Preverbal Number Phrases in Mandarin and the Scalar Reasoning of *jiu*

Cheng-Yu Edwin Tsai

1. Introduction

The distribution of number expressions (e.g. *sange ren* 'three people') in Mandarin is subject to certain restrictions. Preverbal existential/indefinite number expressions in episodic contexts generally require the co-occurrence of the existential verb *you* 'have,' as in (1), whereas preverbal definite number expressions demand the presence of the universal-like operator *dou* (Li, 1998; Cheng, 2009), as in (2).

(1) *(You) [sange ren]   lai   le.
     have three   person come ASP
     'Three people came.'   (Indefinite; *you* 'have' is obligatory)

(2) [Sange ren]   *(dou) lai   le.
     three   person DOU come ASP
     'The three people (all) came.'   (Definite; *dou* 'all' is obligatory)

Li (1998), however, observes that there is a set of exceptional data, where a number expression can serve as subject without the accompany of *you* or *dou*, such as those similar to (3)–(5) below.[1]

(3) [Liangge laoshi] jiu ba naxie xiaohai kongzhi-zhu le.
     two   teacher JIU BA those children control-hold ASP
     'Two teachers (sufficed to have) held controlled over those kids.'

(4) [Sange baomu]   jiu zhaogu yige xiaohai.
     three   babysitter JIU care   one child
     'Three babysitters took care of only one child.'

(5) [Wuge xiaohai] chi-de-wan   shi-wan fan.
     five   child   eat-MOD-finish ten-bowl rice
     'Five children can finish ten bowls of rice.'

These number expressions, according to Li, denote "quantities" and lack a D-head that requires syntactic licensing, hence exempt from the restrictions seen in (1) and (2).

This paper reassesses the data and analysis discussed by Li and suggests that what "licenses" a preverbal number expression in Mandarin is instead the particle *jiu*, the function of which is to underlie a "nested modal structure" that involves the complex operator ONLY HAVE-TO, one that is both scalar and modal. This proposal contrasts with Li's (1998) in attributing the interpretation of the number expressions in (3)–(5) to an (implicit) *clausal* element and making no reference whatsoever to their NP-internal structure.

The organization goes as follows. §2 reevaluates the treatment of number expressions by Li (1998) and addresses its weaknesses. In §3 I propose an analysis for each of (3)–(5) arguing that they are all inherently conditional constructions. §4 concludes this paper.

[1] Minimal adjustments are made on Li's original data for expository purposes.

2. A reassessment of Li (1998)

2.1. Two nominal structures

Li (1998) argues that what the subject number expressions in (3)–(5) share in common is the "quantity-denoting" interpretation, as opposed to the "individual-denoting" property of those in (1)/(2). For instance, the subject in (3) concerns the number of teachers (who held control over those kids) rather than the reference to any existing individuals. Li maintains that the difference in interpretation results from the difference in syntactic structure: indefinite individual-denoting expressions are DPs bearing a null D, as in (6a), whereas quantity-denoting ones are NumPs born without D at all, as in (6b).

(6) a. [$_{DP}$ D [$_{NumP}$ sange xuesheng]]
                     three student

    b. [$_{NumP}$ sange xuesheng]
                 three student

Such distinction in nominal structure, Li suggests, explains the restricted distribution of Mandarin number expressions. An empty category, such as a null D, requires proper government (Longobardi, 1994); indefinite DPs may therefore appear in properly governed positions, e.g. those in (1)/(2), but not subject or topic positions because the latter are not lexically governed in Mandarin (Aoun et al., 1987). NumP, on the other hand, can occur in any position.

Li proposes three arguments to support the DP vs. NumP dichotomy, two of which are reproduced below. First, only DPs, but not (D-less) NumPs, can occur with operators ranging over individuals. Thus, (7), unlike (4), is ungrammatical due to the incompatibility of *you* 'have' (which asserts the existence of individuals) and the quantity-denoting expression 'three babysitters.'

