehensiveness, and the resolution of paradoxes give rise to differentiations and specifications of terms alien to their everyday counterparts. In particular, certain aspects of the original meaning of the terms may be abstracted or made absolute. Thus, while in everyday usage *duān* 端 denotes an extremity or a tip of something, which may be regarded simply as a very small thing, the *duān* 端 'end-point' introduced in the *Mohist Canon* is infinitely small: it is explicitly defined in A 61 as having no dimension, "'end-point' is the element that, having no magnitude, comes foremost" (端, 體之無厚而最前者也). This meaning is clearly a consequence of theoretical understanding of the term, a theoretical "artifact," so to speak. It is often employed with exactly this sense. For instance, in the definition of *cì* 次 'contiguous' (A 69) as "having no interstice but yet not overlapping," it is stated that this is only possible "because the end-point has no magnitude" (端無厚而後可). The meaning of the theoretical terms is thus closely related to the specific forms of knowledge involved: the forms of knowledge reflected upon and the theoretical knowledge generated in this reflection. This is what will be discussed in the following section.

2.2 Theoretical Knowledge in the *Mohist Canon*: Foundations and Elementary Structures

As we discussed in the Introduction, the scientific sections in the *Mohist Canon* represent theoretical reflections on elementary and instrumental forms of knowledge, *i.e.*, knowledge attained through everyday experiences in the natural and technical environment. But the first six sections of the text (A 1–6), which we have included in our selection, present us with reflections of a different kind. They are meta-reflections on the structure and typology of knowledge itself. They thereby constitute a set of "starting points" for the processes of reasoning and argument that underly the subsequent individual passages. Above we have explained how the first two sections, defining a 'basis' (*gù* 故, A 1) and an 'element' (*tǐ* 體, A2), can be understood as describing the two fundamental structural features of the text, the anchoring of arguments in a basis, in previously established statements, and the

[5] See Schemmel 2019.

hierarchical grouping of sections, turning them into elements of thematic sets. But at the same time they describe fundamental structures of human reasoning broadly.

The *gù* 故 'basis' can be understood to refer to any knowledge from which further knowledge can be derived. This may pertain to logical argument, as with inferences drawn on the basis of certain established knowledge. But it may also pertain to the experiential world, where the basis would designate a cause or condition necessary for something to come about. That both meanings are implied is suggested by the usages later in the text of *bì* 必 'inevitable', a term central to the Explanation of A 1. According to that Explanation, a basis can take either of two forms, *viz*., a minor basis, which recognizes an element occurring in an argument without entailing any inevitability of the conclusion, or a major basis, where having a particular element guarantees a certain outcome. The basis as something that must be obtained before a certain thing can come about is thus immediately differentiated with respect to inevitability. The term *bì* 必 'inevitable' may refer to empirical consequences as well as to logical implications, as highlighted in our discussion of section A 51. The causal interpretation of the 'basis' is further corroborated by section A 77 of the lexical appendix, in which *gù* 故 is explicitly listed as a kind of *shǐ* 使 'causing': "being moist is a 'basis'; one inevitably expects the completion of what it brings about" (濕, 故也。必待所為之成也), even if that completion is not inevitable. The 'basis' may therefore be understood as indicating a 'precedent', in the sense of something that must come first, logically or causally.

The second fundamental structure of reasoning introduced at the very beginning of the text is that of identifying an 'element' (*tǐ* 體) as a single component of a multi-component structure. The important point is that an element is not simply a single item in isolation, but is understood fundamentally as an item in some relation with other items, a part in a composite whole. The basic insight that individual things can be put together to obtain composite things, or can be decomposed into building blocks appears to be a very elementary knowledge structure. Yet, the examples given in the Explanation of A 2 point to a more technical understanding, presupposing arithmetics and some type of geometry. The first example, "one of two" (二之一) may simply refer to the fact that either one of two things that make a pair can be considered an element. But it may also refer to the unit, which is contained in the number 'two', and thereby point to the composite character of the natural numbers as aggregates of the unit, as they are defined in definition 2 of book VII of Euclid's *Elements*:

> A number is a multitude composed of units. (Euclid 1956, Vol. 2, 277)

The other example is that of the end-points on a measuring rod (尺之端). Having end-points has just been used in A 1 as an example for an element being a 'minor basis', probably because having end-points is a necessary precondition for something to be a measuring rod, but that alone does not necessarily imply being a measuring rod. The use of the end-point as an example in A 1 as well as A 2 shows that the basis-consequence structure of A 1 and the element-whole structure of A 2 are not mutually exclusive, but complementary aspects of relations. The use of the end-point as an example, which is a theoretical entity as we have argued above, makes

clear that the term ‘element’ not only refers to components that may be taken apart in the real world, but also to the elements resulting from intellectual analysis, thus underlining the theoretical character of the concept. We will come back to the particular type of geometrical and set-related knowledge documented in the *Mohist Canon* later. Here we want only to point out that the way these examples, which in some respects can be seen as mathematical, are used in the Explanations of the first two sections shows that this knowledge serves the Mohist as a tool for his wider analysis of reasoning and language and as a model for rational discourse in general.

In our translation we inevitably have recourse to theoretical terms that come with their own semantic history. While the term ‘element’ in its mathematical connotations appears strikingly appropriate to translate *tǐ* 體, another connotation of that term, closely related to the first one in ancient Greek philosophy, namely that of an immutable building block of the natural world, something everything is made of, such as atoms or the ‘four elements’ of Empedocles and Aristotle, appears to be absent from the Mohist concept. This is a first indication of a deep-lying difference between Mohist and ancient Greek science to which we shall come back.[6]

The four sections A 3 through A 6 identify four specific kinds of ‘knowing’ and ‘thinking’, one building on another: innate knowledge; thinking (on the basis of one’s previous knowledge); experiential knowledge (acquired on the basis of one’s previous knowledge); and a kind of knowledge that comes about from the first three coupled with discussion and reflection. The sequence of sections shows that the Mohists were not only concerned with reflections on certain concrete parts of knowledge, but with a meta-reflection on knowledge itself. Within this four-part buildup of the semantic field of ‘knowing’ and ‘thinking’, the *Mohist Canon* generally seems to represent the discursive, reflective type of knowledge described in A 6, based on the innate and experiential knowledge described in A 3 and A 5. The passages thus document a reflective awareness of the epistemic function of the text, a function that we describe as theoretical. The fact that the entire *Mohist Canon* opens with the considerations set out in these six sections suggests that the purpose was an effort at a systematic reflection on what can be known about how to use language, about how to act and about behaviors in the natural and technical world.

It may be tempting to further identify the *Mohist Canon*’s description of innate and experiential knowledge with our categories of elementary and instrumental knowledge, respectively, explained in the Introduction. But it is important to note that both elementary and instrumental knowledge draw from experience, even though large parts of elementary knowledge are built up early in ontogenesis, and there is usually no awareness of their experiential origins. While for instrumental knowledge the experiential origin is often obvious, because it is only acquired when handling certain cultural artifacts, only modern developmental psychology is able to investigate the role of experience in the construction of our elementary structures of knowledge. For this reason it may be that in some instances what we here describe

[6] On the relation between the mathematical and philosophical use of ‘elements’, see Damerow and Lefèvre 1981, 127–132.

as elementary knowledge is what the Mohists would have conceived of as innate knowledge; see A 3 知材也 "*zhī* 'knowing' is an innate capacity".

This applies in particular to the concepts of time and space. Fundamental structures of our temporal and spatial cognition, such as extendedness or the existence of motion, clearly form part of our elementary knowledge structures. The human ability to form sequences of actions and events in one's mind, the ability to comprehend motion, and the ability to coordinate sequences and motions with each other are all developed in the process of growing up. More complex aspects of the concepts of time and space, in particular concepts of duration and of simultaneity, are constructed from these basic abilities. Elementary knowledge structures are closely linked to action and perception and usually remain unconscious. Yet, they may become externally represented in language or other human means of expression. To begin with, the everyday terms are confined to the concrete contexts of action from which they originate. But under specific societal circumstances they may become the starting point for systematic reflections.[7]

We see this documented in the *Mohist Canon*, A 40, where *jiǔ* 久 'duration' is defined as "spanning different times" (彌異時也), thereby rendering explicit the extendedness implied by the everyday term *jiǔ* 久 'lasting a long time'. By using the verb *mí* 彌 'to span, spread (over, out, through)' to correlate different times, the extendedness of duration is indicated unambiguously. The term *shí* 時 'time' itself can have either punctual or extended meaning. In the following section A 41, this concept of duration is immediately complemented by that of *yǔ* 宇 'spatial extent'. The extendedness of space is made explicit by defining *yǔ* 宇 as "spanning different places" (彌異所也), again using the verb *mí* 彌, perfectly parallel to the temporal case.

The definitions of duration and of spatial extent thus not only document a reflection on the extendedness of time and space, but also show the Mohists' awareness of a close relation between spatial and temporal concepts. The use in both cases of the verb *mí* 彌 clearly indicates that the Mohist conceives of space and time as comparable entities in that both are extended.[8] What is the origin of seeing a parallelism between duration and spatial extent? In fact, a certain parallelism between spatial and temporal concepts appears to be a universal aspect of elementary knowledge.[9] Thus, spatial metaphors used for temporal designations in everyday language are a

[7] Pioneering empirical and theoretical work on the ontogenetic development of these fundamental structures of cognition has prominently been pursued by Jean Piaget and his collaborators, see for instance Piaget 1959, and more specifically Piaget 1969 on the concept of time and Piaget and Inhelder 1956 on the concept of space. The role of external representations in processes of reflection on these knowledge structures and the significance of these processes for a historical understanding of knowledge development has been worked out and discussed by Peter Damerow, see for instance Damerow 1996. This historical-epistemological approach as applied to the concept of space is further developed and discussed, with more references to the literature, in Schemmel 2016.

[8] The use of the verb *zài* 在 'to be located' in a temporal context later in B 14 and B 16 further underlines this parallelism.

[9] See the literature cited in Boltz and Schemmel 2016.

cross-linguistic phenomenon.[10] Extension, which functions as the unifying aspect of space and time in the Mohist sections under consideration, is probably the most basic structural similarity between space and time (Galton 2011). While on the level of elementary knowledge, such unifying aspects remain implicit, enabling, among other things, spatial metaphors for temporal ideas, it is a typical aspect of theoretical knowledge that such structural parallelisms become explicitly addressed on the level of technical terminology. The universal character of the underlying cognitive structure explains why we can find parallel cases of its expression in theoretical texts from other historical societies. Such a parallel case can be found in Aristotelian discussions of space and time. In his *Categories* (4b, 24–25; Aristotle 1983, 36), for instance, Aristotle describes time and place, which we may take to mean space in the respect under discussion, as quantities related by the fact that they are both continuous, an attribute that presupposes extension.

In A 40 and A 41, the Mohists address the parallelism between time and space by explicit juxtaposition of similarly constructed definitions. In later sections they further establish explicit argumentative connections between the defined terms for duration and spatial extent, in particular connections relating to motion. Thus, the Canon of B 13 establishes a relation between motion and space, "'Spatial extent' allows for a shifting about somewhere" (宇或徙), and the Explanation describes expansion as a kind of motion that implies the further occupation of space, "expanding is shifting about and thus occupying further spatial extent" (長徙而又處宇). The phrase *huǒ xǐ* 或徙 'shifting about somewhere' used in that context, is exactly the one by which *dòng* 動 'moving' has been defined in A 49. In B 14 the discussion of the relation between spatial extent and duration is then elevated to a more abstract level, when it is stated that this relation is not of the hard-and-white type (宇久不堅白). We understand *jiān bái* 堅白 'hard-and-white', defined in A 66, as a technical term for the separate recognition of independent, but mutually pervasive properties. While in earlier sections it is applied to attributes of extended bodies (see the discussion below), it is here applied to the fundamental concepts of temporal duration and spatial extent themselves. To answer the question why this relation is not of the hard-and-white type, the Mohists first assert in B 14 that spatial extent, referred to by the phrase 'south and north', exists in connection with the period of the dawn, and again separately in relation to the period of dusk (南北在旦又 在暮). They are thus not mutually pervasive. Furthermore, spatial extent is defined as that which allows for a shifting about (explained in B 13), and because shifting about entails temporal duration (explained in B 14), spatial extent has a dependent relation to temporal duration. This dependent relation is also implied in the statement in B 64 that traveling a longer distance takes a longer time (行脩以久). So 'spatial extent' and 'temporal duration' are not independent attributes, but are inherently linked. Thus they are not of the 'hard-and-white' type.

[10] See, for instance, the recent discussion in Evans 2013. For evidence that the parallelism between space and time is not only a linguistic, but a cognitive, phenomenon, see, for instance, Boroditsky 2000 and Casasanto and Boroditsky 2008.

There is a pair of spatial and temporal concepts that are, by contrast, of the 'hard-and-white' type. As stated in section B 15, the relation between 'lacking duration', *i.e.*, a point in time, and 'spatial extent' is of that type. The Explanation states that the hard-and-white relation presumes that each attribute fills out the other, *i.e.*, is co-incident with the other. This implies that a single point in time is conceived of as filling out the whole of space, and in this respect the basic condition of being mutually pervasive is met. Yet neither of the two is contingent on the other; there is no dependent relation between spatial extent and a moment in time. This proposition in effect implies an abstract notion of simultaneity; a point in time exists throughout all of space.

While the particular form of the argument is specific to its cultural context, exemplified by the central role of the analytic tool 'hard and white', the argument has structural features in common with the spatio-temporal reasoning documented in the Western tradition. The idea that spatial and temporal magnitudes are related by motion, for instance, is also found in ancient Greek philosophy. For example we may refer to Aristotle's discussion of the speed of local motion, in which the time of a motion is related to the space traversed (*Physics* 232a, 23–232b, 15; Aristotle 1995, 103–115; see further *Physics* IV, 11; Aristotle 1993, 379–395). At the same time, there are obvious differences to the two approaches; Aristotle is concerned with defining velocity, while any explicit concept of velocity is absent in the *Mohist Canon*.

There is evidence that the connection of temporal and spatial measures via motion precedes theoretical thinking. In fact, according to Piaget's study of a child's development of the concept of time, the distinction between temporal and spatial order in regard to motion is only gradually achieved in the course of ontogenesis (Piaget 1969, Chapter 3). The same holds for the idea of universal simultaneity. The concept of simultaneity, for instance when comparing two independent motions or actions, is only gradually built up in ontogenesis.[11] And it is only in theoretical contexts that there is an incentive and possible need to spell out the notion that simultaneity pertains to all of space. Another such theoretical context in which universal simultaneity emerges, besides the one at hand, is classical mechanics, for which Isaac Newton postulated a kind of universal time.[12]

Despite the parallelism between space and time, there is an asymmetry in their relation as described by the Mohist. The Mohist claims the relation between spatial extent and lack of duration to be of the 'hard and white' type, but he does not claim the same for the relation between duration and lack of spatial extent. Thus, while one instant in time fills out all spatial extent, the inverse seems not to be the case, *i.e.*, there is no claim of a spatial point filling out all of time. There is in fact no term *wú yǔ* 無宇 which would mean 'lacking spatial extent', as we will discuss below. The asymmetry may be a reflection of the elementary knowledge structure that

[11] See Piaget 1969, in particular chapter 4.

[12] See, for instance, Newton's discussion of space and time in his Scholium to Definition 8 of his *Principia*; Newton 1999, 408–415.

within spatial extent, motion as well as rest is conceivable, but in time, by contrast, there is nothing comparable to rest. This attribute of time, which is not an attribute of space, has been described as 'transience' (Galton 2011).

A 40 and A 41 define *jiǔ* 久 'duration' and *yǔ* 宇 'spatial extent' in terms of *shí* 時 'time' and *suǒ* 所 'place', not in terms of events and extended bodies. Such abstraction of time and space from what they may contain in any particular circumstance is a further consequence of theoretical reflection. In practical contexts there is usually no need and no incentive to introduce a separation between times and spaces from the things that fill them. But how then is the relation between spatial and temporal extension on one hand and corporeal and processual extension on the other conceived of in the *Mohist Canon*?

2.3 Theoretical Knowledge in the *Mohist Canon*: Corporeal Extension

Sections A 52–69 are key to understanding the match between spatial and corporeal extension. This sequence documents a reflection on instrumental knowledge, *viz.*, on knowledge acquired in the use of ruler, compass, gnomon and other basic tools for measurement and construction. It seems that it is the context of measurement then, in which corporeality becomes crucial for the Mohists. This is in stark contrast to ancient Greek geometry. Euclid's *Elements* clearly stem from the reflection on the figures that can be constructed with compass and ruler. At the same time, it is precisely the abstraction from the corporeality of physical objects, and even of real drawings, that characterizes the knowledge of Euclidean geometry. So while with respect to the reflection on instrumental knowledge, the Mohist sequence is comparable to ancient Greek geometry, as Graham points out, the argumentative context, *i.e.*, the relation between the material and the spatial aspects of extension, is a very different one.

The first nine sections (A 52–60) of the Mohist sequence all relate to measurements or constructions, although the instruments that must have been employed—measuring rod, leveling device, gnomon, sighting device, compass, and carpenter's square—are only in some cases mentioned. A 57, for instance, defines *zhí* 直 'being straight' as *cān* 參 'being in alignment'. The underlying idea appears to be derived from the practice of sighting. While two points define a straight line, in the simplest sense 'alignment' is understood as having a third point in a line with the other two. 'Alignment', in other words, allows for an opposite, *viz.*, unaligned. Using the line of sight to define straightness is also found in Greek antiquity (see the discussion of Def. 4, *Elements* Book I, Euclid 1956, Vol. 1, 165–6). The Mohist defines the circle in A 58 with the phrase "being of the same length from a single center" (一中同長). The 'same length' and the 'center' having been defined earlier (A 53 and A 54, respectively), this definition is, despite its brevity, strikingly reminiscent of the parallel definition of a circle in Euclid's *Elements*, as

> a plane figure contained by one line such that all the straight lines falling upon it from one point [later called the center] among those lying within the figure are equal to one another[.] (Euclid 1956, Vol. 1, 153)

The similarity between these two definitions of a circle, which were certainly arrived at independently, may be explained by the similarity of the underlying practical knowledge. In both societies, Warring States China and Classical Greece, the compass, to which the Explanation of A 58 makes explicit reference, was a well- known instrument. The definitions translate the material working of a compass—fixing a center and keeping the distance to it constant—into the respective formalized languages.

The theoretical concept of a dimensionless point can also be found in both the Euclidean and the Mohist traditions. Compare the Mohist definition of 'end-point' in A 61 as "the element that, having no magnitude, comes foremost" (體之無厚而最前者) with the Euclidean definition of a point as "that which has no part" (*Elements* I, Def. 1; Euclid 1956, Vol. 1, 153). Both definitions emphasize the elementary character of a point and either state or imply its lack of magnitude. In the *Elements* this definition applies to any point on a line; the Mohists appear to have no notion of a point apart from an end-point. The latter fact is not surprising given the intuitive recognition that any line segment has end-points by virtue of having tips, *i.e.*, ends. But the notion of a point within a line segment is a much less intuitively obvious concept and gives rise to all sorts of theoretical problems, in particular how a collection of dimensionless entities can bring about an object with measurable dimension. The same concern is seen in ancient Greek discussions of whether or not only end-points of a line can be considered points. Aristotle in his *Metaphysics* describes Plato's position as rejecting the existence of points on lines within geometrical figures, calling them "a geometrical fiction." He seems to have accepted "the beginning of a line" as a point (Aristotle *Metaphysics* 992 a, 25; Aristotle 1933, 75). The Explanation of B 60 in the *Mohist Canon* explicitly states: "With respect to what is in front, the mid-point does not constitute a half-way point, rather it is like a (new) starting point" (前則中無為半, 猶端也). This clearly shows that the Mohists recognize that what was a mid-point of an original measure becomes an end-point when the original measure is divided at that point. In the Mohist case the notion of an end-point has a crucial function in comprehending different arrangements of measuring rods (A 67–79), the origin of the abstract concept of an end-point in the practice of measurement is clear-cut. Yet, as argued at the end of the previous section, the theoretical concept is only formed when a term such as *duān* 端, designating a 'tip' or an 'extremity' in everyday language, becomes part of a network of technical terms, as happens in the Mohist text. The end-point's lack of magnitude is conceived of as absolute, which shows that the concept does not reflect an elementary experience or a concrete perception, but is instead a reflection on the linguistic representation of instrumental actions.

Notwithstanding these similarities between Mohist and Euclidean geometrical definitions, there is no counterpart found in the Mohist text to the propositions of the Euclidean *Elements*. The *Mohist Canon* documents theoretical reflections on the

linguistic representations of instrumental knowledge, but not on constructions of complex figures that can be drawn with straightedge and compass or other diagrammatic representations of instrumental knowledge. In contradistinction to Euclidean geometry, the Mohist geometric definitions relate to the corporeal aspect of extension. A 60 explains linear 'doubling' (*bèi* 倍) as putting two measuring rods end to end in a straight line (尺與尺俱去一端 "a measuring rod together with another measuring rod both extending [linearly] away from a single end-point"). Although the term 尺 *chī* 'measuring rod' taken by itself can be understood to mean something non-corporeal, a 'measure' or a 'measured length', *i.e.*, a 'line', the immediate context implies that the idea of extension is always thought of as corporeal. Along the measuring rod you always get a co-occurrence of spatial magnitude and material filling out (A 65, 於尺無所往而不得二 "on the measuring rod there is no place to which it extends such that you do not get both [filling out and magnitude]"). It therefore appears to be no coincidence, if you think of an end-point to be the end-point of some physical object such as a measuring rod, that the end-point's lack of dimension is expressed as *wú hòu* 無厚 'lacking magnitude'. Spatial magnitude is an inherent feature of physical objects and cannot occur without a material filling out, as we see from A 65, which states that "[w]here there is no filling out there is no magnitude" (無盈無厚). The pair of concepts, *hòu* 厚 'having magnitude' and *yíng* 盈 'filling out' consistently differentiate the material and the spatial aspects of bodies. These are the terms defined in sections A 55 and A 65. While the distinction between spatial and material aspects of bodies emerges in elementary knowledge, the systematic differentiation of the two and the reflection on their relation to each other is clearly an aspect of theoretical thinking.

Sections A 62 and A 63 differentiate *yǒu jiān* 有間 'having an interstice' and *jiān* 間 'interstice' by giving complementary descriptions in the respective sections. "Having an interstice" is described in the Canon (A 62) as "not reaching to the center" (不及中也); in the Explanation it is said that this "refers to what flanks it" (謂夾之者也). Conversely, the 'interstice' itself is described in the Canon (A 63) as "not reaching to the sides" (不及旁也), and in the Explanation it is said that this "refers to what is flanked" (謂所夾者也). This Explanation clearly demands that the flanking things that frame the interstice be material. This excludes the end-point itself of a measuring rod as part of an interstice's flanking framework (尺前於區穴而後於端, 不夾於端與區穴 "measurements starting from an outline and ending at an end-point should not be considered as flanked by the end-point and the outline"). Section A 64 on the *lú* 櫨 'king-post' then relates the 'interstice' to the concept of emptiness, stating that the interstice being empty refers to the absence of the material of the flanking framework. A 62 and A 63 taken together seem to allow for the possibility that the interstice may be filled with a material other than that of the flanking objects, but A 64, by virtue of using the word *xū* 虛 'empty', seems to exclude that possibility.

The Mohist statement (A 65) that being filled out is a necessary precondition to having magnitude is reminiscent of Western theories of space and matter that claim that extension is a property of bodies alone, not of an alleged space independent of bodies. In a certain way, all theories that hold that space is nothing but an aspect of

body maintain this view. Aristotle, for instance, discusses the idea of the void as a place from which all bodies have been removed and concludes that a void cannot exist, thereby refuting ideas about space formulated by the atomists Leucippus and Democritus (Aristotle *Physics* IV, 8; Aristotle 1993, 343–361). A particularly radical version of this view is found in Descartes' claim that body and space are only two aspects of the same thing and that the walls of a vessel would be contiguous if the vessel were empty in the philosophical sense, since between its walls there would be nothing (Descartes, *Principles of Philosophy*, Part 2, § 18; Descartes 1983, 47–48).

But is the Mohist statement actually referring to such a world view, denying extension where there is no bodily filling? The every-day meaning of the term here translated as *hòu* 厚 'magnitude' and defined in A 55, is 'to be thick'. It suggests that 'magnitude' is really about material objects, not about whether or not a concept of extension abstracted from bodies in general has any meaning. In other words, it appears that the Mohist text is actually concerned with the clarification of the use of words, but does not make any claim about the existence or non-existence of space as an entity independent of bodies. If this interpretation is correct, A 65 merely states that the word 'magnitude' applies only where there is body ('filling out'). This interpretation is corroborated by the fact that a term potentially referring to spatial extension unrelated to bodies filling space is given elsewhere in the text, *viz.*, in the sections on temporal and spatial concepts, specifically section A 41, *yǔ* 宇 'spatial extent'. After all, this 'spatial extent' is defined as spanning different places, not spanning over bodies. It therefore appears amenable to a concept of space abstracted from all bodies, although such an abstraction is nowhere made explicit in the text.

It seems that there was no need for the Mohist to position himself in an argument about whether the world was a plenum or whether a perfect void existed. Canon A 65 on 'being filled out' seems not so much to introduce a universal material plenum, than to clarify that the term 'magnitude' designates a spatial extension always accompanied by some material 'filling out'. We know nothing of debates in Warring States China about physical world views involving the question of the existence of a vacuum. The *Mohist Canon* shares with Aristotle's *Physics* a concern with the consistent use of terminology, and both texts particularly deal with spatial terms in this framework. Accordingly, in both texts we can discern elementary structures of spatial knowledge, such as that differentiating the materiality of a body from its extension. In Aristotle there is the additional doctrinal concern with natural philosophy. Aristotle explicitly argues against not only what he considers errors of reasoning, but also world views that he holds to be untenable, such as the atomism of Leucippus and Democritus. In the Mohist case there are no such world views either advocated or rejected. To be sure, B 43 (not included in our translation) mentions the Five Agents *wǔ xíng* 五行 and seems explicitly to reject the prominent Han period thesis entailing a cyclical domination of one agent over the other, "the Five Agents are not possessed of a regular dominance [one over the next]" (五行毋常勝). Yet, not only does this brief mention not allow for a claim that the Mohists recognized a Five-Agent world view of the kind that later became popular in the

Han, there is in fact no clear indication that such a world view had arisen at this time (Henderson 2010, 182).

The discursive content of the *Mohist Canon* does not reflect intellectual traditions dealing with systems of natural philosophy, but rather a concern with rules for consistent reasoning in general. This shows up not only in the sections on knowledge, reasoning, and conduct and government, but also in those on spatio-temporal, mechanical, and optical matters. In the case of spatio-temporal terminology this relation becomes particularly clear from the central role of *jiān bái* 堅白 'hard and white', used as a technical term in Warring States disputations. This establishes a connection between the logical and spatial aspects of reasoning by conveying both spatial coincidence and logical compatibility of attributes. Its definition in A 66, "neither excluding the other" (不相外), in particular, reflects the tight entanglement of logical and spatial arguments when the term *wài* 外 'excluding' is used in a spatial and a logical sense at the same time. Attributes are said to be of the 'hard and white' type when they fill out each other and are compatible, *i.e.*, while being independent, they spatially coincide and do not logically exclude each other. In the Aristotelian tradition attributes pertain to bodies, or substances, and these bodies or substances then occupy a certain place.[13] Logical and spatial exclusion are discussed separately. No substance can have mutually exclusive attributes, and no two substances can be in one and the same place at the same time.[14] In the Mohist text the argument appears to be that contradictory or incompatible attributes cannot be in the same place. Section A 66 thus reflects the elementary knowledge structure of the schema of an object, *i.e.*, no two objects can be in the same place at the same time, but it does so not by referring to some notion of an impenetrable body, but by the observation that contradictory attributes cannot co-exist unless in different places: "When attributes are at odds with each other, this means they exclude each other" (相非是相外也).

Beyond the central use of *jiān bái* 堅白 'hard and white' as a technical term, the *Mohist Canon* often shows multiple connections between spatio-temporal and logical concepts and arguments. Spatial examples may figure in the explanation of logical or set-related canons, as in A 2 體 where the end-points on a measuring rod are taken to illustrate the relation between individual elements and the composite whole. In the sequence of sections on spatial and temporal contingency and inevitability (A 40–51) there is a constant going back and forth between the spatio-temporal and logical realms. It is probably no co-incidence that the consecutive sections A 42 窮 and A 43 盡 both describe instances of exhausting, first in the spatial sense of reaching a limit, and then in a logical sense of any kind of depletion. The Explanation of A 43, *jìn* 盡 'to be exhaustive', involves spatio-temporal concepts, stating that things are either in motion or at rest (俱止動), a *tertium non datur* situation. This kind of situation falls within the scope of 'being inevitable' (A 51 必). Introducing

[13] Thus, according to Aristotle's *Categories*, for instance, quality and place are two different ways of predicating that which exists; see Rapp 2001, 82.

[14] This becomes clear from Aristotle *Physics* IV, for instance at 209a, 7–8 (Aristotle 1993, 282).

the concept of inevitability at the end of this sequence highlights the role of contingency in the foregoing sections. Inevitability and contingency underpin the fundamental questions of what is necessarily implied and what may change or vary, what inference or judgment is inevitable, and what is dependent on the circumstances and may apply in one case and not in another. But this is never explicitly expressed in these definitions. The definitions appear rather to anticipate the illustrations of these things in subsequent propositions.

The match between temporal and processual extension is already expressed in the Canon of A 50 by a definition of *zhǐ* 止 'remaining fixed' as *yǐ jiǔ* 以久 "thereby enduring," which shows that for the Mohist *zhǐ* 止 has an inherently durative sense. The Explanation of A 50 elaborates that, while rest necessarily entails duration, its opposite, *bù zhǐ* 不止 'not remaining fixed', *i.e.*, motion, may come with or without duration. The first is exemplified by a person crossing a bridge, the second by the idealized punctual image of an arrow passing a pillar. So, while resting is compatible only with duration, motion is compatible with both, duration and lacking duration.

While the concept of an instant or a "now" has a clear enough sense in elementary thinking, in the realm of theoretical reflection it may become problematic when related to the concepts of motion and rest. In Zeno's famous paradox of the flying arrow (!), the problematic relation between the theoretical idea of an instant and the question of rest or motion is exploited when it is argued that an arrow cannot move during an instant, and therefore cannot move at all. Aristotle tries to resolve this paradox by arguing that, in the "now", there is neither motion nor rest (*Physics* 239b, 1–2; Aristotle 1995, 175). In the Mohist case, the discussion of the instant, *wú jiǔ* 無久 'lacking duration', implies that it is compatible with *bù zhǐ* 不止 'not remaining fixed', which, for the Mohist, is equivalent to being in motion. It is incompatible with *zhǐ* 止 'remaining fixed', since, for the Mohist being fixed demands duration. While Aristotle responds to the problem by denying instantaneous motion and rest, the Mohist responds otherwise. This shows that, while the elementary knowledge underlying the problem appears to be the same cross-culturally, the theoretical solution is not determined by this knowledge base and may diverge between different theoretical traditions. As we know today, the paradox of motion in an instant was consistently resolved only much later in history with help of the calculus, which introduced the concept of infinitesimal magnitudes.

The problem arises from the theoretical concept of a point in time, which in the Mohist text is expressed by *wú jiǔ* 無久 'lacking duration'. This, in some respect, is the temporal counter-part to *duān* 端 'end-point'. But the parallel is not complete. In A 61 *duān* 端 'end-point' is defined as having no corporeal magnitude (*wú hòu* 無厚), but there is no matching term expressing the lack of purely spatial extent, which presumably would have been *wú yǔ* 無宇. A further asymmetry between the temporal and spatial concepts pertains to the position of the infinitely small in relation to the overall situation under consideration. The end-point is defined only at the limits of a measure, but a point in time is described such that it can be considered as any instant during a motion. The more restricted case is the word *shǐ* 始 'beginning', which is the temporal match to *duān* 端 'end-point', only if 'end-point' is

understood as 'starting point', as is explicitly said in its definition in A 61. In contrast to what is the case for 'end-point', which is defined in corporeal terms, the definition of 'beginning' in A 44 refers to time alone, *i.e.*, duration and non-duration, rather than to some kind of processual extension, *i.e.*, what fills time out and would be comparable to corporeal extension in its relation to space. Not surprisingly, the term 'beginning' is introduced in the sequence on spatio-temporal concepts (A 40–51) reflecting on elementary knowledge, while the term 'end-point', which pertains to measurement, is introduced in the corporeal sequence (A 52–69), which for its part reflects on instrumental knowledge.

B 14 states spatial extent and duration are not of the hard-and-white type. One of its arguments for this claim is that moving about in space entails duration. B 15 states that spatial extent and lacking duration are of the hard-and-white type. Given that according to A 50 motion can occur in an instant, this would seem to contradict the argument of B 15. This apparent contradiction could be resolved by saying that motion in an instant is thought of as traversing no space within that instant, so that there is no dependent relation between an instant and spatial extent. All the same, the argument highlights the delicate nature of the theoretical discussion of instantaneous motion.

In B 16 it is pointed out that the validity and applicability of a statement depends on its appropriate placement in time. The section does not explicitly use the terms 'time' or 'duration' but refers instead to *jīn* 今 'present' and *gǔ* 古 'past' and seems to give a slightly different perspective on the Mohists' notion of time generally. In couching a statement in terms of past and present, time is now understood a providing a historical context that may be either appropriate or inappropriate in connection with a given event. The event specified in B 16, Yao being good at keeping order, is said to be appropriate in regard to the past but incompatible with reference to the present. And in B 53 Yao serving as a paragon is said to be viable in the present, while having been factually located in the past. Both of these observations are regarded by the Mohists as examples of differentiating times, in B 16 implicitly and in B 53 explicitly with the phrase *yì shí* 異時. This phrase in turn connects this perspective on time with the more abstract notion of *jiǔ* 久 'duration', which was defined in A 40 as "spanning different times" (彌異時). In fact, the Explanation of A 40 matches *jīn* 今 'present' and *gǔ* 古 'past' with the concrete observable temporal events of 'dawn' and 'dusk'. B 61 points out an asymmetry of the passage of time, stemming from its directedness. Things that occurred in the past may have ended, their duration thus being limited. But the fact, or experience, of having occurred cannot be undone, and in this respect their duration is limitless.

Reviewing the Mohist sections on corporeal extension and its relation to spatio-temporal concepts, we see that they are of limited mathematical character. While there are sections strikingly reminiscent of Euclidean definitions, their context is not a deductive theory of the properties of geometrical figures, but rather appears to be aimed at providing a solid foundation for judgments about the physical (and social) world. There is another fundamental line of argument in the *Mohist Canon* that on the face of it fits well with the Mohist worldly concerns, but at the same time can be related to intellectual constructs that are today perceived of as mathematical. This is

what we have referred to as the Mohists' systematic concern with sets. They become most obvious when the second section of the *Mohist Canon* (A2) is seen to be devoted to the definition of a *tǐ* 體 'element' as "a part of a composite whole" (分於兼), thus introducing the relation of element and set as one of two fundamental structures of reasoning about the world. The other presented in A1 is that of logical inferences and causal relations. A concern about sets that we would describe as mathematical is particularly addressed in sections B 73–74, which are all about the applicability of the concept *jiān* 兼 'composite whole, set' in the case of lacking knowledge. B 73 in particular states that the concept of a set can be applied even when the number of elements is unlimited. The argument employs the concept of *jìn* 盡 'exhausting' and uses the logical inference that if the limitlessness of a collection is conceived of as that collection filling out (and thereby exhausting) a limitless space, then asking about the limitless already implies its exhaustibility, *i.e.*, the applicability of the set concept to the collection. The topic of the example in the Explanation of B 73 (and, for that matter, those of B 74 and 75) is the possibility of *jiān ài* 兼愛 'comprehensively caring fondly for', a fact that may be taken as an indicator of some continuity between the specifics of the *Mohist Canon* and earlier Mohist social and political doctrines. At the same time, the focus of these sections in the *Mohist Canon* lies on consistent reasoning, whereby they document a concern with a kind of thinking that would in modern terms be described as dealing with set-theoretical structures.

