Classical Logic
and
Chinese Language Structure

Davide Galante

Is the Classical Logic, with its bivalency, atemporality, connective interdefinability, acceptance of third excluded law, valid for all the languages, or is it worth only inside the Indo-European group which produced it? Given its connection with the language, how much is it influenced from it? In other words, the formal logic is something dealing with the language, or with a language (or group of languages)?

The link between thought and language is something that cannot be left out of consideration; as it is said, with every new language you get a new soul. But do we get a new logic too?

In order to answer our question, we have to compare to a language the most different (structure, grammar, phonetic) from the Indo-European languages which discovered and set the formal logic. As we will see later, the Chinese language is perfect for our purpose, being one of the most representative examples of isolating language.

The Chinese language is one of the Sino-Tibetan languages, together with the Tibeto-Birman, the miao-yao and the Thai: they all are isolating languages (analytical), monosyllabic and tonal.

Their lexical units are invariable (analytic): usually words have no suffix or morphology’s changes. Morphemes are made (there are few exceptions) of one syllabi. Every morpheme is phonetically characterised by a tone, which depends on the variation of intensity and duration: thus we have four tones. The same syllable, pronounced in a different tone, has a different meaning.
Words do not content any specification of number, rarely they explain the kind, there is not grammatical concordance, and verbs do not express the temp and the mode. The only distinction is between .RemoveAll "empty words", which have a grammatical meaning end shizì “full words” which have a semantically, concrete meaning. This distinction reminds us the logical difference between categorematic and syncategorematic words. Talking of “words” is problematic itself, as we don’t find, in the Chinese language, a formal system. Even if nearly all of the morphemes may occur on their own, there are compost words in which is very hard to recognise and separate the basic words. Usually we have a “word” when it’s impossible to add other morphemes in a group of two or more.

Here are shown some kinds of Chinese “words” and the way they come out

Co-ordinates: “father - mother” = parents; “mountain - water” = landscape.
Main Element + a modifier: “fly - machine” = aeroplane
Verb - object: “speak - word” = to talk about something
Verb – complement: “speak – clear” = to explain

Here an example of a Chinese writing:

Chao district city outside have one house two mouth people one piece seven ten more year –y old woman and she son; they house very poor often not have food eat; day day beat firewood sell money get one point rice meat pass life.¹

Which means:

In the Chao district, outside the town, there was (a house=) a family of two persons, an old woman (of) more than seventy years and her son; their house was very poor and often had nothing to eat. Everyday they got firewood and sold it to earn money to buy rice. This way their life passed.

It is the order of the words in the sentence, in Chinese, which characterises them. The context is fundamental for a correct interpretation.

This is why the Chinese language has been considered a language grammar without grammar. It’s not true, as the Chinese language has proper rules; but this is not the place to show them.

Given this short account about the language in exam, let’s start to exam its logic.

1. Connectives in the Chinese Language

1.1 Negative

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Do we find this function in Chinese?

The answer is, of course, yes. Actually, there are at least 18 different ways to express it. But we neither have an “abstract” concept of negation, nor a formalisation. In the few cases in which it has been analysed, it has been treated as an act of judgement. Something dealing more with psychology than logic.

Anyway, the meaning of the negation is the same, although it’s expressed in different ways:

-Bu: denies a verb or a predicate. Usually precedes what modifies. The sentences has, in this case, the following aspect:

S Bu P                                  S= Subject   P= Predicate

-Fei: coming, maybe, from Bu Wei, “not be” denies the whole predicate:

S Fei P ye (grammatical particle)

Es.: Tzu fei wo ye = lit. You not me = you’re not as I am
Es: Fei wu thu ye = lit. Not my disciple = he’s not my disciple

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-Wei: has both a temporal meaning (not yet), and a logical reference (not completely). Wei denies the whole predicate, too.

\( S \, \text{wei} \, P \)

Es.: \textit{wei shan ye} = lit. Not very good = he’s not very good

-Fu: to refuse, to fail.

Much more interesting from a grammar and logical point of view, the negations expressed with Mo e Wu So.

Referred to the subject, Mo means “none”. This particle works like western universal quantification:

Es.: \textit{Min mo gan pu fu} = lit. People none dares not to subdue = no one dares not to submit

Wu Suo is referred to the subject. There’s also the negative verb Wu, “they lack of, there’s none of”

-Fou: works as an independent sentence meaning “this is not the case (of)”. Negates the sentence itself.

There are other ways to make a negation in Chinese. But it’s already clear that the concept of negation is present with the same strength of western logic.

