MAX-PLANCK-INSTITUT FÜR WISSENSCHAFTSGESCHICHTE
Max Planck Institute for the History of Science

2013

PREPRINT 442

TOPOI – *Towards a Historical Epistemology of Space*

William G. Boltz and Matthias Schemmel

The Language of 'Knowledge' and 'Space' in the Later Mohist Canon

The Language of 'Knowledge' and 'Space' in the Later Mohist Canon

William G. Boltz (University of Washington, Seattle)
Matthias Schemmel (Max Planck Institute for the History of Science, Berlin)

0. The Later Mohist Canon

What is now conventionally referred to as the Later Mohist Canon consists of chapters 40-45 of the transmitted, received text of the *Mozi* 墨子, one of the major works of social and ethical philosophy of the so-called "Warring States" period of pre-imperial Chinese history, roughly the fifth through the third centuries B.C..[1] These chapters are, specifically, numbers 40-41, titled *Jing*

1. This article has been conceived and written by W Boltz with the use of material jointly worked out with Matthias Schemmel. The understanding of the Later Mohist Canon texts that underpins the analyses and discussions in this paper is the result of extended collaborative research work with M Schemmel and the late Peter Damerow, both of the Max Planck Institute for the History of Science (Berlin). In particular, while the linguistic and philological focus of the present paper, as well as its overall structure, is largely the responsibility of W Boltz, the analyses, interpretations and conclusions of the Mohist Canon textual material as it pertains to the historical epistemology of Chinese science is principally informed by the expertise of M Schemmel. This on-going project has been generously supported in Berlin by Department One (Professor Dr. Jürgen Renn, Head) of the Max Planck Institute for the History of Science, the TOPOI Excellence Cluster (Humboldt University), and in Seattle by the College of Arts & Sciences and the China Program of the Jackson School of International Studies (University of Washington). I am very appreciative of all of this past and continuing support. I am grateful to Robert H. Gassmann (Zürich) for

(A & B) 經 (上 & 下), usually translated as "Canons", numbers 42-43, titled *Jing shuo* (A & B) 經說 (上 & 下), usually translated as "Explanations" (*sc*., of the Canons), and numbers 44-45, titled respectively *Da qu* 大取 and *Xiao qu* 小取, usually translated "Greater, resp. Lesser, Pick".[2] These six chapters in the aggregate are regarded as the "logical" or "scientific" parts of the *Mozi*, often referred to as the "dialectical" chapters. Their structure and content is sufficiently different from the familiar philosophical parts of the *Mozi* to raise the question of whether they actually originate as an integral part of the text generally known as the *Mozi* or not. There are, to be sure, a few apparent similarities between the mechanical descriptions included in these chapters and some of the mechanical devices described in the "military" parts of the *Mozi* (chapters 52-71), but these similarities could be secondary, that is, the result of an influence of one part of a composite text on another, the two parts in question being in origin separate, or they could even be fortuitous. In any case the textual opacity of many of the passages in question makes drawing meaningful comparisons and judgments about textual history difficult.

The traditional view is that the received *Mozi* in its entirety constitutes a single, integral work, ostensibly compiled by someone with the name or sobriquet 'Mozi' 墨子, or by the disciples of such an eponymous figure. This view conforms to the prevailing conventional understanding of transmitted pre-Han texts generally, seeing them as works compiled by someone with the name given to the text. Recent analytical textual research suggests that some of these early texts are considerably less homogeneous in their origin and structure than this traditional view presumes.[3] Much of the *Mozi* is distinctive in comparison with other contemporaneous

---

extensive helpful grammatical and exegetic comments on a penultimate draft of this paper, to the late Judith M. Boltz for advice and assistance on textual and contextual questions of all kinds and for her inexhaustible reserve of encouragement and support, and to YANG Li 楊莉 and SUN Yingying 孫瑩瑩 for very welcome research assistance. Remaining mistakes, confusions and infelicities are of course my own responsibility.
For a discussion of some of the same Mohist Canon passages from a comparative perspective and in a context larger than the one presented here see BOLTZ and SCHEMMEL:forthcoming.

2. These are the translations that have become well-known for these chapter titles thanks to A.C. Graham's comprehensive study of the Later Mohist texts (GRAHAM 1978). Ian Johnston translates the *Jing* and *Jing shuo* chapters similarly, but translates the *Da qu* and *Xiao qu* chapters as "Choosing the Greater" and "Choosing the Lesser," a grammatically slightly less precise rendering than Graham's (JOHNSTON 2010:579, 621 *et passim*).

3. See, for example, GRAHAM 1981 and BOLTZ 2005.

philosophical texts in that its arguments are based on appeals to reason rather than on claims of authority or precedent derived from the sage figures and legendary rulers of antiquity. Even in its central ethico-philosophical parts the *Mozi* is a text constructed primarily along the lines of rational argument and debate, and is not based chiefly on revered tradition or appeals to the wisdom and humane ethics of the heroes of the past. This feature of the philosophical parts of the text is consistent with the rational, dialectical nature of the Canon and Explanation chapters, and therefore allows for the possibility of textual homogeneity in spite of the very different content of the dialectical chapters from the rest of the *Mozi*. While there is no compelling empirical evidence to suggest a separate origin for the dialectical chapters, neither can that possibility be entirely ruled out. Whatever their origin and their relation to the rest of the received text, these "Later Mohist Canon" chapters constitute the richest intact pre-Han textual source for an understanding of early Chinese scientific and logical thinking extant, especially in connection with mechanics, optics, and geometry.

Chapter 40 consists of Canons numbered A 01 - A 98, and chapter 41 consists of Canons B 01 - B 82.[4] The only significant difference between the A set and the B set of Canons is that all of the B set, save one, end with the phrase *shuo zai* X (說 在 X) "the explanation lies with X" where X is typically a single word that serves presumably to account for the proposition set out in the preceding line(s) of the Canon, and none of the A set has such a line. Chapter 42 consists of Explanations A 01 - A 98, and chapter 43 consists of Explanations B 01 - B 82. There is one Explanation for each Canon. 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 梁啟超 (1873-1929), among others, Graham has recognized that the order of the Explanations is very likely original, and he has accordingly re-ordered the Canons such that the numbers of the Canon sections match the numbers of their corresponding Explanation sections.[5]

---

4. The section numbering scheme used here follows that set out in GRAHAM 1978. In citing the text below, lines marked "C" ('Canon') are 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.

5. See 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. In spite of its late date relative to the actual compilation of the text, the *Daozang* printing of the *Mozi* (*Mozi* [a]) is generally considered the closest thing to an *editio princeps* extant (GRAHAM 1993). This is the version that will be used here, with textual emendations noted as necessary.

One way or another many of the sections of the *Jing* "Canons" (abbreviated here as C, chapters 40-41) and their matching *Jing shuo* "Explanations" (abbreviated here as E, chapters 42-43) can be seen as examples of what we might call analytical, rational thinking about natural features or natural conditions of the external world, *e.g.*, phenomena such as the behavior of light and shadows, of reflections, of mechanical devices such as balances, beams and fulcrums, and

---

The received text of the *Mozi* is notoriously corrupted, and these so-called "Later Mohist" sections are no exception. In particular the sequence of sections in the received text of the *Jing* "Canon" chapters (40 and 41) is very confused. Apparently at some point early in its transmission the text was 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). It would seem that the intention was to read the upper panel *in toto* across before moving to the lower panel. The text was subsequently copied by a scribe who usually (but not always) recognized where a given Canon began and ended, but did not recognize, or at least did not respect, this "upper panel - lower panel" arrangement, and therefore copied the text from top to bottom of the whole page, thus inter-weaving the early Canons with the later ones in a confusing shuffle. The text of the *Jing shuo* "Explanation" chapters (42 and 43) would seem not to have suffered such a fate and appears to preserve the original section sequence (*Mozi* [b] 10.17a-20b). In the early twentieth century Liang Qichao recognized that the "head" character of each Explanation section provided a link for matching the Explanation with its corresponding Canon, and that these "head" characters were not to be taken as a part of the actual text of the Explanation itself, but rather served simply as "key words" indicating what Canon passage a given Explanation went with (LIANG QICHAO 1922:8). 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 one to several lines long. 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 paper regarding textual history and textual corruption are 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). 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 as given in this paper may differ on occasion from Graham's understanding or proposals.

such things as motion, space and combinatorics. Seemingly consistent with this concern for rational analysis and explanation, the text opens with a set of six passages giving fundamental definitions of 'reasoning', 'knowing', and 'knowledge'. But there are also included in the Canons explicit statements, probably to be understood as definitions, of such aspects of social morality as Humaneness (*rén* 仁), Propriety (*yì* 義) and Ceremonial Form (*lǐ* 禮), as well. These are followed by passages that describe or analyze social and institutional relations, such as the authority and responsibility that obtains between leader and follower, ruler and subordinate. The collective purport of all of these passages is not simply to set out rational, logical descriptions or definitions of these quotidian features of the natural and social world alone, but to provide an integrated scheme of answers to what A. C. Graham sees as, for the Mohists, "the most troubling of problems," *viz*., "the relation between knowledge and temporal change" (GRAHAM 1978:33). By 'temporal change' Graham is referring to what he has called the 'metaphysical crisis' of the fourth century (B.C.), a period of intellectual ferment and disquiet, characterized by a new and deeply felt skepticism about the naïve, uncritical reverence for antiquity that had characterized the thinking of earlier centuries. This over-riding sense of change and the apparent anxiety that it engendered is in large part a result of the major social and institutional upheavals and pervasive political instability of the Warring States period generally, all seen as arising from a fundamental break with the past (GRAHAM 1978:15-22, GRAHAM 1989:1-8).[6]

One of the most important consequences of this metaphysical crisis and its associated intellectual *angst* was the emergence of a multifaceted culture of disputation and debate among the learned stratum of society and the ruling elite whom it served, centered on how to come to grips with, understand and respond to those aspects of the social and natural world that now entailed new assumptions fundamentally different from those of the past. To this end the Later Mohist Canons and Explanations include definitions and propositions centered on the kind of terminology that would be expected to figure in intellectual debates, to wit, such terms as *fǎ* 法 'model, pattern, objective standard' (A 70), *yīn* 因 'criterion' (A 71), *biàn* 辯 'debate, dispute' (A

6. Though it is only in the few introductory pages of GRAHAM 1989 that he sets out his basic thesis regarding the "breakdown" of the old world order, in fact Graham devotes the first three hundred pages (parts I - III) of this book to a meticulously detailed and careful survey of the social, intellectual and political consequences of the breakdown. In section I.2 he discusses the primary Mohist reaction and in II.2 the later Mohist reaction (GRAHAM 1989:33-53 & 137-70 resp.) The second of these two sections pertains directly to the material of the present paper.