2.4 Theoretical Knowledge in the *Mohist Canon*: Images and Weight

In the propositions, just as in the definitions, we see elementary and instrumental knowledge becoming the object of reflection, leading to the development of theoretical terms and abstract concepts. While in the definitions this came about as a result of discriminating, classifying and interconnecting the meanings of words, in the propositions such terms and concepts typically arise in the context of explaining unexpected behaviors encountered in everyday circumstances. The sequence of sections B 17–24 does this for shadows and mirror images. Optical technology such as flat, concave and convex mirrors, pinhole constructions, and probably also some kind of shadow theater, revealed behaviors inconsistent with the kind of common assumptions that inevitably arise from elementary experiences. This sequence of sections of the *Mohist Canon* appear to be an attempt to account for these disparities between observations and expectations.

Section B 17 says that "a shadow does not shift about," *i.e.*, does not move (景不徙). Elementary experience clearly suggests that shadows move, and at the same time that movement is typically attributed to physical bodies. Taken together these two things would imply that a shadow is a physical body, and that would in turn presuppose such features as three-dimensionality, tangibility, and requiring a mover.

The Mohists recognized that a shadow does not fit these criteria and therefore cannot naturally be regarded as a physical body. This then for the Mohists calls for an explanation. The Explanation says "When light reaches a place, the shadow disappears" (光至景亡); this is tantamount to saying that light causes the shadow to vanish, "as if its existence has been exhausted and its past extinguished" (若在盡古息), thereby denying the shadow any shred of bodily reality. Its apparent motion is only the result of shiftings of light source or occluding object, and the shadow being "recast" (改為) in every instant.

The complementary terms *guāng* 光 'light' and *yíng* 景 'shadow' reflect a dichotomy between light and shadow that arises from elementary experience. B 18 describes an arrangement of light sources in which an area illuminated by one light is at the same time in the shadow resulting from the occlusion of two other lights. This arrangement cannot be explained by the simple dichotomy of light and shadow. It requires the recognition of multiple shadows in the presence of multiple light sources and multiple occluding objects (which in the section at hand are the light sources themselves). In elementary experience, a shadow has the same orientation as the object casting it, but in pinhole projections, the shadow is inverted, violating this expectation. This is described in section B 19. The inverted shadow is explained as resulting from light proceeding along a straight path and crossing at the pinhole. The shadow cast by the foot of the object ends up as the top of the image, and that cast by the head as its bottom. This explanation entails a geometrical argument by assuming light to propagate along straight lines and to cross at a specified point. Both B 20 and B 21 explain further behaviors of shadows that go against elementary expectations, in one case relating to the direction into which a shadow is cast, in the other relating to its shape and size.

In the sections on mirrors (B 22–24) the phenomena to be explained mostly relate to the size and orientation of the images. All sections make use of a systematic distinction between (i) the thing mirrored (鑒者), (ii) the image itself (景), and (iii) what it is mirrored on, *i.e.*, the area on the surface of the mirror that the image occupies (所鑒). This distinction, which is only implicit in B 22, allows the Mohist to explain that an image may become smaller in mirror area (寡區) yet represent a larger part of the mirrored object: "it becomes more, but seems as if fewer," (多而若少). It further allows for the observation of a strict symmetry of mirrored object and image in position and motion towards and away from each other, as centered on the plane of the mirror (Sect. B 22). In B 23 this systematic distinction is used to explain the size and orientation of images in concave mirrors, depending on the position of the mirrored object. Two further concepts are needed for the Mohists' explanation of this variation: The concept of a 'center point' (*zhōng* 中), and the concept that the light skirting the mirrored object proceeds along straight lines (長其直). The center point is either conceived as the origin of the straight light rays that skirt the object and proceed to the mirror (object between center point and mirror) or as the point in which the light rays that skirted the object converge before they proceed to the mirror (center point between object and mirror). From this geometrical arrangement, the Mohist can deduce the size of the area on the surface of the mirror that the image occupies, which he appears to take as a measure for the size

of the image itself. While this construction is wrong from the perspective of geometrical optics, if we identify the Mohist 'center point' with the focal point, it describes qualitatively correctly the size and orientation of an image in a concave mirror in regard to its dependence on the position of the mirrored object relative to this point. Section B 24 treats the case of a convex mirror, stating the correct qualitative relation between the distance of the mirrored object from the mirror and the size of the area on the surface of the mirror that the image occupies and thus the size of the image, but no explanation for this relation is offered.

Taken together, the sections on shadows and mirror images show the emergence of a theoretical understanding of optical phenomena. Sections B 19 and B 23 are of particular interest in this regard, because they explicitly assume that light travels along straight lines, and further they introduce points (*wǔ* 午 'crossing-point', *duān* 端 'end-point', *zhōng* 中 'center-point') to describe geometrical constructions on the basis of which the phenomena at hand are explained. We are thus presented here with a geometrical treatment of optical phenomena that is independent from the origins of geometrical optics in ancient Greece. The sections on mirror images, in particular, can be compared to the Euclidean *Catoptrics*, which mainly discusses reflection in flat, concave and convex mirrors.[15] As was the case for the Mohist definitions of geometrical entities when compared to Euclid's *Elements*, the Mohist sections here on mirror images do not constitute a deductively structured presentation or cover as broad a variety of arrangements as their Greek counterpart. But they do display striking similarities with the Euclidean text as concerns certain central results. Definition IV of the Euclidean *Catoptrics* may be understood as stating that the image of an object in a flat mirror is not seen on the surface of the mirror, but at a certain depth beyond the plane of the mirror (Euclid 1959, 99, see in particular fn. 2), an observation made by the Mohists in section B 22. And the inversion or non-inversion of the image in a concave mirror treated in B 23 is dealt with in Proposition XII of the *Catoptrics* (Euclid 1959, 107–8). Nevertheless, there are marked differences in the Mohist and the Euclidean explanations. Instead of the light rays described in the *Mohist Canon*, the Greek tradition of optics and catoptrics refers to visual rays, *i.e.*, rays that are thought to emanate from the eyes and reach to the perceived objects. The object's position at which its image in the concave mirror flips from upright to upside down, which in the Mohist case was referred to as the 'center point', in the Greek case is the crossing point of the visual rays that, emanating from the eyes, are reflected in the mirror and then skirt the object.

In modern optics there are no visual rays but only light rays. While there are considerations of light proceeding along straight lines in the Greek tradition, for instance in the Pseudo-Aristotelian *Problems* (Problem 15, 911b 5 ff.: Aristotle 2011, 463) or when sun rays are considered in Proposition XVIII of the Euclidean *Optics* (Euclid 1959, 13), the geometrical treatment of optics and catoptrics was mostly done in terms of visual rays. Only much later was the geometrical treatment

[15] Euclid's authorship of the *Catoptrics* has long been disputed. Even if Euclid produced a book on the topic in the third century B.C.E., the received text is generally thought to contain later material; see Smith 2015, 55, fn. 89.

of optical phenomena generally combined with the idea of light rays. In this respect the Mohist text might appear to be "ahead" of its Greek counterparts. It must be pointed out that, while visual rays can reach the perceived object at any place facing the mirror, the Mohist considerations are limited to the light rays skirting the object. Such treatment appears fully legitimate in the case of a shadow, but in the case of a mirror image as in B 23 it would appear to constitute a problematic limitation, because it only explains the silhouette of the image. It is worth noting that a "Mohist mirror," i.e., a Warring States period mirror generally, is a polished bronze surface, and that bronze mirrors have much less reflective quality than later silver or glass mirrors. This might mean that for the Mohist shadows, silhouettes and reflected light are not as sharply distinguished one from the other as we would assume on the basis of modern mirrors.

The sequence on shadows and mirror images is followed by a sequence that similarly examines unexpected behavior, this time dealing with the vertical tendency of weights. The overall argument of this sequence (B 25a–29) proceeds as follows. The general idea that weights descend vertically and in accordance to their magnitude has to be modified in view of different possible arrangements provided by various devices and practical situations and by the materials involved. The different behavior of weights is accounted for in the text by qualifying the term *zhòng* 重 'weight' with further terms such as *jí* 極 'rigidity' (B 25a), *quán* 權 'effectiveness' (B25b, 26), and *zhù* 柱 'pillar-quality' (B 29). In this context, the concept of 'weight' is itself to be understood theoretically, the term being not only applied to heavy objects but also to the abstract quality that causes their downwards tendency, as can be seen in statements such as "This is due to the rigidity not prevailing over the weight" (極不勝重也, B 25a), where the 'weight' must clearly refer to the weight of the rope itself, since no other weights have been applied.

The elementary experience that heavy bodies fall vertically downwards or, if hindered in their fall, press on their support, and that an effort is needed to lift them up, makes the vertical structure of space an elementary knowledge structure that has every indication of being independent of particular cultural circumstances. In section B 27 this general behavior of heavy objects is explicitly described:

> 凡重, 上弗挈, 下弗收, 旁弗劫, 則下直。扡, 或害之也。
>
> Weights, in principle, when you are not pulling them from above, and not letting them down gradually, and not exerting any force on them from the side, then they will come straight down. If they shift sideways, it is because something has interfered with them.

The last sentence indicates the topic of all these sections; this is deviation from the expected behavior of heavy objects. Either they deviate, as indicated here, by departing from the vertical direction (apparently the case for B 27 and B 28). They may also deviate from expected behavior by showing different effects according to further circumstances, *i.e.*, a deviation from another elementary knowledge structure, *viz.*, the assumption that equal causes have equal effects (B 25a and b, 26, 29).

The effect of weights placed on length-wise objects depends on the *jí* 極 'rigidity' of the material the objects are made of (B 25a). That of weights on the two sides of a beam depends on the *quán* 權 'effectiveness (of the weight)', which increases

with the length of the side measured from the fulcrum of the beam (B 25b). Similarly, the behavior of a curtain hung over a pulley or pole depends on the length of the cloth hanging on either side, which determines the side's 'weight' and 'effectiveness' (B 26). But the vertical descent of weights may be modified by devices and arrangements not only with regard to magnitude, but also with regard to direction. In some devices a deliberate interference with direct descent produces a desired result (B 27). In dragging or pushing as well, a deviation from the vertical is essential, just like a ladder leaning against a wall needs to be inclined and cannot be perfectly vertical (B 28). In construction, the fact that weights descend vertically is taken advantage of to create stability. Objects such as stones in a wall are fixed by being piled up, so their being fixed may be attributed to the *zhù* 柱 'pillar-quality' of the arrangement. This fixedness is not equally obtained by means of suspension from a string, which may be drawn out, thus demonstrating the close connection between 'pillar-quality' and vertical descent (B 29). The sequence of sections is thus generally concerned with the vertical order of the world as defined by gravity. This distinction of the vertical from all other directions is also expressed in B 62. There a ball is described as something vertical that cannot be put crosswise. This statement implies that the vertical direction is taken as a default. The basis for that is undoubtedly the behavior of weights.

The unexpected behaviors thus become explicable and the apparent paradoxes resolved at the level of theoretical knowledge where the practical modifications and differentiations of the elementary knowledge structures are systematically reflected. The sequence B25a–29 just discussed also shows a recognition of underlying common structures in apparently different practical operations and an effort to establish a technical terminology to account for this, amounting in effect to a theoretical program.

This program is reminiscent of that documented in the Aristotelian *Mechanical Problems*, the earliest theoretical text on mechanics that has come down to us in the Western tradition.[16] In the text, 35 problems are formulated, which in most cases open with the phrase "Why is it that …?" They address consequences of the use of devices that may appear counter-intuitive or paradoxical or at least demand an explanation. The paradoxes are then resolved and the phenomena explained by identifying a lever-like arrangement. The functioning of the lever is in turn traced through reference to a balance back to the circle. This entails an identification of the fulcrum with the circle's center point and a balance arm as its radius. The program of the *Mechanical Problems* is intended to resolve the apparent contradiction between the functioning of mechanical devices and Aristotelian natural philosophy. By ultimately tracing the functioning of mechanical devices back to the circle, which is a central element of Aristotelian natural philosophy, the task is achieved.

[16] The authorship of the *Mechanical Questions* is disputed, which is why it is often referred to as Pseudo-Aristotle. For an interpretation of the *Mechanical Problems* along these lines, see Renn and McLaughlin 2018. For the parallel with the mechanics sections in the *Mohist Canon*, see Renn and Schemmel 2006.

The *Mechanical Problems* thus documents a constellation of types of knowledge very similar to that of the mechanics sections in the *Mohist Canon*. As is the case for the Mohist text, fundamental structures of elementary knowledge, such as equal effects from equal causes, are challenged by practical experience with instruments and devices. These challenges are then addressed by careful reflection on language and the development and consistent use of technical terminology. The similarity becomes particularly striking in the case of the Mohist section involving weights on a beam, B 25b, because the experience reflected in this section relates to the lever principle that is central in the *Mechanical Problems*. The statement that

> The farther the mover of the load is away from the fulcrum the more it always moves the load[17]

in the *Mechanical Problems* and the statement in B 25b that when

> the base is short and the tip is long [and you] add equal weights to both sides, then the tip will inevitably go down.

in the *Mohist Canon* both describe behaviors that from the viewpoint of classical physics we would associate with the law of the lever, and their similarity is without doubt related to this fact. There are several different kinds of instruments and concrete experiences, ranging from simple levers for lifting loads via carrying beams and shoulder poles to quantitative instruments like balances, all one way or another reflecting the law of the lever, that could underlie this similarity. In the case of the *Mechanical Problems* the invention of a type of balance with unequal arms is known to have preceded the composition of the text. Such a type of balance is described as an artifact whose functioning is to be explained in Problem 20 of the text itself. While the Mohist section B 25b has been repeatedly interpreted as involving weighing instruments, this understanding is mistaken.[18]

The device in question is a beam where weights can be added to both ends. Its fulcrum can be moved so that the beam becomes balanced by virtue of its own weight. If this were a weighing apparatus, the fact that weights can be added to both ends would suggest an equal-arm balance, while, at the same time, the fact that the fulcrum is movable would suggest a bismar-type balance. A weighing apparatus combining these two features is unknown and does not appear to be a particularly practical device. For this reason it is highly unlikely that B 25b is describing an unequal-arm weighing device. Beyond this, there is no evidence, either textual or material, that would point to the existence of such a device at this time in China.[19] More probably the Mohist passage refers to another type of implement. The shoulder pole is a plausible candidate since its practical use entails exactly the kind of mechanical experience described. If something is loaded on one side, that side goes down. One naturally compensates for this movement by shifting the heavy side closer to the shoulder (in effect, the fulcrum), thus making one side shorter and the

[17] *Mechanical Problems* 850b 14–16, Problem 4 (Renn and McLaughlin 2018, 123).

[18] The misunderstanding persists in as recent a publication as Dai 2001a.

[19] For a detailed discussion of this issue, see Büttner *et al*. 2018.

other longer. Unlike the unequal-arms balance in Greece, which allows for the numerical quantification of weights, the shoulder pole or any similar device in China does not allow any means for quantifying the effect of weights or forces. This disparity in what kind of mechanical devices were available may have something to do with the development in Greece of a mathematized theory of mechanics in contrast to its absence in China.

The *Mechanical Problems* operates against a background of an encompassing Aristotelian natural philosophy. This encompassing view demands an integration of mechanical phenomena with the background natural philosophy and leads to a radical reductionist program in that all mechanical phenomena are traced back to the workings of a lever, which explains the apparent inequality between cause and effect, and ultimately to the circle, which is seen as in harmony with the natural world.[20] There is no comparable natural-philosophic background for the *Mohist Canon*. Lacking this, there is no incentive or motivation for the reduction to any central principle. Instead, as shall be laid out in the following section, it is against the background of the Mohist project of a broad theory of knowledge and reasoning that the demand for a rational explanation of seemingly paradoxical phenomena arises, and it is in the context of this theory that the rational explanation is performed.

2.5 The Place of Mohist Theoretical Knowledge in a Global History of Science

What is the *Mohist Canon* about? On the uppermost level it appears to present a theory of knowledge and reasoning, which we may call a 'logic'. This is not a formal logic, which treats thought and argument in abstraction from their relation to the objects in question, but a logic that engages with concrete subject matters. Besides a few passages that are primarily on knowledge and reasoning *in abstracto*, the text is concerned with topics from various fields of knowledge for which it delineates the meanings of terms and lays out the proper ways of reasoning. While different topics are treated in successive sequences of passages, a close interrelation among all topics is indicated, and sometimes even emphasized, by frequent links and references from passages on one topic to the other topics.

The set of topics that the text presents is most peculiar when compared to other discursive texts from the Chinese tradition, be they from about the same time or from later times, but also when compared to the textual traditions of ancient Greece. We may roughly divide the topics into three groups, corresponding to the 'ethics', 'logic', and 'science' in the title of Graham's pathbreaking book: (1) There are passages on ethics and the conduct of government, (2) passages on sophistry and logic, and (3) passages on sciences—optics and mechanics in particular. The topics around

[20] Renn and McLaughlin 2018.

ethics and government, although presented in the *Mohist Canon* in a peculiar format and style, are arguably the least unexpected in the context of Chinese discursive texts of the time. For sophistry and logic there are some indications of a broader contemporaneous tradition, in particular in *Zhuangzi* and in *Gongsun Long*, but there is no comparable systematic exposition of a logic of space and time, contingency and inevitability, and sets and models, as found in the *Mohist Canon*. In its rigorous treatment of topics concerning concrete aspects of optical and mechanical phenomena, the *Mohist Canon* has no equal in the ancient Chinese literature handed down to us. We have pointed to parallel treatments of topics in mechanics, optics, geometry, and the theory of space, time and motion in ancient Greece. But these were usually found in separate texts devoted to one of these fields. It is true that many ancient Greek philosophers, or schools of philosophy, were concerned with a broad spectrum of topics ranging from ethics via theories of knowledge to natural philosophy. Aristotle is a prominent, but by far not the only example. And many works of ancient Greek and Latin philosophy, *e.g.*, Plato's *Timaeus* or Lucretius' *De rerum natura*, span from ethics to cosmology and natural philosophy. But a text integrating the various topics found in the *Mohist Canon* would be exceptional in that tradition, too.

What we see as linking the various topics in the *Mohist Canon* together is an underlying effort to set out a coherent, if inchoate, theory of knowledge and reasoning. Following Graham we may speculate that it is the Later Mohists' aim to put their ethics on firm grounds by demonstrating that—notwithstanding all sophistry and apparent paradoxes—rational argument is possible and a doctrine may be framed without reference to deities, ancient authorities, or a transcendental world. But we may also consider the text to be from a later stage of the development of logical discourse in which it has decoupled from its origins in disputes about ethics to such a degree that no direct concern for a particular doctrine is necessary to motivate its production. In any case, the perspective of a theory of knowledge and reasoning is what binds the passages on different topics together. While the sequential treatment of topics shows that they were indeed perceived as distinct topics by the authors of the text, their combination and close interconnection in the text is clear evidence that, at the same time, the authors regarded them as connected in their pertinence to the overall project. In this context it is important to note how apparently distant topics are related. In particular, as we have argued in the foregoing sections, the logic of space and time, the logic of contingency and inevitability, the logic of elements and sets and the logic of models are not presented as four or more different types of logic. They are connected in that space and time provide conditions of contingency and inevitability, that models may be corporeal or ideal, that elements and sets can be discerned at different levels of analysis, that instruments as corporeal objects extended in space can be resolved into elements and, at the same time, imply certain causal behavior, and so on.

But even if we understand the inner connections of the topics touched in the Later Mohist project, from a broader perspective of the history of theoretical knowledge the origin of this set of topics poses intriguing questions. It is particularly striking that what has been called 'science' in the *Mohist Canon*, the sections

on geometry, optics, and mechanics,[21] relates to precisely those fields of knowledge that were first given a mathematico-deductive treatment in ancient Greece. Ancient Greece saw the emergence, over generations, of a particular type of mathematics, deductive geometry. This development culminated in the composition of Euclid's *Elements* in the third century B.C.E., after which the text became a model for scientific writing in the European and Near Eastern traditions for nearly two millennia. Geometrical knowledge included in the *Elements* and the presentation of knowledge in the form of deductively structured texts became the foundation of other sciences, which were first of all (geometrical) optics and mechanics (*i.e.*, statics).[22]

Geometry, mechanics and optics figure prominently in the *Mohist Canon*. Geometry is not developed into a set of propositions about geometrical figures and thus not applied to the other sciences in a way found in Greek texts. As in the case of ancient Greek mechanics, Mohist mechanics is primarily statics, and Mohist optics prominently contains the germs of a geometrical optics. Given that the differences between the two traditions corroborate the assumption of their independent emergence, how can their similarities be explained? Starting with the most obvious observation, namely what phenomena did *not* become a topic of early theoretical reflection in either culture, we point out that fields that much later became central to physics (such as those related to heat, or to electric and magnetic phenomena), demand technologies that were only developed in the context of industrialization (such as the steam engine and the battery) to become the object of rigorous treatment. Thus the cross-cultural history of theoretical thinking reflects aspects of the history of technology and society at large and underlines the fact that pre-industrial societies will not develop rigorous theoretical treatments of experiential fields beyond their technological reach. It further reflects aspects of the physical world we live in, for instance that electric and magnetic free motive forces are fringe phenomena in our natural environments, while the gravitational force is ubiquitous in the tendency of heavy bodies to move towards the earth. But electric forces do play a central, albeit hidden, role in our everyday natural environment. As we know today, electric forces are decisive for the constitution of solid bodies, and the existence of solid bodies is another universal feature of the natural environments of human societies. It is in the interaction of the individual with its environment, which displays such universal features, that the humanly universal schemata of elementary knowledge are built up. We were able to discern candidates for such universal structural aspects of this elementary knowledge through our analysis of similarities between the independent theoretical constructs of Late Mohism and ancient Greek philosophy and science. The distinction of the vertical direction is one such aspect, the extendedness that pertains to both space and time is another. But because theoretical thinking is constructive and thereby goes beyond the

[21] Graham further includes 'economics'; *cf*. Graham 1978, 53.

[22] *Cf*. Hund 1978, 36–47. Hund further discusses astronomy, which was also geometrically treated early in ancient Greece. Its absence in the *Mohist Canon* is discussed a little further below.

knowledge structures it reflects upon, we also encountered differences in the theoretical constructs based on the same elementary knowledge structures. An example is provided by the deviating answers to the question if motion can exist in an instant of time. In other instances we could see how one and the same aspect of elementary thinking becomes reflected in vastly different theoretical contexts, *e.g.*, when the idea of a spatially universal instant of simultaneity is implied in the Mohist logic of space and time as well as in the foundations of Newtonian mechanics.

The universal structures of elementary knowledge are not sufficient to explain the similarities in Mohist and Greek science mentioned above. The knowledge reflected in geometry, mechanics, and optics is only partly elementary. It is most notably instrumental. It therefore presupposes a familiarity with certain types of instruments and technology to engender that type of practical knowledge that can then be reflected upon. We discerned the geometrical compass, devices using a lever, variously shaped mirrors, and other practical artifacts as underlying the scientific texts from both traditions. The similarities may then be traced back to their shared practical roots, whereby the similarity of the material tools may be either due to parallel developments or to earlier instances of technology transfer (or a combination of both). The striking similarity of the independent definitions of a circle in Euclid's *Elements* and in the *Mohist Canon* becomes comprehensible once the definitions are understood to be translations into theory of the material working of a compass. But we have also pointed to differences in the sciences that may be related to differences in technology: the absence of a quantitative formulation of the law of the lever in the *Mohist Canon* may be due to an absence of unequal armed balances in Warring States China.[23] But even where we assume the same practical knowledge to underlie the two theoretical traditions, there may, of course, be deviations in theoretical understanding. In the optics, for instance, we have pointed to a different understanding of the straight lines that lie at the basis of the causal explanations. These lines were interpreted as visual rays in the Greek tradition and as skirting light rays (not only when discussing shadows, but also mirror images) in the Mohist tradition.

What is important in the context of our question of what topics become the object of rigorously reasoned sciences is that the objects discussed—measurement operations and graphical constructions, shadows and mirror images, and the behavior of weights in the context of using devices—are all related to spatial extension and arrangement and involve necessary dependencies between their elements. These dependencies may be of a spatio-constructive nature or of a causal nature, in many cases they are a combination of both. This is why these topics are amenable to a treatment in the framework of the Greek model of deductive geometry as well

[23] See Büttner et al. 2018, 93. One should note that a quantitative understanding of the law of the lever in the *Mechanical Problems*, with which we have compared the sections on mechanics in the *Mohist Canon*, is not undisputed; see Renn and McLaughlin 2018. Furthermore one should bear in mind that none of the sections on science in the *Mohist Canon* is quantitative or explicitly describes proportionalities.

as in the framework of the Mohist model of a logic of space, time, contingency and inevitability. Owing to fundamental differences between these frameworks, the resulting theories display fundamental differences as well, for instance when the whole point in Greek geometry is abstraction from the corporeality of its elements, while the geometric passages in the *Mohist Canon* appear in the context of a discussion of corporeal extension. All the same, the two frameworks are not incommensurable, they do not constitute mutually incomprehensible worlds. They can be compared, we can even understand them as partly treating the same topics. Both are rational, without one being reducible to the other without a loss. We can thus corroborate for the case of the emergence of theoretical science in ancient Greece and ancient China what Günter Dux has stated more generally for the history of the human mind:

> Neither is humanity confined to a universal basic pattern of conceiving the world and the self, a pattern to which all differences would just be epiphenomena, nor does each culture develop a separate world as an incomprehensible scheme.[24]

Although we are confronted with the challenge of having to compare the very limited textual material from the *Mohist Canon* in the case of ancient China with a much richer textual and intellectual tradition from ancient Greece, we can all the same use this example to approach fundamental questions about the origins of theoretical thinking and the mathematical sciences. In the introduction we raised the question of whether it constitutes a systematic necessity that deductivity first occurs in geometry and is then extended to other sciences, as the Greek example seems to suggest. The *Mohist Canon* answers with a clear "yes and no"; there does not have to be a developed deductive theory of geometry for mechanics or optics to become topics of a rigorous science. At the same time, the rigor of these sciences implies a certain kind of proto-deductivity, by which we refer to the specific differentiation between definitions and propositions and a close logical, albeit not strictly deductive, interrelatedness of the different statements. In view of the long pre-history leading up to the compilation of Euclid's *Elements*, a pre-history to which nothing comparable is known from ancient China, we should regard the *Mohist Canon* as standing at the beginning of a parallel development rather than its end-point, as representing a possible ancient Chinese counter-model to Greek deductive science only in its inchoate state. Unfortunately it is the beginning of a development that then did not take place, or, to the degree that it did take place, of which we have no record handed down to us. But from the way the different topics are treated in the *Mohist Canon* one could envision a development in which geometrical, mechanical, and optical topics are treated with increasing rigor and breadth without one particular science pioneering the others.

Another question from the Greek perspective pertains to the role of astronomy in the rise of theoretical science. Astronomy is among the early mathematical sciences

[24] "Weder ist die Menschheit auf ein universales Grundmuster des Welt- und Selbstverständnisses festgelegt, dem alle Unterschiede nur Epiphänomene sind, noch entwickelt jede Kultur eine eigene Welt als unbegreiflichen Entwurf." Dux 1994, 7–8.

in ancient Greece but conspicuously absent in the *Mohist Canon*. Graham discusses the possibility of a lost Mohist document on "geometrised astronomy", but there is very little evidence for such a document.[25] To be sure, there are early Han period texts such as the parts of the *Zhou bi suan jing* and the third chapter of *Huainanzi* that deal with astronomical phenomena, but there is no evidence that they have anything to do with Mohist thinking. Nor is there any evidence in the ancient Chinese record of a geometrization of astronomy in the way that the Greeks used geometry to describe celestial motions and the workings of the cosmos, as Eudoxus' geometrico-mechanical model and the geometrical models that were later systematically synthesized by Ptolemy exemplify. In fact, as we have pointed out, there is no developed geometry in the Mohist corpus that could be readily applied to celestial phenomena. The *Mohist Canon* shows awareness of astronomical instruments such as the gnomon or the sundial. Yet, it is not at all clear how, beyond this, astronomy could have contributed to the Later Mohist project as we have reconstructed it here. It therefore appears to be a projection from the Greek case to assume that the Later Mohists must have occupied themselves with astronomy and that all records of this occupation have unfortunately been lost.

Finally, looking at the Greek case alone one might get the impression that the development of non-mythological cosmologies and encompassing systems of natural philosophy would be crucial for theoretical science to come about. Greek discussions of space, time and matter took place in such a context, as the case of Aristotle prominently shows, and we even saw that the earliest theoretical treatment of mechanics in Greece, the *Mechanical Problems*, were motivated by the attempt to reconcile mechanical phenomena with natural philosophic tenets. The Mohist case demonstrates that theoretical science may come about in the absence of such philosophy. Yet, it does not affirm the naïve idea that science emerges out of sheer curiosity, once people have the spare time to think about all sorts of problems. As in the case of early Greek science, the theoretical occupation with specific topics is not driven by a practical concern about these topics, but by a broader intellectual project that, to begin with, has nothing to do with these topics. This broader project is the historical outcome of intellectual developments in the respective societies and therefore bears the marks of knowledge constellations within that society. In the Greek case natural philosophy had become an important ingredient in that mix even before the occurrence of systematic reflections on the linguistic representation of knowledge. In China, as the Mohist case reveals, this reflection occurred before the establishment of any encompassing system of natural philosophy and in the context of a search for a theory of reasoning. What is similar in both cases is that the reflection on language emerged in the context of cultures of disputation that essentially concerned political and ethical matters. Judging on the basis of these two cases alone, the development of such a culture of disputation then seems to be a key precondition for the independent emergence of theoretical science in a society.

[25] Graham 1978, 23.

Chapter 3
Text and Translation

Abstract The chapter presents text, translation and commentary for the 68 sections of the *Mohist Canon* on which our analysis in the preceding chapter is based. The topics of the sections range from epistemological foundations via the consideration of logical, set-related and spatio-temporal conditions of knowing to themes in optics and mechanics.

3.1 Epistemological Foundations, A 1–A 6

The *Mohist Canon* starts out with six sections identifying fundamental notions of argument and knowledge, in this way defining terms that will figure either directly or indirectly in subsequent parts of the text.

A 1 introduces the concept of 'basis', which can be understood as a condition for something to come about.

A 2 introduces the concept of 'element' as a part of a composite whole, which has already been used in the Explanation of A 1, and which reoccurs in later sections (A 61 and A 67 in our selection).

A 3–A 6 describe different kinds of knowing and thinking: 'knowing' as an innate capacity (A 3), 'thinking' as starting from this innate knowledge (A 4), 'knowing' as having experienced something, again based on innate knowledge (A 5), and 'wisdom' as having applied one's knowledge in discussing a thing and therefore seeing it more clearly (A 6). These concepts of knowing are not used in the later scientific sections, but they show the Mohists reflecting about different sources of knowledge. In particular, they distinguish a given capacity for knowing, which is also the basis of thinking, experience as a source of knowledge and (rational) discourse as a means of further developing and refining one's knowledge. Acquiring knowledge through the senses is differentiated from having experiential knowledge itself, as illustrated in B 46 (which is not included in our selection) with respect to

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knowledge gained through the senses.[1] The Mohist also recognizes the fact that, until you can give a name to what you do not know, you do not know that you do not know it.[2] Both B 46 and B 48 are propositions, not definitions, and are thus set apart from the opening definitions. Section A 80 deals with how one may come to know something and how to act on that, distinctions that are conceived of as introducing ambiguity into the meaning of the term. This likely accounts for its placement at the end of the definitions, among those sections that explain other ambiguous terms (see Chap. 4).

[1] B 46: 知而不以五路, 說在久。 "Knowing, but not by means of the five 'pathways' (*i.e.*, the five senses); the explanation lies with 'duration'." Experiential knowledge includes knowledge gained through the senses. The sensation ends, but the knowledge endures, thus the relation between this kind of knowledge and 'duration'. See Boltz and Schemmel 2013, 14–15.

[2] B 48: 知其所 不知, 說在以名取。 "Knowing what one does not know; the explanation lies with 'selecting it (*i.e.*, identifying it) by name'." The sense is that you have to be able to give a name to what you do not know, before you recognize that you do not know it. See Boltz and Schemmel 2013, 22.

A 1

C: 故, 所得而後成也。
E: 故:小故, 有之不必然, 無之必不然。體也[a]。若有端。大故, 有之必然[b]。若見[c]之成見也。

C: *gù* 'basis' is what must be the case before something will come about.
E: *gù* 'basis': Minor basis: having it does not entail the inevitability of (a certain thing) becoming so. Lacking it does entail the inevitability of (the same thing) not becoming so. It is an element, like having an 'end-point'. Major basis: having it entails the inevitability of (a certain thing) becoming so, like the fact of something becoming visible entailing someone seeing it.

(a) R: 體也; Graham supplies the phrase 最前之 as a modifier to *tǐ* 體 and understands it as "the unit which precedes all others" (1978, 263). The emendation seems unnecessary; the term *tǐ* 體 alone, meaning 'element, part, unit, component' (see A 2) makes sense here, identifying the 'minor basis' as one part of an argument, in the same way that an end-point is an elemental part (of a measuring rod, per A 2).
(b) R: 有之必無然; emendation Liang Qichao 1923, 67. Graham emends to 有之必然, 無之必不然 "having this, it will necessarily be so: lacking this, necessarily it will not be so" so as to show explicitly the contrast between something inevitably becoming so when the major basis is present and inevitably not becoming so when it is absent (1978, 263). The less radically emended text of Liang Qichao, which we follow here, leaves the second part of Graham's contrast unexpressed.
(c) R: 見 is understood here as *xiàn* 'to appear' (modern 現).

The *Mohist Canon* begins with a set of six basic, epistemic terms, each presented in an individual section. The first of these introduces the concept of a basis as a condition for something to come about. In particular it distinguishes between a 'minor' and a 'major' basis.

Graham's extensive emendations seem motivated by a wish to show that this section, Canon and Explanation together, establishes for the Mohists the clear distinction between a 'necessary condition' and a 'necessary and sufficient condition' (Graham 1978, 264). But in fact the passage, absent Graham's conjectural emendations, does not explicitly show this, and we can only surmise that such a distinction may have been understood from the definitions and explanations of the 'minor basis' and 'major basis' given here. The second phrase of Graham's emendation of R: 有之必無然 is 無之必不然, identical to the phrase that has already been stated as the consequence of lacking the 'minor basis'. It seems unlikely, and perhaps also unnecessary, that the same observation would be made about the 'major basis', since it is already implied. The distinction between the 'minor' and 'major' bases', as we see it, is simply that the former may or may not bring about something, whereas the latter will inevitably bring it about.

The argument can be formally expressed as follows: let B stand for the 'basis' and R for the 'result that may be brought about'. The Canon defines a basis by the implication

$$R \Rightarrow B.$$

In the Explanation, then, two kinds of basis are distinguished. A 'minor basis' is defined by the additional information that B does not necessarily imply R, *i.e.*,

$$B \not\Rightarrow R.$$

It is further stated that

$$\text{not } B \Rightarrow \text{not } R,$$

which implies $R \Rightarrow B$, a mere restatement of the general definition of basis.

The 'major basis' is defined by

$$B \Rightarrow R,$$

so that for it

$$B \Leftrightarrow R,$$

i.e., the 'major basis' is sufficient and necessary for R to come about. Summing up, the Canon defines the set of all bases by the implication $R \Rightarrow B$, while the Explanation distinguishes two subsets, one specified by $B \not\Rightarrow R$ ('minor basis'), the other by $B \Rightarrow R$ ('major basis').