Moreover, in case of multiple negation, as we will see later on, is much more precise. Nevertheless, formalisation is something unknown. Variables made us able to analyse one case for all similar cases; Chinese always applies to one practical case. Here the truth table with the main Chinese negations:

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1.2 Logical product

In Classical Chinese we find particles like “Yu” or “Ji” (with) to connect two words; to connect two sentences they simply put them one after the other, with a simple juxtaposition. “What is important… is that we have direct proof that juxtaposition of terms (or propositions) was consciously felt by the Chinese thinkers as a logical product, as in Kung-sun Lung’s *Pai-ma lun* “White horse is white and horse”.3

1.3 Material implication

In the Classical Chinese, the particle “ce” is used to express “then”. Saying “p ce q” they meant to establish a connection between p and q concerning the world, a coincidence of events. “If you study without thinking, then (ce) you’re lost. If you think without studying, (then, ce) you’re in danger.”4

Using “ce” they wanted to express the co-occurrence of events. It’s always referred to a concrete reality. The implication itself is never taken in consideration, although it is possible to find sentences with implication “if…then”, usually expressed with ju/ruo p, q.

Naturally the concept of implication is included in sentences dealing with the notion of necessity.

There’s also the concept of “in order to”, usually in a negative form (if not-p, not-q):

“If names are not correct, then (ce) speech will not not be in accordance with things. When speech is not in accordance with things, then (ce) tasks are not fulfilled. When tasks are not fulfilled, then (ce) ritual and music will not flourish. When ritual

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and music do not flourish, then (ce) punishments and fines will not be adequate. When punishments and fines are not adequate, then (ce) the people have nowhere to seek refuge”.

Here it’s clear the link between antecedent and consequent, but there’s a lack of a pure logical implication.

It is worthwhile to formalise this passage, in order to show what Chmielewski called “implicit logic”, meaning the logic which, even if not formal, is present in the Chinese Classics.

\[(Np \supset Nq) \cdot (Nq \supset Nr) \cdot (Nr \supset Ns) \cdot (Ns \supset Nt) \cdot (Nt \supset Nu)\]

The conclusion is untold \((Np \supset Nu)\) as it is evident in the reasoning itself.

**1.4 Double negation**

“All that glitters is not gold” (fr.: “Tout ce qui brille n’est pas d’or”. It.: “Non è oro tutto quel che luccica”). This sentence is extremely ambiguous even if no one saying this, means that gold does not glitter. But the logical meaning is the last one! There are a lot of cases in which the common language shows its weakness. Very often, in cases of double negation what is expressed is (logically) the opposite of what is meant: “I ain’t got no money” in English, “on ne la voit nulle part” in French.

For Classical logic, the double negation does not change the truth-value of the starting sentence.

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Horse is not not horse. Chmielewski gave different interpretation of this sentence: “Perhaps the phrase is to be taken

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5 Harbsmeier, pp 115-116.
as an unusual (and in some sense emphatic) statement of the identity of classes covered by the same nominal term, or rather as an application of such a statement to the class covered by the term “horse” […], the phrase can also be conceived in terms of class membership. The problem rises from the ambiguity of the ideogram - ma – which may mean “a horse”, “this horse”, the class “horses”, the idea of “horseness”. However it is interpreted the ideogram, I think that the sentence shows a good use of double negation. Moreover we find: “It is not that I do not keep my faith”, which is clear enough to show that Chinese had and used the double negation.

1.5 Three meanings of “or”

The main problem for Chinese thinkers, was the validity in a dialectic discussion. (bian, “discrimination”). In order to be valid, every dialectic discussion must have a winner. The point of view of Chmielewski is that this “victory” is something objective. Here a quotation from the Mohists.

“It is said: (a) If what is spoken of [by the oppositions] is not similar, it is different. (b) If it is similar, one says [for instance] that it is a puppy, and the other says that it is a dog. (c) If different, one says [for instance] that it is an ox, and the other that it is a horse. (d) If there is not victory in both such cases, it is because there has not been discrimination. (e) As far as discrimination is concerned, the one says that it is-so (shï), the other says that it is-not-so (fei) and the valid [thesis] gets victory.

“Discrimination” is clearly the exclusive function of Classical Logic. But here is a clear difference between (b), where “puppy” and “dog” are compatible, and (c), where “ox” and “horse” are not compatible at all! These two examples, (b) and (c)

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7 Chmielewski, Notes on early chinese logic, part V.
8 Legge, pp.326-327.
10 Chmielewski, Notes on Early Chinese logic, VI.
are chosen in order to show that there is a typical *bian* only if neither both sentences are true, nor both are false. (c) is a clear example of incompatibility (in the modern sense); (b) is not exactly a case of logical sum: in fact there is the case of the falsity of both elements. Anyway, this does not change the fact that Moists had a clear concept of exclusive; but I don’t think they had any notion of the relationship between the principle of non-contradiction and third excluded law.

Two more quotations: “As for Discrimination: one says that it is an ox, the other says that it is not an ox: this is contesting the *That*; these (two *Thats*) are not both valid; since they are not both valid, one necessarily is not valid.” 11 “Every ox is distinct from what is not-ox; there is no way to deny that these (ox and not-ox) are two (separate kinds).” 12 Thus, we find the two concepts of non-contradiction and third excluded law and there is no need for a formalisation. Moreover, the formalisation would clearly show the link between them: a link not grasped by Chinese people. And that is why the two laws were not distinct.