74) and *wěi* 為 'acting on behalf of' (A 75). The overall goal seems to have been to provide a framework for effective disputation and argument based on reason rather than on an appeal to tradition or to the wisdom of the sage-heroes of the past. Among all of the categories one could study in these texts, only those sections from the Canons dealing with spatial concepts and with the preliminary definitions of 'reasoning', 'knowing', and 'knowledge', together with their corresponding sections from the Explanations chapters, will be dealt with directly in this paper.

I. Reasoning, Knowing and Knowledge

One of the distinctive features of the "Later Mohist Canon", which contributes directly to its dialectical or logical character, is that the *Jing* and *Jing shuo* chapters open by giving precise definitions (*Jing*, ch. 40) and matching explanations (*Jing shuo*, ch. 42) for six words that seem to constitute a set of terminological and conceptual starting points for the descriptions, definitions, propositions and analyses to come. Four of these six have to do with 'knowing' and 'thinking'; the first two deal with what we might think of as the logical bases for reasoning.

(1) **A 01**[7]

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 be achieved.

E: *gù* 'basis': Minor basis: having it does not entail the inevitability of (something) becoming so. Lacking it does entail the inevitability of (something) not becoming so. It is an element, like having an 'end point'. Major basis: having it entails the inevitability of (something) becoming so, like the fact of something appearing resulting in someone seeing it.

a R: 體也; ACG 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 02) makes sense here, identifying the 'minor basis' as one part of an argument, in the same way as an end point is an elemental part (of a measuring rod, per A 02).

---

7. Superscript letters in the Chinese text refer to notes on textual variants and emendations listed immediately following the translation. We use "R" as the convention for referring to the received text as found in the Taoist Canon (see fn. 5 above) and "ACG" to indicate an emendation proposed by Graham. See Graham 1978 for identification and bibliographic information regarding the other textual scholars mentioned in these notes.

b R: 有之必無然; emendation Liang Qichao (1922:67). ACG (1978:263) 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. 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).

This is the first of the six basic definitions with which the Mohist Canon begins, introducing the concept of a 'basis', in both a "major" form and a "minor", recognized as a necessary condition for something to come about.

The argument can be formally expressed as follows:[8]

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 bases 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

not $B \Rightarrow$ 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').

Graham's extensive emendation seems motivated by a wish to show that this passage, Canon and Explanation together, establishes for the Mohists a 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

8. This formulation of the argument was prepared by Matthias Schemmel.

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 word *gù* < ***kka-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* < ***kka-s** 固 'solid, firm, fixed, dependable'.[9] The sense underlying all of these words seems to be 'durable ~ enduring'; this accounts also for *gǔ* < ***kka-q** 古 'past, antiquity' and *gù* < ***kka-s** 故 'old, former' (in addition to 'basis, precedent').[10] The same sense can be seen in the *Lüshi chunqiu* text, from about a century after the *Mozi*, using much the same terminology:

---

9. Throughout this paper bold-face starred forms such as ***kka-s** here represent Old Chinese (abbr. OC) reconstructions, largely, but not exactly, as given in the "Baxter-Sagart" scheme (crlao.ehess.fr/document.php?id=1217). Here we write the OC type A "pharyngealized" initial consonants with a double consonant instead of the typographically less familiar consonant marked with superscript [ˤ], and we use -**q** instead of the "Baxter-Sagart" [ʔ] for the OC final glottal stop, which is generally thought to constitute the source of the Middle Chinese rising tone *shang sheng* 上聲). Initial glottal stop is written in the expected way as **ʔ**-.

10. This grouping of words, *viz.*, *gù* < ***kka-s** 故 'basis, precedent', *hù* < ***gga-q** 怙 'rely on, reliable', *gù* < ***kka-s** 固 'solid, firm, fixed', *gǔ* < ***kka-q** 古 'past, antiquity' and *gù* < ***kka-s** 故 'old, former', is based primarily on the fact that they all share the 古 graphic component and have an OC pronunciation similar to that for 古 *gǔ* < ***kka-q**. These two features alone define what is called a *xie sheng* 諧聲 'shared phonophoric' series of characters and is historically the principal organizational feature of the Chinese writing system. Beyond these observable graphic and phonetic facts, which define a *xie sheng* series, we may be able to discern further a shared semantic element, a kind of semantic "common denominator," that fits the meaning of many (in the case given here, all) of the characters in the series. The inclusion of such a semantic common denominator in the word / character set shifts it from its status as a feature of the writing system to a word family, now a feature of the language. This kind of lexical analysis is typical in investigating and determining Chinese etymologies.

> 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 (*Lüshi chunqiu* 498)
>
> "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 makes it so."

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). 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' (Eng. 'reason', Lat. *ratiō*), but seems to have been an empirical notion, associated with the solid dependability of a precedent and the consequent predictability of an outcome. 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.

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 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."

(2) **A 02**

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; an end-point 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', one of the two end-points of a measuring rod.[11]

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* 並也 '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' means, most concretely, 'skeletal form' and is cognate with the word *lǐ* < ***rrij-q** 豊 'ritual vessel' and by extension with the homophonous word *lǐ* < ***rrij-q** 禮 'ritual ceremony', 'ceremonial form'. Early Chinese ritual ceremonies typically involved the use of sets of ritual bronze vessels in precisely determined numbers and arrangements.[12] 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** 䵼 '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 of a quotidian, non-ceremonial nature, whether abstract or physically concrete (such as the bones of a skeleton).

(3) **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]

---

11. For the definition of *duān* 端 'end point' see A 61, given here as passage (3) immediately below.

12. See, for example, Jessica Rawson: "Ritual vessel sets are … composite rather than singular objects and are highly complex, both technically and artistically. This complexity was integral to the ritual performance and could be marshalled to serve both a social and religious programme." (Rawson 1998:113-14). And: "A set is … a functional group. … Changes in numbers or types of vessel in a set, or in form or design, would have … been visible and intelligible through this visibility." (Rawson 1998:115). See also Rawson 1993 and Rawson 1999:359-64.

a R: 序, emendation ACG (1978:82, 310).

Note that the Chinese term *duān* 端 is used just as English 'end-point', to refer equally to the starting point as well as to the termination point of a line or rod. A rod has two "ends", a front end and a back end. A more general gloss for *duān* would be 'tip' or sometimes 'sprout'; typically the word suggests a beginning rather than an ending, as is explicitly indicated in this passage.

Following these two initial definitions of 'basis' and 'element' we have a carefully set out description of kinds of 'knowing'. In Classical Chinese the word *zhī* 知 'to know' is used both for 'factual knowing, understanding' and for 'being acquainted with', that is, 'recognizing, acknowledging', a semantic distinction that is well known from the Romance languages, where the two different meanings are clearly differentiated lexically as in, *e.g.*, Fr. *savoir vs.* [*re*]*connaître* and Sp. *saber vs. conocer*. For the Chinese usage of *zhī* 知 covering both of these senses, note, for example, these well-known lines from the *Lunyu* 論語 [*Analects of Confucius*]:

(a) 五十而知天命

"Upon reaching the age of fifty, I **knew about / understood** [*zhī* 知] the Mandate of Heaven." (*Lunyu* 2.4)

(b) 人不知而不慍，不亦君子乎

"When others do not **recognize** / **acknowledge** [*zhī* 知] you, but you do not chafe (because of that), is this not behaving in the way a junior lord is expected to behave?" (*Lunyu* 1.1)

Examples to show that Classical Chinese *zhī* 知 can be used in both of these senses could be easily multiplied many times over. Sections A 03, A 05 and A 06, as parts of the initial terminological and conceptual starting points of the Mohist Canon set out a much more precise understanding of 'knowing' than just the two familiar senses of 'factual knowing' and 'being acquainted with'.

(4) **A 03**

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’: ‘innate knowing’ means that, given the wherewithal for knowing something, one then will inevitably know it; it is like visual perceptiveness.

a The character 材 (*cái* ‘innate capacity’) is generally regarded as intrusive here and not original, since it is inconsistent in format with other Explanations, and is therefore usually edited out. But in fact, given the clear effort to distinguish ‘knowing’ as an innate capacity in A 03 here from ‘knowing’ as a consequence of experience in A 05 and ‘knowing’ as perceptivity in A 06, it is not at all unreasonable to take the text as it stands and read this as ‘innate (capacity for) knowing’, *i.e.*, ‘innate knowing’ specifically in contrast to experiential knowing (A 05) and perceptivity (A 06).

b The sequence 也者 occurs in A 03, A 04, A 05, and A 06, 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 seems to understand it, starting with a notion of ‘innate knowledge’.