The word *gù* < ***kkak-s** 故 means 'basis, precedent' *i.e.*, something 'solid, dependable, fixed' that can be reliably expected to lead to a certain consequence, hence the more conventional rendering 'reason, cause'. *Cf. hù* < ***gga-q** 怙 'rely on, reliable', *gù* < ***kkak-s** 固 'solid, firm, fixed'; the sense is 'durable ~ enduring', which accounts for *gǔ* < ***kkak-q** 古 'past, antiquity' and *gù* < ***kkak-s** 故 'old, former' (in addition to 'basis, precedent'). The same sense can be seen in the *Lüshi chunqiu* text, from about a century after the *Mozi*, using much the same terminology: 凡物之然也必有故 ... 水出於山而走於海水非惡山而欲海也高下使之然也 "In general as for things being the way they are, there is inevitably a basis for it. ... When water emerges from a mountain and runs toward the sea, it is not because the water dislikes the mountain and prefers the sea. It is rather the difference in elevation that causes it to be so" (Chen Qiyou 1990, 498). The *Shuowen jiezi* dictionary of A.D. 100 defines *gù* 故 as 使為之也 "causing something to take a particular form" (*SWGL* 1329).[3] These examples suggest an understanding of *gù* 故 closer to 'basis' or 'cause' than to 'reason'. For the Mohists *gù* 故 was not something associated with 'reckoning', 'counting' or 'calculating' (Lat. *ratiō*), but seems to have been an empirical notion, associated with the solid dependability of a precedent and the predictability of a consequence. To the extent that these first six sections of the Canons together with their Explanations constitute a set of criteria for constructing defensible arguments in philosophical debates, the term *gù* 故 designates a 'solid basis' from which to argue some point.

[3] Here and in the following, *SWGL* stands for the *Shuowen jiezi gulin* 說文解字詁林, see the 'Chinese primary sources' in the Bibliography.

The verb *rán* 然 'to be like this; to be such, so' is typically used in the *Mojing* text, as it often is in other Classical Chinese texts, to refer in the abstract to any situation that may pertain, or to whatever the case in question may be, without designating any particular situation or circumstance explicitly; thus, 不必然 "...does not entail the inevitability of...becoming so" means that for whatever it is that is at issue, a 'minor basis' will not necessarily bring it about, and so *mutatis mutandis* for the other phrases with *rán* 然.

The word *bì* 必 (see A 51), normally functions adverbially, meaning 'necessarily, inevitably'. The lines here could be translated less formally as "[something] will not inevitably become so" and "[something] will inevitably not become so." But the significance of the inevitability arises from the inalienable relation between something becoming visible and someone seeing it. This is not presented as a casual occurrence here, but as a logically inevitable pairing, like the 'elder brother~younger brother' relation given as an example in A 51.

For the entry for *tǐ* 體 'element' see A 2; for *duān* 端 'end-point' see A 61.

A 2

C: 體, 分於兼也。
E: 體:若二之一, 尺之端也。

C: *tǐ* ‘element’ is a part of a composite whole.
E: *tǐ* ‘element’: like one of two; the end-points on a measuring rod.

As an illustration of one element of a composite whole the Explanation specifies simply “one part of two,” and gives as an example a *duān* 端 ‘end-point’, the end-points of a measuring rod as two elements of the rod. For the definition of *duān* 端 ‘end-point’ see A 61.

The word *jiān* 兼 ‘composite whole’ refers specifically to two or more separate things brought or held together in combination; the *Shuowen* definition is *bìng* 並 ‘to be coupled together’ (*SWGL* 3142). The crucial sense here is precisely the “compositeness” of the whole. A *tǐ* 體 ‘element’ is not just an accidental or random part of a whole, like a piece of broken chalk, but is a ‘separable component’ of an analyzable whole. The word *tǐ* < ***hrrij-q** 體 ‘element’ is cognate with the word *lǐ* < ***rrij-q** 豊 ‘ritual vessel’ and by extension with homophonous *lǐ* < ***rrij-q** 禮 ‘ritual, ceremony’. The semantic implication is that just as a *lǐ* < ***rrij-q** 豊 ‘ritual vessel’ is a meaningful physical component with a precise, well-defined position and function in a *lǐ* < ***rrij-q** 禮 ‘ritual or ceremonial performance’ (*cf. zhì* < ***lit** 鬯 ‘the proper order or sequence of ritual vessels in a ceremonial performance’), so a *tǐ* < ***hrrij-q** 體 ‘element’ is a meaningful component in any composite whole, whether concrete or abstract, of a quotidian, non-ceremonial nature.

For the term 尺 *chí* ‘measuring rod’ see the commentary to A 42.

A 3

C: 知, 材也。
E: 知:材[a]知也者[b], 所以知也而必知。若明。

C: *zhī* ‘knowing’ is an innate capacity.
E: *zhī* ‘knowing’: the ‘innate knowing’ means that, given the wherewithal for knowing something, one then will inevitably know it; it is like vision.

(a) The character 材 is generally regarded as intrusive here and not original, since it is inconsistent in format with other Explanations, and is therefore usually edited out. All the same, given the clear effort to distinguish ‘knowing’ as an innate capacity in A 3 here from ‘knowing’ as a consequence of experience in A 5 and ‘knowing’ as perceptivity in A 6, it is not at all unreasonable to take the text as it stands and read this as ‘innate (capacity type of) knowing’, *i.e.*, ‘innate knowing’ specifically in contrast to the others.
(b) The sequence 也者 occurs in A 3, A 4, A 5, and A 6, and by Graham’s count in seven additional passages (Graham 1978, 266). This seems to be a particularly explicit way of setting off a topic and in that respect suggests that the repeated topic word in the Explanation is intended to be understood precisely in the sense defined in the accompanying Canon.

This is the first of four sections that in the aggregate present a paradigm of different kinds of ‘knowing’ and ‘thinking’ as the Mohist understands it, starting with a notion of ‘innate knowledge’.

The word *cái* < ***ddzə*** ‘innate capacity’ written 材 as here is fundamentally the same word as the homophonous words *cái* < ***ddzə*** 才 ‘talent’ and *cái* < ***ddzə*** 財 ‘inherent material worth’. All three refer to a kind of innate or ingrafted quality; the difference is only in the contextual application of the word. Written 材 it generally refers to ‘timber’ or ‘natural resources’, as 財 it refers to inherent material worth, and as 才 it is simply the basic sense of ‘innate talent’. The word, in all three graphic forms and semantic nuances, is related to the verb *zhí* < ***dək*** 植 ‘to plant, implant’, in the concrete phytogenic sense of an implanted quality the result of grafting, *cf.* homophonous 殖 ‘to set up, plant’ and *zhì* < ***təks*** 置 ‘to set up’. The etymonic sense of the word is most clearly seen in its close relative *zāi* < ***ttzə*** 栽 ‘to implant, as a cutting grafted onto a parent stalk’. The early inscription forms of the character 才 may well be an iconographic representation of the binding of a cutting to a stalk onto which it is being grafted; the Shang inscription form is and the bronze form is  .

For the Mohists, then, what we think of as *zhī* 知 ‘knowing’ is first a natural ability, not an acquired competence of any kind (but *cf.* A 5). This is what the Explanation means when it says “it is like ‘vision’,” that is, if you have the capacity to see something, then you will inevitably see it; the ability to see is not acquired or learned, but is innate. This innate knowledge is the pre-condition for ‘thinking’ (A 4), ‘acquired knowledge’ (A 5), and for ‘wisdom’ (A 6). For further remarks on *cái* < ***ddzə*** 才 and its lexical affines see the discussion at B 16.

A 4

C: 慮, 求也。
E: 慮:慮也者, 以其知有求也, 而不必得之。若睨。

C: *lǜ* ‘thinking’ is seeking.
E: *lǜ* ‘thinking’: ‘thinking’ means that, taking one’s (innate) knowing as a starting point, there is something sought, but one does not inevitably get it. It is like looking around for something.

This section identifies ‘thinking’ as a process taking innate knowing as its starting point and aiming at something, but not necessarily reaching it.

The *zhī* 知 ‘knowing’ of 以其知 “taking one’s knowing” in the Explanation must refer to the innate capacity of A 3. The same phrase 以其知 “taking one’s knowing” occurs also in the Explanations of A 5 and A 6, a parallelism that cannot be accidental. It therefore seems that the ‘innate knowing’ of A 3 is intended as a pre-condition in these subsequent cases. In the opening passage of the *Daxue* 大學 (“The Grand Doctrine,” often translated as “The Great Learning”) we find the phrase 慮而後能得 “think about it, and then you will be able to grasp it” as the final element in a progressive sorites concerned with Ruist goal of “coming to rest at the ultimate good” (*zhǐ yú zhì shàn* 止於至善). The word *lǜ* 慮 ‘thinking’ is thus ‘musing on’, ‘contemplating’, ‘cogitating’ (Johnston 2010, 377), ‘pondering’; for the Mohists an atelic process, not necessarily entailing reaching a conclusion, but, as clearly expressed in the *Daxue* line, intended to lead to some kind of a result.

A 5

C: 知, 接也。
E: 知:知也者, 以其知過[a]物而能貌之。若見。

C: *zhī* ‘knowing’ is coming into contact with [*i.e*., acquired-knowing].
E: *zhī* ‘knowing’: ‘(acquired-)knowing’ means that, taking one’s (innate) knowing as a starting point, having passed by something one then is able to describe it; it is like perceiving something.

(a) Sun Yirang suggested that the character 過 *guò* ‘to pass by’ should be emended to 遇 *yù* ‘to encounter’ on the grounds that 遇 *yù* is semantically closer to the 接 *jiē* ‘come into contact with’ of C than 過 *guò* is and that this makes better sense overall: “... to encounter something and then ...” (see Liang Qichao 1923, 73). He explains the 過 *guò* as an error for an original 遇 *yù* arising from graphic confusion, because the two characters are similar in appearance. There are two reasons to doubt Sun Yirang’s proposed emendation: (i) there is no textual evidence for a variant with 遇 *yù*; the emendation is therefore entirely conjectural, and (ii) the reading with 遇 *yù* is by SunYirang’s own argument easier to understand than the reading with 過 *guò*; but the general rule is, all other things being equal, *lectio difficilior potior* ‘the more difficult reading is to be preferred’. The rationale is that it is likelier for something that is difficult to understand to become changed, either editorially or inadvertently, to something easier to understand than *vice versa*. For these two reasons we do not follow Sun Yirang’s emendation. Moreover, the meaning of 過 *guò* ‘to pass by’ includes a sense of ‘to experience’; Graham draws particular attention to that by pointing out that the text stresses that “the test of knowing a thing is that after experiencing and leaving it behind ... one is still able to describe it” (Graham 1978, 267).

This section seems deliberately intended to draw a contrast with A 3, ‘knowing’ as an innate capacity and anticipates a distinction with A 6, ‘knowledge’ as ‘seeing clearly’. Here we have ‘knowing’ as the result of having come into contact with something, *i.e*., experiential knowledge. As discussed in the commentary to A 4 above, the *zhī* 知 ‘knowing’ of 以其知 “taking one’s knowing” in E refers to the innate capacity of A 3.

Graham points out that the *Lüshi chunqiu* has a section titled *zhī jiē* 知接, which he translates as “In touch by knowing”, and which deals, he says, with “people who are acquainted with the facts but do not *chieh* (*i.e*., *jiē*) ‘connect, catch on’” (Graham 1978, 268). But the *Lüshi chunqiu* passage, and indeed even its chapter title *zhī jiē* 知接 “Knowing through direct contact,” seems not to mean exactly what Graham has proposed, but appears actually to be more explicitly consistent with the Mohist passage here. The opening passage of this section says:

> 人之目以照見之也, 以瞑則與不見同。其所以為照所以為瞑異。
>
> As for a person’s eyes, they are the same whether he sees something thanks to its being illuminated or if he doesn’t see it because of its being darkened. It is the way in which the thing is either illuminated or darkened that is different.

After a short anecdote we then have this:

> 智亦然。其所以接智所以接不智同。其所能接所不能接異。
>
> The capacity for knowledge is also this way. Whether one knows something through direct contact or does not know something through direct contact, the capacity to know is the same. It is whether one is able to be in contact or not with something that is different. (Chen Qiyou 1990, 968)

The sense seems to be that, just as everyone has eyes and therefore the potential to see, and that external conditions govern whether they actually see something or not, so everyone has the capacity for knowing from contact, *i.e.*, from experience, and it is only whether one has come into contact with something or not, *i.e.*, has had a particular experience or not, that governs whether a person has the knowledge in question.

A 6

C: 恕[a], 明也。
E: 恕:恕也者, 以其知論物而其知之也著。若明。

C: *zhì* ‘wisdom’ is seeing clearly.
E: *zhì* ‘wisdom’: ‘wisdom’ means that, given one’s (either innate or acquired) knowledge, in discussing a thing, one’s knowing about it is then brought into focus; like seeing clearly.

(a) 恕: the character in R is not otherwise known as a part of the received orthography, but all the same it seems clearly to stand for the word *zhì* ‘wisdom’, usually written 智.

A 6 identifies ‘wisdom’ as the abstract nominal form of verbal ‘knowing’. The Explanation suggests that ‘wisdom’ is the result of thoughtful discussion, consideration or judgement of something on the basis of one’s knowing. Whether written 恕 or with the more familiar character 智, the word is a deverbal noun *zhì* < ***tre-s** ‘knowledge’ or ‘wisdom’, in *-**s** from the verb *zhī* 知 < ***tre** ‘to know’. While the character 恕 is otherwise unknown in the received writing system, still it conforms completely to the conventions of that system by using the semantic determinative 心 ‘heart-mind’ as the component typically suggestive of cognitive or emotional meanings, added to the etymonic phonophoric graph 知.

This nominal form of the verb *zhī* 知 ‘to know’ completes the Mohist’s initial identification of kinds of ‘knowing’:

zhī 知 ‘knowing’ as an innate capacity (A 3)
zhī 知 ‘knowing’ from experience (A 5)
zhì 恕 ‘knowledge’ or ‘wisdom’ as seeing clearly (A 6).

The nominal form *zhì* 恕 ‘knowledge, wisdom’ in the paradigm is distinguished graphically by the addition of the “heart-mind” classifier, but the two kinds of verbal knowing are not graphically distinguished one from the other. This suggests that notwithstanding the distinction that is drawn here between innate knowing and experiential knowing, these are in some sense seen as different kinds of the same mental phenomenon of ‘knowing’. Accordingly, we can understand the 以其知 “taking one’s knowledge” phrase in E here as referring equally to either innate or acquired knowledge, unlike the same phrase in A 4 and A 5, where this understanding does not obtain. In A 4 experiential knowledge has not yet been introduced, and in A 5 it is precisely experiential knowledge that is being identified.

These three words for ‘knowing, knowledge’ together with *lǜ* 慮 ‘thinking’ (A 4) constitute a kind of rudimentary set of descriptive terms for ‘cognition’. Taken together with the first two items, *gù* 故 ‘basis’ (A 1) and *tǐ* 體 ‘element’ (A 2), they make up what seems to be a set of meta-discursive terminological starting points for the canons and explanations.

3.2 Definition of Force, A 21

The following section is part of the sequence that Graham (1978, 229) designates "Conduct and government". We include it here because it deals with the concepts of force and weight, both of which figure in the sections on mechanics. 'Mechanics' as seen in sections B 25a–B 29, involves specifically the vertical tendency of weights, exactly as described in the Explanation line of A 21.

A 21

C: 力, 形[a]之所以奮也。
E: 力:重之謂也[b]。下舉[c]重, 奮[d]也。

C: *lì* ‘force’ is that whereby the body exerts itself.
E: *lì* ‘force’: ‘Weight’ is a reference to it. Lifting a weight from below is exerting oneself.

(a) R: 刑, the graphic interchange between 刑 and 形 is common. In the received writing system the character 刑 is conventionally used to write the word *xíng* < ***geng** ‘punishment’ and the character 形 for the homophonous word *xíng* < ***geng** ‘(corporal/physical) form’. This suggests that the appearance of classifier 018, 刀 ‘knife’, in the former is to be associated directly with some kind of maiming or disfiguring, *i.e.*, ‘deforming’, as corporal punishment, but in fact the graph 刑 is used write the word *xíng* < ***geng** with the sense of ‘form’ as something cut or carved on the basis of a model and this is the likely reason for the appearance of the 刀 classifier. *Sensu stricto* this emendation is not necessary.
(b) R: null; supplied by Graham on the model of passage number eight in his reconstructed fragmentary “Names and Objects” text, (Graham 1978, 147, 279).
(c) R: 與, emendation (Graham 1978, 279; see also the discussion at Graham 1978, 80).
(d) R: 舊, emended on the basis of the text of C (Graham 1978, 279).

The term *lì* 力 ‘force’ occurs in section B 26 in a mechanical context, but is here introduced as the physical counterpart to *yǒng* 勇 ‘courage’ defined in A 20 (勇, 志之所以敢也 “courage is that whereby the will emboldens itself.”). While the Canon defines *lì* in connection with bodily strength, the Explanation includes the term *zhòng* 重 ‘weight’, a term used technically in the mechanics sections, that is, the section dealing with the vertical tendency of weights, as an example of force.

3.3 Spatial and Temporal Contingency and Inevitability, A 40–51

These 12 sections contain the definitions of ‘enduring’, ‘spatial extent’, ‘reaching a limit’, ‘to be exhaustive’, ‘beginning’, ‘transforming’, ‘lessening’, ‘circling around’, ‘rotating’, ‘moving’, ‘remaining fixed’, and ‘being inevitable’.

A 40 and A 41 present parallel definitions of ‘duration’, as temporal extent, and ‘spatial extent’, terms that reoccur frequently in subsequent passages.

A 42 and A 43 present definitions of two kinds of limit, spatial (‘reaching a limit’) and set-theoretical (‘to be exhaustive’), respectively.

The following seven sections deal with change and motion. A 44 defines ‘beginning’ as a change from ‘not yet’ to ‘already’, and thus being without duration. A 45 describes ‘transforming’ as a change from ‘this’ to ‘that’, thus entailing a substitution or replacement. A 46 describes ‘lessening’ as a change from ‘more’ to ‘less’, *i.e.*, the subtraction of elements from a composite whole. Sections A 47–49 deal with changes in place or position, describing three different types of motion: ‘circling around’, ‘rotating’, and ‘moving’, respectively. A 50 under the term ‘remaining fixed’ illustrates that ‘absence of motion’ cannot occur in the absence of temporal duration, while ‘not being fixed’ is compatible with both having duration and not having duration.

A 51 defines ‘being inevitable’ as either entailing the existence of a counterpart, or the necessity of something either being a certain way or not being this way, thereby turning this sequence of sections into one about contingency and inevitability.

A 40

C: 久, 彌異時也。
E: 久:今[a] 古合[b]旦[c]暮[d]。

C: *jiǔ* ‘enduring’ is spanning different times.
E: *jiǔ* ‘enduring’: ‘present’ and ‘past’ match ‘dawn’ and ‘dusk’.

(a) R: 今久; the order of the head character of E and the first character of the explanation text has become reversed; see Graham 1978, 95–6.
(b) R: 今, emendation Liu Chang, (Graham 1978, 293).
(c) R: 且, emendation Graham 1978, 81.
(d) R: 莫, emendation Graham 1978, 293, although not strictly necessary. The character 莫 is attested writing the word *mù* ‘dusk, evening’ in transmitted texts.

The passage refers to the extension, or ‘span’, of time of a specific duration, *i.e*., the extent of time between two moments, here illustrated by the example of ‘past’ and ‘present’ as an abstract representation of the duration of time correlated with ‘dawn’ and ‘dusk’ as a concrete representation. Note that if the correlation is to be understood in a precisely parallel fashion, the word *mù* 暮 must be understood as referring to the evening previous to the ‘morning’ in question.

For *mí* 彌 ‘span, spread’ generally see, *e.g.*, Sima Xiangru 司馬相如, *Shang lin fu* 上林賦 “Rhapsody on the Imperial Hunting Park,” describing the extent of palaces and lodges that can be seen *mí shān kuà gǔ* 彌山跨谷 “spreading throughout the mountains, straddling the valleys.” (*Wen xuan* 8.7b. See also Knechtges and Xiao 1987, 88–89.)

A 41

C: 宇[a], 彌異所也。
E: 宇:東西蒙[b]南北。

C: *yǔ* ‘spatial extent’ is spanning different places.
E: *yǔ* ‘spatial extent’: east and west entails north and south.

(a) R: 守, emendation Graham 1978, 293.
(b) R: 家, emendation Liu Chang, (Graham 1978, 293). The sense of 蒙 *méng*, usually ‘to cover or enshroud’, here has the meaning of ‘include, comprehend, entail’.

What we translate as ‘spatial extent’ is in its more traditional context usually understood as ‘celestial canopy’, a word that generally carries cosmological overtones. Its concrete meaning is ‘eaves’ of a building, or more particularly, the space defined by the eaves. The word 宇 *yǔ* < ***gwaq** in both meanings, ‘celestial canopy’ and ‘eaves’, is easily seen to be related to the less common word 于 *yú* < ***gwa** ‘space between the corners of the mouth of a bell’. This 于 *yú* < ***gwa** is a technical term, explained in the “Kao gong ji” 考工記 section of the *Zhou li* with the phrase 銑間謂之于 “the space between the corners of the mouth of a bell we call *yú* 于” (40.8b), that is, the space defined by the “arched” portion of the mouth of a *yong*-type bell as seen in the illustration here (Fig. 3.1):

Fig. 3.1 *Yong*-bell (Hubei Sheng 1996, 15; courtesy of the Hubei Provincial Museum)

The parallel of A 41 here with the preceding section, A 40, *jiǔ* 久 ‘enduring’, *i.e.*, ‘temporal extent’, suggests the general sense of ‘spatial extent’, in particular because the same verb *mí* 彌 ‘to span, spread (over, out, through)’ is used in both passages. This is consistent with the meaning of *yǔ* 宇 as ‘eaves’ and with its lexical affine *yú* 于 as ‘the space between the corners of the mouth of a bell’, both constituting concrete senses of spatial extent, and also with *yǔ* 宇 as ‘celestial canopy’, a somewhat less concrete use of the word.

The two sections, A 40 and A 41, seen in tandem suggest that the word *mí* 彌 ‘to span, spread’ is applicable both to space and to time. Spatially, the sense of ‘east and west’ “entailing” ‘north and south’ is, as Graham notes (1978, 294), that the two directional spans are not separated from each other as independent manifestations of space, but are rather two different aspects or perspectives of a single comprehensive spatial extent.

A 42

C: 窮, 或[a] 又[b] 前不容尺也。
E: 窮:或不容尺, 有窮。莫[c] 不容尺, 無窮也。

C: *qióng* ‘having a limit’ means that somewhere advancing further will not accommodate any (additional) measure.
E: *qióng* ‘having a limit’: if somewhere it does not accommodate any (additional) measure, then you have a case of ‘having a limit’. If nowhere it does not accommodate any (additional) measure, then you have a case of ‘not having a limit’.

(a) The word *huò* < ***GGwək** 或 occurs several times in these passages, translated variously as ‘in any case’, ‘somewhere’ (A 49, B 13), ‘(in) one (case)’ (A 67), and ‘something’ (B 27), according to context. All of these translations are alternative reflections of the basic meaning of the word *huò* as a verb phrase adjunct indicating distributional scope of the verb phrase over some, but not all members of an explicit or implicit set, *i.e*., {set X} 或 VP means that the verb phrase applies to some, but not all of the members of set X. The word *mò* < ***mmak** 莫 is the counterpart distributional adjunct indicating the null set, thus ‘in no case’, ‘nothing’ (A 43), ‘nowhere’ (A 65). Both *huò* < ***GGwək** 或 and *mò* < ***mmak** 莫 belong to a small set of words likely morphologically related by having in all cases a suffix **-k** as the ‘distributional’ morpheme.
(b) R: 有; emendation Graham 1978, 294, 有 stands frequently in manuscripts and early texts for *yòu* ‘again’, typically written 又 in the received writing system.
(c) For 莫 see note a above.

The archaeological evidence for the *chí* 尺 ‘measuring rod’ shows clearly that it came to be a fixed, standard length of about 23–24 cm, typically subdivided into 10 equal units. All the same, the word *chí* 尺 is used frequently throughout these chapters of the *Mozi* as a concrete way to refer to any short linear measure without necessarily specifying a fixed length. Thus, when the present passage refers to “not accommodating any (additional) measuring rod,” the meaning must be understood as “not accommodating any further linear measure of any length.”

A 43

C: 盡, 莫不然也。
E: 盡:俱[a]止動[b]。

C: *jìn* ‘to be exhaustive’ means that nothing is not so.
E: *jìn* ‘to be exhaustive’: all are either fixed or moving.

(a) R: 但, emendation Graham 1978, 81.
(b) Graham emends the text by shifting 動 to the opening line of the Explanation of A 44. We maintain the text as transmitted.

In A 42 the *qióng* 窮 refers to ‘exhausting’ space by reaching a limit. Here the ‘exhaustiveness’ refers to identifying all of the options available for any given condition, for example, the two options, being fixed in place or moving, exhaust the possibilities for anything in regard to motion; there is no third option. This is a condition that could have been described by the *mǎ fēi mǎ* 馬非馬 ‘horse/non-horse’ rubric, the Mohist’s label for a *tertium non datur* situation, but that connection is not made here in any explicit way. Rather the fact that this section follows immediately on *qióng* 窮 implies that the Mohist recognized the pertinence of *jìn* ‘to be exhaustive’ beyond spatio-temporal contexts.

When the verb *rán* 然 ‘to be like this, to be so’, does not refer to any explicit state or phenomenon already expressed in the immediate context, it has a generic meaning ‘to be like whatever might be at issue’; see also A 1.

For *zhǐ* 止 ‘remaining fixed’ see A 50 and for *dòng* 動 ‘moving’ see A 49.

A 44

C: 始, 當時也。
E: 始:時, 或有久, 或無久。始當無久。

C: *shǐ* ‘beginning’ pertains to time.
E: *shǐ* ‘beginning’: time in some cases has duration and in some cases does not have duration. The ‘beginning’ corresponds to [the case of] not having duration.

Identifying *shǐ* ‘beginning’ as having no duration, thus a “dimensionless” temporal point matches conceptually the identification of *duān* 端 ‘end-point’ as the spatial element having no magnitude. See A 61.

A 45

C: 化, 徵易也。
E: 化:若𩾌[a]為鶉。

C: *huà* ‘transforming’ is when the set of identifying features switches from one to another.
E: *huà* ‘transforming’: like a frog becoming a quail.

(a) R: 𩾌, a *hapax graphomenon*. The R character is likely a corruption of an original 𩾌 *wā* (var. 圭 & 蛙), identified in the *Shuowen jiezi* as 蝦蟆 *hámá* a kind of ‘frog’ (*SWGL* 6067). The emendation is confirmed by a story in the *Liezi* that says 蛙為鶉 “a frog becomes a quail” (Yang Bojun 1965, 7). The same transformation is recorded in the *Huainanzi* as 蝦蟆為鶉 (He Ning 1998, 763) “a frog becomes a quail,” using the bisyllabic word 蝦蟆 *hámá* ‘frog’ instead of 蛙 *wā* and the single verb 為 *wéi* ‘become’ instead of 化為 *huà wéi*.

This section describes transformation as a change of the characteristics of something. The salient point here, as Graham mentions (1978, 214), is the use of the verb *yì* 易 ‘to switch, change’. Specifically, this is a “substitution” or “replacement”, *i.e.*, the kind of change that entails replacing A with B. The word *yì* < ***lek** 易 in its most concrete sense seems to have referred to agricultural crop rotation, and is likely cognate with *yì* < ***lak** 譯 ‘to translate’ < ‘replace language A with language B’ (Behr 2004, 173–208; esp. 180). *Cf.* also 鬄 *dì* < ***llek** ‘hair-piece’, *i.e.*, “replacement” hair.

Graham notes that the association of 徵 *zhēng* ‘identifying feature’ with the verb 化 *huà* ‘to transform, shift’ is found also in the *Lüshi chunqiu*: 徵雖易, 表雖難, 聖人則不可以飄矣 “Although the identifying features may be changed, although the outward appearance may be difficult (to discern), if one is a sage, then he could not (by those things) be caused to waver” (Chen Qiyou 1990, 1413) and in the *Huainanzi*: 故聖人見化以觀其徵 “Assuredly, a sage will see a transformation and thus observe its identifying features” (He Ning 1998, 946; Graham 1978, 295). The “Zhèng míng” 正名 section of the *Xunzi* is more precise than the *Lüshi chunqiu* about the nature of 化 *huà* ‘to transform’, describing it as 狀變而實無別而為異者謂之化。有化而無別謂之一實。 “Being seen as different when the appearance is altered but the entity is without distinction, we call *huà* ‘being transformed’. When there is a transformation but no distinction we refer to that as a ‘single entity’.” (Wang Xianqian 1972, 16.11; *cf.* Knoblock 1994, 131: “Where the appearance undergoes metamorphosis, but there is no distinction in the reality, yet they are deemed different, it is called ‘transformation’. Where there is transformation but no distinction, it is called one object.”) The complete passage of the *Huainanzi* line cited in the textual note above is 夫蝦蟆為鶉。生非其類。唯聖人知其化。“As for any case of a frog becoming a quail, as living creatures they are not in the same class, so only a sage recognizes this as a transformation.” The implication is that the frog and the quail are the same basic entity, and only appear different as a result of a transformation in their distinguishing marks, their ‘identifying features’ (徵 *zhēng*), *i.e.*, their appearance. (See Liang Qichao 1923, 101.)

A 46

C: 損, 偏去也。
E: 損: 偏也者, 兼之體[a]也。其體或去或[b]存, 謂其存者損。

C: *sǔn* ‘lessening’ is partially removing.
E: *sǔn* ‘lessening’: to be ‘partial’ is to be an element of a composite whole. When some of its elements are removed and some are retained, we refer to what is retained as ‘lessened’.

(a) R: 禮; emendation Graham 1978, 296.
(b) R: null; emendation Graham 1978, 296. In a conventional narrative style we would expect the *huò* 或 to be repeated before the second verb, here *cún* 存, hence Graham’s emendation. The text is, even without the second *huò* 或, still understandable as ‘some ... are removed or maintained’.

The present section identifies the process of ‘lessening’ in material terms, specifically referring to the *tǐ* 體 ‘element’ introduced in A 2. There is evidence for a complementary section on *yì* 益 ‘increase’ immediately following this one that has been entirely lost, except for the head word *yì* ‘increase’. See Graham 1978, 296.

A 47

C: 儇[a], 稧秖[b]也[c]。
E: 儇:句[d]皃[e]也。

C: *xuán* ‘circling around’ is coiling and curving.
E: *xuán* ‘circling around’: a curving appearance.

(a) R: 大益儇; Graham (1978) deletes the two-character phrase 大益, suspecting that it is a remnant from a lost entry for 益 *yì* ‘increase’, the counterpart to the preceding A 46 entry for 損 *sǔn* ‘lessen, decrease’, and not actually a part of A 47. The character 儇 stands for the word *xuán*, usually written 旋 or 還 in the received writing system.
(b) The first of the two characters of R here, 稧, is a *hapax graphomenon*, with an apparent phonophoric 具 *jù* < ***gro-s**. Only 秖, the second of the two, is attested in the transmitted writing system, but it is not entirely clear what word this character stands for in this entry. Understood as *zhī* < ***tij** ‘grain beginning to ripen’, the word with which it is conventionally associated, it seems not to make any sense here. Sun Yirang suggests that it is a variant for 柢 *dǐ* < ***ttij** ‘base of a plant stalk’ (*i.e.*, the phytomorphic specialization of the basic word 底/氐 *dǐ* ‘base’), but this also is difficult to fit to the present context. Graham 1978, 296–97 identifies the two characters 稧秖 together as likely constituting a binome, perhaps inadvertently metathesized, equivalent to 枝拘 *zhī gōu* < ***ke-kko**, found in *Huai-nan zi* 19 (He Ning 1998, 1368) where it seems to mean ‘(branches) coiling and curving’ (see below), but the two modern Chinese readings *zhī* 秖 (***tij**) and *zhī* 枝 (***ke**) are misleading in this regard; their respective OC values as usually understood do not allow for such a graphic interchange.
(c) R: null; emendation Graham 1978, 296–97. This is the only canon entry from A 1 to A 75 with no final *yě* 也. On this basis Graham adds it.
(d) R: 昫; emendation Graham 1978, 297, *cf.* also 枸 *gōu* ‘curved or bent piece of wood’.
(e) R: 民; emendation based on the graphic similarity of the *guwen* form of 民, *viz.* 皃, to 皃, one of the common, if non-standard, graphic variants of the character 貌 *mào* ‘visible characteristics’ (Graham 1978, 195).

This is the first of three sections describing different kinds of motion (‘circling around’, ‘rotating’ and ‘moving’). A 50 then describes rest (‘remaining fixed’). Yang Shuda suggests that the binome 枝拘 *zhī gōu* in *Huainanzi* ought to be read as 積糾 *zhǐ jǔ* < ***ke-q - ko-q**, a phonetically acceptable variant of 枝拘 *zhī gōu* < ***ke-kko,** meaning ‘coiled and curved’ or ‘coiling and curving’, a sense that fits the present context exactly (Yang Shuda 1985, 193).

A 48

C: 運[a], 易也。
E: 運:區穴若斯[b]貌常。

C: *yùn* ‘rotating’ is switching from one to another.
E: *yùn* ‘rotating’: An outline, when like the appearance of a parapet, is recurrent.

(a) R: 庫, emendation Wu Yujiang (Graham 1978, 297); see also A 80 in the “Lexical Appendix” *infra*.
(b) Graham 1978, 297 observes that 斯 *sī* ‘this’ is not a part of the pronominal system of the *Mozi* and so the character 斯 is not likely standing for that word here. He understands it as the verb *sī* ‘cut’ (*Kangxi zidian* 斯析也 ‘split’), though this meaning is difficult to understand here. In the opening sections of *Mozi* 52, “Bei cheng men” 備城門 (“Preparing the city walls and gates [for defense]”) the word *xī*, written either 撕 or 櫰, occurs in the meaning ‘parapet’. Johnston 2010, 737, 739 understands the word correctly as ‘parapet’ in the two chapter 52 occurrences, but fails to make the ‘parapet’ connection with the character 斯 here.

The sense of the word *yì* 易 in the Canon includes the meaning of cyclical switching, *i.e.*, the replacement of one item by another in a defined sequence. It also includes the meaning of switching orientation in space, which we find in the optics Sect. B 23: 景一小而易, 一大而正 “the image is sometimes small and switched, and sometimes large and upright.” The switching involved in the B 23 section must be an inversion in that it is the complement of *zhèng* 正 ‘upright’. The sense of cyclical switching is commonly seen for the word *yùn* 運 denoting the cycle of seasons, *e.g.*, in the *Dadai Liji* 大戴禮記 we find the phrase 觀四時之運 “Observe the rotation of the four seasons” (Wang Pinzhen 1989, 62). Just as for the word *yì* 易, the meaning of the word *yùn* 運 also entails spatial orientation, as is seen in optics section B 19: 景運內 “the shadow is rotated on the inside.” Switching in orientation can be seen as a variant sense of rotation about an axis, a sense clearly inherent in *yùn* 運 as it is found used in, *e.g.*, *Mozi* 35 & 37, *yùn jūn* 運鈞 ‘rotating potter’s wheel’.

We understand *qūxué* 區穴 ‘outline’ as derived from an underlying verb-object construction ‘to delineate the empty/hollow space’. The same term occurs also in A 63. The outline in question here is described as having the appearance of a crenelated parapet. The recurrent switching between crenels and merlons of the parapet fits as a concrete example of the rotational switching from one thing or state to the next.

A 49

C: 動, 或徙[a]也。
E: 動: 偏 際[b] 徙[c] 者, 戶樞, 兔[d] 蝨[e]。

C: *dòng* ‘moving’, implies a shifting about somewhere.
E: *dòng* ‘moving’: something that shifts asymmetrically about a contact point, the pivot of a door, the louse on a rabbit.

(a) R: 從, emendation Graham 1978, 298.
(b) R: 祭, emendation Liang Qichao 1923, 103.
(c) R: 從, emendation Graham 1978, 298.
(d) R: 免, emendation Graham 1978, 298.
(e) R: 瑟, emendation Graham 1978, 298.

The precise meaning of the Canon seems straightforward and unambiguous; the Explanation is by contrast somewhat puzzling in view of the two apparent examples of ‘shifting about’ that it offers. By specifying *piān jì* 偏 際 ‘from an oblique, *i.e.*, asymmetrical, contact point’ the Explanation seems to limit the ‘moving about’ to irregular movement rather than extended, purposeful motions. The “louse on a rabbit” image occurs again in section A 88, dealing with basic pairs of seeming opposites, *tóng yì* 同異 ‘same and different’, and the fact that sometimes ‘sameness’ and ‘difference’ are absolutes and sometimes they are not absolute, but dependent on a given perspective. The “louse on a rabbit” image is used to represent the non-absolute relation between ‘coming’ and ‘going’, *jiù qù* 就去. The louse can be moving haphazardly in one direction on the rabbit, while the rabbit itself can be moving in another direction at the same time.

