TWO SYLLOGISMS IN THE *MOZI*:
CHINESE LOGIC AND LANGUAGE

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Abstract. This article examines two syllogistic arguments contrasted in an ancient Chinese book, the *Mozi*, which expounds doctrines of the Mohist school of philosophers. While the arguments seem to have the same form, one of them (the *one-horse argument*) is valid but the other (the *two-horse argument*) is not. To explain this difference, the article uses English plural constructions to formulate the arguments. Then it shows that the one-horse argument is valid because it has a valid argument form, the plural cousin of a standard form of valid categorical syllogisms (*Plural Barbara*), and argues that the two-horse argument involves equivocal uses of a key predicate (the Chinese counterpart of 'have four feet') that has the distributive/nondistributive ambiguity. In doing so, the article discusses linguistic differences between Chinese and English and explains why the logic of plural constructions is applicable to Chinese arguments that involve no plural constructions.

The *Mozi* is an ancient Chinese book that expounds doctrines of the Mohist school of philosophers, a school founded by Mozi (ca. 479–381 BCE) that flourished in competition with Confucianism during the Warring States period (475–221 BCE). Mozi is well-known for rejecting the Confucian emphasis on family relations in morality by holding the doctrine of universal love (*jian ai*), love for all people without partiality based on family relations. In addition to chapters expounding Mohist moral and political doctrines, the *Mozi* has dialectical chapters that discuss science, logic, and philosophy of language among other subjects.[1] The last of those chapters, the *Smaller Selection* (*Xiao Qu*), presents various pairs of apparently parallel arguments one of which is correct (or valid) and the other incorrect (or invalid).[2] I discuss in this article one of those pairs, a pair of arguments contrasted in the last passage of the chapter. The passage, which I call the *Horse Passage*, contrasts two arguments that seem to have the same form: one of them, which concerns

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[1] They are Chapters 40–45 of the *Mozi*. See Mo (2010), which has the full text of the *Mozi* with Ian Johnston's translation; Graham (1978, pp. 499–525), which has the text of the dialectical chapters with A. C. Graham's translation; and the online Mo (2006). See also Mo (2013), which has Johnston's translation. For a general introduction to Mozi and Mohism, see Fung (1948, chap. 5), Fung (1952, chap. 5), and Fraser (2015). For accounts of the Mohist logic and philosophy of language, see Graham (1978), Harbsmeier (1998, pp. 326–337), Robins (2010), and Fraser (2017).

[2] In addition to the translations listed in note 1, see Johnston (2000, pp. 394–398) and Robins (2010, pp. 248–256) for translations of the *Smaller Selection*.

what holds for any *one horse*, is valid but the other, which concerns what holds for any *two horses*, is not. I aim to clarify the reason for this logical difference.

To analyze the arguments, one might begin by formulating them in English. This approach assumes we can find suitable English counterparts of the Chinese arguments. But Chinese differs from English (and other familiar European languages) in lacking a *grammatical number system*, which includes the *singular* and *plural* forms of nouns and predicates. For this reason, usual translations of the arguments obscure the parallelism between them. We can avoid this problem by using *plural constructions* (e.g., 'horses', 'have four feet') to obtain suitable formulations of the arguments in English. By doing so, we can see that one of the two arguments has a valid form. The form, which I call *Plural Barbara*, is the plural cousin of *Barbara*, a standard form of valid categorical syllogisms. And we can see that the other argument, which apparently has the same form, involves equivocal uses of a key predicate that has the *distributive/nondistributive* ambiguity. We can see that this ambiguity pertains only to predicates that relate to many things taken together (e.g., 'have four feet'), and we can explain the logical difference between the two arguments by applying a system of logic that can explain logical relations among plural constructions, such as *plural logic*.[3]

In §1, I compare the usual translations of the Horse Passage with the translation (the *plural translation*) that I think is adequate for capturing its logic. In §2, I argue that the first of the two arguments contrasted in the passage is valid because it is an instance of Plural Barbara (or its Chinese counterpart). In §3, I argue that the second of them is not a genuine instance of the argument form because it involves equivocal uses of the Chinese counterpart of 'have four feet', which has the distributive/nondistributive ambiguity. In §4, I explain why plural logic is applicable to arguments stated in Chinese, which does not have a grammatical number system. And in §5, I conclude with remarks on the historical significance of the Horse Passage in studies of logic and semantics.

§1. The Horse Passage: One horse and two horses.   The Horse Passage, which figures in the last section of the *Smaller Selection*, contrasts two arguments. One of them (the *one-horse argument*) concerns what holds for any one horse, and the other (the *two-horse argument*) concerns what holds for any two horses. The passage is usually translated roughly as follows:

(H1)   One horse is a horse; two horses are [also] horses. [And] A horse has four feet, which means that one horse has four feet, [but] not that two horses have four feet. . . . one [of these] is correct and one is not.[4]

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3   Plural logic, which extends elementary logic to explain logical relations among plural as well as singular constructions, explains the logic of plural constructions without reducing them to singular constructions. For this approach to the logic and semantics of plural constructions, see, e.g., Yi (1999, 2002, 2005, 2006, 2016), Rayo (2002), McKay (2006), Oliver and Smiley (2016), and Linnebo (2017).

4   See Appendix 1 for the Chinese text of the Horse Passage. All translations of Chinese (including the above translation of the Horse Passage and the translation given below, (H2)) are mine (see note 36 about the translation of the last sentence of the passage). For other translations, see Graham (1978, p. 493), Johnston (2000, p. 387), Mo (2006), Mo (2010, p. 635), Mo (2013, p. 296), and Robins (2010, p. 256). The part omitted in the above translation has the sequel to the passage that contrasts two other arguments that also concern what holds for one horse and what holds for two horses. See Appendix 4 for my analysis of the sequel and Appendix 1 for the Chinese text.