Now, let’s go back to the three meanings of “or”

In the Classical Chinese, there is only one particle: “Yi”, 13 with an “alternative” meaning. Surprisingly, it is never used in declarative sentences. This, of course, does not mean that there was a lack of such important logical concept. Disjunction can be obtained from negation and implication: this is how exclusive was used in ancient China. A declarative sentence had the shape: if not-\(p\), then \(q\):

\[
Np \supset q \quad \text{or} \quad Nq \supset p
\]

There is something important to be noted: with this kind of sentence they wanted to say that, given \(p\) and \(q\), the existence of

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13 Occasionally, to mean our “or” Chinese use *ruo* or *huo*. 
one excluded the other. But the logical meaning is not the same, being the matrix of \( p \supset q \):

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Which is the matrix of \( p \lor q \)

In the same way, the matrix of \( \neg q \supset p \)

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Is the matrix of the connective in an inclusive meaning.

“Logically” speaking, they had no “exclusive”: but, actually, it is the only meaning of “or” they use: in fact we have no corresponding to “aut”, “vel” e “incompatible with”. Nevertheless, there is the most common use of “or”:

“To wish something to live and (at the same time) to wish it to die, is confused (huo)”.14 Clearly here is assumed the equivalence “death = not life”.

“Mohist argument are self-contradictory. On the one hand the Mohists place light emphasis on burial, but on the other they honour the ghosts of the deceased”.

“Incompatible things do non exist. For instance, to reward those who kill their enemies in battle, and at the same time to

esteem deeds of mercy and generosity; to reward with ranks and
ounties those who capture enemy cities and at the same time to
believe in the theory of impartial law “.

2. Logic of predicate

2.1 Constants and Variables

Now I’m going to analyze the Logic of predicates in
Chinese thinkers. The first important thing to point out, is that we
don’t find, in Chinese Classics, variables in the way Classical
Logic uses them; but Harbsmeier think that “mou”, a word used by
the later Mohists has a meaning quite similar to our “variable”. “In
cases of naming on the basis of shape and characteristics, we
neccessarely know that this thing is X (mou), only then do we know
X (mou). In cases where naming cannot be on the basis of shape
and characteristics, we may know X (mou), even if we do not
know that this thing is X (mou). Personally speaking, I think that,
from this quotation, it is quite hard to jump to a conclusion. It is of
course possible to use the variables of Classical Logic to obtain a
formalization of Chinese

2.2 Quantifiers

Using S to denote a Subject, and P for a Predicate, this is the
way Aristotle classified relations between Subject and Predicate:

Every S is P (= PaS)
No S is P (= PeS)
Some S is P (= PiS)
Some S is not P (= PoS)

In Chinese:

PaS = S jie P ye
PeS = S mo P ye
Thus, it is possible to express all the four kinds of relations in Classical Chinese (this makes possible every kind of syllogism: see 2.5 below). Moreover, Chinese shows:

Fan= “Every”, referred only to the object
Bian= “Every”, referred only to the object.
Jin= “None is not like”, referred to the object, unless the object cannot be quantified; in few cases, when no object is in the sentence, it refers to the subject.

What I think is very interesting about quantifiers, is that it is common them to be expressed with periphrasis: “mo pu” (none not), “mo fei” (none is not), “wu pu” (there’s none that not), “wu fei” (there’s non which is not). Among these, only wu pu may refer to the object; the others refer to the subject.16

The quantifier of existence is placed between the subject it refers to, and the verb; thus the sentence has the following structure:

S “huo” V O (= Some S V O). When it refers to the object, we find this structure:
S “yu so” V O (= S V some O).

2.3 First-order Predicate Logic

Being clear that Chinese thinkers never used variables and quantifiers themselves were never considered as formal object, it easy to find applications of predicate logic.

The following are some relations between quantifiers:

\[ Zx(\varphi x) \equiv [\Sigma x (\varphi x)]' \equiv \Pi x (\varphi 'x) \]

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16 Mo cannot precede the name while Zhu “all (member of a class)”, Zhong “the whole crowd of and Gun “the whole group” precede it.
Being $Z$ the “Zero quantifier” (None), $\Sigma$ the “Existence quantifier” (there is at least one), and $\Pi$ the “Universal quantifier” (Every).

The Chinese sentence “Among theme, there is no one who does not respect them”\(^{17}\) (= Everyone respects them), is easy to formalize with the use of quantifiers:

$$\Pi \forall x x = \Pi \forall x x$$

The following quotation, is one of the most famous examples of Chinese Logic. I’m going to follow Chiemlewski’s theory, which points out the logical structures of Chinese.\(^{18}\).

“In Ch’u there was a man selling shields and spears; he praised (his shields) saying: “(My) shields are so strong that nothing can pierce them”. And again he praised his spears saying: “My spears are so sharp that there is nothing they do not pierce”. Somebody asked him: “How about your spear piercing your shield?” The man was not able to reply. Now, a shield which cannot be pierced and a spear for which there is nothing it does not pierce cannot stand at the same time”.