The word *cái* < ***ddzə** ‘innate capacity’, written 材 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 inborn, innate or ingrafted quality; the difference lies merely in the contextual application of the word and its corresponding orthographic form. Written 材, with 木, the ‘dendrological’ (“tree”) semantic determinative, it generally refers to ‘timber’ or ‘natural resources’. As 財, with the 貝 ‘chrematistic’ (“cowry shell”) semantic determinative, it refers to inherent material worth, and as 才 alone it is simply the basic sense of ‘innate quality, talent’. The word, in all three graphic forms and semantic nuances, is related closely to the word *zāi* < ***ttzə** 栽 ‘to implant, as a cutting grafted onto a parent stalk’. The early inscription forms of the character 才 may well have been intended as iconographic representations of the binding of a cutting to a stalk into which it is being grafted; the Shang inscription form (*ca*. 1200 B.C.) is

and bronze forms include examples such as (tenth-eighth cen. B.C.).[13] These words, particularly in the specific sense of 'implanted', are also likely akin to the verb *zhí* < ***dək** 植 'to plant, implant', in the specific phytological sense of an implanted quality resulting from grafting, *cf*. homophonous *zhí* < ***dək** 殖 'to set up, plant' and the nearly homophonous word *zhì* < ***təks** 置 'to erect, set up'.

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 see A 05 below). This is what the Explanation means when it says "it is like 'visual perceptiveness'," 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; so also is the capacity for knowing. Note in this regard:

(5) **B 46**

C: 知而不以五路，說在久。

E: 知[a]：智者[b]以目見而目以火見而火不見。惟以五路，智久不當。以目見若以火見。

C: *zhī* 'knowing', but not by means of the five "pathways;" the explanation lies with 'duration'.

E: *zhī* 'knowing': the knower sees using the eyes; the eyes see using [the light of a] fire, but the fire does not see. Were one only to take the five "pathways" [as the means for knowing], the enduring quality of what is known would not match the reality. Using the eyes to see is like using [the light of a] fire to see.

a R: null; emendation ACG (1978:415).

b R: null; emendation ACG (1978:415).

What is referred to here as the *wǔ lù* 五路 'five pathways' is equivalent to what in slightly later texts is called the 'five offices' (*wǔ guān* 五官), that is, the five bodily "conduits" (eyes, nose, ears, mouth and throat; the throat sometimes replaced by the corporal form or by the heart), understood as a set of anatomical receptors that allow a person to 'perceive' and thus to 'know.'[14]

13. For further remarks on *cái* < ***ddzə** 才 and its lexical affines see the discussion at B 16.

14. See, for example, *Xunzi*, "Tian lun", where the *wǔ guān* are first referred to by the term *tiān*

But the point made here is that knowing cannot be limited to these means alone, since the knowledge endures (*jiǔ* 久) even after the sense perception has ended. These so-called anatomical receptors and their associated sense perceptions are, like adequate light, means to facilitate knowing; they are not the actual knowing itself. The capacity for knowing is thus innate in a way that amounts to more than the simple ability to perceive things through the senses. This innate capacity for knowing is the pre-condition for the process of 'thinking' (A 04) and for 'acquired-knowing' (A 05), as well as for 'knowledge' (A 06) generally.

(6) **A 04**

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) knowledge as a starting point, there is something sought, but one does not necessarily get it. It is like looking around for something.

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

The *zhī* 知 of 以其知 in the Explanation must refer to the innate capacity of A 03. The same phrase 以其知 occurs also in the Explanations of A 05 and A 06, a parallelism that cannot be accidental. It therefore seems that the 'innate knowledge' of A 03 is intended as a pre-condition in these subsequent cases. In the opening passage of the *Daxue* 大學 ("Grand Doctrine," often translated as "Great Learning," *Liji* 60.1a) we find the phrase 慮而後能得 "think about it, and only then will you be able to grasp it" as the final element in a progressive sorites concerned with the Ruist goal of "coming to rest at the ultimate good" (止於至善). The word *lǜ* 慮 'thinking' is thus 'musing on', 'contemplating', 'pondering'; for the Mohists an atelic

---

guān 天官 'celestial offices' or 'natural offices', explained as 耳目鼻口形能，各有接而不相能也。夫是之謂天官 "As for the capacities of the ears, eyes, nose, mouth and corporal form, for each of these there is that with which it comes into contact, but none of these capacities depends on the others. In any respect it is these that we call the 'celestial (or natural) offices'." The following line in the text refers to the *tiān guān* as the *wǔ guān* (*Xunzi* 11.24). The term *tiān guān* can just as accurately be translated 'natural conduits' as 'celestial conduits' (Knoblock 1994:16).

process, not necessarily entailing reaching a conclusion, but nevertheless permitting some kind of a result, as clearly expressed in the *Daxue* line.

(7) **A 05**

C: 知，接也。

E: 知：知[a] 也者，以其知過[b] 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) knowledge as a starting point, having experienced something one then is able to have an impression of it; it is like perceiving something.

a Given the phrase 材 知也者 'innate knowing' at the parallel place in A 03, we could speculate that the word *jiē* 接 'to be in contact with' has dropped out from this Explanation, and that the original text had specifically 接知也者 'acquired knowing'. There is no direct textual or other evidence to support such a speculation.

b Sun Yirang 孫詒讓 (1848-1908) suggested that the character *guò* 過 'to pass by, experience' should be emended to *yù* 遇 'to encounter' on the grounds that *yù* 遇 is semantically closer to the word *jiē* 接 'come into contact with' of C than *guò* 過 is and that this makes better sense overall: "... to encounter something and then ..." (see LIANG QICHAO 1922:73). The suggestion that *guò* 過 is an error for an original *yù* 遇 is presumably based on a claim of graphic confusion; the two characters are similar in appearance, hence one was mis-read for the other. There are two reasons to doubt this proposed emendation: (i) there is no textual evidence for a variant with *yù* 遇; the emendation is therefore entirely conjectural, and (ii) the reading with *yù* 遇 is by SunYirang's own argument easier to understand than the reading with *guò* 過. 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. Liang Qichao

himself, while accepting Sun Yirang's conjectural emendation, conceded that the text with *guò* 過 'to pass by, experience' "still makes sense" (但仍原文亦得, *loc. cit.*) Graham draws particular attention to the fact that the meaning of *guò* 過 'to pass by' includes a sense of 'to experience' 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 03, 'knowing' as an innate capacity and anticipates a distinction with A 06, 'knowledge' as 'seeing clearly'. Here we have 'knowing' as the result of having come into contact with something, *i.e.*, as experiential knowledge. As discussed in the commentary to A 04 above, the *zhī* 知 of 以其知 in the Explanation refers to the innate capacity for knowing of A 03.

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 the section 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 *Lüshi chunqiu* 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。 (*Lüshi chunqiu* 968)
>
> "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."

A line or two later in the same "Zhī jiē" section of the *Lüshi chunqiu* 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。 (*ibid.*)
>
> "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."

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.

In the *Xunxi* 荀子, a text of about a century later than the *Mozi*, chiefly concerned with a program of social ethics that adheres closely to an orthodox Ruist (*i.e.*, "Confucian") line we find that an innate capacity for knowing is clearly distinguished from acquired knowing as the concomitant of experience. In section 22, the well-known "Zheng ming" 正名 ("Setting names straight") section, we find this remark:

> 所以知之在人者謂之知。知有所合謂之智。 (*Xunxi* 16.3)
>
> "The means that lies within a person for knowing we refer to as the 'capacity for knowing'. When there is something (external) with which one's capacity for knowing comes together, we refer to that as 'knowledge'."

Yang Liang 楊倞 (9th cen.) in his note to this passage explains the second sentence as:

> 注：知有所合謂所知能合於物也。 (*ibid.*)
>
> "Note: the phrase 'when there is something (external) with which one's capacity for knowing comes together' means that which one has the capacity to know is able to be brought together with external things."

This *Xunxi* passage seems to reflect a sense very close to the distinction between sections A 03 and A 05 above, that is, a distinction between an innate capacity for knowing on the one hand and the knowing that comes from acquired experiences on the other, what we might call 'resultant knowledge'. More than just a distinction, both the Mohist passages and the *Xunzi* passage make clear that there is an inevitable relation between the two, namely, that the former is a kind of precondition for the latter.

(8) **A 06**

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* 'knowledge' is perspicacity.

E: *zhì* 'knowledge': 'knowledge' means that, given one's (either innate or acquired) knowing, in discussing a thing, one's knowing about it is then brought into focus. It is like perspicacity.

a R: 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* 'knowledge', usually written 智.

A 06 identifies 'knowledge' as the abstract nominal form of verbal 'knowing'. The Explanation suggests that 'knowledge' is the result of thoughtful discussion, consideration or judgment of something on the basis of both one's capacity for knowing and one's experience. Whether written 恕 or with the more familiar character 智, the word is a deverbal noun *zhì* < ***tre-s** 'knowledge' 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.

The word *míng* 明, central to both the Canon and the Explanation in A 06, means at its root 'bright', but it has the same metaphorical semantic extension as the English word, 'bright' > 'intelligent, perceptive, perspicacious' and as an abstract noun, 'intelligence, perspicacity'. In A 03 above (passage number 4) we translated it as 'visual perceptiveness', to emphasize the *visual* quality of the perspicacity in question there. Here the meaning is less nuanced and more general, simply 'intelligence, perspicacity'.

The nominal form of the verb *zhī* 知 'to know' completes the Mohist's initial identification of three kinds of 'knowing':

zhī 知 'knowing' as an innate capacity (A 03)

zhī 知 'knowing' on the basis of experience (A 05)

zhì 恕 'knowledge' as perspicacity (A 06).

The nominal form *zhì* 恕 'knowledge' 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 seen in an important sense as different kinds of the same mental phenomenon of 'knowing'. Accordingly, we can understand the 以其知 phrase in E here as referring equally to either innate or acquired knowledge, unlike the same phrase in A 04 and A 05, where this understanding does not obtain. In A 04 experiential knowledge has not yet been introduced, and in A 05 it is precisely experiential knowledge that is being identified.

All of these three words for 'knowing, knowledge' (A 03, A 05, A 06) appear in later sections of the Canons and Explanations, always in senses (but not inevitably in orthography; see B 48 below) consistent with what is laid out in these opening sections. Together with *lù* 慮 'thinking' (A 04) they constitute a set of descriptive terms for the facts and processes of 'cognition'.