The remark "one is correct and one is not", on this translation, suggests a logical contrast between two groups of statements:

(1) a. One horse is a horse.
     b. A horse has four feet.
     c. One horse has four feet.

(2) a. Two horses are horses.
     b. A horse has four feet. (=(1b))
     c. Two horses have four feet.

(1a)–(1b) imply (1c). By contrast, (2a)–(2b) do not imply (2c). Although both (2a) and (2b) are true, (2c) is not—two horses have eight feet (with four each), not four.

Those who rely on the above translation of the Horse Passage, (H1), might hold that the logical difference between the arguments contrasted in the passage stems from the *singular*/*plural* distinction. On this account, they have different logical forms. For (2a)–(2c) involve plural constructions (e.g., 'horses', 'have') while (1a)–(1c) involve only singular constructions (e.g., 'a horse', 'has').

(1a)–(1c) involve implicit universal quantification.[5] By making this explicit, we can paraphrase the statements as follows:

(1) a′. Anything that is one horse is a horse.
     b′. Anything that is a horse has four feet.
     c′. Anything that is one horse has four feet.

All of these have the universal affirmative form (in short, the **A** form) of categorical statements:

A (the *standard A form*): Anything that is-P is-Q, where 'is-P' and 'is-Q' stand in for predicates of the singular form (e.g., 'is a horse', 'is white', 'runs fast').

And they form the premises and conclusion of a valid categorical syllogism. The argument consisting of them has the form of Barbara:

Barbara:
Anything that is-P is-Q.
Anything that is-Q is-R.
∴ Anything that is-P is-R.

By contrast, (2a) and (2c) involve plural constructions and cannot be paraphrased by statements of the **A** form, for nothing (i.e., no one *thing*) is two horses while some *things* (e.g., Chitu and Dilu[6]) are two horses.[7]

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[5] The same holds for (2a)–(2c) except that (2a) and (2c) involve (implicit) *plural* universal quantification ('Any things are such that . . .') rather than the usual, *singular* universal quantification ('Anything is such that . . .'). See (5a)–(5c) below. Fung (2007, p. 527) takes *yi ma* ('one horse') to figure in the Chinese counterparts of (1a) and (1c) as a definite noun phrase amounting to '*that* one horse'. But the passage suggests no specific horse to which the definite noun phrase would refer. I think it is more plausible to regard the statements as implicit universal quantifications amounting to (1a′) and (1c′) or the like (e.g., (4a) and (4c)) (see below for (4a) and (4c)).

[6] Chitu and Dilu are famous horses of the Three Kingdoms period (AD 220–280) in Chinese history, the setting of the novel *Romance of the Three Kingdoms*.

[7] So 'Anything that is two horses has four feet', unlike (2c), is vacuously true. (Some might hold that (2c) can be paraphrased as 'Anything that consists of two horses has four feet', but applying

Tan (1964, p. 408f) might suggest this account of the logical difference between the arguments contrasted in the Horse Passage. But I do not think it is a good account. The account invokes the singular/plural difference between (1a) and (1c), on the one hand, and (2a) and (2c), on the other. But this difference is an artifact of the English translation, (H1), for Chinese does not have a grammatical number system, as Graham (1978, p. 493) and Johnston (2000, p. 398) rightly note.

Consider, e.g., (1a) and (2a). We cannot get (2a) from (1a) by simply replacing 'one' with 'two', for the English statements have a syntactic difference: (1a) involves only singular constructions (e.g., 'is', 'a horse'), but (2a) involves plural constructions (e.g., 'are', 'horses'). But this difference does not arise from any difference between the Chinese originals:

(3) a. *Yi ma ma ye*.[8] [one horse horse ASN][9]
     b. *Er ma ma ye*. [two horse horse ASN][10]

(1a) and (2a) figure in (H1) as translations of (3a) and (3b), respectively. Unlike the English translations, however, (3a) and (3b) draw complete syntactic parallels. And we can get (3b) from (3a) by simply replacing the numeral *yi* for one with the numeral *er* for two (and *vice versa*).

The singular/plural difference between (1a) and (2a) arises because English has a grammatical number system, which includes the singular/plural morphology. English does not simply use nouns or verbs when they figure in statements, but rather use their singular or plural forms: (1a) and (1b) have the singular and plural forms of the noun 'horse', respectively, as they have the singular and plural forms of the verb 'be' (i.e., 'is' and 'are').[11] Like a variety of languages (e.g., Japanese, Korean, Tagalog), however, Chinese has no singular or plural forms of nouns or verbs because it does not have a grammatical number system. The language simply uses nouns and verbs themselves where languages with such systems would use singular or plural forms of their counterparts. Thus the Chinese noun *ma*, which amounts to the English noun 'horse' (not its singular or plural form), serves the roles of both of its forms, and occurs in (3a) and (3b) without taking a singular or plural form. Similarly, it does not take a singular or plural form in the Chinese counterparts of (1c) and (2c).[12] Thus the two-horse argument draws syntactic parallels with the one-horse argument, and we can get the former from the latter by replacing the numeral *yi* for one with numerals for two.[13]

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the same scheme of paraphrase to (2a) yields a false statement: 'Anything that consists of two horses is a horse.')

[8] In (3a)–(3b), the second *ma* ('horse') figures as a predicate amounting to 'is a horse' or 'are horses'. Chinese common nouns (e.g., *ma*), in the predicate position, can form predicates without addition of copulas (e.g., *nai*), although copulas might be added for special purposes (e.g., emphasis), as in *nai ma* ('is a horse, are horses' [be horse]). See, e.g., Dobson (1974, p. 68f). The sentence final particle *ye* usually figures as an assertion marker (in short, ASN).

[9] Square brackets are used for English glosses of Chinese characters.

[10] Note that the noun *ma* ('horse') combines directly with numerals (*yi* for one and *er* for two) in (3a)–(3b). This conflicts with the thesis about Chinese nouns that Hansen (1983, 1992) holds: all Chinese common nouns are mass nouns (the *mass noun thesis*). See Appendix 3.