Calling:

A= The class of spears
B= The class of shields
R= relation “to pierce”

The first statement can be formalized:

$$\Sigma y_{\in B} \left[ \Sigma (x R y) \right]$$

While the seconds becomes:

$$\Sigma y_{\in A} \left[ \Sigma (x R y) \right]$$

Thus, the conjunction of the two is:

\(^{17}\) Also: $\neg (\exists x): \neg \forall x (\exists y R x)$

\(^{18}\) See Malatesta, Classical Logic as a Formal Transcultural Language. The Case of Tonal Languages: Chinese.
Chiemlewski goes on: “Transforming both members of the conjunction according to De Morgan’s rules for quantifiers and putting the second member in place of the first and vice versa, we get a slightly clearer formula”:

\[ \sum_{y \in Y} \left[ \sum_{x \in X} \left( x \mathcal{R} y \right) \right] \cdot \sum_{y \in Y} \left[ \sum_{x \in X} \left( x \mathcal{R} y \right) \right] \]

Let a be such an x which stands in the second member of the conjunction, and b as an y of the second member:

\((a \mathcal{R} b). (a \mathcal{R} b)\)’

This is a case of

\[ \sum_{y} \left( x \mathcal{R} y \right) \left( x \mathcal{R} y \right) \]’

This formula is incompatible with the law of non-contradiction.

Chiemlewski goes further, and demonstrates that the two sentences “(My) shields are so strong that nothing can pierce them” and “My spears are so sharp that there is nothing they do not pierce”, can not stand at the same time, the one implying the contrary of the other.

(1) \( \sum_{x \in X} \left( y \mathcal{P} (x \mathcal{R} y) \right) ‘ \supset \sum_{y \in Y} \left( x \mathcal{P} (x \mathcal{R} y) \right) ‘ \)

According to the rules for the order of operators

(2) \( \sum_{x \in X} \left( x \mathcal{P} (x \mathcal{R} y) \right) ‘ \supset \prod_{x \in X} \left( x \mathcal{P} (x \mathcal{R} y) \right) ‘ \)

The same for the first member

(3) \( \sum_{x \in X} \left( x \mathcal{P} (x \mathcal{R} y) \right) ‘ \supset \prod_{x \in X} \left( x \mathcal{P} (x \mathcal{R} y) \right) ‘ \supset \prod_{x \in X} \left( x \mathcal{P} (x \mathcal{R} y) \right) ‘ \)
The law of transitivity of the implication, allows us to write (from 1,2,and 3)

\[ \sum_{y \in B} \Pi(xRy) \supset \Pi \sum_{x \in A} x \sum_{y \in B} y \sum_{x \in A} x \sum_{y \in B} y \]

The implicate being, according to De Morgan’s rules

\[ \Pi \sum_{x \in A} (xRy) = \sum_{x \in A} \Pi(xRy) \]

By simple substitution of equivalent terms, we obtain:

\[ \sum_{y \in B} \Pi(xRy) \supset \sum_{x \in A} \Pi(xRy) \]

This way, he demonstrates that “there are some shields which nothing can pierce”, although neither constituting a direct negation of “there are some spears which pierce everything, nor being equivalent to such a negation, actually implies the negation of the first factor”

2.4 Second order Predicate Logic

Here’s an example of second order predicate logic:

“King Wen’s grandson in nothing does not adhere to the model”\(^\text{19}\)

So “It is not that: there is a function \( \varphi \) such that King Wen’s grandson \( \varphi \)-ies and King Wen’s grandson does not adhere to the model (\( \psi \))”

\[ \sum_{\vartheta} (\varphi a \cdot \psi') \]

i.e. \( \Pi(\vartheta a \sum \psi a) \)

Using second order predicates logic, we can obtain a formalization of the case of contradiction showed on the first chapter:

\(^{19}\) Incription, XI sec. a C.
“To wish something to live and (at the same time) to wish it to die, is confused (huo)” Lun Yu.\textsuperscript{20}

Let $\varphi$ stand for “live”, we obtain

$$Z \frac{\neg \varphi \land \neg (\neg \varphi')} 0$$

\textbf{2.5 Syllogism}

Harbsmeier\textsuperscript{21} shows a quote from Wang Chung (27- 100 d.C.)

“The books pof Literati relate that the Prince of Huai-Nan in his study of Taoism assembled all the Taoists of the Empire, and humbled the grandeur of a princedom before the expositors of Taoist lore. Consequently, Taoist scholars flocked to Huai-Nan and vied with each other in exhibiting strange tricks and all kinds of miracles. Then the prince attained to Tao and rose to heaven with his whole household. His domestic animals became geniuses too. His dogs barked up in the sky, and the cocks crowded in the clouds. That means that there was such plenty of the drug of immortality, that dogs and cocks could eat for it, and follow the prince to Heaven. All who have a fad for Taoism and would learn the art of immortality believe in this story, but it is not true.”