The ‘louse’ figures in B 6, this time as a part of an example intended to illustrate the non-comparability of things, and by extension the difference between ‘name’ and ‘thing’: C: 異類不比, 說在量 “things of different categories are not comparable; the explanation lies with ‘gauging’.” E: … 木與夜孰長 … 蝨與瑟孰瑟 “… a tree in comparison with the night, which is longer? … a louse in comparison with a zither, which is more ‘zither-like’?” The latter-mentioned of these two incomparable pairs is a play on words, *i.e.*, it is based on the near homophony of the two words *shī* < ***srit** (from an earlier ***srik**) ‘louse’ (蝨) and *sè* < ***smrit** ‘zither’ (瑟), and, according to Graham, on the further lexical fact that there is a third word *sè* < ***smrit** ‘glistening’ written with the same character as *sè* < ***smrit** ‘zither’, *viz.*, 瑟. The sense then could be understood as “… a louse in comparison with a zither, which is more ‘zither-glistening’?” or simply “… which is more glistening?”

The two words *shī* < ***srit** 蝨 ‘louse’ and *sè* < ***smrit** 瑟 ‘zither’ seem to have been already at the time of this text phonetically close, ***srik** already having become ***srit**. By Han times they have become completely homophonous. We find the following passage in the *Huai-nan zi*, a text from the second century B.C.E.: 頭蝨與空木之瑟, 名同實異也。“the ‘head-louse’ *sè* and the ‘hollow-wood zither’ *sè*, the name is the same, but the thing is different” (He Ning 1998, 1208). This passage clearly bears on the prevalent “language-philosophy” concern of the time with the difference between ‘names’ and ‘things’. The B 6 *Mozi* passage may have the same sense, ‘name’ and ‘thing’ presented as an example of “incomparability”.[4]

For 或徙 see B 13.

[4] For textual notes to and discussion of A 88 and B 6 see Graham 1978, 221–22, 338–41 and 387.

A 50

C: 止, 以久也。
E: 止: 無久之不止, 當牛非馬。若矢[a]過楹。有久之不止, 當馬非馬。若人過梁。

C: *zhǐ* 'remaining fixed' means thereby enduring.
E: *zhǐ* 'remaining fixed': The not-remaining-fixed that lacks duration corresponds to 'ox/non-horse'; like an arrow passing a pillar. The not-remaining fixed that has duration corresponds to 'horse/non-horse'; like a person passing across a bridge.

(a) R: 夫, emendation Graham 1978, 298.

'Remaining fixed' means 'fixed in place' and is inherently a durative phenomenon; there is no other possibility. But for the relation between 'remaining fixed' and 'not remaining fixed' there are two possibilities: (i) the 'remaining fixed' is durative and the 'not remaining fixed' is punctual or (ii) both are durative. The former is of the "ox/non-horse" type; the 'not remaining fixed' is exemplified by an arrow passing a pillar, a momentary, punctual event. The latter is of the "horse/non-horse" type, where the 'not remaining fixed' is exemplified by a person crossing a bridge, clearly a durative event.

We can describe the relation as follows:

(a) being fixed (+F) entails by definition duration (+D): {+F, +D} is the only +F possibility;
(b) not being fixed (−F) can be punctual (*i.e.*, non-durative, −D) or durative (+D), so there are two possibilities: {−F, −D} and {−F, +D};
(c) the relation between {−F, −D} and {+F, +D} is "*x*, not *y*", because changing one feature of the first does not tell you anything definite about the second;
(d) the relation between {−F, +D} and {+F, +D} is "*x*, not *x*" (*tertium non datur*); because "*x*" and "not-*x*" cannot apply simultaneously to something.

In the terms familiar from other parts of the Mohist dialectical sections, and from the texts of the so-called "Logicians" or "Sophists", the relation between {+F, +D} and {−F, −D} is "ox/non-horse" meaning that while being an ox necessarily entails not being a horse, the converse is not the case; that is, not being an ox does not necessarily entail being a horse. By contrast, the relation between {+F, +D} and {−F, +D} is "ox/non-ox", a simple "either/or", "yes or no" choice, with no third possibility. As the following diagram shows, just as the set of 'horses' is a subset of the set of things that are 'non-oxen', but not all 'non-oxen' are 'horses', so the set of +F 'remaining fixed' phenomena is a subset of the set of +D 'durative' phenomena, but not all +D phenomena are +F.

The diagram in Fig. 3.2,[5] reflecting the Mohist text's use of animal names to illustrate the points at issue, is restricted to the +D possibilities. We could use the same diagram to represent the non-durative case marking that portion outside the

[5] The diagram was created by the late Peter Damerow in Berlin as a part of a discussion working out the sense of the section.

Fig. 3.2 Set diagram for 'durative' and 'fixed'

outer circle as −D, but we would have to change the animal labels, *e.g.*, labeling everything outside the outer circle with 'non-horse' and everything within as 'horse', which would be inconsistent with the animal name labeling given in the diagram here. This is because the Mohists are using the animal names on a case-by-case basis, and not systematically for all possibilities.

The text's image of "an arrow passing a pillar" is intended to represent the conjunction of 'not being fixed' and at the same time 'not being durative', since clearly a flying arrow is moving and therefore not fixed, and just as clearly its passing a stationary point, here the 'pillar', is perceived as momentary and therefore not durative, thus {−F, −D}. Similarly, the image of a person crossing a bridge is just as obviously 'not fixed', and also clearly 'durative', thus {−F, +D}. These two images, together with the original Canon statement, which amounts to {+F, +D}, represent all empirically possible combinations of +/− F and +/− D. The fourth combination, *viz.*, {+F, −D}, is a contradiction in terms and, given the premise of the Canon here, is not an actual possibility; that is, from the Mohist perspective as reflected here there is no possibility of a non-durative 'being fixed'.

A 51

C: 必, 不已也。
E: 必:謂商[a]孰[b]者也。若弟兄。一然者, 一不然者, 必[c]不必也。是非必也。

C: *bì* 'being inevitable' means being unable to get rid of.
E: *bì* 'being inevitable': refers to counterparts bringing about each other, like younger and elder brothers. One thing being so and one not so may entail inevitability or may not entail inevitability; but either being this or not being this is a case of inevitability.

(a) R: 臺; emendation Graham 1978, 299.
(b) 孰 = 熟 *shú* 'bring to maturity, develop(ed) fully'.
(c) Graham 1978, 299 proposes an emendation to 止 because the character 止 is frequently confused graphically with 心, a character that in the received orthography clearly suggests 必 and on the grounds that the text is in his view "surely unintelligible" as it stands. We are not persuaded that an emendation is called for and we understand the text of R as registered in the translation above.

The sense in which *yǐ* 已 'to end, stop' is understood here as 'to get rid of' is a fundamental part of the meaning of the word, as can be clearly seen from A 76 (in the lexical appendix) where *yǐ* 已 is given two senses, one *chéng* 成 'to complete' and the other *wàng* 亡 'to get rid of' (*sc*. as of an affliction or illness). Thus, *bì* 'being inevitable' is 'being unable to be gotten rid of' > 'unavoidable, inevitable, necessary'.

The sense of the Canon and the Explanation taken in tandem here is to identify two kinds of 'inevitability'. First, the Canon itself simply defines 'inevitability' broadly as something 'not stoppable', *i.e*., that will come about absent any external intervention that might interrupt it. This includes the sense of 必 *bì* that we find in, *e.g*., the line 景亦小而必正 "the image too is small and inevitably upright" from B 23 describing one aspect of an image of an object seen reflected in a concave mirror. The 'inevitability' here is a statement of what will be the case as a consequence of the arrangement of light source, mirror and object, that is of the empirical situation itself.

The second kind of 'inevitability', exemplified in the Explanation, is what we might call 'logical inevitability', a sub-type of the broad definition given in the Canon. The existence of an older brother *inevitably* entails the existence of a younger brother (the terms used in the Explanation are, *more sinico*, exclusively male), and similarly for all such 'counterpart' (商) pairs. In the same way, there is not necessarily an inevitability in one thing being so or not being so, but there is a logical inevitability in something being either this or not being this, *i.e*., when there are only two choices, "yes" or "no", it is inevitable that if something is one it is not the other. This is another statement of the "ox/non-ox" (*tertium non datur*) relation. In this sense this aspect of inevitability recapitulates the "either/or" sense of part *d* given in the discussion of A 50. This may account for this section following directly A 50.

The word *bì* < ***pit** 必 'to be inevitable' is likely a phonetic "fusion" (sometimes called an *allegro* form) form of the negative prefix **p**- plus the word *shī* < ***hlit** 失 'to make a mistake', thus it is, etymologically, 'unmistakeable'.

Compare Lexical Appendix, A 76.

3.4 Corporeal Extension ("Geometry"), A 52–A 69

The 18 sections contain the definitions of 'level', 'being of the same length', 'center', 'having magnitude', 'the sun at the center', 'to be straight', 'circle', 'square', 'doubling', 'end-point', 'having an interstice', 'interstice', 'king-post', 'being filled out', 'hard-and-white', 'overlapping', 'side-by-side comparing', and 'contiguous'. Graham 1978, 230 designates these as dealing with "Geometry" and puts them parallel to the sections on mechanics, optics and economics. Designating these sections as dealing with geometry is clearly inspired by the close similarity of some of the sections with parts of the Greek tradition of mathematics. In particular the definition of an 'end-point' (A 61) and of a 'circle' (A 58) look strikingly similar to the corresponding definitions of point and circle in Euclid's *Elements*. Other sections deal with geometrical attributes such as 'to be straight' (A 57) or procedures such as 'doubling' (e.g., of a line, A 60).

These similarities should not prevent us from recognizing the fundamentally different character of the Mohist doctrine as compared to Euclidean geometry. While the latter deals with the properties of figures that can be constructed with straightedge and compass and, crucially, leaves out the material dimension of the world, focusing on pure extension, the core and goal of these Mohist sections appears, precisely to the contrary, to focus on the corporeal, or material, aspect of extension. Matter thereby does not enter the stage as some kind of substance as a counter-concept to space, but apparently through the attributes of bodies, such as being hard or being white. These attributes fill out the spatial extension (magnitude) of bodies (A 65), or fill out each other (A 66), thus constituting materiality, the central concept that these sections add to the spatio-temporal extensions introduced in the previous sequence of sections.

The first nine sections (A 52–60) all define spatial attributes that can be determined through measurement by means of an instrument, or can even be constructed using an instrument. The instrument may be a measuring rod, or a more elaborate instrument such as a leveling device (seen in A 52 by implication, but not explicitly mentioned); gnomons or sundials (seen in A 56 by implication, but not explicitly mentioned), compasses (A 58), or the carpenter's square (A 59) may be involved. In A 53, defining the feature 'of the same length', the measuring rod is, of all places, *not* mentioned. A 53 in fact may be taken as describing the basic practice and principle underlying the use of a measuring rod. ('Of the same length' is later made use of in A 54 and A 57.) 'Doubling' (A 60), by contrast, is explicitly exemplified through construction by putting two measuring rods together.

The end-point, defined in A 61, is a theoretical artifact, albeit a fundamental one, and may be seen as a consequence of the systematic reflection on various configurations of measuring rods. It seems to be introduced here in anticipation of the different arrangements of physical objects discussed in A 67–69. The 'end-point' is in part the spatial counter-part to the temporal concept of 'beginning' introduced in A 44. The 'beginning' is a purely temporal concept, denoting a point in time. The end-point, by contrast, does not denote a point in space, but a point as an element of a

physical object. This can be seen from the fact that the phrase 無久 *wú jiǔ* ‘lacking duration’ occurs in the definition of ‘beginning’, while the term ‘end-point’ is defined as the absence of physical magnitude (無厚) rather than the absence of spatial extension (e.g., 無宇).

The relation between spatial and corporeal extensions is further differentiated in the following three sections, starting with contrasting definitions of ‘having an interstice’ and ‘interstice’ (A 62, A 63). In particular, a case of a measurement that does not result in a valid application of the concept of interstice is pointed out in the Explanation of A 63. A 64 then addresses the question of the (non-)materiality of the interstice itself. The point is made that ‘emptiness’ pertains to the interstice and not the thing having an interstice. ‘Emptiness’ is thus given through contrast with the materiality of the thing having the interstice, which makes it a relative rather than an absolute notion.

A 65 then contains an explicit discussion of material filling out that goes together with having magnitude. As will become clear in A 66, the materiality of filling out consists in attributes being present and presumes a physical object.

A 66 introduces the concept of hard-and-white. This further explores the relation of attributes to their spatial distribution, now considering more than one attribute. This brings about the question of the compatibility or the mutual exclusion of two attributes. The concept of hard-and-white establishes a connection between spatial and logical aspects: the condition of the attributes filling out each other is a spatial one, the condition of the attributes not contradicting each other is a logical one.

A 67–A 69 then discuss the different spatial arrangements of ‘overlapping’, ‘side-by-side comparing’, and ‘being contiguous’. ‘Overlapping’ figures in both of the following Canons, and all three Explanations employ the concept of ‘end-point’. It is stated that the overlapping occurring in the case of a hard-and-white situation must be exhaustive, the point being probably that the two attributes must fill out each other (A 67).

A 52

C: 平, 同高也。
E: [null]

C: *píng* ‘level’ means of the same height.
E: [null]

This is the first of three sections involving equal measured lengths.

A 53

C: 同長, 以正相盡也。
E: 同:楗[a]與框[b]之同長也正[c]。

C: *tóng cháng* ‘of the same length’ means that by being laid straight (next to each other) each exhausts the other.
E: *tóng* ‘(of) the same (length)’: As for a door barrier-post and its door frame being of the same length, they are laid straight.

(a) R: 捷, emendation Graham 1978, 304.
(b) R: 狂, emendation Graham 1978, 304.
(c) R: 心, emendation Graham 1978, 304.

The equal length of two things is defined as the end-points of each matching those of the other when laid side-by-side. We can only imagine what was the structure of the door frame and how the barrier-post operated as a device for preventing the door from being opened, but it is clear that the sense of the example in the Explanation is that when laid straight with each other these two parts of the door will be of the same length.

Here *jìn* 盡 ‘exhaust’ has a spatial reference; for *jìn* 盡 referring to attributes more generally see A 43.

A 54

C: 中, 同長也。
E: 中:自是往, 相若也。

C: *zhōng* ‘center’ implies being of the same length.
E: *zhōng* ‘center’: extensions starting from this match one another.

Using the meaning of the term *tóng cháng* 同長 ‘to be of the same length’ as just explained in A 53, the Canon here defines what can be understood as a center-point. The simplest example of a center-point is that of a linear span, the extensions in opposite directions from which will be of equal length. For a circle *zhōng* 中 is the center and the equal length extensions are the radiuses (see A 58). In a limited way the definition is also applicable to any symmetrical non-circular two-dimensional figures, defining the center point of a square, of a rectangle (*sc*. the diagonal cross-lines) or of an equilateral triangle. Such an understanding of a center-point could, clearly, apply to three-dimensional figures, but there is no indication that the Mohist was including that in these analyses.

A 55

C: 厚, 有所大也。
E: 厚:惟端[a]無所大。

C: *hòu* ‘having magnitude’ means that there is something in relation to which it (*i.e.*, the thing that has magnitude) is bigger.
E: *hòu* ‘having magnitude’: Only an end-point has nothing in relation to which it is bigger.

(a) R: null; restoration of 端 by Graham 1978, 305.

In everyday language the word *hòu* 厚 means ‘to be thick’ (one dimensionally). In this passage it has been turned into an abstract term which is then used as a technical element within a conceptual framework, as can be seen from its usage in A 61 (端), A 65 (盈), and A 69 (次).

For the definition of *duān* 端 ‘end-point’ see A 61.

A 56

C: 日中, 正南也。
E: [null]

C: *rì zhōng* ‘the sun at the center’ is being due south.
E: [null]

In this case the ‘center’ refers to the mid-point on the sun’s trajectory between rising and setting, which would have been determined with a device such as a gnomon or sundial.

A 57

C: 直, 參也。
E: [null]

C: *zhí* ‘to be straight’ is to be in alignment.
E: [null]

The Canon defines ‘straightness’ as being in ‘alignment’. The *Shuowen* defines *zhí* 直 as 正見也 ‘to see evenly, directly, straight on’ (*SWGL* 5714).

As Graham points out (1978, 307, 369–70), *cān* 參 is the standard term in Chinese astronomy for aligning two gnomons with an observed heavenly body. Given the astronomical context of A 56, the reference here to an astronomical practice seems likely.

Beyond this, *cān* 參 refers to the three stars of the constellation Orion that in their linear arrangement are sometimes identified as Orion’s ‘belt’.

The word *cān* < ***ttshrum** 參 itself is cognate with the word *sān* < ***ssrum** 三 ‘three’; *cf. cān* < ***ttshrum** 驂 ‘team of three horses’. The implication seems to be that in the simplest sense ‘alignment’ is understood as having a third point in a line with two others. In everyday Euclidean terms any two points, of course, define a line; a third point may or may not lie on the same line, *i.e.*, be in ‘alignment’. ‘Alignment’, in other words, allows for an opposite, *viz.*, unaligned.

A 58

C: 圜, 一中同長也。
E: 圜:規寫攴[a]也。

C: *yuán* ‘circle’ implies being of the same length from a single center.
E: *yuán* ‘circle’: When drawing with a compass, it is the plainest form.

(a) Apart from its occurrence here, the graph 攴 in R is unattested standing as an independent character. It is known in the received writing system only as a graphic component, typically functioning as a semantic classifier (classifier number 066 of the Kangxi scheme), written 攵, in many compound characters. Structurally the character 攴 consists of the ‘hand’ component 又 with 卜 *bǔ* as the phonophoric. Given the propensity of the *Mozi* text to include uncommon forms of characters, it is not unlikely that this is a graphic variant of the received character 扑 standing for the word *pǔ* ‘uncut, unadorned, rough, plain’, which has basically the same two graphic constituents but arranged horizontally rather than vertically. Such positional variation of graphic constituents is not uncommon in the pre-Han script. The character 攴 then we take as standing for the word *pǔ* (normally written 扑) meaning ‘uncut, rough, plain’. See also Graham 1978, 307–08.

Based on the prior identifications of *zhōng* ‘center’ (A 54) and *tóng cháng* ‘to be of the same length’ (A 53) this section identifies a ‘circle’ and goes hand-in-hand with A 59 following.

The *gūi* 規 ‘compass’ and *jǔ* 矩 ‘carpenter’s square’ (see A 59) are two of the most frequently invoked examples intended to represent adherence to objective rules or guidelines. In chapter four of the *Mozi*, “Fa yi” 法儀 (“Rules and Proprieties”) we find this observation:

> 天下從事者, 不可以無法儀。無法儀而其事能成者無有也。雖至士之為將相者, 皆有法, 雖至百工從事者, 亦皆有法。百工為方以矩, 為圓以規, 直以繩, 正以縣。
>
> Anyone who pursues affairs in the sub-celestial realm cannot do without rules and performance guidelines. There is no instance where, without rules and performance guidelines, one’s affairs were able to be accomplished. Even the highest officers who serve as leaders and ministers in all cases have rules. And even those various craftsmen who pursue their trades also in all cases have rules. The craftsmen will use a carpenter’s square to make a square, a compass to make a circle, a snap-line to make something straight, and a plumb-line to make something vertical.

The difference between the indirect admonition of the “Fa yi” chapter and sections A 58 and A 59 of the *Mohist Canon* is that the former is intended to influence social behavior while the latter are meant to provide precise definitions within a terminological system.

A.C. Graham suggests that the sense of *pǔ* 攴 ~ 扑 here is closer to ‘rough’ in the sense of “a rough outline” than it is to ‘plain’ as we have translated it (Graham 1989, 81). This interpretation he gets from the fact that in the “Tian xia” 天下 chapter of the *Zhuangzi* there occurs a list of apparently intentionally self-contradictory or ironic statements of the “dogs can become sheep,” “the eye does not see” kind ascribed to the so-called Sophists, and in this list we find these two statements: 矩不方, 規不可以為圓 “the carpenter’s square does not make a ‘square’; the compass cannot make a ‘circle’” (Guo Qingfan 1975, 1106). Graham, often following the

Chinese commentarial tradition, finds rationales or explanations for most of these statements that fit or rebut the point that the Sophist was allegedly trying to make by invoking such statements in the first place. In the case of the *guī* 規 ‘compass’ he suggests that the explanation lies with the fact that a perfect circle is an ideal form, and is in principle unachievable in practice, and so *mutatis mutandis* for the *jǔ* 矩 ‘carpenter’s square’. And so he understands the word *pǔ* 支 as meaning “a rough approximation (to the ideal).” This interpretation hints at the Greek sense of a geometrically perfect or ideal form, an understanding for which there is no evidence in the *Mohist Canon*, and which therefore seems to us an unjustified, if unconscious, appeal to a Greek conceptual perspective that has no pertinence to the Mohist world.

A 59

C: 方, 匡[a]隅四雜[b]也。
E: 方:矩見支[c]也。

C: *fāng* ‘square’ implies that the frame corners number four and are closed up.
E: *fāng* ‘square’: When drawing with a carpenter’s square, it is the plainest form.

(a) R: 柱, emendation Graham 1978, 308.
(b) R: 讙, emendation Sun Yirang, (Graham 1978, 308).
(c) See the note re 支 in A 58.

Complementing the immediately preceding section describing a ‘circle’, this section similarly identifies a ‘square’. The Canon would seem to allow for any kind of quadrangle; only the Explanation by virtue of invoking the carpenter’s square excludes all such that do not consist of only right angles. In normal parlance both the word *fāng* 方 and the word *kuāng* 匡 ‘square-frame basket’ are typically used for squares, though technically they can refer also to rectangles.

A 60

C: 倍, 為二也。
E: 倍:二, 尺與尺俱[a]去一端, 是無同也。

C: *bèi* ‘doubling’ is making two.
E: *bèi* ‘doubling’: ‘two’ means a measuring rod together with another measuring rod both extending (linearly) away from a single end-point, in this case (*i.e.*, the case of doubling), they will have no shared portion.

(a) R: 但, emendation Graham 1978, 81, 309.

The general notion of ‘doubling’ is illustrated very concretely in linear terms by explaining that two identical measuring rods laid end-point to end-point (in a straight line) such that there are no coincident points will give a doubled length.

A 61

C: 端, 體之無厚[a]而最前者也。
E: [null]

C: *duān* 'end-point' is the element that, having no magnitude, comes foremost.
E: [null]

(a) R: 序, emendation Graham 1978, 310.

Note that although the Chinese term *duān* 端 is here used with the meaning of a starting point, generally it is used in the *Mohist Canon* just as English 'end-point', to refer equally to the "starting point" as well as the "termination point" of a line or rod. A rod has two "ends", a front end and a back end. At the same time the word is often used abstractly. In the *Lunyu* (*Analects of Confucius*) Confucius uses it to mean both 'starting point' and 'end-point': 有鄙夫問於我, 空空如, 我叩其兩端而竭焉。 "If some rustic chap were to ask me about something, no matter how vacuous, I would exhaust myself over it, knocking my head against it *top to bottom*" (*Lun yu* 9.8).

About a century later the word has taken on a moralistic or ethical dimension and figures in some of the best-known passages of the *Mencius* as the "starting point" for what is innately good within a person, *e.g.*,: 惻隱之心, 仁之端也; 羞惡之心, 義之端也; 辭讓之心, 禮之端也; 是非之心, 智之端也。人之有是四端也, 猶其有四體也。有是四端而自謂不能者, 自賊者也。 "A feeling of sensitivity and sympathy is the *starting point* for humaneness; a feeling of diffidence and distaste is the *starting point* for propriety; a feeling of deference and yielding is the *starting point* for ceremony; a feeling for right and wrong is the *starting point* for wisdom. People have these four *starting points* just as they have four limbs. One who, having these four *starting points*, says of himself 'I am unable [to meet these desiderata]' does himself an injurious disservice" (*Mencius* 2A.6).

For the entry for *hòu* 厚 'magnitude' see A 55. For the entry for *tǐ* 體 'element' see A 2.

A 62

C: 有間, 不及[a]中也。
E: 有間[b]:謂夾之者也。

C: *yǒu jiān* ‘having an interstice’ is (the sides) not reaching to the center.
E: *yǒu jiān* ‘having an interstice’: refers to what flanks it (*i.e.*, what flanks the interstice).

(a) R: null; emendation Graham, restoring the two-character phrase 不及 on the basis of a perceived parallelism with A 63 (1978, 311).
(b) R: 聞; emendation Graham 1978, 310.

Beginning here with A 62 the text presents a series of eight terms dealing with spatial arrangements, from ‘having interstices’ to ‘being contiguous’. This section refers not simply to an ‘interstice’ (that is what we find in A 63), but to the object(s) in relation to which the interstice occurs. This may seem to be in some respects a subtle distinction, but it appears to be for the Mohist important.

A 63

C: 間, 不及旁也。
E: 間[a]:謂所[b]夾者也。尺前於區穴而後於端, 不夾於端與區穴[c]。及及非齊之及也。

C: *jiān* ‘interstice’ is not reaching to the sides.
E: *jiān* ‘interstice’: refers to what is flanked. Measurements starting from an outline and ending at an end-point should not be considered as flanked by the end-point and the outline. Those two reachings are not equivalent reachings.

(a) R: 聞. emendation Graham 1978, 310.
(b) R: null; 所 added by Graham 1978, 311.
(c) R: 內, emendation Graham 1978, 310.

To be able to speak of an ‘interstice’ you need two flanking objects that are comparable in their capacity to be identified as boundaries of the interstice. Measuring from an outline with a measuring rod and considering the opposite end of the measuring rod as a flanking point does not define an interstice because on one side the measuring rod reaches the outline but on the other it “reaches” only to its own end-point. The two “flanking” parts are not comparable, and so the two reachings are not equivalent reachings.

As mentioned above (A 48) we understand *qūxué* 區穴 as a verb-object construction ‘to delineate the empty/hollow space’; and presumably the “empty space” can be filled with something and still remain amenable to an ‘outline’.

A 64

C: 櫨[a], 間虛也。
E: 櫨[b]:虛也者兩木之間, 謂其無木者也。

C: *lú.* ‘king-post’ the interstices are empty.
E: *lú* ‘king-post’: What is empty is the interstice between two pieces of wood. It refers to the fact of having no wood.

(a) R: 纑; emendation Sun Yirang (Liang Qichao 1923, 51). The character in R, written with 糸, read *lú* < ***rra**, is defined in the *Shuowen jiezi* as *bù lǚ* 布縷 ‘hempen thread’ (*SWGL* 5906), a definition that may owe as much to the apparent near homophony of *lú* < ***rra** 纑 with *lǚ* < ***ra-q** 縷 (or of *bù lǚ* 布縷 with *bó lú* 薄櫨 [see below]) as with any precise meaning. Graham avers that he finds no meaning of *lú* 纑 that makes any sense here (1978, 311). The word *lú* 櫨, by contrast, means a kind of ‘rectangular piece of wood mounted on top of a pillar, as used, *e.g.*, in the construction of a roof beam’ and would seem to fit the context here. It is entered in the *Shuowen* (*SWGL* 2499, as emended by Ding Fubao, based on a citation in Hui Lin’s *Yiqie jing yin yi*) identified with the binome *bó lú* 薄櫨. Ian Johnston identifies 櫨 *lú* as a ‘king-post’ (Johnston 2010, 428), *i.e.*, “a structural member running vertically between the apex and base of a triangular roof truss.”[6]
(b) R: 纑; see note a *supra*.

The Mohist has recourse to the everyday object of a king-post to illustrate the relation between an interstice and the material frame that forms it (Fig. 3.3).

This reference to the structure of a king-post takes the understanding of ‘interstice’ one step beyond the descriptions of A 62 and A 63 in that it explicitly recognizes the interstice as ‘empty’ (*xū* 虛) relative to the material frame. We might have expected the head character of a section such as this to have been *xū* 虛 ‘empty’, but that notion generally would include much that does not pertain to interstices. By

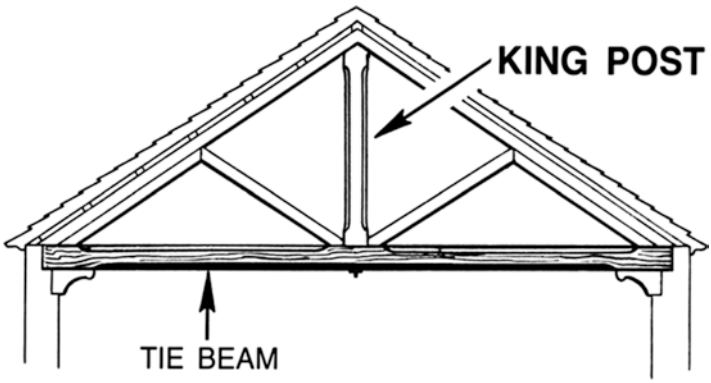


Fig. 3.3 King-post (Wikimedia Commons)

[6] http://dictionary.reference.com, entry: “king post” (https://www.dictionary.com/browse/king-post); accessed on 20 Nov 2021.

the same token, the word ‘empty’ is here used only relative to the material flanking the interstice, not in any absolute sense. The choice of ‘king-post’ to illustrate this sense of ‘empty’ here may have been triggered by the immediately preceding sections on interstices (A 63) and things that have interstices (A 62). The king-post section completes the picture by identifying what is missing when something has an interstice.

A 65

C: 盈, 莫不有也。
E: 盈:無盈無厚。於尺無所往而不得[a]二。

C: *yíng* ‘being filled out’ is nowhere not having something.
E: *yíng* ‘being filled out’: Where there is no filling out there is no magnitude. On the measuring rod there is no place to which it extends such that you do not get both (*i.e.*, filling out and magnitude).

(a) R: 得得; the repetition of the character 得 is a mistake; emendation Graham 1978, 313.

The pair of concepts, ‘magnitude’ and ‘filling out’, consistently differentiate the spatial and the material aspects of physical bodies, yet the passage suggests that neither can occur in the absence of the other, that is, spatial extension of a physical object cannot occur without a material filling out, nor *vice versa*. (Note that in this case the term *chí* 尺 ‘measuring rod’ must refer to the physical object and not to an abstract measure.) The canon here commenting on *yíng* 盈 ‘being filled out’ seems intended to complement the immediately preceding canon dealing with the empty interstices characteristic of the structure of a *lú* 櫨 ‘king-post’. The ‘interstice’ (*jiān* 間) is a spatial extension described as lacking a given material, *i.e.*, is the part that has no wood and therefore is said to be *xū* 虛 ‘empty’. ‘Magnitude’ (*hòu* 厚), by contrast, is a spatial extension that is always accompanied by some material ‘filling out’ (*yíng* 盈).

For the entry for *hòu* 厚 ‘magnitude’ see A 55.

A 66

C: 堅白, 不相外也。
E: 堅白:異處不相盈。相非是相外也。

C: *jiān bái* ‘hard-and-white’ is neither excluding the other.
E: *jiān bái* ‘hard-and-white’: (Attributes in general) when occurring in different locations, do not fill out each other. When attributes are at odds with each other, this means they exclude each other.

This term *jiān bái* 堅白 ‘hard-and-white’ is central to many aspects of the Mohist’s logical discourse. It is defined here, at first unexpectedly, among the terms referring to spatial arrangements, because when understood literally, it refers to features that “fill out each other”, that is, that are co-occurring or coincident. This is precisely the sense of A 65 immediately preceding. The term *wài* 外 ‘excluding’ is to be understood concretely as spatial exclusion, but it equally implies logical exclusion. The explanation states that attributes cannot be called *jiān bái* ‘co-occurring, yet independent’ if they are located on objects in different places, or if they are incompatible with each other. In other words, the sense of *jiān bái* is delimited in two respects; it requires (a) spatial coincidence and (b) logical compatibility. It follows that for any two attributes to be in a *jiān bái* ‘hard-and-white’ relation they must be independent of each other.

A 67

C: 攖, 相得也。
E: 攖:尺與尺俱不盡, 端與[a]端俱盡, 尺與端[b]或盡或不盡。堅白之攖相盡, 體攖不相盡[c]。

C: *yīng* ‘overlapping’ means each entailing the other.
E: *yīng* ‘overlapping’: When a measuring rod is put together with another measuring rod neither is exhausted. When an end-point is put together with another end-point both are exhausted. When a measuring rod is put together with an end-point one is exhausted and one is not. When attributes of the *jiān bái* ‘hard-and-white’ type overlap they exhaust each other. When elements (by contrast) overlap they do not exhaust each other.

(a) R: 無; emendation Sun (Graham 1978, 314).
(b) R: null; emendation Sun (Graham 1978, 314).
(c) R: 盡端; the received text has the character 端 after 盡, which seems to be intrusive.

The first example of the Explanation depicts ‘overlapping’ in the most straightforward way, one thing partially coinciding with another. The ‘overlapping’ of attributes of a *jiān bái* type by contrast must by definition be exhaustive because they “fill out” a single object, just as the overlapping of two end-points will be exhaustive. Similarly, the two elements (*tǐ* 體) referred to in the last phrase of the Explanation must be elements of a single object, and their overlapping corresponds to the overlapping of the two measuring rods of the first line, except now we see that an ‘element’ is understood in an abstract sense, just as ‘hard-and-white’ is the abstract counterpart to the end-point. A 2 exemplified a *tǐ* ‘element’ as an ‘end-point’, yet the overlapping of two end-points cannot be the same thing as the overlapping of two elements, since both elements must belong to a single object, and it is impossible that two end-points of a single object could ever overlap.

A 68

C: 仳[a], 有以相攖, 有不相攖也。
E: 仳:兩有端而後[b]可。

C: *bǐ* ‘side-by-side comparing’ means there is a part where you make (two things) overlap one with the other and there is a part where they do not overlap.
E: *bǐ* ‘side-by-side comparing’: Only given that the two have an end-point (in common) is this possible.

(a) R: 似; emendation Graham 1978, 315.
(b) R: 后; *sensu stricto* the emendation is not necessary, since the two characters 后 and 後 in early texts are commonly used interchangeably for the word *hòu* ‘after’.

It is possible to lay two measuring sticks side by side such that they partially overlap and partially do not, but such a side-by-side comparison is not possible with shapes such as circles and ellipses, which do not have end-points. The explanation of the Canon here makes it clear that *bǐ* ‘side-by-side comparing’ must be of linear shaped objects, and for a meaningful comparison they should have one end-point in common.

A 69

C: 次, 無間而不相[a]攖也。
E: 次:端[b]無厚而後[c]可。

C: *cì* ‘contiguous’ is having no interstice but yet not overlapping one with the other.
E: *cì* ‘contiguous’: Only because the end-point has no magnitude is this possible.

(a) R: 攖; emendation Graham 1978, 315.
(b) R: null, emendation Graham 1978, 315.
(c) R: 厚, emendation Graham 1978, 315.

Whereas A 68 deals with the side-by-side comparison of a linear shaped object, A 69 here is concerned with the same linear shape now arranged tip to tip.

3.5 Model and Duplicate, A 70, A 71

The following two sections define the related concepts of model (A 70) and duplicate (A 71). They have here been included owing to the central role of the idea of a model in Mohist thought (Fraser 2015, 2017), and because the circle and the compass appear as examples.

A 70

C: 法, 所若而然也。
E: 法:意規員三也, 俱可以為法。

C: *fǎ* ‘model’ is that to which something has been made alike and is thus so.
E: *fǎ* ‘model’: thoughts, compass, circle, these three things can all serve as models.

The apparent claim that *yì* 意 ‘thoughts’ can serve as a model seems at first somewhat odd. Similarly, the compass mentioned as item two in the Explanation is also not actually a model *per se*, but is a device used to insure that something *conforms* to a given model. We must understand the phrase *wéi fǎ* 為法 as including a sense of “serving as a means or tool to test something against a model, or against a standard.” This is most clearly the case with tools such as the carpenter’s square and compass, or a plumb-line. These are not ‘models’ of anything; they are tools that will show whether something conforms to a given model or not. In the same way ‘thoughts’ are the means for testing behaviors or attitudes for their conformity (or not) to established models of ethical principles or beliefs. In the *Mozi* text these principles and beliefs are most clearly set out in the so-called “core” chapters (8–37, see the Introduction *supra.*) This capacity to match something, physical or abstract, against a preferred or desired ideal was the crucial feature of *fǎ* ‘model’. See Fraser 2015, 2017.