[11] The noun 'horse' is different from (albeit homonymous with) its singular form, and (1a), for example, has the singular form in both 'one horse' and 'a horse', not the noun itself.

[12] For the same reason, *zu* ('foot') does not take a plural form in the Chinese counterpart of (1b).

[13] The first premise and conclusion of the two-horse argument have different Chinese characters for two (*er* and *liang*). But the characters are interchangeable, and we can ignore the lack of

Does this mean that English, which has a grammatical number system, has no counter-parts of the Chinese arguments that give rise to the same problem? I think not.

For the purpose of considering its logic, we can translate the Horse Passage as follows:

(H2) Any things that are one horse are horses; any things that are two horses are [also] horses. [And] Any things that are horses have four feet, which means that any things that are one horse have four feet, [but] not that any things that are two horses have four feet. . . . one [of these] is correct and one is not.

Then the passage suggests a contrast between two arguments whose premises and conclusions can be formulated in English as follows:

(4)   a. Any things that *are one horse* are horses.[14]
      b. Any things that are horses have four feet.
      c. Any things that *are one horse* have four feet.
(5)   a. Any things that *are two horses* are horses.
      b. Any things that are horses have four feet. (=(4b))
      c. Any things that *are two horses* have four feet.

(4a)–(4c), I think, yield a suitable formulation of the one-horse argument while (5a)–(5c) yield a suitable formulation of the two-horse argument.

On this formulation, the two arguments have the same structure and we can get them from each other by exchanging '(are) one horse' and '(are) two horses'. While the one-horse argument is valid, however, the two horse-argument seems invalid—(5a) and (5b) do not imply (5c), it seems, because any two horses have eight feet, not four. What gives rise to this difference?

§2. Plural Barbara.   We can see that the one-horse argument is an instance of a valid form of categorical syllogisms. Its premises and conclusion (i.e., (4a)–(4c)) are a kind of *plural* categorical statements. They are plural universal affirmative statements, namely, instances of the *plural cousin* of the standard **A** form of categorical statements (in short, the **A*** form):

A* (the *plural A form*): Any things that are-P are-Q, where 'are-P' and 'are-Q' stand in for predicates of the plural form (e.g., 'are horses', 'are white', 'run fast').

So the argument is an instance of Plural Barbara, the plural cousin of the standard, singular form of Barbara:

Plural Barbara:
Any things that are-P are-Q.
Any things that are-Q are-R.
∴ Any things that are-P are-R.

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parallelism between the two arguments that arises from the use of different characters for two. See Appendix 2.

[14] Some might take 'are one horse' (unlike 'is one horse') to be ill-formed, but the predicate phrase figures in, e.g., 'Dilu and Yuyan *are* not *two horses*, but one horse', which is true ('Yuyan' is another name of Dilu, as 'Tully' is another name of Cicero).

We can get the argument by replacing 'are-*P*', 'are-*Q*', and 'are-*R*' with 'are one horse', 'are horses', and 'have four feet', respectively.

Some instances of the plural **A** form (e.g., 'Any things that are horses are equine') are commonly used interchangeably with their singular cousins of the standard, singular **A** form (e.g., 'Anything that is a horse is equine'). But they do not exhaust all instances of the plural form. Its instances include plural constructions that have no well-formed singular cousins and those whose singular cousins are not equivalent to them: 'Any things that are two horses are horses' (=(5a)), 'Any things that are two horses have four feet' (=(5c)), 'Any things that are brothers have the same surname',[15] 'Any things that are brothers with the same mother have different birth days', etc. So instances of Plural Barbara include arguments consisting of **A*** statements of the second kind, such as (6):

(6) Any things that are two brothers with the same parents are two siblings with the same mother.
Any things that are two siblings with the same mother have different birth days.
∴ Any things that are two brothers with the same parents have different birth days.

This argument is valid although it is not an instance of the standard singular form of Barbara.[16] And we can see that Plural Barbara (like its singular cousin) is a valid argument form.[17] This explains the validity of the one-horse argument.

If so, why is the two-horse argument not valid? Is it not a counterexample to the validity of Plural Barbara? I think not. The argument is not a proper instance of the form, for it involves equivocal uses of the predicate 'have four feet'. I explain this in the next section.

§3. The distributive/nondistributive ambiguity. Consider two horses: Chitu and Dilu. How many feet do they have? There are two possible answers:

(7) a. They have four feet.
     b. They have eight feet.

Both are in a way correct, for the two horses *each* have four feet and have eight feet *in total*. This does not mean that they are both correct answers to the same question, but that they can be given as correct answers to different questions:

(8) a. How many feet do they *each* have?
     b. How many feet do they have *in total*?

If so, the question 'How many feet do they have?' is ambiguous. One might use it to raise either the first question or the second. And these questions have different answers: (7a) can be given as the correct answer to (8a), and (7b) to (8b). Moreover, (7a) and (7b) are also ambiguous. One might use (7a) to answer not only (8a) but also (8b), for it is ambiguous between (7a′) and (7a″):

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[15] This is a variant of the main premiss of Argument I in Church (1956, p. 1): 'Brothers have the same surname.'

[16] The second premiss and conclusion of (6) are false, but this does not affect its validity.

[17] We can use the logic of plural quantification to show that Plural Barbara is a valid form, as we can use the logic of singular quantification to show that Barbara is a valid form. See, e.g., Axioms 6–8 in Yi (2006, p. 263).

(7)   a′. They *each* have four feet.
      a″. They have four feet *in total*.[18]

Similarly, (7b) is ambiguous between 'They *each* have eight feet' and 'They have eight feet *in total*.' And we can take the ambiguity of (7a) and (7b) to arise from a systematic ambiguity of their predicates: 'have four feet' and 'have eight feet'. For example, 'have four feet' can mean either *each have four feet* or *have four feet in total*. As used to mean the former, it can be analyzed as, roughly, 'be such that *every one of* them has four feet';[19] as used to mean the latter, it can be analyzed as, roughly, 'be such that their feet (i.e., the things that are feet of any of them) are four'.