Man is a living creature. His rank may be evere so high, even princely or royal, his nature cannot be different from that of other creatures. There is not creature but dies. How could man become an immortal? Birds, with feathers and wings can fly. But how could they rise to heaven? How should man without feathes and plumes be able to fly and rise? Were he feathered and winged, he would only be equal to birds, but he is not; how then should he ascend to heaven?\textsuperscript{22}

Harbsmeier finds here a clear example of syllogism:
All men are creatures
All creatures are mortal
Then: all men are mortal.

This is a clear example of Barbara syllogism: A a B, B a C, A a C. There is a lack of formalization, but there is the same a development of reasoning, starting from two premises, and finishing with a conclusion.

I find very interesting the last part of the quotation: if $x = \text{(birds)}$ that has feathers and wings; $y = \text{man}$; $\psi = \text{to fly}$; $\varphi = \text{rise to Heaven}$

$$\Pi_x (\psi x) \quad \Pi_y (\varphi y)$$

There is a reductio ad absurdum

Even if $x = y$ (absurd), what is obtained is (by substitution of equal terms):

$$\Pi_y (\psi y) \quad \Pi_y (\varphi y)$$

Even if men and birds were the same, this is not enough.

Another quotation:

Liang Chhiu-Wei said to: “I will never reach youe level of attainments until I die!”. Yen-Tzu answered: “I have heard it said that “in action those who persevere succeed. In walking those who persevere arrive.” I am no different from other men. I persevere in my actions and do not let up. I persevere on my path and do not rest. There’s nothing hard about it”.24

The structure is:

23 To be precise, the formalization should be done using the theory of classes, but I think it can be avoided in this case.
Those who persevere, arrive
I persevere
Then: I arrive

All this shows not only the Aristotelian structures of though, but also structures which derive from them with the introduction of individuals and personal pronouns. The last example includes a singular term: so this cannot be considered a pure syllogism; but the aim was to show the correctness of the way of reasoning.

2.6 Sorites

About implication, I quoted a chain reasoning by Confucius (‘If names are not correct, then (ce) speech will not not be in accordance with things. When speech is not in accordance with things, then (ce) tasks are not fulfilled. When tasks are not fulfilled, then (ce) ritual and music will not flourish. When ritual and music do not flourish, then (ce) punishments and fines will not be adequate. When punishments and fines are not adequate, then (ce) the people have nowhere to seek refuge’, which is one of the most common kind of chain reasoning in Chinese. P. Masson-Oursel looks at it as a sorite (among them, he defines “progressive”, “regressive” and “mixed” sorites).

Here’s another example ($\alpha$):

“If one repeatedly agglomerates one’s Virtue, there is nothing one cannot overcome; if there is nothing one cannot overcome, one knows no bounds; if one knows no bounds, one is able to keep the kingdom.”

In this quotation, there is the particle “ce”, which we said is equivalent to our implication (if...then). Thus, we can symbolize the quotation, as the logical product of three implications:

\[(p \text{ ce } q) \ (q \text{ ce } r) \ . \ (r \text{ ce } s)\]  and then \[(p \supseteq q) \ . \ (q \supseteq r) \ . \ (r \supseteq s)\]

By the law of transitivity of implication:

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[\(p \supset q\) . \((q \supset r)\) . \((r \supset s)\)] \(\supset\) \((p \supset s)\)

(It has to be noticed that the conclusion is never expressed in Chinese, probably because it is given as clear and evident on its own.) The last formula is a tautology. Notice that the sentences constituting the first part of it are quite vague about truth, although it does not change the logical validity.

It is common to find chain-reasoning in which the order of premises is inverse (\(\beta\)):

(1) In order to obtain a kingdom there is a way;
(2) If one obtains the people, one obtains the kingdom;
(3) In order to obtain the people, there is a way;
(4) If one obtains the hearts of the people, one obtains the people
(5) In order to obtain the hearts of the people, there is a way;
(6) If one collects for the people what they like and does not impose on them what they dislike, [one obtains the hearts of the people].

The difference with the previous chain-reasoning is clear: first of all, only sentences (2)-(4)-(6) constitute the reasoning, being (1)-(3)-(5) of no use. The second difference is that in (\(\alpha\)) we had a kind of chain \((p \supset q) \cdot (q \supset r) \cdot (r \supset s)\), while now (\(\beta\)) the structure is \((r \supset s) \cdot (q \supset r) \cdot (p \supset q)\). Here is the lack of the final part of reasoning too. The logical structure is:

\[
[(r \supset s) \cdot (q \supset r) \cdot (p \supset q)] \supset (p \supset s)
\]

which, by the law of commutative property, is correct. There are also “double” chain reasoning (\(\gamma\)):

(1) If one is easy, one is easy to know;
(2) If one is simple, one is easy to follow;
(3) If one is easy to know, one has affection;
(4) If one is easy to follow, one has efficacy;
(5) If one has affection, one can last for long;
(6) If one has efficacy, one can attain greatness;
(7) If one can last for long, one has the virtue of the sage;
(8) If one can attain greatness, one has the activity of the sage.