Chapter four of the *Mozi* text is titled *fǎ yí* 法儀 ‘models and exemplars’ and sets out propositions about the nature and importance of models. After mentioning the tools that a craftsman uses to insure his work adheres to the desired model, *viz.*, the carpenter’s square, the compass, plumb-lines, etc., and after dismissing parents, teachers and sovereigns as unworkable prospective role models because the majority of all of these classes of people are not humane (*rén* 仁), the text concludes with the observation that 莫若法天 “nothing is as good as taking heaven as a model.” Heaven serves as an acceptable model, indeed the model for ethical considerations *par excellence*, precisely because its “operations are broad and free of self-interest” (天之行廣而無私). Heaven is not a remote, religious entity to be worshiped or revered abstractly, but is rather the premier example of an undiscriminating—but still judgmental—agency, rewarding the good with benefits and the bad with misfortune, regardless of social status or rank. The point is not simply to esteem heaven for this, but to take it as a model, a basis to on which to gauge one’s own behavior, and act with comparable equanimity toward people similarly, regardless of social status or rank.[7]

For notes on *yí* 儀 see the discussion under B 53, below.

[7] The term *fǎ* is used in the Han period mathematical text known as the *Jiu zhang suan shu* 九章算術 in the technical meaning of ‘divisor’, a sense that can be seen to follow from the more basic sense of ‘model, pattern’ > ‘standard’ > ‘standard unit’, namely as something against which something else is measured; *e.g.*., 100 measured against the “model” (*i.e.*, the ‘unit’) 5 is 20. See Chemla and Guo 2004, 919. Also in Han times the term comes to be used as the descriptive label for a body of pre-imperial texts that are understood as dealing with behavioral models and patterns in a socially prescriptive sense, *i.e.*, as laws. This sense is already apparent in the *Mozi* chapter four passage discussed above and in the passage also from *Mozi* chapter four included in the discussion under A58 earlier. This then constitutes the “school” known from Han texts as *Fǎ jiā* 法家, the “Legalists”.

A 71

C: 佴[a], 所然也。
E: 佴: 然也者, 兒[b] 若法也。

C: *èr* ‘duplicate’ is that which has been made to be like this.
E: *èr* ‘duplicate’: The word *rán* ‘to be like this’ means the appearance is like the model.

(a) R: 佴 here Graham emends to *yīn* 因 (1978, 316), which he translates as ‘criterion’, chiefly on the basis of his understanding of this passage in a Mohist dialectical context overall. See Graham 1978, 214–16. He translates the Canon line as “The *yin* (criterion) is that wherein it is so.”
(b) R: 民, emendation Graham 1978, 316; see also Graham 1978, 194–96 and *infra* A 47. In several other sections the same word is written in the conventional way, as 貌.

The character/word 佴 *èr* is uncommon, but not unattested. The *Shuowen* glosses it as *cì yě* 佽也 ‘to serve as a second; to assist’, emended by the Southern Tang *Shuowen* exegete Xu Kai 徐鍇 (920–74) in his *Shuowen jiezi xizhuan* 說文解字繫傳 to *cì yě* 次也 ‘sequel, second’ (*SWGL* 3537), and the *Erya* (*shi yan* 釋言 section) glosses it as *èr* 貳 ‘two, second, duplicate’. The sense of *cì* 佽 ‘to serve as a second’ is nothing more than a somewhat specialized sense of the basic word *cì* 次 ‘sequel, second’. Understood in this way the Canon line makes sense as written, and we have translated it accordingly, preferring not to follow Graham’s emendation on the grounds that when a text can be understood as written, absent other textual evidence to the contrary, emendation is not called for. In a 1964 article Graham himself did not emend the line and translated it as “The duplicate is what is made so” (Graham 1964, 18).

To be sure, a meaning ‘criterion’ as Graham would have it can be seen as a quasi-technical sense of *yīn* 因 ‘to rely on something’ > ‘to serve as grounds for’ and follows nicely from A 70 *fǎ* ‘model’. Graham prefers to see the Canon as defining *yīn* ‘criterion’, ‘criteria’ being the set of identifiable individual features on the basis of which something can be said to conform to a model. Three sections in the *jing* and *jing shuo* chapters mention *yīn* 因 explicitly, A 97, B 3 and B 15; in the last two it occurs as the object of the formulaic *shuo zai* 說在 phrase, thus 說在因 “the explanation lies with *yīn* ‘the basis’.” In both of these sections the context implies choices of one of a pair things, and *yīn* is the ‘basis’ upon which the choice is made. While this could be understood as ‘criteria’, it seems not to refer to a set of features as much as simply something on the basis of which to choose between alternatives. A 45 uses the word 徵 *zhēng* as the set of ‘identifying features’ of some X that, when changed, turns X into Y. Because it involves a set of features, this seems to come closer to the sense of ‘criteria’ than does the word *yīn*.

See also the discussion of *yīn* 因 in B 15.

3.6 Spatial and Temporal Contingency and Inevitability—Reprise, B 13–B 16

As Graham (1978, 30, 230) has observed, these four sections can be characterized as being parallel to (A 40–51). They present propositions on spatial extent, duration, and motion. In contrast to the definitions (A 40–51), the discussion is now augmented with the concept of hard-and-white which was introduced only in A 66.

B 13 establishes a relation between motion and spatial extent.

In B 14 the concept of hard-and-white, which so far has been solely applied to attributes of spatially extended objects, is now used in connection with space and time themselves. It is argued that the relation between spatial extent and duration is not of the hard-and-white type, since they are neither mutually pervasive nor independent. They are not mutually pervasive, because spatial extent exists separately at different periods of time, and they are not independent, because they are linked by motion. B 15 then states that the hard-and-white relation does in fact apply to lacking duration (a point in time) and spatial extent. These are considered to be independent from each other but also to fill out each other.

B 16 discusses the non-arbitrary contingent relation between events and time; uncharacteristically invoking an ostensibly historical event to illustrate the point.

B 13

C: 宇或徙[a], 說在長。
E: 宇:長[b] 徙而又[c] 處宇。

C: ‘Spatial extent’ [allows for] a shifting about somewhere. The explanation lies with ‘expanding’.
E: *yǔ* ‘spatial extent’: expanding is shifting about and thus occupying further spatial extent.

(a) R: 從, emendation Graham 1978, 82.
(b) R: 長宇, head character in second position.
(c) R: 有, emendation Graham 1978, 367.

This and all following sections are distinguished from the preceding ones in that they state a proposition rather than delineating the meaning of a term. Because these are not definitions, the head character appears purely as a formality introducing the Explanation.

The sense of ‘expansion’ intended here by the word *zhǎng* 長 ‘growing’ is seen most clearly in the closely related modern Chinese expression *péng zhàng* 膨脹 ‘to expand, inflate’, used in connection with both an inflating economy and an expanding universe; *zhǎng* < ***trang-q** 長 ‘growing’ is likely a close cognate of *zhàng* < ***trang-s** 脹 ‘expanding’, both < ****b-trang-q/s,** as the binome *péng zhàng* < ***bbrang - trang-s** 膨脹 would suggest; *cf.* also *zhàng* < ***trang-s** 帳 ‘curtain’ < “billowing”, *zhāng* < ***trang** 張 ‘to stretch, expand’ (as *e.g.*, a bow-string or a string on a musical instrument), also read *zhàng* < ***trang-s** meaning ‘to swell’.

Space is here associated with a capacity for movement in one direction or another. The immediately following section B 14, gives a characterization of the nature of the ‘extent of space’—‘duration of time’ relation in an explicit, technically phrased statement. This in turn may account for the proposition of *yǔ* 宇 ‘spatial extent’ here in concrete terms as ‘shifting about somewhere’.

B 14

C: 宇久[a] 不堅白, 說 在 <?>。
E: 宇:南北在旦[b], 又[c] 在暮[d]。宇徙久。

C: (The relation between) ‘spatial extent’ and ‘temporal duration’ is not of the hard-and-white type. The explanation lies with ...
E: *yǔ* ‘spatial extent’: South and north exist in relation to the dawn and also exist in relation to dusk. Within spatial extent, shifting about (entails) temporal duration.

(a) R: The two parts of the first line of C are not contiguous in R at this point and have been (re-) joined by Graham (1978, 368) basing himself on the earlier work of Luan Tiaofu (1957, 14). The same instance of a defective text accounts for the missing word of the 說在 phrase.
(b) R: 且, emendation Graham 1978, 81.
(c) R: 有, emendation Graham 1978, 81.
(d) R: 莫, emendation Graham 1978, 368.

The hard-and-white relation type is defined as that relation in which one attribute occurs coincidentally with, but independently of the other. Graham specifies *jiān bái* ‘hard-and-white’ as the technical term for “the separation of distinct, but mutually pervasive properties” (Graham 1978, 171). But spatial extent exists in connection with the dawn, and again separately in relation to the dusk. Furthermore, spatial extent is defined as that which allows for a shifting about (B 13), and because shifting about entails temporal duration, spatial extent therefore has a dependent relation to temporal duration. So ‘spatial extent’ and ‘temporal duration’ are not independent attributes, but are inherently linked. Thus they are not of the ‘hard-and-white’ type.

B 15

C: 無久與宇堅白, 說在因。
E: 無:堅得白必相盈也。

C: (The relation between) 'being without duration' and 'spatial extent' is of the hard-and-white type. The explanation lies with the criterion.
E: *wú* 'being without': When the hard entails the white, each inevitably fills out the other.

The Explanation states that the 'hard-and-white' relation requires as a matter of definition that each attribute fills out the other, *i.e.*, is co-incident with, but independent of, the other, and phrases this requirement as a matter of 'inevitability'. (See A 51, *bì* 必 'inevitability'.) Here 'inevitability' is thus a consequence of the definition of 'hard-and-white' and therefore an instance of its logical use. (See A 66, *jiān bái* 堅白 'hard-and-white'.)

The relation between the absence of temporal duration, *i.e.*, being temporally punctual, and spatial extent is said to be of this type, that is to say that there is no dependent relation between spatial extent and a moment in time. Section B 14 has just made clear that the relation between *yǔ* 宇 'spatial extent' and *jiǔ* 久 'temporal duration' is not of the 'hard-and-white' type. We now have in a sense the complement to that, the relation between a 'point in time' (*wú jiǔ* 'being without duration') and *yǔ* 'spatial extent', which is said to be of the 'hard-and-white' type. This implies that a single point in time was conceived of as filling out the whole of space, and in this respect the basic condition of being mutually pervasive is met, yet neither of the two is contingent on the other; there is no dependent relation between spatial extent and a moment in time. B 14, by contrast, explicitly states that there is a dependent relation between temporal duration and spatial extent, to wit, that mediated by a shifting about. Here, in B 15, 'mutual pervasiveness' is the necessary precondition for the pertinence of the hard-and-white relation, and in this way the former is a basis for the latter.

The word *yīn* < ***ʔin** 因 'the basis on which something is determined or decided', *i.e.*, 'criterion', is the introvert "*-n* extension" of the word *yī* < ***ʔəj** 依 'to rest on, depend on'. The difference between the **-i-** vowel in *yīn* < ***ʔin** 因 and the **-ə-** in *yī* < ***ʔəj** 依 may be the result of a vocalic raising and fronting accompanying the suffix *-n*, *i.e.*, perhaps a shift ****ʔən** > ***ʔin**. There can in any case be little doubt that the two words are cognate; *cf. yīn* < ***ʔin** 茵 ~ 絪 'mat', 'a physical object on which to rest something'. The **-ə-** shows up in the *yīn* 因 *xié shēng* series in *ēn* < ***ʔʔən** 恩 'kindness', where the geminate (or pharyngealized) initial consonant characteristic of type A syllables blocked any vocalic fronting.

B 16

C: 在諸其所然, 未然者[a]。說在於是。
E: 在:堯善治, 自今在諸古也。自古在之今, 則堯不能治也。

C: Locating something in relation to where (in time) it is properly so, or where (in time) it has not yet become so. The explanation lies with being in relation to this (appropriate or inappropriate time).
E: *zài* 'locating': "Yao was good at keeping order." This is, from a present perspective, locating it in the past. If one, looking from a past perspective, locates it in the present, then it means Yao will not be able to keep order.

(a) R: 未者然; emendation Liang Qichao 1923, 361.

The point seems to be that there is a non-arbitrary relation between events and time. Events are spatial occurrences and by the same token they occur over time. Therefore they are characterized as having both a 'spatial extent' (*yǔ* 宇) and 'temporal duration' (*jiǔ* 久), and this pairing is, according to B 14 not of the hard-and-white type, *i.e.*, does not entail independent attributes. This means that the two features 'spatial extent' and 'temporal duration' as they pertain to events (such as Yao keeping order) are dependent in some way each on the other; events are temporally contingent and therefore are not independent of the time in which they occur; thus the example regarding Yao. Located in the proper time he is good at keeping order (an event that is historically recognized, even if legendary from a modern perspective); located in an inappropriate time, he is unable. See also B 53.

Note that the use of the verb *zài* 在 'to be located somewhere' or causatively, 'to place something somewhere', has both here and in B 14 a specification of time as the grammatical direct objects. Typically *zài* 在 locates things in space. The Mohist use of *zài* 在 this way must be intended to underscore the dependent connection between space and time that B 16 sets out.

Etymologically, *zài* < ***ddzə-q** 在 'to be located somewhere' is closely related to the word *cái* < ***ddzə** 材 'innate capacity' and to what we suggested above is fundamentally the same word, *cái* < ***ddzə** 才 'talent', both referring to a kind of innate or ingrafted quality. The underlying sense for all of these is 'implanted', thus for *zài* 在, 'set, located'. The character 在 is in its original structure simply the basic graph 才 augmented by the "earth" semantic determinative, 土 (Kangxi number 032), thus indicating clearly the spatial sense of the 'locating' (and concretely, in origin, probably also the phytological sense, *i.e.*, 'planting' or 'trans-planting'; *cf. shì* < ***dzə-q** 埶 'to dibble', the Old Chinese type B counterpart to *zài* < ***ddzə** 在). See also the discussion at A 3.

For brief etymological speculations about the words *gǔ* 古 'past' and *jīn* 今 'present' see Boltz 1992.

3.7 Shadows and Mirror Images ("Optics"), B 17–B 24

The eight sections usually described as dealing with optics (see, *e.g.*, Graham and Sivin 1973) deal in fact only with the properties of shadows (B 17–21) and mirror images (B 22–24). The character 景 is used commonly in Warring States period texts to write both the word *yǐng* meaning 'shadow' (typically written 影 in the transmitted writing system) and the word *jǐng* 'light, luminescence; luminescent image, mirror image'. Which word is intended in any instance of the character must be inferred from context. The written language of the Mohist text does not differentiate the two words, suggesting that they are seen as closely related to each other and that they represent complementary aspects of light, *viz.*, an image cast as a shadow and an image reflected in a mirror. It is not an 'optics' in the Greek sense of a theory of vision, but a study of shadows and a catoptrics (study of mirrors).

B 17 appears to make the point that the motion of a shadow is only apparent. The shadow does not move; what does in fact move is either the light source or the object casting a shadow (or both). The apparent motion of the shadow is created through the effect of light reaching places that were in shadow before and no longer reaching places that were illuminated before.

B 18 deals with a configuration of three lights in a row that results in a division of the surrounding space into a portion without shadow, a portion with a single shadow, and a portion with a double shadow. Since the first and the second are illuminated by two or three light sources, the paradoxically-sounding statement holds that the areas of double shadow are exactly those that are illuminated by a single light source each.

B 19 describes the inversion of the silhouette of a shadow projected through a pinhole onto a screen. The text implies a propagation of light rays along straight lines. Interestingly, that implication is seen only in those sections where image inversion is involved, as here and in B 23. In other sections where straight-line light propagation might be invoked, as in B 24, we do not find it explicitly mentioned. Therefore we have no clear evidence that the Mohists generalized the concept of light propagation along straight lines, which would have been a necessary condition for the development of a geometrical optics.

B 20 deals with the paradoxical situation that a person's shadow is cast in the direction of the sun, rather than away from it, a situation that occurs when the sunlight is reflected or scattered off of an upright plane surface.

B 21 states that the shape and the size of a shadow depend not only on shape and size of the object casting the shadow but also on its position and place, as, *e.g.*, an object's distance from the screen or light source in a shadow theater.

B 22 describes the image one sees observing a plane mirror from above, pointing out the unexpected properties of size and shape as the image source moves.

B 23 describes the different variations of an image in a concave mirror (enlarged and upright or reduced and upside down), and explains them in terms of three

elements: the thing mirrored, the image, and the occupied area on the surface of the mirror. The reversal of the image is explained by means of a geometrical treatment in which light is assumed to travel along straight lines in tandem with a concept of focal point (‘center’).

B 24 describes the variation of an image in a convex mirror (large or small but always upright) and explains it, as in B 23, in terms of three elements: the thing mirrored, the image, and the occupied area on the surface of the mirror.

B 17

C: 景不徙[a]。說在改為。
E: 景:光至景亡。若在盡古息。

C: A shadow does not shift about. The explanation lies with being re-cast.
E: *yǐng* 'shadow': When light reaches a place, the shadow disappears; as if its existence has been exhausted and its past extinguished.

(a) R: 從, emendation Graham 1978, 82.

This is the first of a series of sections dealing with optics. The sense is that what might appear at first to constitute the shifting of a shadow, is to be understood instead as the disappearance of the old shadow and its re-emergence anew in a different position. When the shadow seems to move it is actually being extinguished, perhaps only partially, by the arrival of light, and re-cast in a different place. It is either the object casting the shadow or the light source that moves, not the shadow itself as if it were an actual object. Just as the former shadow is gone, the past is extinguished (not shifted); both are replaced by the new.

This is one of the comparatively few *Mozi* "jing" or "jing shuo" passages that is found cited in later, transmitted texts. The *Liezi*, "Zhongni" 仲尼 section, includes it in a kind of seriatim listing of "imponderables," that is, short counter-intuitive statements that seem to propose paradoxes or impossibilities, presumably intended to provoke unconventional thinking. One of these statements says 有影不移 "There are shadows that do not move." Each such statement is then given what purports to be an explanation. For this one we find a passage that is essentially the same as the B 17 Canon here, though using the verb *yí* 移 'move' rather than *xǐ* 徙 'shift about': 影不移者說在改也 "As for the fact that the shadow does not move, the explanation lies with it [instead] changing" (Yang Bojun 1965, 88). The received text of the *Liezi* is a late third century compilation, and is thus half a millennium or more later than the *Mozi* text. Its reference to the "shadow not moving" is therefore clearly derived from the *Mozi* line. Apart from the chronological improbability of the "Mo jing" line somehow being derived from the *Liezi* line, the difference between 說在改也 in *Liezi* and 說在改為 in *Mozi* also suggests that the *Liezi* line is taken from a *Mozi* original because the latter, with 為 as a somewhat uncommon sentence final word, is clearly the *lectio difficilior* relative to the former. An editorial change from 改為 're-made, re-cast' to 改也 'changed' is easier to imagine than the reverse.

The "Tian xia" 天下 chapter of the *Zhuangzi* has a line that seems likely to reflect the same underlying sense, though not worded in a way that suggests the *Mozi* line directly: 飛鳥之景未嘗動也 "The shadow of a flying bird has never moved." This occurs in the same kind of list as in the *Liezi* of counter-intuitive statements characteristic of that "philosophical" group usually called the Sophists, intended presumably to stimulate discussion and debate. Other examples of the same kind of statement are "a wheel does not touch the ground," "fire is not hot," "fast though the barbed arrow flies, there is a time when it is neither moving nor at rest." (Translations

of the “non-shadow” lines from Graham 1981, 284.) As Graham (1978, 274) points out, the late third century commentator Sima Biao 司馬彪 in his note to this line says

> 鳥之蔽光猶魚之蔽水。魚動蔽水而水不動。鳥動影生, 影生光亡。亡非往, 生非來。墨子曰影不徙也。[8]
>
> A bird’s interrupting the light is similar to a fish’s interrupting the water. As a fish moves it interrupts the water, but the water does not move. A bird moves; a shadow arises. A shadow arising [means] the light disappears. Disappearing is not moving away; arising is not coming forth. Mozi said “A shadow does not shift about.”

Sima Biao’s point seems to be that since a shadow is an interference or absence of light, it is not actually anything in its own right, and an absence of something is not something that can move forward. So, *mutatis mutandis* for a shadow arising. We cannot know with certainty if the Mohist was thinking of it this way, but it seems consistent with the sense of this *Mojing* section.

[8] Sima Biao’s commentary to the *Zhuangzi* is lost. It has been reconstructed several times by Qing scholars from citations in later texts. Here we rely on that by Sun Fengyi 孫馮翼 (fl. 1800), included in the *Wen jing tang congshu* 問經堂叢書.

B 18

C: 景二, 說在重。
E: 景:二光夾一光, 一光者景也。

C: The shadows are two in number. The explanation lies with doubling.
E: *yǐng* 'shadow': Two lights flanking one light; what is singly lighted is a shadow.

What is referred to as 'singly lighted' in the Explanation means an area illuminated by only one of the light sources. In Fig. 3.4 below these are the areas marked by the number 2. When three light sources are arranged linearly as A–B–C in the figure, B flanked by A and C, A will cause a shadow of B towards C; C will cause a shadow of B towards A. And B will cause shadows of both A and C, each directed outward from A, resp. C. These two symmetrical shadows caused by B will each fall within the scope of the shadows of B caused by A, resp. C, but will be perceptible by virtue of being darker than the surrounding shadow. The schematic diagram shown in Fig. 3.4 illustrates the patterns of shadows that can be observed when three candles are put in a row, as A, B, and C (see the photograph in Fig. 3.5).

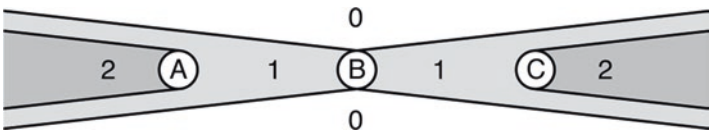


Fig. 3.4 Arrangements of light sources A–B–C and corresponding single (1) and double (2) shadows

Fig. 3.5 Three candles in a row

The “two in number” phrase refers to the fact that on each side of the central light source B there is a dual-shadow pattern; a darker shadow completely encompassed by a lighter shadow (numbers 2 and 1 in the figure). The “doubling” refers to the darker part being the result of shadows of two different objects caused by two different light sources. The area of these double shadows is illuminated by a single light, A, resp. C. Therefore the areas that are singly lighted are precisely those that consist in double shadows.[9]

[9] The section is often interpreted as having to do with the distinction between umbra and penumbra. But this distinction arises with only one or two light sources. This interpretation makes it difficult, therefore, to understand the first sentence of the Explanation, which seems to refer to three light sources (Dai 2001b, 107–108).

B 19

C: 景倒[a]在午有端與景長。說在端。
E: 景:光之入[b]煦若射。下者之入[c]也高，高者之入[d]也下。足蔽下光，故成景於上[e], 首蔽上光, 故成景於下。在遠近有端與於光, 故景運[f]內也。

C: The shadow becomes upside down at a crossing, where there is a point in conjunction with which the shadow elongates. The explanation lies with the point.
E: *yǐng* 'shadow': When light enters, it emanates like arrows shot from a bow. The entry of the low part is upward, the entry of the high part is downward. The foot blocks the light from below; on this basis it forms a shadow above. The head blocks the light from above; on this basis it forms a shadow below. Located at some distance there is the point conjoined with what is in the light. On this basis the shadow is rotated on the inside.

(a) R: 到, emendation Graham 1978, 375.
(b) R: 人, emendation Graham 1978, 82.
(c) R: 人, emendation Graham 1978, 82.
(d) R: 人, emendation Graham 1978, 82.
(e) R: 止, emendation Graham 1978, 376.
(f) R: 庫, emendation Graham 1978, 376; see A 48 where 運 is defined as *yì* 易 'to switch', a definition that fits its usage in this passage perfectly.

This section seems to describe the inversion of an image as it appears silhouetted on a surface from light passing through a pinhole in another surface. The Explanation makes it clear that the Mohist conceived of this image as a shadow. The entering of the light into and its emanation from the pinhole is compared to the shooting of arrows from a bow. The verb *xù* 煦 usually means simply 'warm, congenial', but occurs in passages specifically associated with the warmth of a sunrise, a warmth that accompanies the impression of sunlight emanating from a rising sun. The *Shuowen jiezi* includes the gloss *chì* 赤 'red' for this word, a gloss that suggested to Sun Yirang (1986, 390) the word *xiá* 霞 'the reddening sky of a sunrise, aurora', an image that is not inconsistent with the general meaning 'emanate'. The character 煦 of the received text sometimes alternates with the related character 呴 standing for the phonetically similar word *xǔ* 'to exhale, blow out (from)', a meaning that is not unrelated to the sense of 'emanate' suggested here. Using this word and this understanding then the Mohist passage describes the inversion of the image of what is in the light (於光) passing through a pinhole (端, the base point) and the consequent inversion of the top and bottom parts of the silhouette.

The *duān* 'base point' in the Canon line is the point of the 'crossing' (午) that was perceived as the starting point from which the cone of the inverted shadow image grows. The 'base point' in the Explanation line is now described as the endpoint of the cone of the shadow image on the side where the light enters the pinhole. The two cones together describe the geometry of the situation that is defined by the "arrow-like" behavior of light proceeding along straight lines, passing through a pinhole (Fig. 3.6).

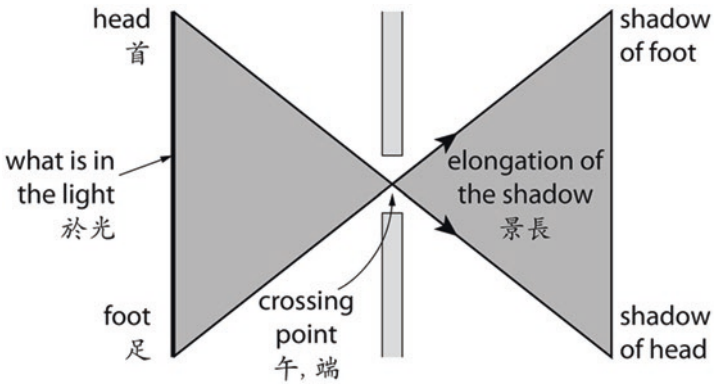


Fig. 3.6 Reconstruction of arrangement in section B 19

This is sometimes thought to describe the image produced by a *camera obscura*, but the text only refers to blocking the light and therefore allowing only for a shadow image. Graham and Sivin 1973, 120–25 discuss this section at length, in the end not agreeing with each other on the correct interpretation. Graham 1978, 375–78 is largely unchanged from his earlier analysis, thinking that it describes reflection in a concave mirror. For his part Sivin prefers to understand this as describing a kind of *camera obscura*. We have in our understanding differed from both, but ended up closer to Sivin’s explanation than to Graham’s.

B 20

C: 景迎日。說在慱[a]。
E: 景:日之光反燭人則景在日與人之間。

C: The shadow turns toward the sun. The explanation lies with completing the cycle.
E: *yǐng 'shadow'*: If the light of the sun reverses and illuminates a person, then the shadow lies between the sun and the person.

(a) 慱: *tuán* 'to complete a cycle'; this character rarely occurs in transmitted literature. It is said to occur in one (non-standard) version of the *Tai xuan jing* 太玄經 (compiled by Yang Xiong 揚雄, late first century B.C.E.), in the line 月闕其慱賤始退 "as the moon becomes defective (*i.e.*, begins to wane), its completed cycle becomes attenuated and begins to retreat." The received *Tai xuan jing* text of this line has 摶 *tuán* which is understood as 團 *tuán* 'round', in this context simply "full", but the subtler sense of 慱 *tuán* is 'a completed cycle' (Liu Shaojun 1998, 6).

The 'completed cycle' sense characterizes the light-shadow phenomenon that the Mohist is describing here in that the light emanates from the sun, reverses by being reflected off of something, illuminates a person which then casts a shadow *back towards* the sun, in a sense thus completing the cycle. This sense is inherent in the Canon's use of the word *yīng* 迎 'to turn toward, to meet from an opposing direction'. The first part of the cycle consists in the behavior of the light, the second part in that of the shadow, yet for the Mohist these seem to be two aspects of a single phenomenon. The character 景 can be used to write the word *yǐng* 'shadow' (in the received script typically written 影) and also the word *jǐng* 'light, image'. The two words *yǐng* < ***qrang?*** and *jǐng* < ***krang?*** (perhaps from an earlier ***C.qrang?***, see Baxter and Sagart 2014, 28) '(sun-)light, brightness' are likely related to each other as variants of a single lexical base. In the sections describing the optical features of mirrors, beginning with B 22, the character 景 clearly refers to the reflected image, not a shadow, thus probably writing the word *jǐng*, not *yǐng*.

B 21

C: 景之大小。說在柂[a]正遠近。
E: 景: 木柂景短大, 木正景長小。大小於木則景大於木。非獨小也, 遠近也[b]。

C: The shadow’s being large or small, the explanation lies with tilt and distance.
E: *yǐng* ‘shadow’: If the post is tilting, then the shadow is short and broad; when the post is straight upright, then the shadow is long and thin. As for its size in relation to the post, the shadow is bigger than the post. This is not solely due to its smallness, but also due to its distance.

(a) R: 地, emendation Graham 1978, 379.
(b) R: has no 也; to understand the meaning as ‘due to ...’ the final 也 is necessary.

The Canon raises the subject of a shadow’s size, and the Explanation first observes that the length and size of a post’s shadow will vary according to whether the post is upright or tilted (toward the light source). This does not address the question of the size of the shadow relative to the post itself. The shadow will generally be bigger than the post, irrespective of the post’s tilt, and this is said not to be due to actual size alone, but distance as well. A possible arrangement in which these features of a shadow could be observed is one similar to a shadow theater where a single or confined light source casts an object’s shadow on a vertical surface.

B 22

C: 臨鑑而立, 景倒[a], 多而若少。說在寡區。

E: 臨:正鑒[b]景寡, 貌態[c] 白黑遠近柂正異於光。鑒景當, 俱就去。參[d]當, 俱[e] 向[f] 背[g]。鑒者之澤[h] 於鑒無所不鑒, 景之澤無數而必過正。故同處。其體俱然, 鑒分。

C: Looking down from above into a mirror and then standing up, the image is upside down. It becomes more, but seems as if fewer. The explanation lies with reducing the area.

E: *lín* 'looking down': In a flat mirror the image is reduced; in appearance, brightness, distance and tilt it may be different from what is in the light. When the image in the mirror (and the object mirrored) are *vis-à-vis* each other, both approach and recede in tandem. When they are kept in alignment this way they turn either face-to-face or back-to-back in tandem. The parts of the object mirrored shining toward the mirror are nowhere not mirrored. The image's lustrousness is unlimited and will inevitably have passed beyond the plane (of the mirror); on that basis it will be confined to the same area (on the mirror surface). All of its elements will behave like this, mirroring the parts.

(a) R: 到, emendation Graham 1978, 379.
(b) the word *jiàn* 'mirror' is written 鑑 in C and consistently 鑒 in E. This is a case of free allography, there is no difference in the word written.
(c) R: 能.
(d) R: 忝, emendation Graham 1978, 379–80.
(e) R: 俱俱.
(f) R: 用, emendation Graham 1978, 380.
(g) R: 北.
(h) R: 臭, for an obsolete character 臯, standing for *zé* 'lustrous, glossy' (modern orthography 澤), emendation Li Yü-shu (Graham 1978, 380), 2x.

This is the first of three types of mirror, flat, concave and convex, that the text discusses and is the only one that includes any reference to the internal features of an image. Other sections deal only with silhouette-images or shadows. Here the character 景 clearly writes the word *jǐng* and refers to the image reflected in a mirror, whereas in preceding sections the same character was writing the word *yǐng* 'shadow'. See the note in B 20.

The section discusses visual effects that can only be observed when internal features of the image are taken into account. The Canon has to be understood as describing a movement and the consequent change in the mirrored image. As a person stands up from looking down into a mirror what he sees will change from a partial image "looking back up at him" to a fully standing image that will appear upside down. The image will have become smaller in mirror area yet contain a larger part of his person, hence the comment that 多而若少 "it becomes more, but seems as if fewer," so also for the comment that 說在寡區 "the explanation lies with reducing the area." The Explanation first identifies those respects in which a mirror image might vary from the features of the actual object and then notes how the movement of the object is reflected symmetrically in the movement of the mirrored

image. By contrast, then, the Explanation goes on to state that only those parts of the actual object that “shine toward the mirror” are mirrored. In other words, the mirror image only includes what faces the mirror; nothing from the back of the object will appear in the mirrored image, unless of course turned toward the mirror. The image will appear to be located not on the surface of the mirror but “beyond” it, because a mirror image is naturally seen as three dimensional. Even though the mirrored object may be large, depending on its position relative to the mirror the place of the image on the surface of the mirror may be small. And because this is true for every part of any object mirrored, the mirroring is understood as a perfect part-to-part isomorphism, even when the image area is reduced from that of the object.

B 23

C: 鑑洼[a], 景[b]一小而易, 一大而正。說在中之外內。

E: 鑒[c]:中之內。鑒者近中則所鑒大, 景亦大。遠中則所鑒小, 景亦小, 而必正。起於中緣正而長其直也。中之外。鑒者近中則所鑒大, 景亦大。遠中則所鑒小, 景亦小, 而必易。合於<中... >[d]而長其直也。

C: The mirror is concave; the image is sometimes small and switched, and sometimes large and upright. The explanation lies with being inside or outside the center.

E: *jiàn* 'to be mirrored': As for being within the center, when the thing mirrored is near to the center, then what it is mirrored on is large, and the image also is large. When it is distant from the center, then what it is mirrored on is small, and the image also is small and (in both cases) inevitably upright. This is due to (the light) arising from the center, skirting the upright object and then extending along its direct path. As for being outside the center, when the thing mirrored is near to the center, then what it is mirrored on is large, and the image too is large; when it is distant from the center, then what it is mirrored on is small, and the image too is small and (in both cases) inevitably switched. This is due to (the light) converging at < the center … > and then extending along its direct path.

(a) R: 位, emendation Graham 1978, 381; the character interchanges with 窪, 哇 and 窊, all writing the same word *wā* 'concave'.
(b) R: 量, emendation Graham 1978, 382.
(c) Here and in B 24 following the text systematically registers an orthographic distinction between the noun *jiàn* 'mirror' and the homophonous verb *jiàn* 'to be mirrored', the former written 鑑 and the latter written 鑒, two characters that are conventionally taken as standing in free variation for *jiàn* 'mirror'. Thus in this case the head character of E is not simply a token reference to C, but reflects the fact that it is the verb 'to be mirrored' that figures centrally in the E text.
(d) R: null. Graham suggests that parallelism with 起於中緣正而長其直也 in the preceding line implies a lost three-character phrase, beginning with 中.

The Mohist recognizes three components to a reflection on a concave mirror, (i) the thing mirrored (鑒者), (ii) the image itself (景), and (iii) the area on the surface of the mirror that the image occupies (所鑒). Recognizing a distinction between the image itself and the surface that the image occupies is because there is a three-dimensional perception that makes the image appear to be behind the plane of the mirror. What the text refers to as the 'center' (中) is from a modern perspective the focal point only in regard to how size and orientation of the image change depending on the position of the mirrored object relative to that point. It is seen by the Mohists as the point of confluence of the straight lines that define the contours of the silhouette-image, but that understanding is not correct from the viewpoint of geometrical optics, although qualitatively it produces the right results. The fact that the Mohists call this point the 'center' may indicate that they conceived of it as the geometrical center of the curvature of the mirror.

The Explanation includes the observation that when an object stands between the 'center' and the mirror, the light that is responsible for the image seems to 'arise

from’ (起於) the ‘center’ and then proceeds in a straight line to produce an upright image. The crucial corresponding phrase in the text that would explain the behavior of the light when an object stands outside of the area defined by the ‘center’ and the mirror is regrettably defective, but the first words suggest that the understanding might have been that the light ‘converges’ or ‘comes together’ (合於) at the ‘center’ and then proceeds in a straight line to produce an inverted image. This Explanation only considers the silhouette-image. It cannot explain the internal features of a mirrored image, because it always considers light as coming from behind the object mirrored.