In A 80 the three basic kinds of knowledge are identified according to what we might call their differing 'sources' and are matched collectively with four kinds of knowledge based on 'function' or 'consequence'. The idea seems to be to associate 'knowing', irrespective of how one comes to know something, with the consequence of knowing, or with the potential efficacy of knowing.

(9) **A 80**[15]

C: 知。間[a]，說，親。名，實，合，為。

E: 傳受之，聞也。方不廖[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: [*via*] 'an interstice removed', or 'explanation', or 'at first-hand'; [consists in] 'name', 'substance', 'correspondence', 'behavior'.

E: To receive it *via* transmission is 'hearsay'; that "a square will not rotate" is [an example of] 'explanation'; to be witness to it oneself is 'first-hand'; that whereby one refers to something is 'name', the thing referred to is

15. For a discussion of the context of A 80 and its interpretation from a perspective slightly different from here see Boltz et al. 2003:7-8 and Boltz 2006:37-39.

'substance', name and substance matched is 'correspondence', intent enacted is 'behavior'.

a R: *jiān* 間 'interstice', but on the basis of the matching Explanation passage, which has *wén* 聞 'to hear', *i.e.*, "hearsay" in the corresponding spot, coupled with the obvious graphic resemblance of the two characters at issue with each other and the ease with which one could be misread for the other, and finally in view of what would seem "obvious," this *jiān* 間 is not surprisingly often emended to *wén* 聞. All the same, and in spite of the reasonableness of the arguments for emending the text, the Canon passage is understandable and in fact sensible and consistent as it stands. One means for acquiring knowledge is "at a step removed," *i.e.*, at an 'interstice, interval', in other words, as distinct from *qīn* 親 'personally, at first hand', the last-listed in this passage of the specified ways for acquiring knowledge. It is not altogether impossible that *jiān* 間 'interstice' could have appeared in the Canon and *wén* 聞 'hearsay' in the Explanation.[16]

b R: 廗, a graph otherwise unattested. Basing himself on earlier explanations of Sun Yirang and Wu Yujiang, Graham understands this anomalous graph as a variant (or "mistake") for 庫, which in turn is taken as 厙 . This he then recognizes as interchangable with 軍, originally 匀 (because of the graphic overlap of 厂, 勹 and 冖), which is then taken finally as standing for the word *yùn* 'to rotate', conventionally written 運 (1978:83).

This passage is reminiscent of the *Xunzi* "Zheng ming" passage cited above (p. 18) in that it implicitly distinguishes a 'capacity for knowing' from 'knowledge gained through experience' and sets out the relation between the two. Functionally, or consequentially, knowing may take a nominalist, categorical form, indicated here by the word *míng* 名 'name'. When this corresponds to some aspect of external reality, referred to here by the word *shí* 實 'substance', the consequence is an instance of experiential knowing. The word *hé* 合 in A 80 here that is translated as 'correspondence' is the same word that in the *Xunzi* passage above is translated as

16. For the definition and understanding of *jiān* 間 'interstice' in these passages see passage numbers 19 and 20 (A 62 and A 63) below.

‘comes together’, in both instances referring to the matching of one’s innate capacity for knowing with some external phenomenon that results in knowledge based on experience. The final point set out in A 80 is that ‘knowing’ of whatever kind may lead to taking some action, in some respect or on some account. This is the sense of the single word *wéi* ~ *wěi* 為 ‘to act, behave’ ~ ‘to act on behalf of, behave on some account’ in the Canon and the phrase *zhìxíng wéi* ~ *wěi yě* 志行，為也 “intent enacted is ‘behavior’” in the Explanation.

Beyond these basics, we find in B 48 an explicit recognition of the significance of “knowing what one does not know.” Confucius expresses this sense informally and somewhat indirectly in *Lunyu* 2.17, speaking to his disciple Zi Lu 子路:

> 誨女知之乎。知之為知之，不知為不知，是知也。
>
> “Let me instruct you about ‘knowing things’ ! --- When you know something, act like you know it; when you do not know something, act like you do not know it. This is ‘knowing’.”

The Later Mohist Canon sets it out in B 48 in precise, categorical terms.

(10) **B 48**

C: 知其所[a]不知，說在以名取。

E: 智[b]：雜所智與所不智而問之，則必曰是所智也，是所不智也。取去俱能之，是兩智之也。

C: *zhī* ‘knowing’ what one does not know; the explanation lies with selecting according to the ‘name’.

E: *zhì* ‘knowledge’: if, having mixed together what one knows and what one does not know, someone inquires about it, then you will inevitably say “This is what I know; this is what I do not know.” In selecting the one [by name] and setting aside the other [as not named and therefore not known] you are showing a capacity for dealing with both; and this is knowing the two equally.

a R: 所以; the 以 deleted on the basis of the Explanation, ACG (1978:417).

b R: this is the conventional graph for the word *zhì* ‘knowledge’, which was written 恕 in A 6 above. See A 6, text note a. Here as the head character for

the Explanation it can easily be understood as the noun *zhì* 'knowledge', but the same character is clearly used for the verb *zhī* 'to know' five times in the Explanation line. Four of those instances are nominalized with *suǒ* 所, a syntactic construction only possible with a verb, and the fifth is as the transitive verb 'to know'. The Canon, by contrast, writes the verb in the expected, conventional way as 知.

The import of this section lies in identifying "what is known" by name as distinct from "what is not known" and therefore cannot be identified by name. The Canon reference to "selecting according to the *míng* 名 'name'" carries with it the connotation of something that is known by virtue of having been associated with a *míng* < ***mReng** 名 'name'. The verbal form of the word is *mìng* < ***mreng-s** 命, always meaning in the Later Mohist texts 'to name', never having the sense of 'to command', common elsewhere (GRAHAM 1978:199). By correctly recognizing the complementary categories "what is known" and "what is not known" by name, one in effect asserts control over both, which entails knowing that there is a category of things not known and therefore not identifiable by name. The 'setting aside' of the Explanation refers to the ability to acknowledge those things that a person knows he does not know, thus in effect knowingly establishing the category of "what one does not know."

Just as recognizing "what is known" and "what is not known" as two categories of knowledge is important to the Mohists, so we see in B 09 that they also recognize the differences among a thing 'being so', 'knowing that it is so' and 'conveying the knowledge that it is so', clearly showing their recognition of the difference between an empirical fact and the perception of that fact that leads to one's knowing about it.

(11) **B 09**

C: 物之所以然，與所以知之，與所以使人知之，不必同。 說在病。

E: 物：或傷之，然也。見之，智也。告[a]之，使知之也。

C: That whereby a thing is as it is, in connection with that whereby one knows this, and in connection with that whereby one causes others to know this, --- none of these three things inevitably entails the next. The explanation is exemplified by 'malady'.

E: *wù* ‘thing’ : someone injured it, thus it is so; seeing it means knowing [that it is so]; reporting it is causing someone else to know about it.

a R: 吉; emendation Sun Yirang (ACG 1978:359).

The sense, expressed in an exceedingly indirect way in the wording of this passage, seems to be that something can be so whether anyone knows it or not, but for someone to know it, it must first be so. Similarly, someone must know something before he can cause anyone else to know it, but it is not inevitable that his knowing it will lead to his causing someone else to know it.

II. Abstract Space

In English and in many European languages the concept of an abstract 'space' is both recent and vague. This is in contrast to such similar notions as 'place', 'location', 'room', and 'position', all of which are reasonably concrete and straightforward, both lexically and conceptually, and are well attested in texts of early European languages.[17] Etymologically the word 'space', from Lat. SPATIUM, suggests 'extent, span'; the concrete Latin meaning is said to be 'race-course', in particular a 'lap' around a race-course. Lat. SPATIUM is phonetically consistent with the Indo-European root *sph_1-to- 'fattened, distended' > 'extended' (> 'prospered'), but its actual derivation from this root cannot be readily demonstrated (DE VAAN 2008:578). Conceptually SPATIUM can apply to both temporal and areal extents; see, *e.g.*, Cicero, *spatium praeteriti temporis* 'the depth of time gone by' (*Pro Archia Poeta* I.1.) Section eighteen of Mallory and Adams' comprehensive survey of the Proto-Indo-European lexicon and the Proto-Indo-European world is called "Space and Time," but among the eight Indo-European roots listed in their table 18.1, under the heading 'space', not one includes among its devolved forms either Lat. SPATIUM or Eng. *space* (MALLORY and ADAMS 2006:287-88). They all have instead to do with 'open area', 'room', 'locale', 'position' and 'border', --- visible notions readily apprehensible. The concept of abstract space disconnected from these concrete parameters seems to be, lexically at least, absent in early texts.

For his part Aristotle does not provide any direct discussion of 'space' *per se*, but his apparent understanding of it slips in through a side door, so to speak, in the course of his discussion of 'place' (*Physics* IV.1-5, WATERFIELD 1996:78-90) and, particularly, in his discussion of 'distance' and 'time' as *continua* in connection with motion. These are the well-known discussions into which Aristotle has introduced Zeno's famous paradoxes (*Physics* VI.2, WATERFIELD 1996:141-44). One of the best known of these paradoxes is called, coincidentally, "The Race-course." Here it is argued 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

---

17. Eng. 'place' (*via* French) < Lat. PLATĒA 'wide street, town square, plaza' < Gk. πλατύς 'wide, broad, flat', akin to Lat. PLĀNUS 'level, flat'; 'location' < Lat. LOCUS 'place'; 'room', akin to Eng. *ream* 'to widen', Ger. *Raum* 'open area, room' and *räumen* 'to clear out or open up an area', Lat. RŪS 'open area, countryside' (whence Eng. *rural*, *rustic*); 'position' < Lat. PŌNERE 'to put, place'. One way or another these all have to do with 'place, locale, area', a completely straightforward notion, *contra* abstract 'space'.