Say that a predicate is *distributive*, if it is true of some things (e.g., Chitu and Dilu) if and only if it is true of every one of them (e.g., *both* Chitu and Dilu). And say that a predicate used in a specific sense figures *distributively*, if the predicate as so used is true of some things if and only if it is true of every one of them. Then the predicate 'be equine' is distributive.[20] But 'be two horses' is not: the predicate is true of Chitu and Dilu (they are two horses), but not of Chitu (Chitu is not two horses but one horse). Now, consider two unequivocal predicates that the uses of 'have four feet' in (7a) amount to:

P1. each have four feet (viz., be such that every one of them has four feet)[21]
P2. have four feet in total

P2 is not distributive. The predicate is true of Chitu and also of Dilu (Chitu, for example, has four feet), but not of the two (they have eight feet in total, not four). By contrast, P1 is distributive. For example, the predicate is true of Chitu and Dilu (*they* each have four feet) and also true of every one of them (for Chitu has four feet and so does Dilu).[22] So we can say that the predicate 'have four feet' has the *distributive/nondistributive* ambiguity.[23]

We can now turn to the two-horse argument, which consists of (5a)–(5c) (or their Chinese counterparts). Consider (5b) and (5c). Like (7a), both statements have two readings matching the distributive and nondistributive uses of 'have four feet'. We can formulate the two readings of (5b) as follows:

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[18] One who says (7a) as an answer to (8b) gives an incorrect answer, for (7a″) (as said about Chitu and Dilu) is false. But this does not mean that one cannot give (7a) as an answer (correct or incorrect) to the question.

[19] Or 'be such that *every one of* them is such that its feet (i.e., the things that are feet of it) are four'.

[20] Similarly, the Chinese predicate of (3a)–(3b), *ma*, is distributive. The same holds for its English counterpart, the predicate of which the singular form is 'is a horse' while the plural form is 'are horses' (so it is equivalent to 'be one or more horses'). See §4.

[21] This predicate is an example of what I call *neutral expansions*. See, e.g., Yi (2005, pp. 481–485).

[22] P1 (i.e., 'each have four feet') is true of anything (i.e., any one thing) of which the singular 'has four feet' is true, and *vice versa*. We can explain this by using the logical truth 'Something is one of something if and only if the former is identical with the latter' (see Theorems 3[b] and 4[a] in Yi (2006, p. 264f)).

[23] Most nondistributive predicates are usually called *collective predicates*, for 'be two', for example, is true of many things (e.g., Chitu and Dilu) *collectively* or *taken together*. But this term is misleading, for most distributive predicates (e.g., 'be equine') are true of many things taken together although they are *also* true of every one of the many things of which they are true. For example, 'be equine' is true of Chitu and Dilu *collectively* and also true of them *individually* (i.e., true both of Chitu and of Dilu). Similarly, P1 is true of Chitu and Dilu collectively as well as individually.

(5)   b′. Any things that are horses (*each*) *have four feet*.

b″. Any things that are horses *have four feet* (*in total*).

Similarly, we can formulate the two readings of (5c) as follows:

(5)   c′. Any things that are two horses (*each*) *have four feet*.

c″. Any things that are two horses *have four feet* (*in total*).

Like the two readings of (7a), these readings of (5b) and (5c) are not equivalent. (5b′) and (5c′) are true (every one of any horses has four feet), but (5b″) and (5c″) are false (Chitu and Dilu, which are two horses, for example, have eight feet in total).

If so, which readings do (5b) and (5c) have in the two-horse argument? They must be read as (5b′) and (5c″), respectively, for (5b) is meant to be true while (5c) is meant to be false. If so, they cannot combine with (5a) to yield an instance of Plural Barbara, which requires the predicate replacing 'are-*R*' to figure without equivocation in the second premiss and conclusion.

The two-horse argument, we have seen, is not a proper instance of Plural Barbara because it involves equivocation of a key predicate: 'have four feet' (or its Chinese counterpart). We can get a proper instance of the form by using the predicate in the same sense in (5b) and (5c), either distributively or nondistributively. This does not pose a threat to Plural Barbara, either, because the arguments we can get by doing so are equally valid. (5a) and (5b′) imply (5c′), and (5a) and (5b″) imply (5c″).[24]

This completes my account of the logical difference between the two arguments contrasted in the Horse Passage. On this account, the one-horse argument is valid because it is an instance of Plural Barbara (or its Chinese counterpart) but the two-horse argument is not because it involves equivocation. For the Chinese counterpart of 'have four feet' has the same ambiguity as the English phrase. One might use it distributively for two horses (e.g., Chitu and Dilu) because they *each* have four feet. Or one might use it nondistributively, in which case it is not true of two horses because they have eight feet (not four) *in total*. The two-horse argument, which is meant to be invalid, involves both uses: the distributive use in the second premiss and the nondistributive use in the conclusion.

In *Later Mohist Logic, Ethics and Science*, a monument in the study of the dialectical chapters of the *Mozi*, Angus C. Graham rightly notes that the Horse Passage draws attention to the distributive/nondistributive distinction. He says that the passage "concerns the distinction . . . between distributive and collective" (1978, p. 493). But he does not relate the distinction to the ambiguity of 'have four feet'. Instead, he uses it to draw a distinction between 'be one' and 'be two'.[25] He would probably take the same distinction to hold between 'be one horse' and 'be two horses', and his point in the statement quoted above might be that the logical difference between the one-horse and two-horse arguments arises

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[24] In (4a) and (4b), both of which are meant to be true in the one-horse argument, 'have four feet' must be taken to figure interchangeably with 'each have four feet' to yield an instance of Plural Barbara. The statements (taken together) have three other readings, but those readings, too, yield valid arguments. One of the resulting three arguments is an instance of Plural Barbara (albeit one with a false premiss), and the other two (which are not instances of the form) are also valid because 'Any things that are *one horse* each have four feet' and 'Any things that are *one horse* have four feet in total' are logically equivalent.