For *yì* 易 see A 48.

B 24

C: 鑑團, 景一[a]小一[b]大[c]而必正。[d]
E: 鑑:鑒[e]者近則所鑒大, 景亦大。其[f]遠, 所鑒小, 景亦小, 而必正。
景過正故招[g]。

C: The mirror is convex; the image is sometimes small and sometimes large, but inevitably upright.
E: *jiàn* 'mirror': When the thing mirrored is near, then what it is mirrored on is large, and the image too is large. As for its being at a distance, what it is mirrored on is small, and the image too is small and (in both cases the image is) inevitably upright. The image extends beyond the (vertical tangent) plane (of the mirror) and on that basis is drawn out (on the sides).

(a) R: The two parts of C are not contiguous in R at this point and have been (re-)joined by Graham (1978, 384) basing himself on the earlier work of Luan Tiaofu (1957, 87).
(b) R: null, the two characters 小一 are added speculatively by Graham 1978, 384.
(c) R: 夭, emendation Graham 1978, 384, as part of a restoration of the whole line.
(d) R: 說在得. Graham suspects the three-character sentence 說在得 is misplaced here and belongs to a later, now defective, canon. See *infra* 25b. This leaves B 24 as a rare case of a Canon without a *shuō zài* phrase among the B numbers.
(e) see textual note c in B 23, immediately preceding.
(f) R: 亦, emendation Graham 1978, 384.
(g) 招 *zhāo* 'beckon, call', here in the particular sense of being "called," *i.e.*, drawn out or stretched in an increasingly attenuated form toward the edge of the mirror.

As in the preceding section, the Mohist recognizes three components to a reflection, now on a convex mirror, (i) the thing mirrored (鑒者), (ii) the image itself (景), and (iii) the area on the surface of the convex mirror that the image occupies (所鑒). The passage correctly describes the variation in size of the latter two qualitatively according to the distance of the thing mirrored from the mirror itself. Specifically in the case of a convex mirror, the image gives the appearance of shrinking at the edges as the surface recedes.

While in section B 23 a complete account was given of why the image varies in size and orientation, including the notion of a 'center point' (中), no such explanation is provided in this section.

3.8 Vertical Tendency of Weights (“Mechanics”), B 25a–B 29

These six sections, usually described as “Mechanics” (Graham 1978, 385), all deal expressly with the vertical descent of weights (重 *zhòng*) and anomalies arising from either deviation from the vertical direction (e.g., B 27) or disparity of the effect of equal weights (e.g., B 25a and 25b). To be sure, these are mechanical behaviors, but as described here the clear emphasis is on the behavior of weights when manipulated in various ways, so we use the more specific phrase ‘vertical tendency of weights’ rather than ‘mechanics’.

B 25a deals with the different effect of weights placed either on a horizontally hung rope or on a horizontal beam. While the rope bends already under its own weight, the beam does not bend even if you place a weight on it. The difference is explained by referring to the ‘rigidity’ (極 *jí*), which we may also call ‘pole-quality’, prevailing in the case of the cross-bar but not in the case of the rope. The different effect of a weight in the two situations is thus explained by means of the additional term ‘rigidity’.

B 25b deals with the different effect of weights placed on different sides of a beam whose fulcrum is not in the middle of the beam. Placing equal weights on the two sides, the longer side (measured from the fulcrum) will descend. This is explained by referring to the ‘effectiveness’ (權 *quán*) this side of the beam has gained over the other by having become the longer side. The different effect of a weight in the two situations is thus explained by means of the additional term ‘effectiveness’.

B 26 deals with the different behavior of the two sides of a pulley, or a curtain pole, over which a curtain is pulled, depending on the length of the cloth on the two sides. To pull the curtain up from the shorter side, a force has to be exerted. If the curtain remains fixed in place although no force is exerted, this is due to the construction having been arrested in some way. When the curtain is equally long on both sides of the pulley or pole, it may remain fixed. But when the curtain is longer on the pulling side, it will come down by itself. The different behaviors are again explained by the pair of terms encountered in B 25b: weight (*zhòng* 重) and effectiveness (*quán* 權). This time we do not have equal weights on two sides of different effectiveness, but two sides whose weight and effectiveness are changing in tandem; the side that is getting longer constantly gains both weight and effectiveness, while the other side loses both. When weight and effectiveness are equal on both sides there is equilibrium. But if the weight and effectiveness get used up, the curtain falls down. The different behavior of the two sides of a pulley is thus explained by the same pair of terms, weight and effectiveness, that was employed in explaining the unexpected behavior of the arrangement involving a lever (B 25b).

B 27 contains the general statement that weights descend vertically if nothing interferes with them. The device referred to in this section, whose description remains obscure and which is sometimes speculatively thought to be a kind of wheeled ladder, may have presented a prominent instance exactly of such an interference. Moreover, this interference with vertical descent appears to have been

instrumental for the functioning of the device, the movement of the ladder. This establishes a strong connection with the next section, which makes a general statement about the necessity of the deviation from the vertical whenever horizontal forces are in play.

B 28 deals with the case of leaning and makes the general claim that, whenever horizontal forces are involved (pressing against, pushing, dragging or being bent under something), the agent cannot be exactly upright, just as a ladder leaning against a wall cannot be exactly upright. In fact, speaking from a modern perspective, in leaning, a person's or an object's weight, which is a vertical force, is used to produce a horizontal force component. Given the emphasis on the vertical descent of weights in the previous section, this section apparently reflects an intuitive understanding of the use of leaning in producing a stable arrangement when horizontal forces are involved. The section thus fits very well into this sequence of sections on deviations from vertical descent.

B 29 comes back to the discussion of the vertical, now considering the relation between being fixed in place and moving downwards. The point is made that piling things one above the other actually fixes the position of the object on top; it cannot descend due to the 'pillar-quality' (*zhù* 柱) of the arrangement. Construction techniques often involve this when stones or bricks are arranged to build walls. Fixing something with a string from above does not have this pillar-quality: the string may be drawn out thus turning the 'pulling (holding) from above' into a 'letting gradually down'. The section thus emphasizes the close connection between the vertical descent of weights and the stability of a plinth. The difference in behavior (being fixed in place or descending) is due to the difference between piling up and suspending. Considering the material aspect of this difference, the section is reminiscent of the first section in this sequence, explaining the different behavior of weights on rigid objects as compared to that on cords. But the explanation is not given in terms of rigidity (*jí* 極) but rather in terms of pillar-quality, thus emphasizing the difference in arrangement over that in material.

B 25a

C: 負[a]而不撓, 說在勝。
E: 負:衡木加[b]重焉而不撓, 極勝重也。右校交繩, 無加焉而撓, 極不勝重也。

C: Bearing but not being deformed, the explanation lies with prevailing.
E: *fù* ‘bearing’: A cross-bar when you add a weight to it is not deformed. This is due to the rigidity prevailing over the weight. A plaited cord twisted to the right, [even] when nothing is added to it, becomes deformed. This is due to the rigidity not prevailing over the [cord’s own] weight.

(a) R: 貞, emendation Graham 1978, 387.
(b) R: 如, emendation Graham 1978, 387.

The Canon addresses the phenomenon of something not bending under a load. The Explanation goes on to contrast a wooden beam with a plaited cord, each set out horizontally, in that the former does not bend though burdened with a weight, while the latter does bend even in the absence of any weight added. The difference lies in the varying degrees of rigidity (*jí* 極) of the two objects. This shows that for the Mohist the term *zhòng* 重 refers not only to heavy objects but also to the more abstract quality of weight, here the weight of the rope itself.

The word *jí* 極 ‘ridge-pole’ here means ‘rigidity’ indicating the quality pertinent to this explanation.[10] Eng. *rigid*, from Latin *rigeō* ‘to be stiff, rigid’, is cognate with both Eng. *reach* and Ger. *reichen*, showing the same semantic link between ‘rigidity’ and ‘reach’ as seen in *jí* 極 ‘ridge-pole’ itself, which also means ‘reach’ as a noun in the sense of ‘furthest reach, extremity’.

In this interpretation the phrase 交繩 is taken to refer to a plaited or braided (modern *jiǎo* 絞) rope, and the phrase 右校 is understood as the act of braiding such a rope, so there is a puzzling redundancy overall: “a rightward braided plaited rope.” This may refer to a kind of ‘double braided rope’, *i.e.*, a rope that is braided out of strands that are already plaited, in order to enhance its strength. It is not clear what the significance of the adverbial 右 ‘right(ward)’ is; the same phenomenon would be observed when the rope is twisted leftward. All the same, the point presumably is that in the everyday act of horizontally stringing up a plaited rope, even when taut, the rope will deform downwards of its own accord, that is, from its own weight.

[10] Boltz 2006.

B 25b

C: 衡[a] […]。說在得[b]。
E: 衡:加重於其一旁必垂[c], 權重相若也。相衡則本短標長。兩加焉重相若則標[d]必下, 標得權也。

C: The beam […] The explanation lies with gaining.
E: *héng* 'beam': If you add a weight to one of its sides [that side] will inevitably drop down. This is due to the effectiveness and the weight matching each other. If they are made level with each other, then the base is short and the tip is long. Add equal weights to both sides, then the tip will inevitably go down. This is due to the tip having gained effectiveness.

(a) R: original text defective, restored by Graham 1978, 387.
(b) R: restored here from B 24, Graham 1978, 387.
(c) R: 捶,
(d) R: 摽.

The passage may be understood as based on a practical situation in which a beam is balanced either by being suspended or supported at one point, *i.e.*, a fulcrum. If a weight is attached to one side of the beam then this side will drop down. Here, the term *zhòng* 重 'weight' is complemented by another term, *quán* 權 'effectiveness'. We understand this term as designating an abstract measure of the effect of the weight. In the case at hand, the weight and its effectiveness match each other, *i.e.*, the effect of the weight is as expected, the side where the weight is placed goes down. So far, this is in accord with our expectations and would not have required the introduction of any additional technical term. The beam with the weight attached to one of its sides is then brought back into a horizontal position by moving the fulcrum. The result is that one side of the beam, when measured from the fulcrum, is shorter than the other. The Mohist calls the side having the weight attached to it the *běn* 本 'base', which is now short, and the other side the *biāo* 標 'tip', which is now long. Adding equal weights to both sides of the beam, the tip declines. This appears inconsistent with the assumption that equal causes have equal effects and therefore is not what one would intuitively expect. One would expect the tip to go down only if the weight laid on that side was greater than that laid on the side of the base. It thus seems that the weight on the tip-side is somehow more effective than that on the base-side. This is expressed by the statement that the tip has gained in *quán* 權 'effectiveness'. Most probably, the lost Canon referred to this phenomenon which forced the Mohist to introduce the technical term 'effectiveness'.

The central question addressed by this section is as follows: how can it be that one and the same heavy body has, under certain circumstances, a different effect from what one would expect it to have? It is answered by introducing a pair of abstract terms, weight and effectiveness, that differentiate the concept of weight in order to account for its different behavior under certain circumstances.

This section is sometimes interpreted as referring to an unequal-arms balance, such as a steelyard or a bismar. But not only is there no evidence that such balances existed this early in China, neither does that kind of balance conform to the description given here, with weights added to both sides.[11] Instead, the Mohist would have likely been familiar with the kind of situation described from the use of a shoulder-pole, where the shifting of the fulcrum is an automatic reaction to adding a load to one side.

[11] For a discussion of the evidence for unequal-arms balances in China, see Büttner *et al*. 2018. Griet Vankeerberghen begins a long article on the word *quán* 權 used in early texts metaphorically for ‘action’ with this Mohist passage (Vankeerberghen 2005). She bases her understanding of this passage on Graham 1978, but translates *quán* as ‘leverage’ instead of maintaining Graham’s ‘positional advantage.’ While ‘leverage’ for *quán* is not altogether inappropriate, her subsequent discussion of the passage perpetuates the old mistake of thinking of the device described as a weighing apparatus.

B 26

C: 挈[a]與收[b]反[c]。說在薄。

E: 挈:有力也[d] 引，無力也不止[e]。所挈之止於施[f] 也，繩製[g]挈之也。若以錐刺之。挈:長重者下，短輕者上。上者愈得，下[h]者愈亡。繩直，權重相若，則止[i]矣。收:上者愈喪，下者愈得。上者權重盡，則遂[j]。

C: Pulling something up in conjunction with letting something gradually down are the reverse of each other. The explanation lies with [the behavior of] curtains.

E: *qiè* 'pulling something up': when one exerts force, it is drawn up and taut; in the absence of force, it does not remain fixed. When that which is pulled is fixed mid-way it is due to the cord being pulled askew, sticking it [in place] as if with an awl.

Pulling something up: The long and heavy is below, the short and light is above. The more the one above gains, the more the one below loses. When the cord hangs straight and the effectiveness and the weight match each other, then it would remain fixed.

Letting something down gradually: The more the one above loses, the more the one below gains. If the effectiveness and the weight of the one above are exhausted, it drops.

(a) R: 契, emendation based on E.
(b) R: 枝, emendation Graham 1978, 390).
(c) R: 板 [*bǎn* 'wood block'] understood as 反 *fǎn* 'to reverse, turn back, alternate'.
(d) R: Graham emends 也 to 之 here, but not in the parallel next line, on the grounds that nowhere else in these chapters do we find the "subjectless" initial clause marked by 也 (1978, 390). The text is understandable as written with 也 in both places, and therefore the emendation is not required.
(e) R: 心, emendation Graham 1978, 82.
(f) R: 施 [*shī* < ***hlaj** 'spread out'] for *yí* < ***laj** 'shift, move, reach to' (移 in the received script), nominally 'reach' as an extent or span or trajectory; the *locus classicus* for this reading and meaning of the character 施 is *Xunzi*, "Ru xiao": 若夫充虛之相施易也 "It's like the shifting and alternating of full and empty," where Yang Liang says 施讀若移 "施 is to be read like 移." Graham suggests an emendation to 迤 *yǐ* 'slanting, turning', but this seems to be unduly influenced by the next phrase.
(g) R: 制 for 掣 *chè* 'to drag sideways, to skew'.
(h) R: 下下, erroneous doubling of the 下; emendation Graham 1978, 391.
(i) R: 心, emendation Graham 1978, 82.
(j) R: 遂 [*suì* < ***s-lut-s** 'advance'] for *zhuì* < ***lrut-s** 'fall, drop down' (隊/墜 in the received script).

The two phases of motion, that of the pulling up and that of the letting something down in a controlled descent, are portrayed as complementing each other, hence the use of the verb 反 *fǎn* 'to reverse, turn back, alternate' in the Canon. When pulling something up a force must be maintained in order to keep it from falling back down. To fix the object being pulled over the pulley mid-way on the far side, the cord is pulled askew and anchored by some device (the passage specifies an awl). When pulling a curtain over a rod, for example, if the two sides of the curtain hang at equal lengths and the pull-cord can be released and hangs vertically, then the curtain will remain fixed by itself.

As in the preceding section, the word *quán* 權 ‘effectiveness’ is used in tandem with *zhòng* 重 ‘weight’. The phrase 權重相若 (“the effectiveness and the weight match each other”) here, as in B 25b, refers to a situation where the lengths on both sides of the mechanism are equal to each other and therefore the weight by itself determines the effectiveness. Letting something down gradually is the complementary process to pulling something up. When there is no longer either effectiveness or weight of the upper part on the near side, the thing simply falls down on the far side.

B 27

C: 挈 […] 車梯 […]。[a]

E: 挈:兩輪高, 兩輪為輲[b], 車梯也。重其前, 弦其前載[c], 弦其軷[d]而縣重於其前, 是梯[e] 挈, 且挈則行。凡重, 上弗挈, 下弗收, 旁弗劫, 則下直。扡[f], 或害之也。汓[g] 埽者不得汀[h]直也。今也廢尺於平地, 重不下, 無跨[i]也。若夫繩之引軷也, 是猶自舟中引橫也。

C: Pulling something up […] a cart-ladder […].

E: *qiè* 'pulling something up': One pair of wheels is tall, another pair serves as trundle wheels; this is a cart-ladder. Weigh down its front part, string up its front load-bearing part, string up its *gu*-part, then suspend a weight from its front part. This kind of ladder is pulled up, and at the same time that it is pulled up, it goes forward. Weights, in principle, when you are not pulling them from above, and not letting them down gradually, and not exerting any force on them from the side, then they will come straight down. If they shift sideways, it is because something has interfered with them. *The thing that makes the ladder move smoothly is unable to come straight down. If you erect a measuring stick on level ground, the weight will not descend because it does not have any sideways tilt. If on the other hand you tie a cord to it and pull the gu-part, this is similar to pulling the cross-bar from within a boat.*

(a) R: null; the canon is lost. Restored to this extent by Graham 1978, 392–93. Some scholars consider that there is no missing Canon text at all and that the Explanation text is actually a part of the Explanation of B 26, the preceding section. That analysis largely disregards the occurrence of the word 挈 in E preceding the sentence 兩輪高 "one pair of wheels is tall." The 挈 in E looks like an entry character and suggests, as Graham points out, a corresponding Canon. Even taking it as a portion of the Explanation of B 26 does not help overcome the defective and obscure nature of the passage.

(b) R: 輲 for the more common character 輇, standing for the word *quán* 'a spokeless wheel', *i.e.*, a solid wheel.

(c) R: erroneously repeats the four-character phrase 弦其前載.

(d) The character 軷 is rare; it occurs in the *Shui hu di* 睡虎地 manuscripts (third cen. B.C.E.) as the name of a part of a carriage, but is as vague there as it is here (Shuihudi 1990, pt. 2, 49). Sun Yirang identifies it as the same word as is written 胡 in Zheng Xuan's commentary to a *Zhou li* passage, where it seems to mean the 'front part of a carriage'. Sun Yirang [1893] 1986, 336.

(e) R: 埽; emendation Sun Yirang (Graham 1978, 393).

(f) Understood as *yǐ* 'sideways'.

(g) 汓: this is a well-attested *gu wen* variant for *liú* 流 'to flow'.

(h) 汀: Graham understands this character as explicitly writing the verb *xià* 'to descend' as opposed to the word *xià* 'below', written with the conventional character 下 (Graham 1978, 393).

(i) 跨: writing *páng* 'beside'.

The text is sufficiently vague and what it purports to describe sufficiently obscure that we do not see any purpose in speculating idly about the structure of the device in question. That part of our translation given in italics is very tentative and incomplete, owing to the obscure and likely corrupt nature of the original text.

Beginning in the middle of the Explanation we find a description of the behavior of weights in general, preceding an observation about how, by contrast, the device in question works: the general statement says that in the absence of any external perturbation, the weight ‘will come straight down’; the description of the device says that it ‘is unable to come straight down.’ This would suggest that the intention of this part of the description is to contrast explicitly the operation of the device, whatever it is, with the normally expected behavior of a weight.

B 28

C: 倚者不可正。說在梯[a]。
E: 倚:倍, 拒, 揵[b], 軸[c], 倚焉則不正。

C: What is leaning cannot be made upright. The explanation lies with a ladder.
E: *yǐ* 'leaning': if one is pressing back against something, or pushing forward on something, or dragging something, or bent under something; in all of these cases one is leaning relative to it, and thus not upright.

(a) R: 剃 [*tì* 'to shave off fur or hair'].
(b) R: 堅 [*jiān* 'hard'] for 揵 *qiān* 'to drag'; variation between the presence and absence of a semantic classifier is exceedingly common.
(c) 軸: non-standard allograph for *qū* 屈 'to bend or bow down'; the classifiers 身 and 尸 are both in origin semantically associated with 'corporal or somatic form, body' and thus the graphic alternation is historically not surprising.

By referring to the example of a leaning ladder, the section claims that whenever horizontal forces are involved (in actions such as of pushing and dragging) the agent cannot be upright. The summing-up formula (說在 X) of the canon in this case gives no more than an illustrative example.

B 29

C: 堆[a]之必住[b], 說在廢[c]材[d]。

E: 堆[e]:竝[f]石絫[g]石, 耳夾帚[h]者, 廢[i]也。方石去地尺, 關石於其下, 縣絲於其上, 使適至方石。不下, 柱也。繆[j] 絲去石, 挈也。絲繼[k], 引也。未變而名易, 收也。

C: A pile's inevitably being fixed in place. The explanation lies with setting a plinth in place.

E: *duī* 'pile': Setting out stones side-by-side or in piles, or laterally flanking rooms, these are instances of setting out in place. A square stone is separated from the ground by the distance of a *chi*; fill in the space beneath it with stones, suspend a string above it, let it just reach the square stone. The stone does not come down due to the pillar-quality [of the stones underneath it] keeping it fixed in place. Wrap the string around it, remove the [other] stones; the square stone is now being pulled (and held) from above. If the string is extended, it is now being drawn [*i.e*., let] down. [The arrangement] still has not changed, but the feature at issue [what holds the stone] is switched; the square stone is now being gradually let down.

(a) R: 推; emendation Chang Ch'un-yi (Graham 1978, 395).
(b) R: 徃; a rare graphic variant for 往, which is in turn often found as an error for 住; emendation Sun Yirang (Graham 1978, 395).
(c) For 撥 *bō* 'to set out in place'.
(d) The character 材 here stands for the basic word *cái* 'material resources (used for some purpose)', but in the particular sense of 'plinth'; *cf*. the term *shí cái* 石材 in the *Shangshu dazhuan* 尚書大傳 line 大夫有石材 "For the Grand master there is a stone plinth", where the phrase 石材 is glossed by Zheng Xuan as 柱下磌也 "the stone base underneath a pillar" (*Shangshu dazhuan* 1937, 103).
(e) R: 誰; emendation Chang Ch'un-yi (Graham 1978, 395).
(f) For 並 *bìng* 'side-by-side'.
(g) *guwen* for 累 *lěi* 'to pile up'.
(h) For 寢 *qǐn* 'side rooms'.
(i) R: 法; emendation Graham (1978, 396) and then understood as c above.
(j) R: 膠 for 繆 *jiū* 'to wrap around'.
(k) R: 絕; The pre-Han Guodian 郭店 and Wangshan 望山 bamboo strip manuscripts include at least half a dozen occurrences of a graph that, in a standard *kaishu* transcription, looks like 𢆶. Perhaps the best-known instance of this graph is found in the opening line of the Guodian text that matches chapter 19 of the received *Laozi*. The character there corresponding to the Guodian 𢆶 is 絕 standing for the word *jué* 'to cut off, terminate'. Because of this correspondence and because the *Laozi* passage is so well known, the graph 𢆶 is usually understood as an early form of the character 絕 and understood as *jué* 'cut off'. But the palaeographic data, including evidence from the *Shuowen jiezi*, suggest instead equally compellingly that the Guodian 𢆶 could just as well be an early graph for the character 繼 standing for the word *jì* 'to continue, extend', a sense directly opposite to 絕 *jué* 'cut off' (See Boltz 1999, 598–99; Boltz 2013, 21–23). Scholars are about equally divided as to which is the preferred conclusion. We suspect that the same uncertainty obtains here and that in spite of what we find in the transmitted, received text the word of the original passage could have been *jì* 'to continue, extend', written 𢆶 as a non-standard form of 繼. The word *jué* 絕 occurs in B 52 with a meaning 'snap' (Graham's term) or 'breaking' of a hair. This occurrence may have influenced the passage here, leading to the corruption of 繼 *jì* 'to continue, extend' to 絕 *jué* 'to cut off, terminate'.

The section illustrates the effect of 'piling' rocks to form a plinth, a procedure known as 'pillaring', and the supporting capacity of such a structure. In particular, pulling something from above and letting something down gradually are the same in not providing any "pillar support."

The relation between 挈 *qiè* 'pulling something up' and 收 *shōu* 'letting something down' as explained here is consistent with that set out in B 26 above, where these two actions are described as complementary to each other. Here their behaviors are shown to be no more than different ways of looking at the same thing. The sense of 挈 *qiè* can be seen to include 'holding from above' as well as 'pulling from above'.

Without emendation (k) as given above, the penultimate sentence of the Explanation says 絲絕, 引也 "if the string breaks, it is due to having been pulled." To be sure, this by itself makes sense and the whole Explanation could be so understood. But it means that the square stone falls freely, crashing into the ground, and yet the Explanation refers to this process as 收 *shōu*, which we saw in B 26 is best understood as 'letting something down gradually (as for example by a connected cord)', and says that (the arrangement) 未變 "still has not changed". The snapping of the string would seem to constitute a "change" in the structural arrangement of the device governing the behavior of the large stone. And the use of the modal negative 未 'still not' (emphasis on the 'still') seems to suggest further the unchanged nature of the structure in question.

What has changed is the *míng* 名. Graham translates the last part of the Explanation 未變而名易 "Without any alteration except the substitution of the name..." and goes on to remark that many scholars and translators ill-advisedly emend the *míng* 名 to something else, often to *shí* 石 'stone', thereby losing precisely the Mohist's point (Graham 1978, 396). He is certainly correct to speak against any emendation of the word *míng* 名. But his understanding of it as 'name' coupled with his translation of *yì* 易 as 'substitution' slightly misses the salient point. The word *ming* here means 'the point/question/feature at issue' and the word *yì* 易 here means specifically 'switch (something with its complement, opposite or counterpart)'. The two word phrase thus refers to the 'central feature at issue' (*míng* 名, *viz*., what holds the large stone) 'switching'. That is, switching from suspension by a cord from above to being let down gradually by the same cord and coming to rest, its movement governed by what receives it and then supports it from below. The relation between cord and stone remains intact; the point where the controlling force is exerted is what switches.

3.9 Mechanical and Temporal Bases for Judgment, B 52–B 53

In view of these two sections we can see that the Mohists recognize that judgments can be contingent on either mechanical (B 52) or temporal (B 53) circumstances or conditions.

B 52

C: 均之絕否[a], 說在所均。
E: 均: 髮均縣。輕而髮絕, 不均也。均[b]其絕也, 莫絕。

C: Whether things in equal conditions break or not. The explanation lies with what conditions are made equal.
E: *jūn* ‘being equal or even’: Hairs are suspended evenly. If, (when attaching the hair to even) a light weight, a hair breaks, it is because (the attaching) was uneven. When (the attaching) is even, as for their breaking, none will break.

(a) R:不, *sensu stricto* the emendation is not necessary, since the character 不 can stand by itself for the negative *fǒu* ‘or not’.
(b) There is a matching passage in the *Liezi* that adds a 也 at this point, clearly indicating that the word 均 *jūn* ‘making equal’ is to be understood as a topic (Yang Bojun 1965, 107).

The Explanation does not actually specify attaching anything, but the occurrence of the verb *xuán* 縣 ‘to suspend’ and the following word *qīng* 輕 ‘light weight’ seem to demand this understanding. In spite of the hairs being even, *i.e.*, hanging down with the same length, if a weight is attached unevenly, *i.e.*, such that not all of the hairs bear an equal share of the weight, those bearing the greatest weight may break. Therefore, evenness of the length of hairs does not prevent the hair from breaking, it is evenness of the attaching that is crucial.

The word *jūn* < ***kwin** ‘to be even, equal’, here written 均, is etymologically the same word as *jūn* ‘potter’s wheel’, conventionally written 鈞. In view of the use and purpose of a potter’s wheel, the meaning ‘even, equal’ can easily be seen to be an abstraction of that word. The word *jūn* ‘potter’s wheel’ itself, irrespective of how it is written, is a lexical affine of *yùn* < ***win-s** ‘rotate’ (運), explained by the mechanism whereby a potter’s wheel functions.

B 53

C: 堯之儀[a]也, 生於今而處於古而異時。說在所義二。

E: 堯: […][b] 霍[c]。或以名視人, 或以實視人。舉友富商也, 是以名視人也。指是臞也, 是以實視人也。堯之義也, 是聲也生[d] 於今, 所義之實處於古。若殆於城門與於臧也。

C: Yao's serving as a paragon, lives in the present, but is located in the past; thus differentiating the times. The explanation lies with that whereby someone may be deemed a paragon numbering two.

E: *yáo* 'Yao': […] braised meat. In one case one takes the name as the means to show something to others, in the other case one takes the object as the means to show something to others. If you present a friend as a 'rich merchant', this is taking the name as the means for showing him to others. If you point out that this is a piece of braised meat, this is taking the object as the means for showing it to others. As for "Yao's serving as a paragon," the sound of this phrase lives in the present, the object that is deemed 'a paragon' is located in the past. It is like 'possibly at the city gate' or 'with truant Zang himself'.

(a) R: 義, see Graham 1978, 421.
(b) R: Graham suggests missing words or a missing phrase, given the subsequent lines of E (Graham 1978, 422). The missing part may have mentioned the 友 'friend' or perhaps the 富商 'rich merchant', balancing the seemingly isolated mention of the 霍 'braised meat'.
(c) Writing the word *huò* 'braise', for 臞, which occurs with the conventional classifier later in the Explanation.
(d) R: null; restored from C (Graham 1978, 422).

The last sentence of the Explanation seems intended to be an example of the contrast between subjective and objective belief. The word *dài* 殆 in the first of the two possibilities mentioned indicates a reticent subjective judgment on the part of the speaker. The absence of any corresponding word in the second of the two possibilities suggests this is to be taken as an objective judgment. This complementarity matches the *míng* 名 and *shí* 實 of the main part of the Explanation. The word *zāng* 臧 is conventionally used as a generic name for any kind of a person, especially people of little distinction and low repute. The *Xiaoqu* 小取 chapter (*Mozi* chapter 45) has a line that says: 臧人也, 愛臧愛人也。 "Zang means person, to care fondly for Zang means to care fondly for someone" (see also Graham 1978, 226–27, 257, 422–23).

The word *yí*, translated here as 'paragon' and written in the received text of this line as 義, is elsewhere in the *Mozi* written with the expected character 儀, *i.e.*, with classifier 009, 人. The sense is primarily 'what is suitable or what matches appropriately (some particular reference point or circumstance)', and thus by extension a 'standard' or 'model'. In referring to an individual the sense is someone who is an "ideal model" of some desirable type, thus a 'paragon' or 'exemplar'. In the majority of its occurrences in classical Chinese literature generally the word *yí* means 'proper, suitable or exemplary ceremonial behavior or performance'. In the *Mozi* it is paired pleonastically with *fǎ* 法 'model, pattern', as *fǎ yí* 法儀 'models and exemplars', the title of chapter four of the *Mozi* text. See also the discussion under A 70 *supra*.

References to historical (or legendary) figures in these passages are uncommon. The focus of this passage and B 16, which also mentions Yao, is the distinction between past (古) and present (今), and it seems that the only way the Mohist can refer concretely to this is by using the name of what was for them a historical figure associated with the past.

3.10 Spatial and Temporal Paradoxes, and Spatiotemporal and Modular Correspondences, B 60–B 65

The six sections B 60–65 are part of the sequence B 32–82, which Graham (1978, 230) groups together and designates "Problems in disputation." We include them in our selection of scientific sections because of their close relation with *spatial and temporal contingency and inevitability* (B 60, 61, 63 and 64), with *vertical tendency of weights* (B 62) and with *model and duplicate* (B 65).

B 60 and 61 both describe paradoxes relating to space and time, 'approaching but not reaching' (B 60) and 'absent but not dismissible' (B 61). In B 62 a ball is explicitly said to be vertically oriented, and its vertical orientation is distinguished from all other possibilities. This privileging of the vertical likely has its origin in the behavior of weights and thus establishes a relation to the sections on mechanics. In B 63 the paradox raised in the Canon again has the sense of a riddle. How can one advance in space without coming closer to any given place? This is resolved in the Explanation by describing the motion of spreading out.

B 64 specifically points out the connection, but also the distinction, between linear extent and duration in travel. Interestingly, the spatial counterpart of 'duration', 'spatial extent', is here replaced by 'linear extent'. The section reiterates, now for linear extent, the dependent relation between time and space in regard to movement that was first formulated in B 14. B 65 shows that the dependent relation between object and category is determined alone by whatever criteria are chosen.

B 60

C: 非半弗斮[a]則不動。說在端。
E: 非: 斮半進, 前取也。前則中無為半, 猶端也。前後取, 則端中也。斮必半, 毋與非半, 不可斮也。

C: If you do not hoe except for half, then you do not make any headway. The explanation lies with the starting point.
E: *fēi* 'except for': When hoeing, to advance half-way is taking it from what is in front. With respect to what is in front, the mid-point does not constitute a half-way point, rather it is like a (new) starting point. Taking what is in front and what is behind, then the starting point is the mid-point. In hoeing you inevitably do half, so you do not get anything other than a half remaining. And that remaining half cannot be hoed.

(a) the character in R is a non-standard allograph for *zhuó* 斲 ~ 斫 'hoe'.

The Explanation here illustrates a mathematical, logical sense of *bì* 必 'inevitability' (A 51). "In hoeing you inevitably do half" means that no matter how much or how little you hoe, you will inevitability do half of it before you do all of it. Once you have done half, there is still half remaining. And what was the half-way point when you started out becomes a new starting point when you begin to hoe the second half. Clearly, this will be the case no matter how many first halves you hoe, repeatedly. So there will always be a new starting point that was the half-way point of the immediately preceding part that was hoed, and thus there will always be a part that cannot be hoed. The 'inevitability' in this is relational; the fact that you inevitably first hoe a half, means that there is a half remaining. And the relation between this "hoed half" and the "remaining half" is comparable to the relational 'inevitability' in the "younger sibling" ~ "older sibling" pair seen in A 51. As a logical consequence the one presupposes the other.

The argument set out here is reminiscent of Zeno's paradox "Achilles and the tortoise" or "the race-course" discussed by Aristotle (*Physics* VI, 2; Aristotle 1995, 103–117). There it is alleged that motion is impossible because before a moving body starting out from an origin O can reach an end-point E it must first reach a half-way point, which will be the distance from O to E divided by two, thus, OE/2. But since the half-way point OE/2 is its own end-point, a moving body must reach the half-way point relative to OE/2 before it can reach OE/2. That half-way point will be half of OE/2, or OE/4. And since OE/4 is also an end-point, the moving body must reach its half-way point, *viz*., OE/8 before it reaches OE/4. It is easy to see where this is leading. Since any movement, no matter how small, takes some amount of time, and since there are an infinite number of progressively smaller (each by half) half-way distances between any starting point O and any ultimate end-point E, the implication is that it would require an infinite amount of time to move from O to E. Therefore, motion is impossible in any finite period of time. Aristotle's refutation of this argument is to observe that it presumes that distance is continuous and is infinitely divisible (hence all of the half-way points), but fails to treat time in the

same way. Aristotle's pointed observation is that time also is infinitely divisible, just as distance is, but by the same token just as time can be finite in extension, so can distance. The two are precisely comparable in this respect, infinitely divisible but finite in extension. So, while he does not say so explicitly, Aristotle seems to understand 'space' as comparable to 'time' in these respects, both of them entailing *extension.* (See Shields 2007, 215–20.)

The same understanding, expressed in elementary mathematical terms, underlies the explanation that, if the distance from O to E is defined as 'one' (whatever the unit), the sum of all of the increments I, each half as long as its preceding increment, necessary to reach E is equal to 'one'; thus the first increment is $I_1 = 0.5$; $I_2 = I_1$ plus half of I_1, thus $0.5 + 0.25 = 0.75$; $I_3 = I_1$ plus half of I_1 plus half of half of I_1, which is $0.5 + 0.25 + 0.125 = 0.875$; $I_4 = 0.5 + 0.25 + 0.125 + 0.0625 = 0.9375$, and so forth. The limit of I_n as n approaches infinity is 1.0. (David Berlinski in his popular "tour of the calculus" explains Zeno's paradox in just this way; see Berlinski 1995, 122–25.)

The Mohist section appears at first to refer primarily to a paradox similar to the Greek one. In hoeing there is always a moment when you have hoed half the field. When you then continue to hoe the remainder, you always reach a half-way point and you always have a half left. Therefore you can never hoe the whole field. But in fact there is a subtle point expressed here, to wit, that the relation between a hoed half and the remaining half is logically, not just empirically, inevitable.