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 half-way points between any starting point O and any ultimate end-point E, the intended 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*.[18]

Compare to this the Later Mohist sections that deal with the same idea:

(12) **A 41**

C: 宇[a]，彌異所也。

E: 宇：東西蒙[b]南北。

C: *yǔ* 'spatial extent' is spanning over different places.

E: *yǔ* 'spatial extent': east-and-west entails north-and-south.

---

18. This simple summary is based on the considerably more sophisticated discussion in 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 (BERLINSKI 1995:122-25).

a R: 守; emendation ACG (1978:293).

b R: 家; emendation Liu Chang, (GRAHAM 1978:293). The sense of *méng* 蒙, usually 'to cover or enshroud', here has the meaning of 'include, comprehend, entail'.

The word 宇 *yǔ* < *GWA-q, which we translate here 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. In both meanings 'celestial canopy' and 'eaves' the word is easily seen to be related to the less common word *yú* < *GWA 于 'space between the corners of the mouth of a bell'. This *yú* < *GWA 于 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" (*Zhou li* 40.8b), that is, the space defined by the "arched" portion of the mouth of a *yong*-type bell as seen here in illustration one.

Illustration 1: *yong*-bell (HUBEI SHENG 1996:15)

The use in this *Mozi* section of the verb *mí* 彌 'to span, spread (over, out, through)' is consistent with the meaning of *yǔ* 宇 as 'eaves' and with its lexical affine *yú* 于 as 'the space spanning 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 same verb *mí* 彌 'to span, spread (over, out, through)' is used in a parallel way in the Canon line of section A 40 *jiǔ* 久 'enduring', *i.e.*, 'temporal extent', the section that immediately precedes this one in the original Mohist order, given here as (13), immediately below.

(13) **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 been reversed.

b R: 今; emendation Liu Chang, (GRAHAM 1978:293).

c R: 且; emendation ACG (1978:81).

d R: 莫; emendation ACG (1978:293), although not strictly necessary. The character 莫 is well attested writing the word *mù* 'dusk, evening' in transmitted texts.

Just as *yǔ* 宇 'spatial extent' is expressed in A 41 as a 'span' stretching from one extremity to another, so this section refers to the extension, or 'span', of time of a specific duration, here illustrated by the example of 'past' and 'present' as an abstract representation of the duration of time correlated with 'dawn' and 'dusk' as concrete representations. Note that if the correlation is to be understood in a precisely parallel fashion, the word *mù* 暮 'dusk' must be understood as referring to the evening previous to the morning in question. The two sections, A 41 and A 40, seen in tandem suggest that the general sense of *mí* 彌 'to span, spread (over, out, through)' 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. Temporally, the corresponding image of 'present' and 'past' matching 'dawn and dusk' in the Explanation of A 40 allows only for a one-dimensional,

"linear" understanding, in contrast to the two-dimensional sense of 'spatial extent' in A 41.[19]

The close relation that the Mohist sees between space and time, that is, between spatial *extent* and temporal *duration*, in a sense that seems completely consistent with Aristotle, is nowhere more clearly apparent than in section A 50.

(14) **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'. It is like an arrow passing by a pillar. The not-remaining fixed that has duration corresponds to 'horse/non-horse'. It is like a person passing across a bridge.'

a R: 夫; emendation ACG (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, because there is no possibility of a contrast between a punctual remaining fixed and a durative remaining fixed; only the durative remaining fixed is possible. The 'not remaining fixed' is exemplified by an arrow passing by a pillar, a momentary, punctual event. The pair 'remaining fixed' and 'not remaining fixed' is of the "horse/non-horse" type because both can be durative; the durative 'not remaining fixed' is exemplified by a person crossing a bridge, clearly a durative event.

---

19. 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 彌山跨谷 "spreading across the mountains, straddling the valleys" (*Wen xuan* 8.7b; see also KNECHTGES 1987:88-89).

We can describe the relation as follows:

a. being fixed (+F) entails by definition duration (+D), therefore {+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 the valence of one feature does not tell you anything definite about the other;

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 the same thing.

In the terms familiar from other parts of the Mohist dialectical sections, and from the roughly contemporaneous records of the so-called "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.[20] 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.[21]

---

20. The name "Sophists" is the descriptive designation usually given to those fourth century B.C. figures who are associated with exploring the nature of argumentation and debate as exercises in logic and reasoning rather than for purposes of ethical or political suasion. Hui Shi 惠施 and Gongsun Long 公孫龍 are the two best known names among this group; to only the second of these is there an attributed extant transmitted text, *viz*., the *Gongsun Longzi* 公孫龍子. Hui Shi, who is sometimes regarded as the closest thing to a "Renaissance Man" in pre-imperial China, is known only from accounts preserved in other transmitted texts, such as the *Zhuangzi* 莊子. A. C. Graham points out that a match with the Greek Eleatics is actually more accurate than with the Sophists. For a full discussion of the so-called "Sophists" in fourth century B.C. China, including the points made here, see GRAHAM 1989:75-95.

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

The text's image of " an arrow passing by 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 by a stationary point, here represented by 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 in A 50, is not an actual possibility; that is, from the Mohist perspective as reflected here there is no possibility of a non-durative 'being fixed'.

The relation between spatial extent and motion is further illustrated in B 13:

(15) **B 13**

C: 宇或徙[a]，說在長。

E: 宇:長[b] 徙而又[c]處宇。

C: *yǔ* 'spatial extent', [allows for] a shifting about somewhere. The explanation lies with 'expanding'.

E: *yǔ* 'spatial extent': as something expands and shifts about it will then occupy further spatial extent.

a R: 從; emendation ACG (1978:82).

b R: 長宇; head character in second position; see GRAHAM 1978:95-6.

c R: 有; emendation ACG (1978:367).

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 likely < ****b-trang-q/s**. The ****b-tr**- initial cluster is reflected in the dimidiated binome *péng zhàng* **< *bbrang-trang-s** 膨脹; *cf*. also *zhàng* < ***trang-s** 帳 'curtain' < "billowing", *zhāng* < ***trang** 張 'to stretch, expand' (as a bow-string or a string on a musical instrument), also read *zhàng* < ***trang-s** meaning 'to swell'.[22]

Space is here associated with a capacity for movement in some direction or another. This would seem to constitute an effort to bring some perceivable, concrete aspect to the otherwise very abstract notion of space. The immediately following section gives a characterization of the nature of the 'extent of space' - 'duration of time' relation in an explicit, technically phrased statement:

(16) **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) *yǔ* 'spatial extent' and *jiǔ* 久 '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.

---

22. The hypothesis of an initial consonant cluster consisting of a bilabial-plus-dental (as in ****b-tr**) in this series is supported by the phono-graphic analysis of the character 長 in the *Shuowen jiezi* dictionary of A.D. 100, which says that the graph *wáng* < ***mang** 亡 is (in an inverted form) the phonophoric component in *zhǎng* < ****b-trang-q** 長 (*SWGL* 4213). The OC initial ***m**- of *wáng* < ***mang** 亡 appears denasalized in the proposed complex initial cluster ****b-tr**- of *zhǎng* < ****b-trang-q** 長. This kind of alternation between homorganic nasal and oral consonants in related OC words is not infrequently seen.

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 based on the earlier work of Luan Tiao-fu (1978:368). The same instance of a defective text accounts for the missing word(s) of the 說在 phrase.

b R: 且; emendation ACG (1978:81).

c R: 有; emendation ACG (1978:81).

d R: 莫; emendation ACG (1978:368), though see (13) above, A 40, textual note d.

The hard-and-white relation type is defined as that relation in which one attribute may or may not occur 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 period of the dawn, and again separately in relation to the period of dusk. Furthermore, spatial extent is defined as that which allows for a shifting about (see B 13 [passage (15)] above), 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.

(17) **B 15**

C: 無久與宇堅白，說在因。

E: 無[a]:堅得白必相盈也。

C: (The relation between) *wú jiǔ* 'being without duration' and spatial extent is of the 'hard-and-white' type. The explanation lies with the criterion.

E: *wú*: When the hard entails the white, each necessarily fills out the other.

a This is an example of a E "head word" based on the first word in the C, but which is not a semantically integral part of the E line itself.

The Explanation states that the hard-and-white relation type means that each attribute fills out the other, *i.e.*, is co-incident with (but independent of) the other. The relation between the absence of temporal duration, *i.e.*, being temporally punctual, and spatial extent is said to be of this type.

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 criterion 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.

The word *yīn* < *ʔin 因 is used in the Mohist dialectical chapters to mean 'criterion', 'the basis on which something is determined or decided'. It is the introvert "-*n* extension" of the word *yī* < *ʔəj 依 'to rest on, depend on'.[23] Here it refers to the fact of 'mutual pervasiveness' as a necessary criterion for the hard-and-white relation type. That is to say, being of the hard-and-white type *rests on* the two features in question being mutually pervasive (GRAHAM 1978:368).

(18) **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 (temporally) it is so, or where (temporally) it has not yet become so. The explanation lies with being in relation to this (appropriate or inappropriate time).

E: *zài* 'locating': "Yao excelled at keeping order." From a present perspective this statement locates something in the past. If one were to look from a past perspective and locate it in the present, then Yao would not be able to keep order.

---

23. 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 (including oneself)'. 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.

a R: 未者然; emendation Liang Qichao (GRAHAM 1978:361).

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 on each other. Events are temporally contingent and therefore are not independent of the time in which they occur. Thus the example regarding Yao, *viz.*, when located in the proper time he is good at keeping order (a belief about Yao that constitutes one of the central tenets of the revered traditional view of high antiquity, even if legendary from a modern perspective), whereas when located in an inappropriate time, he would be unable to manage this.