[25] He says: the Mohists "distinguish what we should call the distributive and the collective use of words. Although we cannot say of two objects 'They are both two' . . . we can say that in some respect 'They are both one' " (Graham 1978, p. 37).

because the second (unlike the first) involves a nondistributive predicate: 'be two horses'. And those who give this account might conclude that the Horse Passage shows that Plural Barbara is not a valid form: while its instances involving only distributive predicates are valid, the form has invalid instances involving nondistributive predicates.

But this is not correct. The two-horse argument, we have seen, is not a proper instance of Plural Barbara. And all proper instances of the form, as noted above, are valid. Such instances include (6) and the two variants of the two-horse argument we can get by eliminating the equivocation in (5b) and (5c):

(a) the argument that consists of (5a), (5b′), and (5c′);
(b) the argument that consists of (5a), (5b″), and (5c″).

Like the original two-horse argument, these arguments involve the nondistributive predicate 'be two horses',[26] and (6) involves *only* nondistributive predicates. Nevertheless, all these arguments (like the one-horse argument) are valid. One cannot explain this while rejecting the validity of Plural Barbara.

Moreover, the one-horse argument, too, involves a nondistributive predicate: 'be one horse'. Graham suggests that 'be one' is distributive by saying "we can say [of two objects] that in some respect 'They are both one' " (1978, p. 37). This is correct. Although 'Chitu and Dilu are one' is false,[27] 'Chitu and Dilu are *both* one' is true—this statement is equivalent to 'Both Chitu and Dilu are one' and thus to 'Chitu is one and Dilu is one.' But this does not mean that 'be one' is a distributive predicate. It is not true of Chitu and Dilu taken together (they are not one but two), but true of every one of them (Chitu is one and so is Dilu). So the predicate is not distributive. The same holds for 'be one horse'.

§4. Semantics of Chinese nouns and predicates.
Consider two English sentences:

(9) a. Chitu is a horse.
     b. Chitu and Dilu are horses.

In these sentences, the noun 'horse' and verb 'be' take singular and plural forms, and one cannot get (9b) from (9a) by simply replacing the singular term 'Chitu' with the plural term 'Chitu and Dilu'. But it is not the same in Chinese. We can get the Chinese counterpart of (9b) from that of (9a) by simply replacing the name *Chitu* with the phrase *Chitu yu Dilu* ('Chitu and Dilu'), for Chinese nouns and verbs themselves serve the roles of both the singular and plural forms of their English counterparts.[28] The reason is that Chinese, as we have noted, does not have a grammatical number system. For this reason, the noun *ma* ('horse') figures without taking a singular or plural form in (3a). This means that neither the singular (1a) or (1a′) nor the plural (4a) is closer to the Chinese sentence than the other in morphosyntactic structure. As we have seen, however, the plural translation (4a) helps to

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[26] And (b) involves another nondistributive predicate: 'have four feet (in total)'.

[27] The sentence has a reading on which it is true, for 'be one' also has the distributive/nondistributive ambiguity: '(each) be one' and 'be one (as taken together)'. On the usual reading (the second), however, the predicate figures nondistributively, which is what I argue above.

[28] Thus the Chinese counterpart of 'is a horse' is the same as that of 'are horses'. The Chinese predicate is *ma*, for the noun *ma* ('horse') can figure as a predicate amounting to both 'is a horse' and 'are horses' without addition of a copula, as in (3a) and (3b). (A copula (e.g., *nai*) might be added for special purposes, as in *nai ma* [be horse].) See note 8.

explain the logic of the Horse Passage while the singular translations (1a) and (1a′) distort the logic. What is the reason for this difference?

The Chinese noun *ma* is a counterpart of the English noun 'horse', not its singular form, and figures where English would have either form of the noun. From the morphosyntactic point of view, then, the singular and plural forms of the English noun are equally close to (and removed from) the Chinese noun. But this does not mean that they have the same *semantic* standing as English counterparts of the Chinese noun. In semantic terms, the Chinese *ma* is closer to the plural form of the English noun than to its singular form. For the plural form, unlike the singular form, inherits the full semantic profile of the noun 'horse', of which *ma* is the Chinese counterpart. Let me explain.

To compare the semantics of the Chinese *ma* with those of the English noun 'horse' and its forms, it is necessary to distinguish the English noun from its singular form, which is its homonym. For this purpose, let me use 'HORSE' and 'horse*' for the noun and the singular form, respectively.

The singular form 'horse*' denotes (i.e., is true of) *any one horse*. It denotes, e.g., Chitu. For 'Chitu is a horse' is true, and the sentence is true if and only if 'horse*' denotes something that the singular term 'Chitu' refers to (viz., Chitu). And the plural form 'horses' denotes *any horses*. It denotes, e.g., Chitu and Dilu (taken together), which are horses. For 'Chitu and Dilu are horses' is true, and the sentence is true if and only if 'horses' denotes some things (taken together) that the plural term 'Chitu and Dilu' refers to (viz., Chitu and Dilu).[29] How about the noun 'HORSE'? Its semantic profile must include those of the two forms, for their semantic profiles are, so to speak, projections of that of the noun to singular or plural contexts. So the noun denotes any *one or more* horses. It denotes any one horse as the singular form does, and any two or more horses as the plural form does.[30] It is the same with the Chinese noun *ma*. It figures in the Chinese counterparts of both (9a) and (9b) (without taking a singular or plural form). Thus *ma* denotes Chitu (as 'horse*' does), and also denotes Chitu and Dilu taken together (as 'horses' does). And it must denote any one or more horses because both (3a) and (3b), for example, are true.