There are two different chains: (1)-(3)-(5)-(7) and (2)-(4)-(6)-(8): and so: \([p \rightarrow q], (q \rightarrow r), (r \rightarrow s_1), (s_1 \rightarrow t_1) \supset (p \rightarrow t_1)\) and \([p_2 \rightarrow q_2], (q_2 \rightarrow r_2), (r_2 \rightarrow s_2), (s_2 \rightarrow t_2) \supset (p_2 \rightarrow t_2)\). We can write: \((p_1 \rightarrow q_1) \cdot (p_2 \rightarrow q_2) \cdot (q_1 \rightarrow r_1) \cdot (q_2 \rightarrow r_2) \cdot (r_1 \rightarrow s_1) \cdot (r_2 \rightarrow s_2) \cdot (s_1 \rightarrow t_1) \cdot (s_2 \rightarrow t_2)\). As the purpose was clearly to demonstrate that \((p_1 \cdot p_2 \equiv t_1 \cdot t_2)\), here is a correct, but maybe unconscious) use of the derivational law:

\[\ [(p \rightarrow q) \cdot (r \rightarrow s) \supset (p \cdot r \rightarrow q \cdot s)\]

Which is nothing but the Leibniz’s Praeclarum Theorema.

3. Logic of classes

3.1 Classes

As seen in the previous chapters, Classical Chines allows us to talk about both enunciative and predicate’s Logic. In this chapter I’m going to look for a logic of classes in Chinese thinkers.

3.2 Class concept in Chinese thinking

According to Graham Chinese thinkers did not have any notion of class; another point of view is Chmielewski’s, who finds it out of the White horse Paradox.

What is certain is that we never find a notion or definition of class. This does not mean that there’s a lack of focus to this aspect of, I could say, reality.

27 Chmielewski. Notes on Early Chinese Logic, parte II.
28 Graham [1965], “Two Dialogues in the Kung-sun Lung-Tzu”, in Asia Major II, 2, pag. 128-152.
The main concept if speaking of an (eventual) theory of classes is the one of lei, which can be translated with “kind”. Fei lei, on the other hand, means “not similar”. Lei is mainly used in biologic classification: “Tigers and men belong to different lei"[Chuang tzu]. From this meaning, it shifted to “similarity”:

“All things of the same category are similar”

Then lei was used not only for natural things, but also for “artificial” things, categories we would say: similar things (from a point view), belong to the same lei.

I think that it is correct to talk about a Chinese theory of classes, although it is not the mathematical theory of Western Philosophy. And it is not a case that the concept of “property” itself, which is essential in a theory of classes, as a semantic corresponding in the Chinese language. Chinese thinkers lacked of abstraction. Nevertheless there are various words denoting the concept of property: xing (nature), mao (exterior shape) zhuang (shape, visual form), and many others which may be translated with “quality”. The lack of a standard word does not support the lack of the concept: Harbsmeier reminds us of the fact that mandarin Chinese, the pronouns “he” and “she” are exactly the same and no one suppose that they do not know the difference between male and female genders.

Chmielewski supposes that there is a correct application of the theory of classes in the white horse dialogue.

3.3 White horse paradox

One of the most discussed dialogues of Chinese thought is the White Horse Paradox. This dialogue has been approached in

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29 The concept of gendre is still far from a biological classification.
There is also a lack of grammatical number; this function is made by ordinal numbers. A latin speaker would say: “unus homo”, “tres homines”. A Chinese says: “one man”, “three man”.
different ways, with different theories: platonic ideas, concept of universals and particulars, application of classes’ Logic to quote the most used. Of course it has also been considered a simple sophism, with no connection with Logic. The paradox, in his simplest form says: “White horse is not horse”, which may be interpreted in many different ways. It is the ambiguity of Chinese language that allows this paradox to rise: Chinese “ma” in fact, means “horse”, but also “horseness”, or “The Idea of horse”. And “fei” is ambiguous as well, meaning “is not”, but also “is not the same of”. This vagueness, for a logician is fundamental: “A white horse is not a horse” is clearly different from “The idea of white horse is not a horse”: but both translations are correct!

The idea that Chinese thinkers had a mature conception of “universal” is supported by another part of, third chapter:

There are no things (in the world) that are without zhi, but these zhi are without zhi (i.e. they cannot be analysed further or split up into other zhi).
If the worlds had no zhi, things could not be called things (because they would have manifested attributes).
If, there being no zhi, the world had no things, could one speak of zhi? Zhi do not exist in the world. Things do exist in the world. It is impossible to consider what does exist in the world to be (the same as) what does not exist in the world. In the world there exist (materially) no zhi, and things cannot be called zhi. If they cannot be called zhi, there are not (themselves) zhi.
There are no (materially existing) zhi, (and yet it has been stated above) there are no things that are without zhi. That there are no zhi (materially existing) in the world, and that things cannot be called zhi, does not mean that there are no zhi, because there are no things that have not zhi.
That there are no zhi existing in the world (in time and space), arises from the fact that all things have their own names, but these are not themselves zhi (because they are individual names, not universals).
Zhi, moreover, are what are held in common in the world (because they are manifested in all members of the relevant class).
No zhi exist in the world (in time and space), but no things can be said to be without zhi (because every individual thing manifests an assortment of various universal qualities).  