Note that the use of the verb *zài* 在 'to be located somewhere' or causatively, 'to place something somewhere', here and also in B 14 requires us to understand *time* as the grammatical direct object. This is atypical. Typically *zài* 在 locates things in space. The Mohist use of *zài* 在 in this unexpected way must be to underscore the dependent connection between space and time that B 16 sets out. Etymologically, *zài* < ***ddzə-q** 在 'to be located somewhere' is related to the words *cái* < ***ddzə** 才 'talent', *cái* < ***ddzə** 材 'innate capacity' and *cái* < ***ddzə** 財 'inherent material worth', all fundamentally referring to a kind of innate or ingrafted quality of one kind or another. The underlying sense for all of these is 'implanted, inset', thus for *zài* 在 the precise sense is 'implanted' > 'set, located, positioned'. The character 在 is in its original graphic form simply the basic graph 才, still carrying both the phonetic value ***ddzə** and the semantic sense of 'implanted, inset', augmented by the "earth" semantic determinative, 土 (*Kangxi* classifier number 032), thus indicating clearly the spatial sense of the 'locating' (and concretely, in origin, probably the phytological sense, *i.e.*, 'planting' or 'trans-planting'; *cf. shì* < ***dzə-q** 剌 'to dibble', the OC type B counterpart to *zài* < ***ddzə-q** 在).

Section A 62 begins a short series of five definitions, the first three concerning 'interstitial space', followed by two that in the end define the technical term *jiān bái* 'hard-and-white'. All of these in one way or another have to do with the notion of a 'delimited space'.

(19) **A 62**

C: 有間，不及[a]中也。

E: 有間：謂夾之者也。

C: *yǒu jiān* ‘having an interstice’ is (the sides) not joining at the center.

E: *yǒu jiān* ‘having an interstice’: refers to what flanks it (*i.e.*, what flanks the interstice).

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

This section refers not simply to an ‘interstice’ (that is what we find in A 63, following), but to the object(s) in relation to which the interstice occurs. Or we may see it as ‘interstice’ in relation to what defines the interstice. This may seem to be in some respects a subtle distinction, but it appears to be important for the compilers of the text.

(20) **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. Measured spans starting from an outline and ending at an end point should not be considered as flanked by the end point and the outline. Two such reachings are not equivalent reachings.

a R: 聞; emendation ACG (1978:310)

b R: null; 所 added by ACG (1978:311).

c R: 內; emendation ACG (1978:310).

To be able to speak of an ‘interstice’ you need two flanking objects that are comparable in their capacity to be identified or perceived naturally as limits to 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 endpoint. The two "flanking" parts are not comparable, and so the two reachings are not equivalent reachings.

The phrase *qūxué* 區穴 is understood here as a verb-object construction 'to delineate the empty/hollow (space)'; presumably the "empty space" can be filled with something and still remain amenable to an 'outline'.

(21) **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. This refers to the part of it where there is no wood.

a R: 纑; emendation Sun Yirang (LIANG QICHAO 1922:51). The character in R, written with 糸, read *lú* < ***rra**, is defined in the 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 *lǘ* < ***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 *lú* 櫨 as a 'king-post' (JOHNSTON 2010:428), *i.e.*, "a structural member running vertically between the apex and base of a triangular roof truss." (Dictionary.com.http://dictionary.reference.com; see illustration 2 immediately below).

b R: 纑; see note a *supra*.

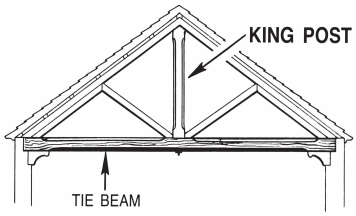

Illustration 2: ‘king-post’ (commons.wikimedia.org)

Two points are clear from this section, (i) the importance of the distinction between the flanking object(s) and the space being flanked, as is already evident in A 62 and A 63; while the king-post is made of wood, the interstice is empty, and (ii) an interstice is ‘empty’ by virtue of the absence of whatever material the flanking parts consist of, but by the same token, it need not be absolutely empty. There is no sense of a ‘void’ implicit in this section.

(22) **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 ACG (1978:313).

The pair of concepts, *hòu* 厚 ‘magnitude’ and *yíng* 盈 ‘filling out’, consistently differentiate the spatial and the material aspects of physical bodies, yet the section suggests that neither can occur in the absence of the other, that is, spatial extension 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 ‘filling out, being filled out’ seems intended to complement the immediately preceding Canon dealing with the empty interstices characteristic of the structural functioning of a *lú* 櫨 ‘king-post’. The ‘interstice’ (*jiān* 間) is a spatial extension described as lacking a given material, *i.e.*, 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).

(23) **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 places, do not fill out each other. When attributes are incompatible with each other, this means they exclude each other.

This term *jiān bái* 'hard-and-white' is central to Mohist 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, but independent of each other. This is precisely the sense of the immediately preceding section A 65. The term *wài* 外 'excluding' is to be understood concretely in terms of spatial exclusion, but it equally implies logical exclusion. The Explanation states that attributes cannot be called *jiān bái* 'co-occurring' if they are located 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 or physical 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.

III. Mohist Space and Time and Modern Space-time

Sections A 40 and A 41 taken together, and A 50, B 14, B 15, and B 16 [numbers 13, 12, 14, 16, 17 and 18 respectively of part II above] all involve one way or another the intersection, so to speak, of 'space' and 'time'. More precisely in Mohist terms, they deal with the comparability of, and relation between, 'spatial extent' and 'temporal duration'. In the most straightforward sense, A 40 and A 41 seen side-by-side show how the Mohist understood 'spatial extent' and 'temporal duration' as comparable and analogous, each characterized by an open-ended extensiveness. Section A 50 is crucial in this respect in that it sets out the relation between being fixed in a place and temporal duration, thereby identifying by implication an inalienable link between 'spatial extent' and 'temporal duration'. There is no possibility of a relation between being fixed in space and punctual, non-durative time. In B 14 it is explained that 'temporal duration' and 'spatial extent' are not independent of each other and thus do not constitute a 'hard-and-white' type relation, but in B 15 just the opposite is said of a 'point in time' and 'spatial extent'. We are able to infer from these sections taken in the aggregate that 'space' and 'time', when seen as characterized by an open-ended 'extensiveness' and 'durativeness', are mutually contingent and thus not of the 'hard-and-white' type. Conversely, when time is punctual, that is, momentary, it fills out all of space, but because there is no possibility of mediation by movement, punctual time and spatial extent are in fact independent of each other. In this form they are of the 'hard-and-white' type.

Section B 16 is unusual among the Later Mohist texts in that it makes a direct reference to a major historical (though in fact legendary) figure of Chinese antiquity. This serves as a concrete example of how historical events were seen as temporally contingent and thus of the inter-relation of 'space' and 'time' at the human level. The use of actual names and places, and ostensibly real events and situations in these chapters is highly atypical. Such a reference here underscores the fact that for all of the apparent rigorous formality of these texts, the Mohist was writing on the basis of experiential knowledge (and in this case, belief), rather than from either innate or theoretical knowledge. Spatial extent and temporal duration both were real features of the everyday world; the Mohist is illustrating what he sees or infers to be their quotidian nature. And this understanding is linked directly to perceived historical reality, as the reference to Yao shows.

The two eminent physicists Fang Lizhi 方勵之 and Zhou Youyuan 周又元 some years ago wrote a brief discussion of the concepts of space and time in ancient China in which they tried to show what they referred to as "remarkable similarities" between the ideas of ancient Chinese civilization and such modern developments in physics as Einstein's special and general theories of relativity and Edwin Hubble's discovery of the red shift (FANG and ZHOU 1996). Perhaps the most remarkable of the "remarkable similarities" that they were eager to illustrate consists in the purported similarity between what they call the ancient Chinese "unity of time and space" and the modern model of the universe in which time and space together form a unified whole, often referred to as 'space-time'. To demonstrate their contention of a conceptual unity of time and space in ancient China Fang and Zhou invoke, in addition to other, mostly later, texts, sections A 40 and A 41 from the Later Mohist Canon *Jing* and *Jing shuo* chapters, precisely the sections with which we began this discussion in part II above. In their eagerness to show that these two sections taken together are the equal of Einstein's space-time unity they read the Canon line of A 40 (C: 久，彌異時也) as "jiu [zhou] is composed of different times." (FANG and ZHOU 1996:57). And by their silent use of square brackets they allow themselves to equate the head-word *jiǔ* 久 'temporal duration' of A 40 with *zhòu* 宙, a word meaning something like 'central beam, ridge pole, structural mainstay' and by semantic extension 'primary, principal or chief conduit, lead (actor)', but rarely used in Classical Chinese by itself. Not only do they miss the correct meaning of the verb *mí* 彌 'to span, extend, spread out', but in addition, their implication that the word *zhòu* 宙 is somehow an equivalent of the actual head-word *jiǔ* 久 'temporal duration' allows them to couple *yǔ* 宇 ('spatial extent', from A 41) with *zhòu* 宙, bringing this pair of words together to form the familiar binomial word *yǔ zhòu* 宇宙, conventionally understood in the modern language as 'cosmos' or 'universe', but which actually means in classical texts something more like the 'celestial or cosmic edifice'.[24]

It is undoubtedly the well-known modern Chinese word *yǔ zhòu* 宇宙 'cosmos, universe' that has inspired the questionable implication that *zhòu* 宙 is the equivalent of the Mohist's *jiǔ* 久 'temporal duration'. The *yǔ* 宇 part is, as we discussed at some length above, the 'eaves' or 'rim' of a kind of 'canopy'. The *zhòu* 宙 part is the central 'lodge pole' or main 'purlin' of the

24. A. C. Graham describes it as "… *yü* and *chou* do not seem to be clearly conceived as space and time abstracted from the physical cosmos; they seem rather to be the 'cosmos as it extends' and the 'cosmos as it endures'." (GRAHAM 1978:365).

figurative structure.[25] There is no lexical, textual or etymological basis for understanding *zhòu* 宙 as interchangeable with, or the equivalent of, *jiǔ* 久 'temporal duration', as Fang and Zhou's transcription "jiu [zhou] …" implies. Nevertheless, from this point on Fang and Zhou argue as if the *Mozi* text showed *prima facie* evidence for the "unity of time and space" as expressed by the binomial word *yǔ zhòu* 宇宙 understood in its modern sense of 'cosmos, universe', and they proceed as if the relation between *yǔ* 宇 and *jiǔ* 久 were no different from that between *yǔ* 宇 and *zhòu* 宙.[26] As we have seen, the word *yǔ* 宇 'eaves' > 'spatial extent' is a central term in the Later Mohist texts; the word *zhòu* 宙, by contrast, does not occur in these texts at all, nor does the binomial word *yǔ zhòu* 宇宙.