The Chinese *ma*, we have seen, has the same semantic profile as the English 'HORSE'. Moreover, it has the same semantic profile as the plural form 'horses', for this has the full semantic profile of 'HORSE'.

The *Oxford English Dictionary* defines 'plural' as "denoting more than one" (OED 2006). This suggests that 'horses', for example, cannot denote one horse (e.g., Chitu) although it can denote two or more horses taken together. But this is not correct. If it is, 'one or more horses' must be equivalent to 'two or more horses'[31] and (9b) to 'Chitu and Dilu are two or more horses'. But they are not. If John has only one horse, 'John has one or more horses' is true but 'John has two or more horses' is false. And (9b) is logically equivalent to 'Chitu is a horse and Dilu is horse', which does not imply 'Chitu and Dilu are two or more horses' because it is logically compatible with 'Chitu is identical with Dilu.' Moreover, 'Dilu and Yuyan are one (and the same) horse', like 'Cicero and Tully are one

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[29] Similarly, 'Chitu and Dilu are two horses' is true if and only if 'two horses' denotes Chitu and Dilu (taken together), and this holds if and only if both 'two' and 'horses' denote them (taken together). (Note that 'two' is not distributive.)

[30] The account of the semantics of 'HORSE' and its singular and plural forms sketched above is based on my treatment of plural constructions as devices for talking about the many. For the treatment, see, e.g., Yi (2005, 2006).

[31] For the left disjunct of 'one or more' (i.e., 'one') would be incompatible with the plural 'horses', if 'horses' could not denote any one thing.

(and the same) person', is true ('Yuyan' is another name of Dilu), and yet one can correctly say 'Dilu and Yuyan are horses.' This means that 'horses' can denote Dilu, which is only one horse. And we can see that the plural form must denote any other horse as well. Like 'HORSE' and *ma*, then, the plural 'horses' denotes any one or more horses.

By contrast, the singular 'horse*' does not have the full semantic profile of the noun. Its use is limited to singular contexts (e.g., 'Chitu is a horse', 'Dilu is a horse', etc.), and its semantic profile can be taken to result from curtailing that of the noun for singular contexts. Although it is homonymous with the noun, we can take it to result from adding to the noun a silent morpheme, '-ϕ', as in 'HORSE-ϕ'. Unlike the plural morpheme '-s', which serves essentially as an agreement marker without semantic significance, the silent morpheme is semantically potent: it turns a noun denoting any one or more of the things of a certain kind (e.g., the horses) to a form that cannot denote two or more of those things (e.g., two horses) taken together.

Now, it would be useful to compare the two translations of the Horse Passage: (H1) and (H2). Although it is less colloquial than (H1), as we have seen, (H2) helps to clarify the logic of the Horse Passage. Moreover, we can see that it is a better translation. Consider (3a), which figures as the first premiss of the one-horse argument. The translations of (3a) in (H1) and (H2) amount to the singular (1a′) and the plural (4a), respectively. Now, (4a) has the same logical content as (3a), but (1a′) falls short. Consider (10a)–(10b):

(10)   a. If Chitu and Dilu are one horse, they are horses.
       b. If Dilu and Yuyan are one horse, they are horses.

The Chinese counterparts of (10a)–(10b) are instances of (3a), which involves implicit universal quantification. Similarly, (10a)–(10b) are instances of the plural (4a). But neither is an instance of the singular (1a′). Similarly, the singular translations (1b) and (1c) of the second premiss and conclusion of the one-horse argument fail to capture their logic.[32]

§5. Concluding remarks.   A key predicate figuring in the two arguments contrasted in the Horse Passage, as we have seen, has the distributive/nondistributive ambiguity. The predicate amounts to the English predicate 'have four feet'. This can be used as short for '(each) have four feet' (P1) or for 'have four feet (in total)' (P2). The same holds for the Chinese predicate.

Now, consider two English arguments involving the predicate 'have four feet':

(11)   Any horses have four feet.
       Chitu is a horse.
       ∴ Chitu has four feet.
(12)   Any horses have four feet.
       Chitu and Dilu are horses.
       ∴ Chitu and Dilu have four feet.

Although (11) is a valid argument, (12) has a reading on which it is not. For the argument might be taken to involve the distributive use of 'have four feet' (or P1) in the first premiss

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[32]   Some might object that (4a) also falls short because its instances do not include the singular 'If Chitu is one horse, it is a horse.' On my account of plural constructions, however, the plural quantifier 'Any things' is equivalent to 'Any one or more things' and plural quantifications (e.g., (4a)) have singular instances as well as plural instances. See, e.g., Yi (2016, p. 267).

and the nondistributive use (or P2) in the conclusion. If so, why does (11) not have the same ambiguity?

I think (11) is also ambiguous because it involves the same predicate. But this does not give rise to a *logical* difference for (11). The two readings of the predicate (P1 and P2) coincide with regard to any one thing (e.g., Chitu): P2 denotes anything (i.e., any *one* thing) that P1 denotes, and *vice versa*.[33] Thus (11) is valid in all four readings resulting from disambiguating the predicate.[34] And one might ignore the distributive/nondistributive ambiguity as long as the predicate figures with the singular form: 'has four feet'. So some might explain the validity of (11) by reducing it to its singular cousin where the predicate figures only with the singular form:

(11′) Any horse has four feet.
       Chitu is a horse.
       ∴ Chitu has four feet.

On their explanation, 'Any horses have four feet' is equivalent to 'Any horse has four feet' and (11) is valid because (11′) is valid.

But this does not help to explain the validity or invalidity of (12) on the various readings. Moreover, the plural 'Any horses have four feet' is not equivalent to the singular 'Any horse has four feet'. Although the singular statement is true on both readings, the plural statement has a reading on which it is false. On the nondistributive reading of 'have four feet', 'Any horses have four feet' is false because two horses (e.g., Chitu and Dilu), for example, have eight feet in total. On this reading, too, (12) is a valid argument. But one cannot explain this by reducing the argument to (11′).