Zhuangzi 33 includes a similar paradoxical observation: 一尺之捶, 日取其半, 萬世不竭。"Given a stick of one *chi* in length, if you remove half of it daily even in a myriad generations it will not be exhausted." In neither the *Zhuangzi* nor the Mohist text is the paradoxical character of the statements made explicit. The *Zhuangzi* passage occurs as part of an enumeration of similar paradoxes identified as useful in repartees with the logicians. This shows that it was understood as a paradox.

While the Mohist generally shows no recognition of a dimensionless point other than the two end-points of a measuring stick or of a line, in this section a mid-point is recognized and identified with a new starting point.

B 61

C: 可無也, 有之而不可去。說在嘗然。
E: 可: 無也。已給則當[a] 給, 不可無也。久有窮, 無窮。

C: It can be lacked, but having had it, then it cannot be disposed of. The explanation lies with having experienced it being so.
E: *kě* 'can': Lacking, when something has already been provided then you have encountered its having been provided, and that cannot be lacking. As for duration, (in one respect) there is a limit and (in one respect) there is no limit.

(a) Based on the wording of the Canon, Graham (1978, 433) emends this *dāng* 當 < ***ttang** 'to encounter, confront' < 'apposite' to *cháng* 嘗 < ***dang** 'once', but the emendation is not necessary, and the text can be translated and readily understood as it stands. The word *dāng* 當 here is effectively the full verbal form of the adverbial *cháng* 嘗 'once, to have experienced'; the two words may well be related to each other.

In one respect there being a limit and in one respect there being no limit refers to the fact that the thing having been provided may no longer be present, but the experience of it having been provided endures. The distinction between the temporally finite nature of the event and the enduring nature of the experience matches the distinction seen in B 53 between Yao as an example of proper behavior (the object) in the past and the enduring reputation of Yao (the name) as an example of proper behavior in the present.

B 62

C: 正而不可擔[a], 說在摶。
E: 正:丸[b]無所處而不中縣, 摶也。

C: Being upright, but not permitting of being put crosswise; the explanation lies with being round.
E: *zhèng* 'being upright': A ball is in no position not in line with its vertical axis; due to it being round.

(a) Graham accepts Sun Yirang's emendation to 搖 *yáo* 'shake, agitate' and translates "cannot be made to waver." While this makes good sense, to be sure, the graph 擔 in R, standing for the word *dān* 'to carry on a cross-bar across one's shoulders', can be understood as 'to put something crosswise, *i.e.*, out of vertical alignment'. Apart from the conservative guideline for accepting the received version of a text whenever feasible, this reading allows the sentence to be understood as it stands in a way perhaps even preferable to the emended version in that it recognizes the use of vocabulary from everyday experience to express a seemingly technical phenomenon.
(b) R: 九 emendation (Graham 1978, 435).

The formulation of the Canon suggests something of a deliberate riddle. How can something, standing upright, not be able to be put crosswise? This is resolved in the Explanation by identifying the thing as a ball. The interesting aspect of this section is that it clearly privileges the vertical direction. With a ball one might argue that it has no orientation, or that it has any orientation one wishes to attribute to it. Here it is explicitly said to be vertically oriented, and its vertical axis is distinguished from all other possibilities. This is likely to be connected to the vertical tendency of weights, which is dealt with in sections B 25a–29.

B 63

C: 宇進無近, 說在敷。
E: 宇:區[a]不可偏[b]舉, 宇[c]也。進行者先敷近, 後敷遠。

C: Advancing in spatial extent, yet without drawing near to any place, the explanation lies with 'becoming spread out'.
E: *yú* 'spatial extent': When a demarcation cannot be established in any direction, this means spatial extent. (As concerns) people who go forward, first the spread is near, later the spread is far.

(a) R: 傴, emendation Sun Yirang (Graham 1978, 435).
(b) Perhaps to be understood as 遍 / 徧 *biàn* 'in all directions, universally'.
(c) R: 宇 (Graham 1978, *loc. cit.*).

The motion at issue is undirected, with no limit or goal. In the case of such motion, advancing entails a starting point, but does not imply coming near to any specified or defined thing. The Canon itself can be understood as describing diffusion; but the 進行者 ("people who go forward") of the Explanation suggests intentionality and therefore seems to imply an animate subject. The association of motion with time is clearly included in the Explanation, though not directly mentioned. *Cf.* in this regard B 64.

B 64

C: 行脩[a]以久, 說在先後。
E: 行[b]:行者必先近而後遠。遠近[c], 脩也。先後, 久也。民行脩, 必以久也。

C: Traveling a long distance takes a long time. The explanation lies with 'earlier and later'.
E: *xíng* 'traveling': travelers will inevitably be near earlier and then become distant later. 'Distant or near' has to do with linear extent; 'earlier or later' has to do with temporal duration. When people travel a long distance they inevitably take a long time.

(a) R: 循, emendation Graham 1978, 435.
(b) R: 行者, with 者 intrusively following the "head" character, probably under influence of the immediately following phrase 行者 'travelers'.
(c) R: 遠脩近, emendation Graham 1978, 436.

Here again we see the Mohist drawing attention to the dependent relation between space and time in regard to movement, but in this case space is referred to linearly with the term *xiū* 脩 'linear extent' whereas in earlier passages the term used was regularly *yǔ* 宇 'spatial extent'. This may be due to the emphasis on linear extent in traveling as contrasted with the two-dimensional nature of 'spatial extent' in B 63, explained as *fū* 敷 'becoming spread out'.

See in this connection B 14; see A 40 for the entry for *jiǔ* 久 'enduring, temporal duration'. There is no entry for the comparable term *xiū* 脩.

B 65

C: 一法者之相與也盡, 若方之相召[a] 也。說在方。
E: 一:方貌盡俱有法而異, 或木或石, 不害其方之相召[b] 也。盡貌, 猶方也[c], 物俱然。

C: The correspondence among objects based on the same model is exhaustive, like squares evoking one another. The explanation lies with being square.
E: *yī* 'one': When the aspects of the appearance of the square are exhaustively (accounted for) and all (of the objects in question) adhere to the model, then their being different—some wood, some stone—is not detrimental to their evoking one another as squares. Exhausting the aspects of their appearance, like squares, the objects are all so.

(a) Sun Yirang, followed by Graham (1978, 437), emends *zhào* 召 'to evoke, call forth' in the received text to *hé* 合 'to match' presumably because the phrase *xiāng hé* 相合 'to match one another' is a common phrase and seems to fit the sense readily, whereas *xiāng zhào* 相召 seems at first sight to make little sense. But in fact 相召 is attested more than a dozen times in early transmitted texts with a meaning 'call forth/evoke one another', or 'one calls forth/evokes the other', *e.g.*, 物故以類相召也 "objects assuredly evoke each other according to their category" (*Lü shi chunqiu*), 飲食相召 "eating and drinking call forth each other" (*Zhuangzi*). One of the cardinal rules of thumb in regard to emending texts is that the less understandable or less common reading (*lectio difficilior*) is likelier to be the original than is the easier reading (*lectio facilior*), the reasoning being that it is likelier that a difficult reading will be emended or altered in a way that makes it understandable than the reverse. In this instance clearly the sense of the phrase 相召 is less obvious than that of 相合, making it the *lectio difficilior*. A second guideline is simply that if the text makes sense as written, there must be very persuasive evidence to justify an emendation. For these reasons we read the text here as it stands in its received form.
(b) R: 台. Graham (1978, 437), following Sun Yirang, emends this also to *hé* 合. Clearly 台 *tái* does not make any sense in this line, but our emendation to 召, consistent with the received text of the Canon, is a less radical proposal than the dual emendations to 合 suggested by Sun Yirang and endorsed by Graham.
(c) the three-character phrase 猶方也 "like squares" is identified by Graham as a likely a gloss on the original text that has been inadvertently elevated to the level of primary text.

Using the concept of 'set of identifying features' (*zhēng* 徵) as used in A 45, we may rephrase the Canon as saying that adhering to a model means fulfilling the set of identifying features that characterize the model. The Explanation then clearly states that differences outside the set do not violate the adherence to a model.

3.11 Sets of Indeterminate or Unknown Extent, B 73–B 75

The three sections here argue that the fundamental concept of a composite whole, or set, is applicable even if certain information about the components is unknown or unknowable. In B 73 the unknowable arises from the infinite nature of the composite whole. In B 74 it is the number of elements that is unknown, but there is no implication that this number may be infinite. In B 75, by contrast, it is the place of the elements that is unknown.

B 73

C: 無窮不害兼。說在盈否。

E: 無:「南者有窮則可盡。無窮則不可盡。有窮無窮未可智則可盡不可盡[a]未可智, 人之盈之否未可智,[b] 人之可盡不可盡亦未可智而必人之可盡愛也誖。」人若不盈無[c] 窮則人有窮也。盡有窮無難。盈無窮則無窮盡也。盡無[d]窮無難。

C: Being without limits is not detrimental to being a composite whole. The explanation lies with being filled out or not.

E: *wú* 'being without': [claim:] If the south has a limit, then it can be exhausted. If it does not have a limit, then it cannot be exhausted. If whether having a limit or not cannot yet be known, then whether it can be exhausted or not cannot yet be known, and thus people's filling it out or not cannot yet be known. Whether people can be exhausted or not also cannot yet be known, and so inevitably (it follows that) people's being able to be exhaustively cared for is fallacious.—[rebuttal:] If people do not fill out the limitless then they have a limit. And exhausting what has a limit presents no difficulty. If they fill out the limitless then the limitless is exhausted. And (therefore) exhausting what has no limit presents no difficulty.

(a) R: 不可盡不可盡, accidental repetition of the three-character phrase; emendation Graham 1978, 448.
(b) R: 而必, introduced erroneously from the same phrase later in the passage; emendation Graham 1978, 448.
(c) R: 先, graphic confusion with 无, allographic for 無; the same error in the reverse occurs in the C text of B 57; emendation Graham 1978, 448.
(d) R: 有, apparently a misreading of 其, itself (in its early form 亓), the result of a confusion with 无, allographic for 無; emendation Graham 1978, 448.

What we have termed the "claim" in the Explanation often uses the phrase 未可智 "cannot yet be known" or "still cannot be known"; using the aspectual negative *wèi* 未, indicating incomplete action and allowing for the possibility that it could become known at a later time. To have written 不可智 would have meant something is 'unknowable', but such an absolute claim does not fit the present argument, because it is unnecessarily strong and might be wrong. The phrase "cannot yet be known" will never be absolutely wrong; the circumstances may change such that the thing in question becomes knowable. All applications of the phrase 未可智 "cannot yet be known" follow from the first, which refers to the limitedness or unlimitedness of something, in particular the south. If in the future a limit is experienced, the south will be known to be limited. As long as no limit is encountered the answer remains still not knowable. Graham accommodates this aspectual sense of the *wèi* 未 by translating 未可智 as "unknowable *a priori*" (Graham 1978, 448–49). The knowing 智 involved here must refer to the 'acquired-knowing' defined in A 5, rather than the 'innate knowing' defined in A 3.

This is one of three sections that have the structure of an explicit claim and a rebuttal. (The other two are B 38 and B 82, see Graham 1978, 449.) The reference in the Explanation is clearly to *jiān ài* 兼愛 'comprehensively caring fondly', one of

the best-known Mohist doctrines. By using terms that have been defined in earlier parts of the Canon, *e.g.*, 'knowing' 智 *zhī*, 'filling out' 盈 *yíng*, 'exhausting' 盡 *jìn*, and 'reaching a limit' 窮 *qióng*, and by examining and resolving the alternative cases, the argument laid out in the Explanation comes close to what can be considered an ideal formal proof of a proposition.

B 74

C: 不知其數而知其盡也。說在明者。
E: 不: 二, 智其數。「惡智愛民之盡之[a]也」, 或者遺乎其問也。盡問人則盡愛其所問。

C: Not knowing their number, but knowing that they are exhaustively (accounted for). The explanation lies with one who is clear about (the scope of his reference).
E: *bù* 'not': Being two, we know their number. (So, in asking) "How do we know someone's caring fondly for the people (accounts for) them exhaustively," some have been left out from this question. If one is exhaustive in asking about people, then being exhaustive in caring fondly for those about whom one has asked (follows).

(a) R: 文, emendation Graham 1978, 449; this is a frequently seen graphic corruption in the *Mozi* text.

The section appears to presume a discussion about *jiān ài* 兼愛 'comprehensively caring fondly', only asking about the possibility of showing care to the set of all people. If the question "how do we know someone's caring fondly for the people accounts for them exhaustively" refers only to a restricted set of people, that set will by definition exclude others and the question becomes irrelevant in the discussion of 'comprehensively caring fondly'. If, by contrast, the question refers to all people exhaustively, then the set of all people to be taken care of has been defined by the reference in the question.

Graham (1978, 450) excepts Sun Yirang's emendation of the phrase 明者 of the Canon to 問者 'the one who asked'. The received text reading 明者 'one who is clear about (it)' seems understandable as given, referring to being clear about the difference between asking about a limited set and about an all-inclusive set.

B 75

C: 不知其所處不害愛之, 說在喪子者。
E: 不:若[a] 智其數而智愛之盡之[b] 也, 無難。

C: Not knowing where they are located is not detrimental to caring for them fondly. The explanation lies with one who has lost a son.
E: *bù* 'not': It is like "when knowing their number, then knowing that the caring fondly exhaustively (accounts for) them presents no difficulty."

(a) R: 若不, head character in second position; see Graham 1978, 95–6.
(b) R: 文, emendation Graham 1978, 449; this is a frequently seen graphic corruption in the *Mozi* text.

The Explanation does not live up to the level of argumentation reached in B 73 nor even B 74's argument that not knowing the number does not stand in the way to complete exhaustion.

Chapter 4
Lexical Appendix

Abstract The chapter presents text, translation and commentary for the 12 sections that constitute a 'lexical appendix' to the definitions of the *Mohist Canon*. The Canon of each typically gives one or more glosses for the entry word, the Explanations usually provide contexts and specific examples for the glosses that show what the intended inter-connections are and allow us to see how the semantic scope of the entry word might be conceived.

Throughout our work we have largely followed A. C. Graham (1978) in recognizing that both the *jing* 'Canons' and *jing shuo* 'Explanations' of the *Mobian* text divide themselves into two major categories by type of passage, (a) sections that can be identified as 'definitions' (A 1 through A 87) and (b) sections that can be identified as 'propositions' (A 88 through B 82). The Mohist text itself does not use any kind of meta-language to refer to these two different types of section, but the distinction becomes apparent from the structural features of each. As will have become clear from the preceding material, the 'definitions' characteristically end with a sentence final *yě* 也, as is befitting a proper definition, and the 'propositions' typically end with a sentence of the form *shuō zài* X (說在 X) "the explanation lies with X" where X is a single word or a short phrase that seems intended somehow to epitomize the sense of the Canon, though the intended explanation is not always obvious. The last 12 of Graham's 'definitions' sections, A 76 through A 87, do not conform to the wording structure or content type of the rest of the definitions; in particular they tend not to be in full-sentence form and there is no sentence final *yě* 也. Nor are they propositions in any obvious sense, and they do not end with the *shuō zài* X phrase expected of *Mobian* propositions.[1] Graham includes them among the 'definition'

[1] Sections A 88–A 98 also do not have the characteristic *shuō zài* X phrase. All the same, Graham has included them among the 'propositions', specifically identified as a part of a sub-class of the propositions that he calls "procedures of description." (Graham 1978, 336–38) Elsewhere he calls them "propositions in the art of description" (Graham 1978, 94). Graham speculates that the expected *shuō zài* X phrase was "probably eliminated from [them] … at Stage 2" (Graham 1978, 348). By "Stage 2" he is referring to one stage in his speculation about how the text was altered in the course of its early transmission (Graham 1978, 94–95). Finally, the *shuō zài* phrase that we find

M. Schemmel, W. G. Boltz, *Theoretical Knowledge in the* Mohist Canon,
Archimedes 63, https://doi.org/10.1007/978-3-031-08797-4_4

sections, but says of them that they are "words with more than one usage" and refers to them generally as 'ambiguous' (Graham 1978, 323). Christoph Harbsmeier, by contrast, prefers to regard these sections as the first 12 sections of the 'propositions' (Harbsmeier and Needham 1998, 328, fn 2).

Whether one follows Graham's view that these are definitions of ambiguous words or Harbsmeier's that they are propositions, equally ambiguous, the 12 sections are anomalous with respect to the rest of the *Mohist Canon*, and that anomaly has something to do with their lexical nature. In view of this we examine these sections here as a group, which we call the "Lexical Appendix." Graham's characterization of them as 'ambiguous' is perhaps a little less specific than their content would call for.[2] The Canon of each typically gives one or more glosses for the entry word. These glosses vary sometimes in their meanings in ways that we might not immediately see as linking them semantically to the entry word. The Explanations usually provide contexts and specific examples for the glosses that show what the intended inter-connections are and allow us to see how the semantic scope of the entry word might be conceived. In several of the sections we find glosses and explanations that seem to distinguish the use of words when referring to a kind of language behavior from their use in referring to real-world contexts. In other cases it looks like the Canon or the Explanation, or both in tandem, are presented in a way to draw attention to an apparent semantic "polarity", *i.e*., oppositional senses, inherent in a single word's usage. These aspects of the *Mohist Canon* taken together with those parts of the text that Graham has identified or reconstructed as "Names and Objects" (which we do not deal with here) would suggest a conscious interest in language as a part of the Mohists' larger concern with real-world knowledge.

Harbsmeier has said that the "Later Mohists did not show a special interest in the meanings of words as such, but primarily in the relation between words and objects" (Harbsmeier and Needham 1998, 329). It is not clear what kind of qualification Harbsmeier's "as such" brings to the statement, but it seems unmistakeable that the Mohist was not only interested in the relation between words and objects, but also that between speech acts and real-world acts.[3] This entails recognizing a distinction between using words as linguistic acts of some kind and using them to refer to objective, non-linguistic things. Both of these involve a concern with 'words' and 'language' in a way seen only in one other pre-Han text, *viz*., chapter 22 of the received text of the *Xunzi* 荀子, titled

in the received text of B 24 is likely not original there and is the consequence of a defective text. Graham regards it as a misplaced line from B 25b and has edited the text accordingly. This leaves the present edited state of B 24 also without the expected *shuō zài* phrase.

[2] Harbsmeier states this slightly differently from Graham, calling the sections A 76–B 12 as a group "an opening section [of the whole 'propositions' portion of this part of the *Mobian*] on ambiguity of terms" (Harbsmeier and Needham 1998, 328). Not only does he include, *contra* Graham, sections A 88–B 12 in this group, his wording, more strongly than Graham's, would suggest that he sees a deliberate desire to set out a sequence of sections dealing specifically with 'ambiguity'.

[3] We are not using the term 'speech act' here in the precise sense first proposed by the British philosopher J. L. Austin (1911–1960), distinguishing locutionary and illocutionary speech, that has since become a major consideration in linguistic philosophy.

"Zheng-ming 正名." This *Xunzi* chapter is certainly the primary pre-Han text dealing with the question of "what is the right use of names?"[4] Graham says that this chapter "contains very little not in the Mohist summa" (Graham 1978, 39). But the "Mohist summa," *i.e*., the *Mobian*, conversely, contains a great deal not in the *Xunzi*, "Zheng-ming" chapter. This is of course because the latter is a text centered exclusively on the right use of names, chiefly, as Christoph Harbsmeier has pointed out, as a matter of proper social prescription and behavior (1998, 322), whereas the *Mohist Canon*, in spite of its scattered implications on the difference between the use of words as speech acts and their use to refer to external phenomena, is clearly not primarily centered on either words or language usage. This is what makes the linguistic aspects of the sections that constitute what we have called a "Lexical Appendix" (as well as of sections elsewhere in the *Mobian* and of Graham's reconstructed "Names and Objects") so interesting; they reveal a kind of awareness that language functions as a representation of knowledge, where knowledge is as much of the physical world as it is of the logical and lexical.

[4] Harbsmeier says of Xunxi's "Zheng-ming" chapter that it is "the most coherent and sustained discursive survey of the problem of logic that has come down to us from ancient Chinese times" (Harbsmeier and Needham 1998, 321).

A 76

C: 已。成, 亡。
E: 已:為衣, 成也。治病, 亡也。

C: *yǐ* ‘coming to an end’: may be ‘completing’, may be ‘getting rid of’.
E: *yǐ* ‘coming to an end’: in making a garment one ‘completes it’, in curing an illness, one ‘gets rid of it’.

Graham (1978, 197 and 323–24) points out that *yǐ* 已 ‘ending, coming to a stop’ is the only word that is used in the *Mohist Canon* for ‘end, stop’. The common word *zhōng* 終 ‘to come to an end’ does not occur in these dialectical parts of the *Mozi*. Graham goes on to suggest that this may have something to do with how the Mohists think of time. In fact, because of its likely etymological affinity with *dōng* < ***ttung** 冬 ‘winter’, the primary sense of the word *zhōng* < ***tung** 終 ‘end’ is probably ‘cyclical end’ (though the presence of the “silk” classifier suggests rather a linear end). This distinguishes it semantically from *yǐ* 已 ‘come to an end’ which, as A 76 here clearly shows, has the sense of a completion that entails a change from one state to another (*e.g.*, as the text says, ‘completing an unfinished garment’, ‘curing an illness’). In this connection it is likely that *yǐ* 已 ‘end’ is the underlying lexical form of homophonous *yǐ* 矣, the sentence final particle that marks *perfective/change of state* aspect in the classical language. In other words the perfective aspect marker *yǐ* 矣 is a grammaticalized form of the verb *yǐ* 已 ‘end, complete’. This sense accounts, as Graham points out, also for the adverbial use of *yǐ* 已 as ‘already’.

The Canon is not simply pointing out an ambiguity or semantic breadth associated with the word *yǐ* 已 ‘coming to an end’, but shows what are actually opposite senses of the word; ‘to bring to an end’ is to ‘terminate’, *i.e.*, to “get rid of” whereas to ‘complete’ is in one sense precisely the opposite, and the point of the section may be to draw attention to that sense and that fact.

Compare A 51.

A 77

C: 使。謂, 故。
E: 使:令謂[a]也。不必成。濕, 故也。必待所為之成也。

C: *shǐ* 'causing': may be 'calling', may be 'a basis'.
E: *shǐ* 'causing': ordering something is 'calling something'; it may not inevitably be completed; being moist is a 'basis'; one inevitably expects the completion of what it brings about.

(a) R: 謂謂, emendation Graham 1978, 297.

Understanding 故 *gù* in C as 'basis' > 'providing a basis for' > 'cause' is consistent with A 1; note in particular the *Shuowen* definition for *gù*: 使為之也 'to cause something to bring some other thing about'. Duan Yucai (1735–1815), perhaps the most important of the Qing philologists to study and comment on the *Shuowen*, says in his note to this *Shuowen* entry 墨子經上曰故所得而後成也 "The Canon, part A, of the *Mozi* says: *gù* 'basis' is what must be the case before something will come about," repeating exactly the text of the Canon of A 1 (*SWGL* 1329).

The somewhat redundant sense of 使為 is removed by Xu Kai (920–974), the younger of the two Xu brothers who edited the *Shuowen* text in the Song period. He emends the definition to simply 使之也 'to cause something to happen'.

Note that the inevitability mentioned in the Explanation pertains to the expectation, not the result. This is equally applicable to either the 'minor basis' or the 'major basis' as set out in A 1.

Here, as with A 76 above, the two glosses given in the Canon do not represent simply semantic scope or nuance, but are intended, we suspect, to reflect fundamental differences in meaning and usage of a single word. In this case the glosses are used precisely to distinguish 'causing' as a *speech act* (*wèi* 謂) from 'causing' as a *physical phenomenon* (*gù* 故), an example of the recognition of an intrinsic distinction between linguistic behaviors and external physical events. Beyond this, as set out in the Explanation of these two glosses, the opposition between causation 'not inevitably' leading to something in one case and 'inevitably' leading to something in the other suggests the same kind of opposition seen in A 76 above, and the point of the section may again be to draw attention to the fact that a single lexical item can in its usage entail this kind of seeming opposition.

A 78

C: 名。達, 類, 私。
E: 名:物達也。有實, 必待之[a]名[b]也。命之馬, 類也。若實也者, 必以是名也。命之臧, 私也。是名也止於是實也。聲出口, 俱有名。若姓字[c]。

C: *míng* ‘naming’: may be unrestricted, categorizing or personal.
E: *míng* ‘naming’: the word *wù* ‘thing’ is unrestricted; given any object, it inevitably allows for this kind of name. Giving it the name ‘horse’ is categorizing; any object of this sort will inevitably take this name. Giving it the name Zang is personal. The particular name remains fixed with the particular object. When sounds emerge from the mouth they all have naming-power, either like a surname or like a given name.

(a) R: 文, emendation Graham 1978, 325, 之 is used regularly in the Later Mohist texts as the demonstrative modifier ‘this’.
(b) R: 多, emendation Graham 1978, 325.
(c) R: 宇, emendation Graham 1978, 325.

The word *dá* 達 ‘unrestricted’ means here having no restrictions on the applicability of a name. Our translation ‘unrestricted’ for the word *dá* 達 is taken from Graham 1978, 325; it is rendered ‘all-obtaining’ by Rafael Suter, who says that the Mohists “reserve” the word *wù* 物 for a “thing *of any kind*.” This is in contradistinction to the term *shí* 實 which Suter identifies in the Mohist context as the word for ‘things’ as “non-linguistic ‘objects’.” (Suter 2017) This in turn entails an implicit difference between ‘name’ as a linguistic device, contrasting one thing from another by virtue of its name and ‘name’ as an external, real-world label for something. For the sense of ‘kind’ as a category, the Mohists use the word *lèi* 類, as the Explanation shows with respect to naming something ‘horse’ *mǎ* 馬.

The last part of the Explanation, “when sounds emerge from the mouth they all have naming-power,” seems to mean that all utterances have a naming function, *i.e.*, they will inevitably be associated nominally with something. In the phrase “either like a surname or like a given name” ‘surname’ is used to designate a category, and ‘given name’ is used to designate the particular. The same observation is found in *Mencius* 7B.36, where instead of *zì* 字, the particular is referred to by the word *míng* 名: 姓所同也, 名所獨也 “Surnames are considered to be held in common; given names are considered to be held individually.”

The word *mìng* < ***mreng-s** 命 ‘to give a name to’ is derived from *míng* < ***mreng** 名 ‘name’ by the addition of the OC ***-s** that derives transitive verbs from nouns. By Warring States period times the derivational relation between the two words seems already to have been non-productive and not widely recognized. At the same time the semantic scope of the word *mìng* < ***mreng-s** 命 ‘to give a name to’ came to include ‘to call, to order, to issue a mandate’. As a consequence, the word *míng* 名 ‘name’ was commonly used for the transitive verb ‘to name’ and perhaps read *mìng* < ***mreng-s**.

A 79

C: 謂。移, 舉, 加。
E: 謂:麗[a] 狗犬命, 移[b] 也。狗犬舉也。叱狗加也。

C: *wèi* ‘referring’: may be transferring, adducing or applying.
E: *wèi* ‘referring’: pairing ‘whelp’ and ‘dog’ in giving the name is transferring; ‘whelp’ or ‘dog’ [either used alone] is ‘adducing’; shouting at a dog is ‘applying’.

(a) R: 灑謂; the order of the head character of E and the first character of the text has become reversed, see Graham 1978, 95–6; 灑 stands for 麗 *lì* ‘to pair with’, see Graham 1978, 326.
(b) R: null, emendation Graham 1978, 326.

yí 移: “pairing ‘whelp’ and ‘dog’” may be a reference to the common use of *wèi* 謂 ‘to refer to something by a different name’, *e.g.*, 謂 狗犬 “to refer to a ‘whelp’ as a ‘dog’.”
jǔ 舉: The term ‘adduce’ entails the sense of 謂 used to raise a topic for further comment. Sometimes this is grammatically the same as the first case, to refer to some object with a comment rather than a different name for the object.
jiā 加: shouting at a dog is ‘applying’, *i.e.*, addressing the dog directly (with some kind of command).

The Mohist is again here concerned with the difference between what can be recognized as a ‘speech act’ on the one hand versus a ‘real-world event’ on the other. The Explanation suggests that the verbal sense of *yí* 移 ‘transferring’ is understood as a speech act in that it involves only a relation between lexical items, whereas *jǔ* 舉 ‘adducing’ and *jiā* 加 ‘applying’ refer to real-world behaviors that pertain to a real dog.

A 80

C: 知。聞[a], 說, 親。名, 實, 合, 為。
E: 知:傳受之聞也。方不運[b] 說也。身觀焉親也。所以謂名也。所謂實也。名實耦合也。志行為也。

C: *zhī* ‘knowing’: may be having heard, by explanation or personal; may be about names, about objects, about [their] conjunction or about acting.
E: *zhī* ‘knowing’: having received something transmitted is ‘having heard’; that a square object will not roll is ‘explicable’; being an observer to it yourself is ‘personal’*;* that whereby something is referred to is a ‘name’; what is referred to is the ‘object’. The name and the object as a pair is a ‘conjunction’; when one’s intentions are carried out it is ‘acting’.

(a) R: 間, emendation Graham 1978, 327.
(b) R: 廔, emendation Graham 1978, 327, basing himself on earlier explanations of Wu Yujiang and Sun Yirang; 廔 is taken as a misprint for 庫 which is then taken as a variant of the unfamiliar character 厙; this is in turn understood as a graphic variant of 匀 (= 軍 *jūn*), the phonophoric of 運 *yùn* ‘to roll’. The latter part of this emendation is confirmed conclusively by the same occurrence of 庫 for 運 *yùn* ‘to rotate’ in the Canon of A 48, which emendation is unambiguously indicated by 運 as the head character of the Explanation.

While it is self-evident that a square object will not role, the comment in the Explanation is not trivial because it is intended to illustrate a kind of knowing that can be easily explained (說), distinct from the things you know having heard about them or observed them personally.

Notice that the Canon uses the word *shí* 實 ‘(non-linguistic) object’, conforming to the distinction seen in A 78 between the word *wù* 物 as the term that is used to name referentially a “thing *of any kind*” and *shí* 實 the word for a non-linguistic ‘thing’, *i.e.*, ‘object’, and the Explanation follows in exactly this same sense. See the discussion at A 78. By including the statements “that whereby something is referred to is a ‘name’; what is referred to is the ‘object’” the Explanation is consistent with the *yí* 移 ‘transferring’ sense of *wèi* 謂 ‘calling’ in the immediately preceding section. Finally, the Explanation concludes by pairing the lexical item ‘name’ and the real-world ‘object’, making the speech act together with what it refers to a form of knowing.

A 81

C: 聞。傳[a], 親。
E: 聞:或告之傳也。身觀焉親也。

C: *wén* ‘hearing’: may be transmitted, may be personal.
E: *wén* ‘hearing’: someone telling you something is ‘transmitted’; being an observer to it yourself is ‘personal’.

(a) R: 愽, emendation Graham 1978, 328; the 愽 in R is a non-standard variant of 博 *bó* ‘wide-ranging’. While the E text with *chuán* 傳 ‘transmit’ makes it likely that Graham’s emendation is correct, it is not impossible to read the text as it stands with 愽 / 博 *bó* ‘wide-ranging’, thus “*wén* ‘hearing’ may be ‘wide-ranging’ (*i.e*., widely known), or may be ‘personal’.” That the E text unambiguously writes *chuán* 傳 ‘transmit’ would then have to be understood as a secondary change from 愽/博 *bó* ‘wide-ranging’; thus “when others announce it, it is ‘widely known’” to “someone telling you something is ‘transmitted’,” an example of the *lectio facilior* supplanting the *lectio difficilior*.

A 82

C: 見。體, 盡。
E: 見:特[a] 者體也。二者盡也。

C: *jiàn* ‘seeing’: may be elemental, may be exhaustive.
E: *jiàn* ‘seeing’: in particulars, is elemental*;* in the aggregate, is exhaustive.

(a) R: 時, emendation Graham 1978, 329, based on conjecture of Sun Yirang.

In A 2 體 ‘element’ is explained as 二之一 “one of two,” where we can understand the ‘two’ as a composite set. By the same token we can understand the 二者 here also as a ‘composite set’, and thus standing for elements in the aggregate.

A 83

C: 合。正, 宜, 必。
E: 合[a]:與[b] 立, 反中, 志工, 正也。臧之為, 宜也。非彼必不有, 必也。聖者, 用而勿必。必也者, 可而[c] 勿疑。反[d] 者, 兩而勿偏。

C: *hé* 'conjoining': may be 'straightforward', 'appropriate' or 'inevitable'.
E: *hé* 'conjoining'*:* standing together, opposites in accord, intention and result, are examples of straightforward conjoining; Zang behaving as he does, is appropriate conjoining; were it not for something, something else inevitably would not come about, is inevitable conjoining. As for the sages, take advantage of them but do not regard [what they say] as inevitable. As for 'inevitability', accept it, do not be suspicious of it; as for opposites, regard them as dual, but do not privilege one over the other.

(a) R: 古, emendation Graham 1978, 330.
(b) R: 兵, emendation Graham 1978, 330.
(c) R: null, emendation Graham 1978, 330 on the grounds that the phrase 可勿 is grammatically impossible, given the precise sense of 勿 negating only transitive verbs with third-person pronominal direct object.
(d) R: 仗, Graham emends this to 仮 and treats it like the 反 of the earlier sentence (1978, 330).

The use of 正 in these lexical appendix entries is somewhat formulaic and serves to specify the meaning of the word in question in an unqualified and absolute sense, thus, here, 'straightforward conjoining', and so *mutatis mutandis* in the subsequent sections.

The phrase 反中 ('opposites in accord') is grammatically subject-verb, *fǎn* 反 'opposites'—中 *zhòng* 'to hit the mark exactly'. The sense may refer to the kind of experiences that later in an analytical context come to be called 'action-reaction'.

The reference to an individual (here named Zang, the rough equivalent of "John Doe") and his behavior is called *yí* 宜 'appropriate conjoining', *i.e.*, the conjunction of a person and the behavior typically identified or associated with that person; *yí* < ***ngraj** 宜 'to behave in a way proper to an individual according to status or position', akin to *wǒ* < ***nggaj** 我 'I, we, me, us' and to *yì* < ***ngrajs** 義 'ritual or ceremonial behavior proper to an individual'.

The meaning of the line 非彼必不有, 必也 in the Explanation here is effectively the same as the definition of a 'major basis' in A 1, 大故, 有之必然 ('Major basis: having it entails the inevitability of (a certain thing) becoming so'). The point here in A 83 is to show that the necessary condition and its inevitable consequence constitute a conjunction defined by the two elements' causal relation.

The reference to the 'sages' and what they stand for or say seems to be intended to encourage recognizing a distinction between what they advocate and what may in fact be the case. The former does not necessarily imply the latter. So the Mohist endorses an open-minded response to their teachings, take advantage of them when it makes sense to do so, but do not regard them as inevitably right. Inevitability, the text asserts, should be accepted and not doubted, but the doctrines and claims of the sages vis-à-vis contrary opinions or facts are one of two opposites, to be recognized for what they are but not given preferential treatment. This train of thought generally seems to arise from the category of 'inevitable conjoining'. This line of the E

sounds atypically polemical in this part of the *Mozi*, though it is not inconsistent with the more narrative parts, especially, *e.g*., chapters 38 and 39, *Fei ru* 非儒 "In opposition to Confucians." Here it may be a kind of marginal note that has inadvertently been included in the primary text.

A 84a

C: 欲。正, 權利, 且。
E: [null]

C: *yù* ‘desiring’: straightforward desiring, appreciating the effectiveness of the benefits, being on the verge of.
E: [null]

This and the following section have been put together by Graham as A 84. Given the fact that there is no other example of a pair of opposite terms being identified or disambiguated in a single Canon, coupled with the absence of any Explanation to provide a guide to the identification of Canon boundaries, we prefer to treat them as two separate Canons, splitting them up as A 84a and A 84b.

Including the term *qiě* 且 ‘being on the verge of, about to’ in C here is likely intended to suggest a connection with *yù* 欲, which also has the meaning ‘about to’; *cf.* English *will* (i) marker of future tense (“It will be so”) and (ii) ‘want’ (“I will that it be so”).

A 84b

C: 惡。正, 權害。
E: [null]

C: *wù* ‘disliking’: straightforward disliking, appreciating the effectiveness of the harm.
E: [null]

For the identification of this section, see the note at A 84a immediately above.