Apart from its use in the binomial word *yǔ zhòu* 宇宙, the *locus classicus* for the single word *zhòu* 宙 occurs in *Zhuangzi*, section 23, "Geng sang chu" 庚桑楚, in a line that has every appearance of being in origin a kind of exegetic note that has been secondarily elevated to the level of the original text:

> 有實而無乎處，有長而無乎本剽 ...。有實而無乎處者，宇也。有長而無本剽者，宙也。(8.7a-b)
>
> It has substance, but is always without locale. It has length, but is always without base or tip. … As for having substance, but always without any locale, this is 'spatial extension'. As for having length, but without base or tip, this is the 'mainstay conduit'.

How exactly to interpret these lines is one of the many tantalizing problems in the *Zhuangzi*, but the sense of *zhòu* 宙 would seem to be that of a 'central ridge-pole, purlin', serving to define the complementary arched or vaulted vertical dimension of a dome-like figure, the peripheral rim-like

25. The binomial word *yǔ zhòu* 宇宙 occurs frequently in Warring States period texts. It occurs four times in the *Zhuangzi*, in every case referring only to 'space', or 'spatial extent', never with any unambiguous reference to time, notwithstanding the tendency of modern translators to render it as 'space and time'. In all of these occurrences the word has the sense of unlimited, we might say infinite, space, but there is all the same no basis in either the texts or the history of the word itself for including 'time' as a part of its meaning. That meaning comes only much later and even then is 'time' only in a very vague sense.

26. Perhaps in a linguistically naïve way even the approximate phonetic similarity of modern Chinese *zhòu* to *jiǔ* has contributed to this proposal on the part of Fang and Zhou, but in fact the two words are phonetically very different from each other in their OC forms, ***lrus** and ***kwəʔ** respectively, and there is virtually no possibility that they could be related to each other in any etymological way.

horizontal base of which is the *yǔ* 宇, here associated with *shí* 實 'substance'. The passage says that both of these aspects of the "cosmic edifice" are to be thought of as without spatial limit, but there is no sense of time involved in any respect. The closest concrete analogue, if anecdotal, to the "cosmic edifice" connoted by the term *yǔ zhòu* 宇宙 may be the physical object called *zhòu* 胄, a kind of 'helmet', typically cast bronze, and therefore likely more ceremonial than genuinely functional (illustration three).[27]

Illustration 3: a Shang period *zhòu* 胄 'helmet' (http://www.cfucn.com/ttjb/f/20120405/15893_2.html)

The circular or oval base rim is the analogue of the *yǔ* 宇 'spatial extent', and the pronounced central vertical ridge that bisects the helmet from front to back is the analogue of the *zhòu* 宙. There can be little doubt that the two homophonous words *zhòu* 胄 'helmet' and *zhòu* 宙 'ridge-pole, mainstay conduit', both OC ***lrus**, are etymonic affines of *yóu* < ***lu** 由 'to proceed from, lead or head out from'. The word *yóu* < ***lu** 由 'to proceed from, head out from' itself is in turn

27. Not to be confused with the homophonous and graphically very similar word *zhòu* 胄 'posterity, descendants'; *zhòu* < ***lrus** 胄 'helmet' consists graphically of the phonophoric *yóu* < ***lu** 由 'to proceed from, lead from' and the *Shuowen* classifier 277, *mào* 冒 'kind of child's head-covering, cap' (*SWGL* 3364, 3366), whereas *zhòu* < ***lrus** 胄 'posterity, descendants' is graphically the same phonophoric with Kangxi classifier 130, *ròu* 肉 'flesh' on the bottom.

likely cognate with its OC type A phonetic counterpart, *dào* < ***llu-q** 道 'to lead, move ahead'. [28] And both *yóu* < ***lu** 由 'to proceed from, head out from' and *dào* < ***llu-q** 道 'to lead, move ahead' are lexical affines of *shǒu* < ***hlu-q** 首 'head'.

The word *zhòu* 宙 occurs in chapter eleven of the *Guanzi*, in the phrase *zhòu hé* 宙合, which Rickett translates as 'The All-Embracing Unity', 天地萬物之橐，宙合有橐天地。(4.1b) "Heaven and Earth are the receptacles for all things. The All-Embracing Unity serves as a receptacle for Heaven and Earth." (Rickett 1985:204). In neither the *Zhuangzi* line above nor the *Guanzi* passage here can we discern any sense of 'time' in the usage of the word *zhòu* 宙. Several centuries later the word occurs frequently in the *Huainanzi*. As with the *Zhuangzi*, only once does it occur other than in the binomial word *yǔ zhòu* 宇宙, and that is in a passage in chapter eleven, "Qi su" 齊俗, where, again as with the *Zhuangzi,* the line has the appearance of being a kind of definition, or even a textual note that has been inadvertently introduced into the main text:

> 往古來今謂之宙，四方上下謂之宇，道在其間，而莫知其所。
> (*Huainanzi* 11.9b-10a)
> "Moving from the past and coming to the present, we refer to this as *zhòu* 'the chief timeline'. The four directions together with above and below, we refer to this as *yǔ* 'spatial extent'. The Dao is located in their midst; no one knows its place."

Here the word *yǔ* 宇 'spatial extent' includes a vertical dimension, and there is, to be sure, a discernible temporal sense in the meaning of *zhòu* 宙. For both words the line has in effect the nature of a definition and in that respect is similar to the *Zhuangzi* line. Even so, the sense in which the word *zhòu* 宙 pertains to time as expressed in this *Huainanzi* line is limited to the notion of a kind of 'timeline' from 'past' to 'present', something that is not immediately equatable with an abstract sense of 'time' and does not serve to justify a claim that the word *zhòu* 宙 is in any way the equivalent of *jiǔ* 久 'temporal duration'.[29]

It seems likely that Fang and Zhou allowed themselves to be misled by the use of the word *yǔ zhòu* 宇宙 to mean 'universe, cosmos' in a modern, scientific sense, a sense that does not fit the ancient Chinese context any more than Greek 'cosmos' in its modern English sense fits the classical Greek context.[30] The unhappy consequence of this somewhat willful disregard for the

28. Now read *dǎo* in modern standard Chinese.

29. For the etymological sense of *gǔ* 古 'antiquity, past' and *jīn* 今 'present' see Boltz 1992.

30. For the mythic dimension of Plato's use in the *Timaeus* of the word 'cosmos' as the 'order of

integrity and meaning of the *Mozi* text is that instead of presenting a legitimate and highly interesting synopsis of the Later Mohist understanding of the inter-relation of 'spatial' and 'temporal' extent, constructively contrasted perhaps with the modern understanding, Fang and Zhou have set out an over-simple, anachronistic and impressionistic proposition that does not reflect accurately the world of thought in ancient China and has little value for the serious comparative study of the history of science.

existence', created by the Demiurge, see VOEGELIN 1966:183-204. English 'cosmos' is, of course, the Greek word κόσμοσ. The everyday Greek meaning is 'order'. In a political context it means 'well-ordered', as of a state or city; as ornament it means the same, hence English *cosmetic*. The second law of thermodynamics would suggest that 'cosmos' as 'order' is not an especially apt way to label the universe, in spite of the word's now well-established modern usage in this sense. The Greeks came closer to an accurate description of the universe when they called it χάος, *i.e.* 'chaos'.

Primary sources

Guanzi

Guanzi 管子. *Sibu beiyao* 四部備要 ed.

Huainanzi

Huainanzi 淮南子. *Sibu beiyao* 四部備要 ed.

Liji

Liji zhushu fu jiaokan ji 禮記注疏附校勘記. Ruan Yuan 阮元, ed., Banqiao 板橋: Yi-wen 藝文, n.d., photographic fac-simile of the 1807 Jiangxi, Nanchang fuxue 南昌府學 edition.

Lunyu

Lunyu zhushu fu jiaokan ji 論語注疏附校勘記. Ruan Yuan 阮元, ed., Banqiao: Yi-wen, n.d., photographic fac-simile of the 1807 Jiangxi, Nanchang fuxue 南昌府學 edition.

Lüshi chunqiu

Lüshi chunqiu jiaoshi 呂氏春秋校釋. Chen Qiyou 陳奇猷, ed., Shanghai: Xuelin 學林, 1990.

Mozi

(a) *Mozi* 墨子. *Daozang* 道藏 (1445).

(b) *Mozi* 墨子. Bi Yuan 畢沅, ed., Preface dated 1783. *Sibu beiyao* 四部備要.

SWGL

Shuowen jiezi gulin 說文解字詁林. Ding Fubao丁福保, ed., Shanghai: Commercial Press, 1928; rpt. Taibei, 1970.

Wen xuan

Zengbu liuchenzhu Wen xuan 增補六臣注文選, Taibei: Huazheng 華正, 1974 photographic fac-simile reprint of the 1247 wood-block printing of the You Mao 尤袤 ed.

Xunzi

Xunzi jijie 荀子集解. Wang Xianqian 王先謙, ed. Taibei: Lantai 蘭臺, 1972.

Zhou li

Zhou li 周禮. *Zhou li zhushu fu jiaokanji* 周禮注疏附校堪記, Ruan Yuan 阮元 ed. (rpt.) Banqiao 板橋: Yiwen 藝文, n.d., photographic fac-simile of the 1807 Jiangxi, Nanchang fuxue 南昌府學 edition.