To give a proper account of the logical difference between (11) and (12), then, it is necessary to develop an account of logic that one can apply to plural constructions of English as well as its singular fragment. A major task in developing such an account is to give an adequate account of the logical difference between distributive and nondistributive predicates and the related ambiguity of predicates relating to many things taken together (e.g., 'be two horses', 'have four feet'). And a passage of the *Mozi*, we have seen, has one of the earliest discussions of logical problems arising from the distributive/nondistributive distinction.[35] By giving a sharp formulation of such a problem, the passage highlights the need to attend to and control the distinction in studies of logic and semantics.

§6. Appendix 1: The Horse Passage.   The Horse Passage figures in the last paragraph of the last section (§9) of the *Smaller Selection* of the *Mozi*. Here is the passage as given in the online Mo (2006):

(H) 一馬，馬也；二馬，馬也. 馬四足者，一馬而四足也，非兩馬而四足也. . . . 此乃一是而一非者也. (Any things that are one horse are horses; any things that are two horses are [also] horses. [And] Any things that are horses have four feet, which

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[33] For both P1 and P2 denote something (i.e., some one thing) if and only if it has four feet (see note 22).

[34] For example, 'Chitu is a horse' and 'Any horses *are such that every one of them has four feet*' imply 'Chitu *has four feet in total*'.

[35] For a historical perspective, it is notable that Plato discusses the nondistributivity of '(be) one' and '(be) two' in the *Hippias Major* 301d–302b (see, e.g., Woodruff's translation in (Plato 1982, p. 27f)).

means that any things that are one horse have four feet, [but] not that any things that are two horses have four feet. . . . one [of these] is correct and one is not.[36])

See also Graham (1978, pp. 492, 523–524) and Mo (2010, p. 634) for the text. The omitted part has the sequel to the passage:

(H*) . . . . 一馬，馬也. 馬或白者，二馬而或白也，非一馬而或白. . . . (. . . Any things that are one horse are horses [as any things that are two horses are horses]. If [the] horses are such that some of them are white, it means that there are some things that are two horses and some of them are white, but not that there are some things that are one horse and some of them are white. . . .[37])

This passage is discussed in Appendix 4.

§7. Appendix 2: *er* and *liang*.   The first premiss and conclusion of the two-horse argument have different Chinese characters for two: *er* (the premiss) and *liang* (the conclusion). But *liang* is often used as an alternative form of *er*, which figures in the main series of Chinese numerals as the numeral for two.[38] So I treat *liang* as a mere variant of *er* and take the argument to be an apparent instance of Plural Barbara. But *liang* has a somewhat different use. Dobson says that it is also used as a numeral of "group form, 'two conceived as a pair' " in Archaic (or Old) Chinese (1974, p. 497; cf. p. 13). And Graham takes it to figure in the argument as an "adjunct" that "marks off a pair from other things", and translates *liang ma* [two/pair horse] as "a pair of horses (taken together)" (1978, p. 192).

On this reading of *liang*, the two-horse argument can be formulated as follows:

(5*) Any things that are *two* horses are horses. (=(5a))
      Any things that are horses have four feet. (=(5b))
      ∴ Any things that are *a pair of* horses (*taken together*) have four feet.

This is not an instance of Plural Barbara and fails to draw even apparent syntactic parallels with the one-horse argument. But it results from contracting two (apparent) instances of Plural Barbara:

(5′) Any things that are *a pair of* horses (*taken together*) are two horses.
      Any things that are two horses are horses. (=(5a))
      ∴ Any things that are *a pair of* horses (*taken together*) are horses.
(5″) Any things that are *a pair of* horses (*taken together*) are horses.
      Any things that are horses have four feet. (=(5b))
      ∴ Any things that are *a pair of* horses (*taken together*) have four feet.

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[36] The translation in parenthesis is the plural translation (H2) given in §1, which compares it with the usual, more colloquial translations (e.g., (H1)). See also the last paragraph of §4. The complete translation of the last sentence of the passage is '*These are pairs of which* one is correct and one is not', where 'these' refers to various pairs presented earlier (including the two pairs of arguments contrasted in the passage and its sequel), but I omit the italicized part for the purpose of discussion of the pair of arguments contrasted in the passage. See Appendix 2 for discussion of the two Chinese numerals for two used in the passage: 二 *er* and 兩 *liang*.

[37] See Appendix 4 for the translation.

[38] See, e.g., Dobson (1974, pp. 13, 497).

On this analysis, (5*) rests on an implicit assumption: the first premise of (5′).

The Horse Passage, on the analysis, holds that the conclusion of (5*) is false while its two explicit premises and the implicit assumption are all true. This poses a problem for the validity of Plural Barbara. But we can resolve this problem as well by applying the account of invalidity of the argument consisting of (5a)–(5c) presented in §3. Like this argument, (5*) involves equivocation of 'have four feet': it is used distributively in the second premise but nondistributively in the conclusion. This equivocation in (5*) results from the same equivocation in (5″). This means that (5″) is not a proper instance of Plural Barbara.

§8. Appendix 3: The mass noun thesis.   In analyzing the Horse Passage, I treat the Chinese noun *ma* ('horse') as a count noun that has the same semantic profile as its English counterpart: the noun 'horse' (or 'HORSE') (see §4). Like the English noun, it denotes any one or more of some individuals belonging to the same kind (viz., the horses). And in Classical Chinese, the written language of the classical literature that includes the *Mozi*, the noun can directly combine with numerals, as in (3a)–(3b), where it combines directly with *yi* ('one') and *er* ('two'). This is sufficient (if not necessary) for classifying it as a count noun. Although the noun does not take a singular or plural form, this is not because it is a mass noun. It does not take such a form for the same reason that the Chinese verb for love, for example, does not take a singular or plural form in the Chinese counterparts of 'He *loves* her' and 'They *love* her.' The reason is that Chinese, unlike English, does not have a grammatical number system. In languages without a grammatical number system, count nouns have neither singular nor plural forms.