This document is crucial to our investigation, showing the existence of what Western philosophy called “universalia”. But there is something more in these lines: the concept of “property” arises too. Zhi are qualities of existing objects, and cannot be split away from them. Nothing is without zhi; a zhi is unsplittable, as the atom. Zhi define things: without zhi, we could not call anything. “No zhi exist in the world. Things exist in the world”; it makes me think of Platonic Ideas. Without analyzing deeply the quotation, it is clear that there is a mature concept. Looks like we have all the main tools in order to analyze the White Horse Dialogue.

3.4 The dialogue

The dialogue starts with the master saying that a white horse is not a horse; the pupil rises up various objections, never left unanswered. Here the dialogue, taken in his English translation from Harbsmeier.

A: Is it admissible that “a white horse is not a horse”?  
B: It is admissible.  
A: Why should this be so?  
B: “Horse” is that by which we name the shape. “White” is that by which we name the colour. Naming the colour is not (the same as) naming the shape. Therefore I say “white horse is not (the same as) horse”.  
A: But if one has a white horse one cannot be said not to have a horse; and if one cannot be said not to have a horse, how can (what one has) not be a horse? (In other words) if having a white

31 Harbsmeier, p. 186.
horse counts as having a horse, why should the white one not be a horse?

B: If someone is looking for a horse, you can offer him a brown or a black horse. If (on the other hand) he is looking for a white horse, you cannot offer him a brown or a black horse. Supposing (now) that “white horse” was nothing other than “horse”. Then what he would be looking for would be the same thing. And if what he is looking for was the same thing, then the white one would not be different from “a horse”. But if what he is looking for (in those two cases of “white horse” versus “horse”) was the same, why should it be that the brown and the black horses were acceptable in one case but not in the other? It is evident that the admissible and the inadmissible are not the same as each other. Therefore, since a black or brown horse remains the same but since one can answer that there is a “horse” and cannot answer that there is a white horse”, this means that the thesis that a white horse is not a horse is conclusively true.

A: You are considering a horse that has a colour not to be a horse. But it is not the case that there are colourless horses in the world. Then (by your argument) there would be no horses in the world. Is that admissible?

B: Horses certainly have colour. That is why there are white horses. If horses had no colour, there would (only) be horses plain and simple. How could one pick out white horses? Therefore “white” is not the same as “horse”. “White horse” is “horse” combined with “white”. But “horse” combined with “white” is not (he same of) “horse” Therefore I maintain: “a white horse” is not “horse”

A: If “horse” not yet in combination with “white” counts as “horse”, and “white” not yet in combination with “horse” counts as “white”, then when we put together “white” and “horse” to make a combined term “white horse”, we give names that are out of combination to things that are in combination, and that is not quite admissible. Therefore I say that “a white horse is not a horse” is not quite admissible.
B: Since you consider “having a white horse” is “having a horse”, does this mean that “having a horse” counts as “having a brown horse”? Is that admissible?
A: It is not quite admissible.
B: When you make a distinction between “having a horse” and “having a brown horse”, you are making a distinction between “brown horse” and “horse”. Since you make a distinction between “brown horse” and “horse”, then “brown horse” must count as not being (the same as) “horse”. To consider “brown horse” as not (the same as) “horse” and to consider that in the case of “white horse” you have (the same as) a “horse”, that is (like saying) “flying things move in a pond, inner and outer coffins change places”. These are the most contradictory words and the most confused formulations.

“If one has a white horse, one cannot be said not to have a horse” means that one separates off the “white”. If the white is not separated off, then having a white horse one cannot be said to have a horse. Therefore, as regards the reason why one counts as having a horse, it is exclusively because (of) the word “horse” that one counts as having a horse. It is not because of (the expression) “white horse” that one counts as having a horse. Therefore “counting as having a horse” cannot refer to any (particular) sort of horse.

“White” does not fix that which it declares white. That which it declares white may be left out of account. In “white horse”, when one says “white”, one fixes what one declares white. That which fixes what one declares white is not (the same as) the “white”. “Horse” does not reject or pick out with respect to the colour. That is why one can come up with a brown or black horse (when asked to point out a horse). White horse” does reject and pick out with respect to the colour. Brown and black horses are all rejected on the grounds of the colour. Therefore one can only come up with white horses (when asked to point out a white horse).
Now, that which rejects something is not (the same as) that which does not reject it. That’s why I say “a white horse” is not “a horse”.

From a logical point of view, it is the second objection that has a great relevance: the master points out that looking for a white horse is different from looking for a horse. This, as Harbsmeier\(^\text{32}\) writes, shifts the point of view: the difference between “looking for” and “having” creates a transition from an extensional context to a intentional one (being the intention a “concept”, where the extension is made of existing objects).