Zhuangzi

Zhuangzi 莊子. *Sibu beiyao* 四部備要 ed.

****

References

BERLINSKI 1995

David Berlinski, *A Tour of the Calculus*. New York: Pantheon.

BOLTZ 1992

William G. Boltz, "Notes on Chinese Etymology: The past and present of *kŭ* 古 'past' and *chīn* 今 'present'." *Oriens Extremus* 35.1/2.35-43.

BOLTZ 2005

William G. Boltz, "The Composite Nature of Early Chinese Texts." In Martin Kern, ed., *Text and Ritual in Early China*. Seattle & London: University of Washington Press. Pp. 50-78.

BOLTZ 2006

William G. Boltz, ""Mechanics in the *Mohist Canon*: Preliminary Textual Questions." In Hans Ulrich Vogel et al., eds., *Zhongguo keji dianji yanjiu* 中國科技典籍研究 (*Studies on Ancient Chinese Scientific and Technical Texts*). Zhengzhou: Elephant Press. Pp. 32-40.

BOLTZ et al. 2003

William G. Boltz, Jürgen Renn, Matthias Schemmel, "Mechanics in the *Mohist Canon* and its European Counterpart: Texts and Contexts." Berlin: Max-Planck-Institut für Wissenschaftsgeschichte, preprint 241.

BOLTZ and SCHEMMEL: forthcoming

William G. Boltz and Matthias Schemmel, "Theoretical reflections on elementary actions and instrumental practices: the example of the Mohist Canon." To appear in Matthias Schemmel, ed., *Spatial Thinking and External Representation: towards a historical epistemology of space*. Berlin: Edition Open Access.

FANG and ZHOU 1996

Fang Lizhi 方勵之 & Zhou Youyuan 周又元, "Concepts of space and time in ancient China and in modern cosmology." In Fan Dainian & Robert S. Cohen, eds., *Chinese Studies in the History and Philosophy of Science and Technology*. Dordrecht, Boston, London: Kluwer Academic Publishers. Pp. 55-60.

GRAHAM 1978.

A.C. Graham, *Later Mohist Logic, Ethics and Science*. Hong Kong: The Chinese University Press & London: School of Oriental and African Studies, University of London.

GRAHAM 1981

A.C. Graham, *Chuang-tzŭ: the Inner Chapters*. London: George Allen & Unwin.

GRAHAM 1989

A.C. Graham, *Disputers of the Tao, Philosophical Argument in Ancient China*. La Salle, Illinois: Open Court.

GRAHAM 1993

A.C. Graham, "*Mo tzu* 墨子", in Michael Loewe, ed., *Early Chinese Texts, A Bibliographical Guide*. Berkeley [Ca.]: Institute of East Asian Studies, University of California & Society for the Study of Early China. Pp. 336-41.

HUBEI SHENG 1996

Hubei sheng bowuguan 湖北省博物館, *Zeng Hou Yi mu wenwu yishu* 曾侯乙墓文物藝術. Wuhan: Hubei Meishu.

JOHNSTON 2010

Ian Johnston, *The* MOZI, *a Complete Translation*. New York: Columbia University Press.

KNECHTGES 1987.

David R. Knechtges, *Wen xuan*, v. 2. Princeton: Princeton University Press.

KNOBLOCK 1994.

John Knoblock, *Xunzi: A Translation and Study of the Complete Works*, v. III. Stanford: Stanford University Press.

LIANG QICHAO 1922.

Liang Qichao 梁啟超, *Mojing jiaoshi* 墨經校釋. Shanghai: Shangwu, 1922.

MALLORY and ADAMS 2006.

J.P. Mallory and D. G. Adams, *The Oxford Introduction to Proto-Indo-European and the Proto-Indo-European World*. Oxford: Oxford University Press.

RAWSON 1993

Jessica Rawson, "The Ancestry of Chinese Bronze Vessels" in Steven Lubar & W. David Kingery, eds., *History from Things, Essays on Material Culture*. Washington [D.C.] & London: Smithsonian Institution, pp. 51-73.

RAWSON 1998

Jessica Rawson, "Chinese Burial Patterns: Sources of Information on Thought and Belief" in Colin Renfrew & Chris Scarre, eds., *Cognition and Material Culture: the Archaeology of Symbolic Storage*. Cambridge: McDonald Institute for Archaeological Research, University of Cambridge, pp. 107-33.

RAWSON 1999

Jessica Rawson, "Western Zhou Archaeology" in Michael Loewe & Edward L. Shaughnessy, eds., *The Cambridge History of Ancient China*. Cambridge: Cambridge University Press, pp. 352-449.

RICKETT 1985

W. Allyn Rickett, *Guanzi*. Princeton: Princeton University Press.

SHIELDS 2007.

Christopher Shields, *Aristotle*. London & New York: Routledge.

DE VAAN 2008.

Michiel de Vaan, *Etymological Dictionary of Latin and the other Italic Languages*. Leiden & Boston: Brill.

VOEGELIN 1966

Eric Voegelin, *Plato*. Baton Rouge (La.): Louisiana State University Press.

WATERFIELD 1996.

Robin Waterfield (trans.), *Aristotle, Physics*. Oxford: Oxford University Press.

MAX-PLANCK-INSTITUT FÜR WISSENSCHAFTSGESCHICHTE

Max Planck Institute for the History of Science

Preprints since 2011 (a full list can be found at our website)

411 Henning Schmidgen & Urs Schoepflin (eds.) **Hans-Jörg Rheinberger : a Bibliography**

412 Renate Wahsner & Horst-Heino v. Borzeszkowski **Erkenntnis statt Erbauung: Hegel und das naturwissenschaftliche Denken der Moderne**

413 Mirjam Brusius **From photographic science to scientific photography: Photographic experiments at the British Museum around 1850**

414 Viktor J. Frenkel **Professor Friedrich Houtermans – Arbeit, Leben, Schicksal. Biographie eines Physikers des zwanzigsten Jahrhunderts.** Herausgegeben und ergänzt von Dieter Hoffmann, unter Mitwirkung von Mary Beer

415 Ilana Löwy (ed.) **Microscope Slides – Reassessing a Neglected Historical Ressource**

416 André L. Blum, John Michael Krois und Hans-Jörg Rheinberger (Hrsg.) **Verkörperungen**

417 Pietro Daniel Omodeo **Sixteenth Century Professors of Mathematics at the German University of Helmstedt.** A Case Study on Renaissance Scholarly Work and Networks

418 Peter Schöttler & Hans-Jörg Rheinberger (éds.) **Marc Bloch et les crises du savoir**

419 Albert Presas i Puig (ed.) **A Comparative Study of European Nuclear Energy Programs**

420 Mathias Grote & Max Stadler (eds.) **Membranes Surfaces Boundaries** Interstices in the History of Science, Technology and Culture

421 Frank W. Stahnisch **The emergence of *Nervennahrung*: Nerves, mind and metabolism in the long eighteenth century**

422 Pietro Daniel Omodeo, Irina Tupikova **Aristotle and Ptolemy on Geocentrism: Diverging Argumentative Strategies and Epistemologies** (TOPOI – Towards a Historical Epistemology of Space)

423 Han F. Vermeulen **Linguistik und Völkerkunde – der Beitrag der historisch-vergleichenden Linguistik von G.W. Leibniz zur Entstehung der Völkerkunde im 18. Jahrhundert** [Leicht erweiterte Fassung des Working Papers No. 133 aus dem MPI for Social Anthropology]

424 Alfred Gierer **Mit Schiller gegen den „Egoismus der Vernunft".** Zeitübergreifende Gedanken zur Natur des Menschen

425 Annette Vogt **Die Berliner Humboldt–Universität von 1945/1946 bis 1960/1961**

426 Klaus Geus, Martin Thiering (eds.) **Common Sense Geography and Mental Modelling**

427 Renate Wahsner **Kann eine moderne Naturphilosophie auf Hegelsche Prinzipien gegründet werden?** Spekulatives und naturwissenschaftliches Denken

428 Stefano Bordoni **Widening the Scope of Analytical Mechanics** Duhem's third pathway to Thermodynamics

429 Pietro Daniel Omodeo **Copernicus in the Cultural Debates of the Renaissance: Reception, Legacy, Transformation** [Part I & II]

430 Mark Geller & Klaus Geus (eds.) **Productive Errors: Scientific Concepts in Antiquity** (TOPOI – Dahlem Seminar for the History of Ancient Sciences)

431 Klaus Gottstein **The Amaldi Conferences. Their Past and Their Potential Future**

432 Mikuláš Teich **The Scientific Revolution Revisited**

433 Lorraine Daston & Jürgen Renn (Hrsg.) **Festkolloquium für Hans-Jörg Rheinberger**
Beiträge zum Symposium am 24. 1. 2011 im Max-Planck-Institut für Wissenschaftsgeschichte

434 Conference **Epistemology and History. From Bachelard and Canguilhem to Today's History of Science**

435 Jens Høyrup **Sanskrit-Prakrit interaction in elementary mathematics as reflected in Arabic and Italian formulations of the rule of three – and something more on the rule elsewhere**

436 Jens Høyrup **A hypothetical history of Old Babylonian mathematics: places, passages, stages, development**

437 Jürgen Renn **Schrödinger and the Genesis of Wave Mechanics**

438 Pietro Daniel Omodeo **L'*iter* europeo del matematico e medico scozzese Duncan Liddel**

439 Irina Tupikova & Klaus Geus **The Circumference of the Earth and Ptolemy's World Map**

440 Pietro Daniel Omodeo und Jürgen Renn **Das Prinzip Kontingenz in der Naturwissenschaft der Renaissance**

441 Horst Kant und Jürgen Renn **Eine utopische Episode – Carl Friedrich von Weizsäcker in den Netzwerken der Max-Planck-Gesellschaft**