Now, many linguists and philosophers deny that Chinese has any count nouns (see, e.g., Hansen (1983, 1992)). They hold the *mass noun thesis* for Chinese, the thesis that all Chinese common nouns are mass nouns, which cannot directly combine with numerals. In modern dialects of Chinese (e.g., Mandarin), common nouns cannot directly combine with numerals: the noun *ma*, for example, requires special expressions called *numeral classifiers* (CL) to combine with numerals, as in *yi pi ma* ('one horse' [one CL horse]). They argue that the mass noun thesis yields a good explanation of this requirement (the classifier requirement) and some other features of Chinese nouns (e.g., the lack of plural morphology), which they take to be related to the classifier requirement. But there is an obvious problem for holding this thesis for Classical Chinese: Classical Chinese does not have a substantial numeral classifier system and has nouns that can combine directly with numerals, as *ma* ('horse') does in (3a)–(3b). Moreover, I think the thesis has problems even with Modern Chinese. In modern dialects of Chinese, as in Classical Chinese, some nouns (e.g., *ma*) can combine directly with Chinese counterparts of some counting expressions that relate to the number: 'countless', 'a large number of', 'a majority of', etc. Such nouns cannot be mass nouns, and they must be taken to denote one or more of some individuals that belong to the same kind (e.g., horses). Thus I think both Classical and Modern Chinese have count nouns. And I propose a syntactic criterion of Chinese count nouns: Chinese count nouns, unlike mass nouns, can combine directly with the Chinese counterparts of 'countless', 'a large number of', and 'a majority of'. This criterion is applicable to both Classical and Modern Chinese and rules that *ma* is a count noun in both stages of the Chinese language.[39]

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[39] For more about my accounts of numeral classifiers and the mass/count distinction, see Yi (2009, 2011a,b, 2014, 2018, forthcoming), which have references to studies that propose the mass noun

§9. Appendix 4: The sequel to the Horse Passage.   The translations of the Horse Passage in §1 omit the sequel to the passage that contrasts two other arguments.[40] In line with the plural translation of the Horse Passage, (H2), we can translate the sequel as follows:

(H*) . . . . Any things that are *one horse* are horses [as any things that are *two horses* are horses]. If [the] horses are such that some of them are white, it means that there are some things that are *two horses* and some of them are white, but not that there are some things that are *one horse* and some of them are white. . . .   (My italics)

Like the Horse Passage, this passage contrasts two arguments one of which results from replacing 'two horses' in the other with 'one horse':

  (13) Any things that are *one horse* are horses.
        The horses are such that some of them are white.
        ∴. There are some things that are *one horse* and some of them are white.
  (14) Any things that are *two horses* are horses.
        The horses are such that some of them are white.
        ∴. There are some things that are *two horses* and some of them are white.

If we take the 'some' in 'some of them' to be short for 'some *but not all*', we can see that (14) is a valid argument.[41] But (13) is not. Although both of its premises are true, its conclusion is false—no one horse can include both a white horse and a nonwhite horse, while two horses can include both a white horse and a nonwhite horse (e.g., a black horse). What is the reason for this difference between (13) and (14)?

    The invalidity of (13), unlike that of the two-horse argument in the Horse Passage, is not due to equivocation. This means that the validity of (14) does not stem from the argument form that it shares with (13):

 (14*) Any things that are-P are horses.
        The horses are such that some [but not all] of them are white.
        ∴. There are some things that are-P and some [but not all] of them are white.

(13) is a counterexample to the validity of (14*). We can confirm this by considering some other instances of the form:

  (15) Any things that *are black horses* are horses.
        The horses are such that some [but not all] of them are white.
        ∴. There are some things that *are black horses* and some [but not all] of them are white.
  (16) Any things that *are two black horses* are horses.
        The horses are such that some [but not all] of them are white.
        ∴. There are some things that *are two black horses* and some [but not all] of them are white.

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thesis. Incidentally, the Chinese counterpart of (1b) and (4b), *ma shi zu* ('Horses (each) have four feet' [horse four feet]), raises further problem for the mass noun thesis, as Fung (2007, pp. 527f) and Fraser (2007, p. 433) point out. See also Harbsmeier (1998).

[40] See Appendix 1 for the texts of both the Horse Passage and the sequel.

[41] Suppose that some of the horses are white while some of them are not. Then one of the former and one of the latter are two horses, and some but not all of them are white.

(17) Any things that *are three horses* are horses.

The horses are such that some [but not all] of them are white.

∴ There are some things that *are three horses* and some [but not all] of them are white.

These arguments result from replacing 'are-*P*' in (14*) with the italicized predicates. But none of them is valid.[42]

(14*) is not a valid argument form, we have seen, although (14) is a valid argument. The validity of (14) rests on logical features of the predicate 'be two horses' that it does not share with other predicates (e.g., 'be one horse', 'be black horses'). It is straightforward to see that (18) is a logical truth:

(18) If something that is a horse (e.g., a white horse) is not identical with something that is also a horse (e.g., a black horse), then the former and the latter *are two horses*.[43]

And we can use this to show that (14) is valid. But this does not mean that other instances of (14*) (e.g., (13)) must also be valid, for the results of replacing the italicized 'are two horses' in (14) with most other predicates are not logical truths.

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[42] Although both premises of (15) are true, its conclusion cannot be true (no black horses can include a white horse). It is the same with (16). (17) is also invalid, although its conclusion is true. Its premises do not imply 'There are *three* horses.' (Similarly, the premises of (15) and (16) do not imply 'There are *black* horses' and 'There are *two black* horses', respectively.)

[43] We can use plural logic to show that this is a logical truth. (Its converse is also a logical truth.) See, e.g., Yi (1998) and Yi (1999, p. 188f).

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