A 85

C: 為。存, 亡, 易, 蕩, 治, 化。
E: 為:中商[a], 存也。病, 亡也。買鬻, 易也。霄燼[b], 蕩也。順長, 治也。黿[c] 買[d], 化也。

C: *wéi* 'acting': may be sustaining, eliminating, switching, dislodging, putting in good order or transforming.
E: *wéi* 'acting': for according exactly with a counterpart it means 'sustaining'; for illnesses it means 'eliminating'; for buying and selling it means 'switching'; of snow-slush or ashes it means 'dislodging'; of conforming and leading it means 'putting in good order'; of the frog and trading it means 'transforming'.

(a) R: 早臺, emendation Graham 1978, 332; 中商 *zhòng dí* understood as verb-object, 'to accord exactly with a counterpart'.
(b) R: 盡, emended on the basis of suggestion by Graham 1978, 332.
(c) *wā* 'frog' as in A 45.
(d) Based on the E text of A 45, which specifies the *chún* 鶉 'quail' as the thing into which the frog is transformed, the expected word here should be *chún* 鶉 'quail'. As reasonable as such an emendation sounds, it is also possible to understand the text as it stands, which by default we are obliged to do.

At first glance the Explanation's reference to 買 in the last example 黿買 'frogs and trading' as 化 'transforming' would seem to be inconsistent with the preceding reference to 買鬻 'buying and selling' as 易 'switching'. It appears that the two references to trading reflect different aspects of that kind of transaction. Buying and selling seen as a bilateral exchange is an example of 'switching', the same action viewed from opposing perspectives. By contrast 買 in its second occurrence is not simply 'buying' but is the whole of a commercial transaction, 買賣 *mǎi mài*, *i.e.*, trading one thing for another, turning one thing into another. The two verbs *mǎi* < ***mmraj-ʔ** 'buy' and *mài* < ***mmraj-s** 'sell' are no more than morphological variants of a single word; the *-**s** of *mài* 'sell' marking the causative sense of *mǎi* 'buy', that is 'sell' < 'cause [someone] to buy'. In other words, what seem to be two distinct verbs can be understood as two parts of a single action, and the character 買 in the E text here could stand for the word for the transaction in general without specifying direction. It thus seems to refer to trading as the transformation of a commodity from one form to another, just as the frog was described in A 45 as being transformed into a quail. If we understand it in this way, the sense of 買 *mǎi* in 買鬻 *mǎi yù* 'buying and selling' is "half" of the sense it has in 黿買 *wā mǎi* 'frogs and trading', and this may be another instance of drawing attention to apparently opposite (or in this case quasi-opposite) meanings of the same word.

For the semantic relation between 化 *huà* 'transform', 'convert', *cf.* 貨 *huò* 'commodities, goods convertible into something of equivalent value'.

A 86

C: 同。重, 體, 合, 類。
E: 同:二名一實, 重同也。不外於兼, 體同也。俱處於室, 合同也。有以同, 類同也。

C: *tóng* ‘same’: may be of a duplicate kind, an elemental kind, a conjoined kind or a categorical kind.
E: *tóng* ‘same’: two names and one object means a ‘duplicated kind of sameness’; not external to the composite whole means an ‘elemental kind of sameness’; all located in a room means a ‘conjoined kind of sameness’; having something whereby they are the same means a ‘categorical kind of sameness’.

A 87

C: 異。二, 不[a] 體, 不合, 不類。
E: 異:二必異, 二也。不連屬, 不體也。不同所, 不合也。不有同, 不類也。

C: *yì* ‘different’: may be of a being-two kind, a not-functioning-as-elements [of a single composite] kind, a not-conjoined kind or a not-in-a-single-category kind.
E: *yì* ‘different’: two inevitably different means ‘being two’; not connected or attached means ‘not functioning as elements [of a single composite]’; not in the same place means ‘not conjoined’; not having something whereby they are the same means ‘not in a single category’.

(a) R: null, restored on the basis of E (Graham 1978, 334).

Correction to: Text and Translation

Correction to: M. Schemmel, W. G. Boltz, *Theoretical Knowledge in the* Mohist Canon, Archimedes 63, https://doi.org/10.1007/978-3-031-08797-4_3

This book was inadvertently published with incorrect characters in Chapter 3. The characters have now been updated in the chapter.

Abbreviations:
p. = page
l. = line
→ = should be replaced by

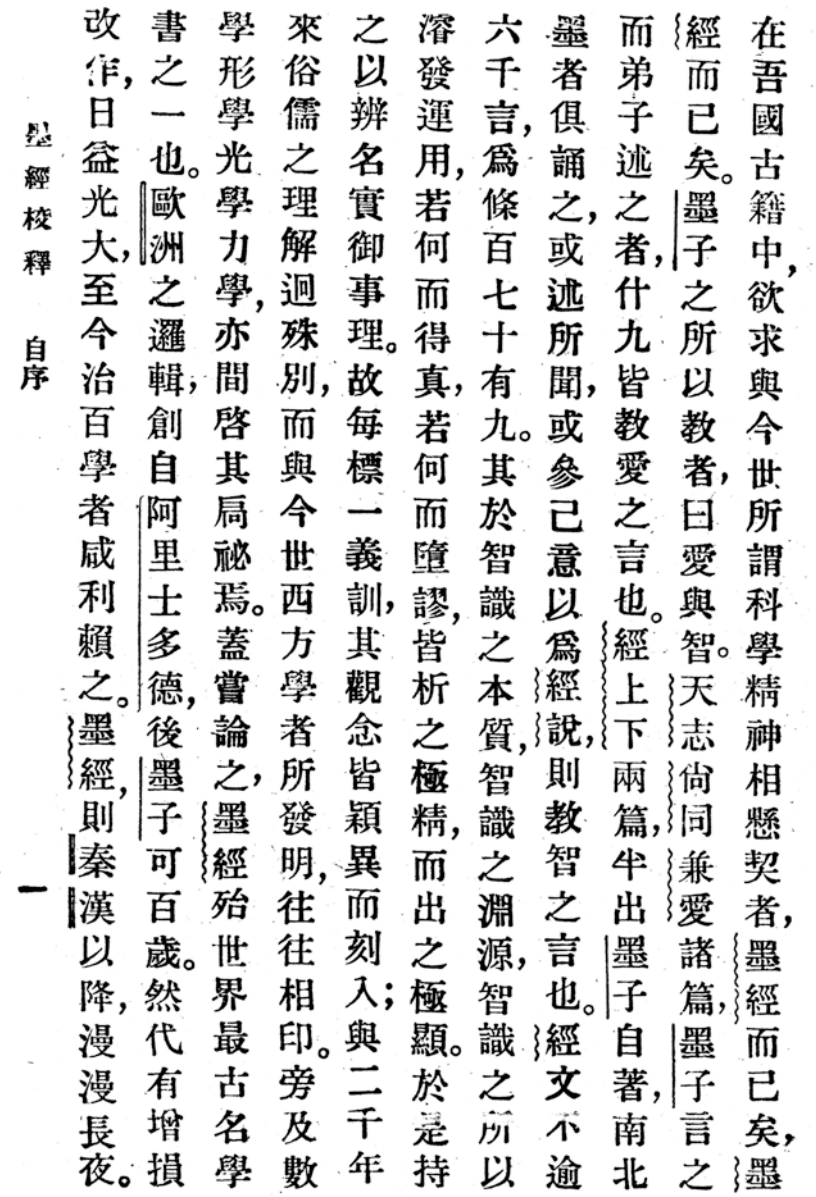
Corrections:

Section 3.3 p.93 l.17 B→ 稘
Section 3.8 p.154 l.9 R→ 摣

The updated original versions for this chapter can be found at https://doi.org/10.1007/978-3-031-08797-4_3

M. Schemmel, W. G. Boltz, *Theoretical Knowledge in the* Mohist Canon, Archimedes 63, https://doi.org/10.1007/978-3-031-08797-4_5

Textual Appendix: Reproduction of Liang Qichao's "Preface" to the *Mojing jiaoshi*
《墨經校釋》 梁啟超自序



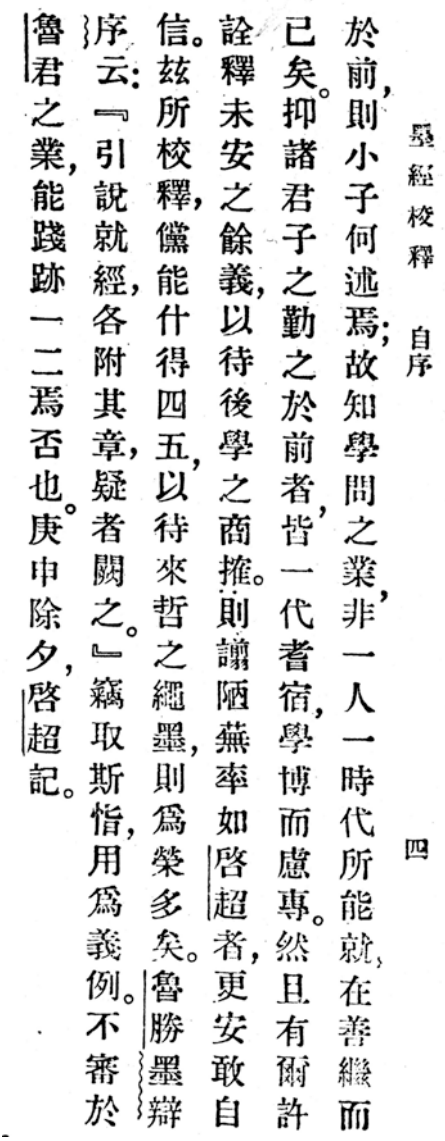
自序

在吾國古籍中，欲求與今世所謂科學精神相懸契者，墨經而已矣。墨經而已矣。墨子之所以教者，曰愛與智。天志尚同兼愛諸篇，墨子言之而弟子述之者，什九皆教愛之言也。經上下兩篇，半出墨子自著，南北墨者俱誦之，或述所聞，或參己意以爲經說，則教智之言也。經文不逾六千言，爲條百七十有九。其於智識之本質，智識之淵源，智識之所以濬發運用，若何而得真，若何而墮謬，皆析之極精，而出之極顯。於是持之以辨名實御事理。故每標一義訓，其觀念皆穎異而刻入；與二千年來俗儒之理解迥殊別，而與今世西方學者所發明，往往相印。旁及數學形學光學力學，亦間啓其扃祕焉。蓋嘗論之，墨經殆世界最古名學書之一也。歐洲之邏輯，創自阿里士多德，後墨子可百歲。然代有增損改作，日益光大，至今治百學者咸利賴之。墨經，則秦漢以降，漫漫長夜。

M. Schemmel, W. G. Boltz, *Theoretical Knowledge in the* Mohist Canon,
Archimedes 63, https://doi.org/10.1007/978-3-031-08797-4

茲學既絕，則學者徒以空疏玄渺膚廓模棱破碎之說相高，而智識界之榛塞窮餓，乃極於今日。吁！可悲已。後世治此者，惟於晉得一魯勝，蓋總經上下經說上下四篇，名曰墨辯，而爲之注。其序見存於晉書隱逸傳；其注則隋書經籍志已不著錄，蓋亡之久矣。墨子全書，本稱難讀，而茲四篇者特甚。原文本皆旁行，今本易以直寫，行列錯亂，不易排比，一也。說與經離，不審所屬，無以互發，二也。章條句讀，交相錯逗，上屬下屬，失之千里，三也。文太簡短，其或譌奪，末由尋繹語氣以相是正，四也。案識之語，羼入正文，不易辨別，五也。累代展轉寫校，或强作解事，奮筆肊改，譌復傳譌，六也。古注已亡，無所憑藉質證，七也。含義奧衍，且與儒家理解殊致，持舊觀念以釋之，必致誤繆，八也。夫世既莫知重其學矣，而治之復具此八難，是以明珠委塵，幽蘭棄莽，悠悠千禩，莫或顧視也。清乾嘉間，校勘學大昌。汪容甫中畢秋帆沅各校注墨子，畢本頗行於世，

王懷祖（念孫）伯申（引之）父子及俞蔭甫（樾）所著書，於墨子皆有所讐釋，墨子自是稍稍可讀矣。張皋文（惠言）著墨子經說解，而墨經始有專注。吾鄉先正鄒特夫（伯奇）陳蘭甫（澧）兩先生，時時引西來之學解墨經，學者益漸驚茲經所蘊之富。然皆斷章單義，間有發明，未得百之一二。孫仲容（詒讓）著墨子閒詁，全書疑滯，剖抉略盡。獨茲四篇，用力雖勤，而所闡仍寡；卽以校勘論，其犁然而有當者，亦未始得半。作始之難，理固然也。比年以來，歐學東注，學者憑借新知，以商量舊學，益覺此六千言者，所函義浩無涯涘。若章太炎（炳麟）胡適之（適）所撰述，時有徵引濬發，深造蓋邁先輩。啓超幼而好墨，二十年來，於茲經有所校釋，隨劄記於卷端，得若干條；未及整理，輒復亡散。今冬方在清華園爲諸生講國學小史，值歲暮休暇，輟講，利用餘晷，遂檢舊槀，比而次之，得數萬言，命曰墨經校釋。其於畢張孫諸君子之說持異同者蓋過半。然非諸君子勤之



墨經校釋　自序　四

於前，則小子何述焉；故知學問之業，非一人一時代所能就，在善繼而已矣。抑諸君子之勤之於前者，皆一代耆宿，學博而慮專。然且有爾許詮釋未安之餘義，以待後學之商搉。則譾陋蕪率如啓超者，更安敢自信。茲所校釋，儻能什得四五，以待來哲之繩墨，則爲榮多矣。魯勝墨辯序云：『引說就經，各附其章，疑者闕之。』竊取斯恉，用爲義例。不審於魯君之業，能踐跡一二焉否也。庚申除夕，啓超記。

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Bibliography

Chinese Primary Sources

Erya 爾雅, [*Song ben*] *Shisanjing zhushu fu jiaokanji* [宋本] 十三經注疏附校勘記, Ruan Yuan 阮元 (1764–1849), ed., 1815. Taibei: Yiwen yinshu guan, 1955, rpt.

Jin shu 晉書 ("History of the Jin Dynasty"), Fang Xuanling 房玄齡 et al., comp., *ca*. 647. Beijing: Zhonghua shuju, 1974.

Kangxi zidian 康熙字典. Zhang Yushu 張玉書 (1642–1711) et al., comp.

Lun yu 論語 ("Analects of Confucius"), [*Song ben*] *Shisanjing zhushu fu jiaokanji* [宋本] 十三經注疏附校勘記, Ruan Yuan 阮元 (1764–1849), ed., 1815. Taibei: Yiwen yinshu guan, 1955, rpt.

Mengzi 孟子 ("Mencius"), [*Song ben*] *Shisanjing zhushu fu jiaokanji* [宋本] 十三經注疏附校勘記, Ruan Yuan 阮元 (1764–1849), ed., 1815. Taibei: Yiwen yinshu guan, 1955, rpt.

Shangshu Dazhuan 尚書大傳: *Shangshu Dazhuan fu xulu biane* 尚書大傳附序錄辨譌, Chen Shouqi 陳壽祺 (1771–1834), comp., Congshu jicheng 叢書集成 ed. Shanghai: Shangwu, 1937.

Shuihudi Qinmu zhujian zhengli xiaozu 睡虎地秦墓竹簡整理小組, *Shuihudi Qinmu zhujian* 睡虎地秦墓竹簡. Beijing: Wenwu, 1990. (abbr. Shuihudi 1990).

Shuowen jiezi gulin 說文解字詁林, Ding Fubao 丁福保, ed., Shanghai: Shangwu yinshu guan, 1928; Taibei: Taiwan Shangwu yinshu guan, 1970, rpt. (abbr. SWGL).

Shuowen jiezi xizhuan 說文解字繫傳, Xu Kai 徐鍇 (920–74), comp., incorporated in the *Shuowen jiezi gulin*.

Sui shu 隋書, ("History of the Sui Dynasty"), Wei Zheng 魏徵, comp., *ca*. 636. Beijing: Zhonghua shuju, 1974.

Wen jing tang congshu 問經堂叢書, Sun Fengyi 孫馮翼, comp., *ca*. 1800. Taibei: Yiwen yinshu guan, 1968, rpt.

Wen xuan 文選: *Zengbu liu chen zhu Wen xuan* 增補六臣注文選, Xiao Tong 蕭統 (501–531), comp., Li Shan 李善 (?–689) et al., annotated, Taibei: Huazheng 1974 rpt.

Literature

Allan, Sarah. 2007. On the Identity of Shang Di and the Origin of the Concept of a Celestial Mandate (天命 tian ming). *Early China* 31: 1–46.

Aristotle. 1933. *Metaphysics: Books I–IX*. Hugh Tredennick (transl.). Loeb Classical Library 271. Cambridge, MA: Harvard University Press.

M. Schemmel, W. G. Boltz, *Theoretical Knowledge in the* Mohist Canon,
Archimedes 63, https://doi.org/10.1007/978-3-031-08797-4

———. 1983. *The Categories. On Interpretation. Prior Analytics*. Harold P. Cooke and Hugh Tredennick (transl.). Loeb Classical Library 325. Cambridge, MA: Harvard University Press.
———. 1989. *Posterior Analytics. Topica*. Hugh Tredennick and Edward S. Forster (transl.). Loeb Classical Library 391. Cambridge, MA: Harvard University Press.
———. 1993. *The Physics: Books I–IV*. Philipp Henry Wicksteed and Francis M. Cornford (transl.). Loeb Classical Library 228. Cambridge, MA: Harvard University Press.
———. 1995. *The Physics: Books V–VIII*. Philipp Henry Wicksteed and Francis M. Cornford (transl.). Loeb Classical Library 255. Cambridge, MA: Harvard University Press.
———. 2011. *Problems: Books 1–19*. Robert Mayhew (transl.). Loeb Classical Library 316. Cambridge, MA: Harvard University Press.
Baxter, William Hubbard, and Laurent Sagart. 2014. *Old Chinese: A New Reconstruction*. Oxford: Oxford University Press.
Behr, Wolfgang. 2004. 'To Translate' Is 'To Exchange' 譯者言易也: Linguistic Diversity and the Terms for Translation in Ancient China. In *Mapping Meanings: The Field of New Learning in Late Qing China*, ed. Michael Lackner and Natascha Vitinghoff, 173–210. Leiden: Brill.
———. 2018. 'Self-Refutation' (bèi) in Early Chinese Argumentative Prose: Sidelights on the Linguistic Prehistory of Incipient Philosophy. In *Concepts of Philosophy in Asia and the Islamic World. Vol. 1: China and Japan*, Studien zur interkulturellen Philosophie, 25, ed. Raji C. Steineck, Ralph Weber, Robert Gassmann, and Elena Lange, 141–187. Leiden/Boston: Brill.
Berlinski, David. 1995. *A Tour of the Calculus*. New York/Toronto: Pantheon Books/Random House of Canada.
Boltz, William G. 1992. Notes on Chinese Etymology: The Past and Present of *kǔ* 古 'Past' and *chīn* 今 'Present'. *Oriens Extremus* 35 (1–2): 35–43.
———. 1999. The Fourth-Century B.C. Guodiann Manuscripts from Chuu and the Composition of the Laotzyy. *Journal of the American Oriental Society* 119 (4): 590–608.
———. 2006. Mechanics in the '*Mohist Canon*': Preliminary Textual Questions. In *Studies on Ancient Chinese Scientific and Technical Texts: Proceedings of the 3rd ISACBRST*, ed. Hans Ulrich Vogel, Christine Moll-Murata, and Gao Xuan, 32–40. Zhengzhou: Daxiang chubanshe.
———. 2013. Why So Many *Laozi*-s? In *Studies in Chinese Manuscripts: From the Warring States Period to the 20th Century*, ed. Imre Galambos, 1–32. Budapest: Institute of East Asian Studies, Eötvös Loránd University.
Boltz, William G., and Matthias Schemmel. 2013. *The Language of 'Knowledge' and 'Space' in the Later Mohist Canon*, Preprint 442. Berlin: Max Planck Institute for the History of Science.
———. 2016. Theoretical Reflections on Elementary Actions and Instrumental Practices: The Example of the '*Mohist Canon*'. In *Spatial Thinking and External Representation: Towards a Historical Epistemology of Space*, ed. Matthias Schemmel, 121–144. Berlin: Edition Open Access.
Boroditsky, Lera. 2000. Metaphoric Structuring: Understanding Time Through Spatial Metaphors. *Cognition* 75 (1): 1–28.
Brindley, Erica. 2009. 'The Perspicuity of Ghosts and Spirits' and the Problem of Intellectual Affiliations in Early China. *Journal of the American Oriental Society* 129 (2): 215–236.
Büttner, Jochen, Jürgen Renn, and Matthias Schemmel. 2018. The Early History of Weighing Technology from the Perspective of a Theory of Innovation. In *Emergence and Expansion of Preclassical Mechanics*, Boston Studies in the Philosophy and History of Science 333, ed. Rivka Feldhay, Jürgen Renn, Matthias Schemmel, and Matteo Valleriani, 81–109. Cham: Springer.
Casasanto, Daniel, and Lera Boroditsky. 2008. Time in the Mind: Using Space to Think About Time. *Cognition* 106: 579–593.
Chemla, Karine, and Guo Shuchun, eds. 2004. *Les neuf chapitres: Le classique mathématique de la Chine anciennne et ses commentaires*. Paris: Dunod.
Chen Qiyou 陳奇猷. 1990. *Lüshi chunqiu jiaoshi* 呂氏春秋校釋. 2nd ed. Shanghai: Xuelin chubanshe.

Cheng, Anne Anlin. 2001. *The Melancholy of Race: Psychoanalysis, Assimilation and Hidden Grief*. Oxford: Oxford University Press.
Dai Nianzu 戴念祖. 2001a. *Lixue shi* 力学史. Changsha: Hunan jiaoyu chu ban she.
———. 2001b. *Guangxue shi* 光学史. Changsha: Hunan jiaoyu chu ban she.
Damerow, Peter. 1996. Abstraction and Representation. In *Abstraction and Representation: Essays on the Cultural Evolution of Thinking*, Boston Studies in the Philosophy of Science 175, ed. Peter Damerow, 371–381. Dordrecht: Kluwer.
———. 2007. The Material Culture of Calculation: A Theoretical Framework for a Historical Epistemology of the Concept of Number. In *Mathematisation and Demathematisation: Social, Philosophical and Educational Ramifications*, ed. Uwe Gellert and Eva Jablonka, 19–56. Rotterdam: Sense Publ.
Damerow, Peter, and Wolfgang Lefèvre. 1981. *Rechenstein, Experiment, Sprache: Historische Fallstudien zur Entstehung der exakten Wissenschaften*. Stuttgart: Klett-Cotta.
———. 1996. Tools of Science. In *Abstraction and Representation: Essays on the Cultural Evolution of Thinking*, Boston Studies in the Philosophy of Science 175, ed. Peter Damerow, 395–404. Dordrecht: Kluwer.
Defoort, Carine. 2001. Is There Such a Thing as Chinese Philosophy? Arguments of an Implicit Debate. *Philosophy East and West* 51 (3): 393–413.
Defoort, Carine, and Nicolas Standaert. 2013. *The Mozi as an Evolving Text: Different Voices in Early Chinese Thought*, Studies in the History of Chinese Texts, 4. Leiden/Boston: Brill.
Descartes, René. 1983. *Principles of Philosophy*. Valentine Rodger Miller and Reese P. Miller (transl.). Synthese Historical Library 24. Dordrecht: Reidel.
Dux, Günter. 1994. Überlegungen zu einer empirischen Grundlegung des Geistes und der Geistesgeschichte: Eine Einleitung. In *Der Prozeß der Geistesgeschichte*, ed. Günter Dux and Ulrich Wenzel, 7–12. Frankfurt a. M: Suhrkamp.
Elman, Benjamin. 2005. *On Their Own Terms: Science in China, 1550–1900*. Cambridge, MA: Harvard University Press.
Euclid. 1956. *The Thirteen Books of Euclid's Elements*. Thomas Heath (transl.). 2nd edn., Revised with Additions. New York: Dover.
———. 1959. *L'optique et la catoptrique*. Paul ver Eecke (transl.). Paris: Blanchard.
Evans, Vyvyan. 2013. Temporal Frames of Reference. *Cognitive Linguistics* 24 (3): 393–435.
Falkenhausen, Lothar von. 2006. *Chinese Society in the Age of Confucius (1000–250 BC): The Archaeological Evidence*, Ideas, Debates, and Perspectives, 2. Los Angeles: Cotsen Institute of Archaeology, University of California.
Fraser, Chris. 2015. Justification and the Role of Heaven (in: Mohism). In *Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta. https://plato.stanford.edu/entries/mohism/#heaven. Accessed 3 July 2019.
———. 2017. *Mohist Canons*. In *Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta. https://plato.stanford.edu/entries/mohist-canons/. Accessed 19 July 2019.
Galton, Antony. 2011. Time Flies But Space Does Not: Limits to the Spatialisation of Time. *Journal of Pragmatics* 43: 695–703.
Graham, A.C. 1964. The Logic of the Mohist 'Hsiao-ch'ü. *T'oung Pao* 51 (1): 1–54.
———. 1978. *Later Mohist Logic, Ethics, and Science*. Hong Kong/London: Chinese University Press/School of Oriental and African Studies, University of London.
———. 1981. *Chuang-tzŭ: The Inner Chapters*. London: George Allen & Unwin.
———. 1989. *Disputers of the Tao: Philosophical Argument in Ancient China*. La Salle: Open Court.
———. 1993. Mo tzu 墨子. In *Early Chinese Texts: A Bibliographical Guide*, ed. Michael Loewe, 336–341. Berkeley: The Society for the Study of Early China/The Institute of East Asian Studies, University of California.
Graham, A.C., and Nathan Sivin. 1973. A Systematic Approach to the Mohist Optics (ca. 300 B.C.). In *Chinese Science: Explorations of an Ancient Tradition*, ed. Joseph Needham, Shigeru Nakayama, and Nathan Sivin, 105–152. Cambridge: MIT Press.

Guo Qingfan 郭慶藩. 1975. *Zhuangzi jishi* 莊子集釋. Daming Wangshi chuban gongsi.
Harbsmeier, Christoph, and Joseph Needham. 1998. *Science and Civilisation in China. Vol. 7, Part 1: Language and Logic in Traditional China*, ed. Kenneth Robinson. Cambridge: Cambridge University Press.
He Ning 何寧. 1998. *Huainanzi jishi* 淮南子集釋. Beijing: Zhonghua shuju.
Henderson, John B. 2010. Cosmology and Concepts of Nature in Traditional China. In *Concepts of Nature: A Chinese–European Cross-Cultural Perspective*, ed. Hans Ulrich Vogel and Günter Dux, 181–197. Leiden/Boston: Brill.
Hsiao Kung-ch'üan. 1979. *A History of Chinese Political Thought. Part 1: From the Beginnings to the Sixth Century*. Princeton: Princeton University Press.
Hsü, Immanuel C. Y. (Ed. and transl.) (1959). *Intellectual Trends in the Ch'ing Period*. (Annotated Translation of Liang Qichao's 清代學術概論.) Cambridge, MA: Harvard University Press.
Hubei sheng bowuguan 湖北省博物館. 1996. *Zeng Hou Yi mu wenwu yishu* 曾侯乙墓文物藝術. Wuhan: Hubei Meishu.
Hund, Friedrich. 1978. *Geschichte der physikalischen Begriffe, Teil 1: Die Entstehung des mechanischen Naturbildes*. Mannheim: Bibliographisches Institut.
Jensen, Lionel M. 1997. *Manufacturing Confucianism: Chinese Traditions and Universal Civilization*. Durham/London: Duke University Press.
Johnston, Ian, ed. 2010. *The Mozi: A Complete Translation*. New York: Columbia University Press.
Karlgren, Bernhard. 1950. *The Book of Odes*. Stockholm: Museum of Far Eastern Antiquities.
Knechtges, David R., and Xiao Tong. 1987. *Wen Xuan, Or, Selections of Refined Literature. Vol. 2: Rhapsodies on Sacrifices, Hunting, Travel, Sightseeing, Palaces and Halls, Rivers and Seas*. Princeton: Princeton University Press.
Knoblock, John. 1994. *Xunzi: A Translation and Study of the Complete Works. Vol. 3: Books*, 17–32. Stanford: Stanford University Press.
Kurtz, Joachim. 2011. *The Discovery of Chinese Logic*. Leiden/Boston: Brill.
Lefèvre, Wolfgang. 1979. Die Lehre vom Geraden und Ungeraden: Zur Rekonstruktion des Ursprungs der wissenschaftlichen Mathematik in der griechischen Antike. In *Aufmerksamkeit: Klaus Heinrich zum 50. Geburtstag*, ed. Olav Münzberg and Lorenz Wilckens, 297–320. Frankfurt a. M: Roter Stern.
Levenson, Joseph R. 1967. *Liang Ch'i-ch'ao and the Mind of Modern China*. Berkeley/Los Angeles: University of California Press.
Lewis, Mark Edward. 1990. *Sanctioned Violence in Early China*. Albany: State University of New York Press.
———. 1999a. Warring States Political History. In *Cambridge History of Ancient China*, 587–650. Cambridge: Cambridge University Press.
———. 1999b. *Writing and Authority in Early China*. Albany: State University of New York Press.
Li Feng. 2003. 'Feudalism' and Western Zhou China: A Criticism. *Harvard Journal of Asiatic Studies* 63 (1): 115–144.
———. 2006. *Landscape and Power in Early China*. Cambridge: Cambridge University Press.
———. 2008. *Bureaucracy and the State in Early China: Governing the Western Zhou*. Cambridge: Cambridge University Press.
———. 2013. *Early China: A Social and Cultural History*. Cambridge: Cambridge University Press.
Liang Qichao 梁啟超. 1923. *Mojing jiaoshi* 墨經校釋. Shanghai: Shangwu.
Liu Shaojun 劉韶軍. 1998. *Taixuanjing jizhu* 太玄經集注. Beijing: Zhonghua shuju.
Lloyd, G.E.R. 2004. *Ancient Worlds, Modern Reflections: Philosophical Perspectives on Greek and Chinese Science and Culture*. Oxford/New York: Clarendon Press/Oxford University Press.
Luan Tiao-fu 欒調甫. 1957. *Mozi yanjiu lunwenji* 墨子研究論文集. Beijing: Renmin chubanshe.
Meyer, Dirk. 2012. *Philosophy on Bamboo: Text and the Production of Meaning in Early China*. Leiden: Brill.
Needham, Joseph. 1959. *Science and Civilisation in China. Vol. 3: Mathematics and the Sciences of the Heavens and the Earth*. Cambridge: Cambridge University Press.
———. 1962. *Science and Civilisation in China. Vol. 4: Physics and Physical Technology, Part 1: Physics*. Cambridge: Cambridge University Press.

Newton, Isaac. 1999. *The 'Principia': Mathematical Principles of Natural Philosophy*. Bernard Cohen and Anne Whitman (transl.). Berkeley: University of California Press.

Nylan, Michael. 1999. A Problematic Model: The Han "Orthodox Synthesis," Then and Now. In *Imagining Boundaries: Changing Confucian Doctrines, Texts, and Hermeneutics*, ed. Kai-wing Chow, On Cho Ng, and John B. Henderson, 17–56. Albany: State University of New York Press.

Piaget, Jean. 1959. *The Construction of Reality in the Child*, The Basic Classics in Psychology. New York: Basic Books.

———. 1969. *The Child's Conception of Time*. London: Routledge & Kegan Paul.

Piaget, Jean, and Bärbel Inhelder. 1956. *The Child's Conception of Space*. London: Routledge & Kegan Paul.

Rapp, Christof. 2001. *Aristoteles zur Einführung*. Hamburg: Junius.

Rawson, Jessica. 1999. Western Zhou Archaeology. In *The Cambridge History of Ancient China: From the Origins of Civilization to 221 BC*, ed. Michael Loewe, 352–449. Cambridge: Cambridge University Press.

Renn, Jürgen, and Peter McLaughlin. 2018. The Balance, the Lever and the Aristotelian Origins of Mechanics. In *Emergence and Expansion of Preclassical Mechanics*, Boston Studies in the Philosophy and History of Science 333, ed. Rivka Feldhay, Jürgen Renn, Matthias Schemmel, and Matteo Valleriani, 111–137. Cham: Springer.

Renn, Jürgen, and Matthias Schemmel. 2006. Mechanics in the '*Mohist Canon*' and Its European Counterparts. In *Studies on Ancient Chinese Scientific and Technical Texts: Proceedings of the 3rd ISACBRST*, ed. Hans Ulrich Vogel, Christine Moll-Murata, and Gao Xuan, 24–31. Zhengzhou: Daxiang chubanshe.

Salomon, Richard. 1995. On the Origin of the Early Indian Scripts. *Journal of the American Oriental Society* 115 (2): 271–279.

Scharfe, Hartmut. 2002. *Education in Ancient India*, Handbuch der Orientalistik, 2. Abt., Indien, 16. Leiden: Brill.

Schemmel, Matthias. 2016. *Historical Epistemology of Space: From Primate Cognition to Spacetime Physics*. Cham: Springer.

———. 2019. Everyday Language and Technical Terminology: Reflective Abstractions in the Long-Term History of Spatial Terms. Preprint 492. Berlin: Max Planck Institute for the History of Science.

Selin, Helaine, ed. 1997. *Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures*. Dordrecht: Kluwer.

Shields, Christopher. 2007. *Aristotle*. London/New York: Routledge.

Smith, A. Mark. 2015. *From Sight to Light: The Passage from Ancient to Modern Optics*. Chicago: University of Chicago Press.

Smith, Kidder. 2003. Sima Tan and the Invention of Daoism, "Legalism", *et cetera*. *The Journal of Asian Studies* 62 (1): 129–156.

Sun Yirang 孫詒讓. 1986. *Mozi jiangu* 墨子間詁. Beijing: Zhonghua shuju.

Suter, Rafael. 2017. Philosophy of Language: Pre-Qín Through Eastern Hàn. In *Encyclopedia of Chinese Language and Linguistics. Vol. 3: Men–Ser*, ed. Rint Sybesma, 375–395. Leiden/Boston: Brill.

Takashima, Ken-ichi. 2017. Shāng 商 Chinese, Textual Sources and Decipherment. In *Encyclopedia of Chinese Language and Linguistics. Vol. 4: Sha–Z*, ed. Rint Sybesma, 5–22. Leiden/Boston: Brill. https://referenceworks.brillonline.com/entries/encyclopedia-of-chinese-language-and-linguistics/shang-chinese-textual-sources-and-decipherment-COM_00000377?s.num=1. Accessed 9 July 2017.

Thote, Alain. 2003. Du message à l'image: le décor des bronzes Shang et Zhou, XVe-IIIe s. av. J.-C. *Arts asiatiques* 58: 73–85.

Vankeerberghen, Griet. 2005. Choosing Balance: Weighing ("Quan" 權) as a Metaphor for Action in Early Chinese Texts. *Early China* 30 (6): 47–89.

Waley, A., and J.R. Allen. 1996. *The Book of Songs*. New York: Grove Press.

Wang Pinzhen 王聘珍. 1989. *Dadai Liji jiegu* 大戴禮記解詁. 2nd ed. Beijing: Zhonghua shuju.
Wang Xianqian 王先謙. 1972. *Zengbu Xunzi jijie* 增補荀子集解. Taipei: Lantai shuju.
Yang Bojun 楊柏峻. 1965. *Liezi jishi* 列子集釋. Hong Kong: Taiping shuju.
Yang Shuda 楊樹達. 1985. *Huai nan zi zheng wen* 淮南子證聞. Shanghai: Shanghai guji chu ban she.
Zufferey, Nicolas. 2003. *To the Origins of Confucianism: The Ru in Pre-Qin Times and during the Early Han Dynasty* = [*Ru Yuan*], Schweizer asiatische Studien, Monographien, 43. Bern/New York: Peter Lang.
Zuo Yuhe 左玉河. 2004. *Cong si bu zhi xue dao qi ke zhi xue: xue shu fen ke yu jin dai Zhongguo zhi shi xi tong zhi chuang jian* 从四部之学到七科之学: 学术分科与近代中国知识系统之创建. Shanghai: Shanghai shudian chu ban she.

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