The following objection allows the master to show that “white horse” is “white” + “horse”, which is different from “horse”. Picking a white horse means that white horse and horse are not the same thing. At this point there is one more objection which is not dealing with the common sense. Once joined, “white” and “horse” do not have the same reference: “White” in “white horse”, does not refer to any white object, but only to those which are, at the same time horses. The same in the case of “horse”. This means that one cannot look at “white horse” as a sum of all horses plus all white objects because this would transform all white things and all horses in “white horses”\(^\text{33}\). We are getting closer to an interpretation dealing with the logical concept of class. The master uses what had been an objection, taking advantage from the fact that having a white horse implies having a horse, whereas having a horse does not implies having a white one.

3.5 Considerations

Hu Shih thinks that the dialogue shows that Gongsong Long discovered qualities (whiteness and horseness in our case). Feng holds the point of which sees in the ideograms “ma” and “bai ma” the Universals “whiteness” and “white horse” (“fei”, in this case,


\(^{33}\) Cfr. Needham (Harbsmeier) [1998], *Scienze and Civilization in China*, vol. VII
would take the meaning “is not the same as”. Graham thinks that all this only shows that “whiteness is not horse”.

I think that the most interesting point of view is Chmielewski’s, who uses the logic of classes to explain the dialogue. Here’s is point of view:

(1) Horse has not the property of rejecting-selecting colour
(2) White horse has the property of rejecting-selecting colour
(3) What has not the property of rejecting-selecting the colour is not what has the property of rejecting-selecting the colour
(4) White horse is not horse

Let A and B stand for “Class horse”, “class white horse” and Φ for “has the property of rejecting-selecting the colour”

(1) Φ’A
(2) Φ B
(3) (X)Φ’X.(X)ΦX=0
(4) A≠B

In the logic of classes it is absolutely correct, being a case of:

Σφ(Φ’A · ΦB) ⊃ (A ≠ B)

There is another clear example:
(1) Horse is what commands shape (and only shape)
(2) White is what commands colour (and only colour)
(3) What commands colour (and only colour) is not what commands shape (and only shape)
(4) White horse is not horse

Let A be "Class horse”, B be “class white (objects)”, Φ be “commands shape (and only shape)” and Ψ be “commands colour (and only colour)”:

(1) ΦA
Also this part is considered valid: Chmielewski finds here a particular case of:

\[\sum_{\Phi \cdot \Psi} (\Phi A \cdot \Psi B) \cdot [(X) \Psi X \cdot (X) \Phi X = 0] \supset (B \cdot A \neq A)\]

In other words, the interception of two classes, A and B is different from both of them.

4. Conclusion

In his Aspects of Chinese Sociolinguistics (Stanford University Press, Standford) dated 1976, the linguist and mathematical Y. R. Chao wrote that looking for Chinese Logic could have meant looking for “how logic operates in Chinese”. I think Chao had a great intuition, which today many researchers share: Harbsmeier, in the first pages of his Science and Civilization in China, vol. VII part 1 nearly apologizes for the fact that the conclusion of his work is going to be the same feared by Chao.

It is impossible to deny the transculturality of Logic.\textsuperscript{34} I totally agree with Chmielewski’s symbolization, his way of finding out of the White Horse Paradox the logic of classes.

The important difference between Indo-European and Chinese Logic is that the last one is a kind of “practical” logic, dealing with everyday’s life, a kind of “popular wisdom” which does not allow to undervalue it: I tried to demonstrate that it is a syllogism is possible without variables; that the lack of a notion of “property” does not cut out the classification itself (and, consequently, a logic of Classes); that even without a specific

\textsuperscript{34} Cfr. Malatesta, Classical Logic as a Formal Transcultural Language. The Case of Tonal Languages: Chinese.
grammatical particle standing for “or…or…” it is possible to express the exclusive. There’s nothing which the Chinese language cannot express.

There is no doubt that western thinkers have always and in a better point of view: variables, symbolization, formalization\textsuperscript{35}, axiomatic theory, have been important notions which made it possible to set, one for all, the logical relations, undependently from the context. Chinese never did that. But the lack of symbolization does not implies a lack of logical structures, easy to find when looked for them. The application of Classical Logic to Chinese classics comes easy, it is not forced at all. There is no reason to put join two things that are separate just in order to reach a purpose.

I hope I have showed, in this work, a comprehensive view on basic concept and functions of Classical Logic in the Chinese writers (and language). I have tried not to force the quotations in order to get what I was looking for, making, at the same time, myself sure not to violate the rigour of Classical logic.

No one, I suppose, would dare to say that maths is not transcultural for the difference in writing the numbers in different civilizations. The same, I think, is true for what concerns Logic: there’s one Logic, expressed in different ways. Although grammatical structures may vary (that’s why I compared to Chinese Language, cfr. introduction) Logic itself looks exactly the same.

REFERENCES


\textsuperscript{35} Briefly, I remind the reader that symbolization is only one more condition for a higher level of formalization. See Agazzi [1961] Introduzione ai Problemi dell’Assiomatica, milano, Vita e Pensiero.


MALATESTA, M. *Classical Logic as a Formal Transcultural System. The Case of Tonal Languages: Chinese in Advances in Artificial Intelligence and Engineering Cybernetics*, Proceedings of the 11th International