(7) * You [sange baomu]   jiu zhaogu yige xiaohai.
          have three   babysitter ᴊɪᴜ care   one   child

Second, a DP can enter into a coreferential relation with and bind a following nominal, while a D-less NumP cannot due to the absence of D, as evidenced by the pair in (8).

(8) a. [Sange ren]$_i$ tai-bu-dong   zhejia gangqin. *Tamen$_i$-de liliang   tai xiao.
         three   person lift-not-move this   piano   they-ᴘᴏss   strength too small
         'Three people cannot lift up this piano. Their strength is too weak.'

    b. You [sange ren]$_i$ hui lai.   Tamen$_i$ hai hui dai   liwu   lai.
         have three   person will come they   still will bring present come
         'There are three people coming and they will bring presents.'

2.2. Problems

One major problem of Li's (1998) account is that the observed data do not directly support (6). If the two nominal structures do exist which carry different semantic properties ("quantity-" vs. "individual-denoting"), one should be able to detect ambiguity in *every* sentence where a number phrase appears in a governed position. The reason is that, while a DP containing a null D must be properly governed, a NumP need not be *but can be*; the latter has free distribution, as Li claims. It then follows that a number expression in a (governed) object position should always give rise to two interpretations: "individual," if it contains an empty D, and "quantity," if otherwise. There is nothing in Li's (1998) analysis that bars a quantity-denoting NumP from occurring in a governed position.

But the data cited in Li's work do not demonstrate such ambiguity. In every example, the relevant number expression is either individual-denoting or quantity-denoting, but never *both*. Li states that (1), for instance, must be interpreted as individual-denoting because *you* assert the existence of individuals. But this simply means there is no way to tell whether any given number phrase is a DP or NumP in the presence of some interacting operator; it is just as fair (and, in fact, more desirable) to say that *it is the associated operator that derives the interpretation of a number expression, regardless of the internal structure of the latter*. All the data reported by Li indeed appear to support this view: whenever a number

phrase gets interpreted in one way or another, there is always an accompanying *clausal* element (*you*, *dou*, *jiu*, or the infixal modal *-de-*) which gives rise to one perceived reading while barring the other. Li's first argument based on co-occurring operators turns out to be strong support for a very different approach in which the nominal structure plays no role at all.

In addition, whether a "NumP" does exist that bears different coreferential/binding properties from a "DP" is unclear. The first clause in (9) is identical to (4), which Li takes to instantiate a NumP in the subject position. However, this NumP can bind a following pronoun in the second clause, thus falsifying the claim that a NumP cannot be coreferential with/bind a following nominal.

(9)   [Sange baomu]$_i$ jiu zhaogu yige xiaohai. Tamen$_i$ zenme bu duo   zuo yidian shi?
      three   babysitter JIU care   one child   they   how   not more do   some thing
      'Three babysitters$_i$ took care of only one child. Why don't they$_i$ do some more?'

At this point, the "quantity-denoting" interpretation has become an obscure semantic notion. What does it mean for a number phrase to denote just quantities but not individuals? How can a number phrase denote individuals while excluding a quantity interpretation? If a NumP does not contain an empty D and is inherently quantity-denoting, why can't it serve as a quantity-denoting subject of an episodic sentence? That is, why is (1) not a grammatical, quantity-denoting sentence when without *you*?

3. Proposal

It seems more plausible, from the above discussion, to pursue a different analysis that attributes the alleged "individual" vs. "quantity" readings of number phrases to the operators outside of the nominal domain. I propose that it is a (scalar) modal operator in the exceptional paradigm exemplified by (3)–(5) that leads to the so-called "quantity" interpretation, which, under my proposal, is actually the intensional interpretation of nominals in modal/conditional contexts.

3.1. The semantics of jiu: Scalarity and modality

I argue that the preverbal particle *jiu* is the source of the "quantity" reading in (3)/(4).[2] In particular, *jiu* is indicative of an implicit complex operator, which I dub ONLY HAVE-TO. It should be regarded as maximally similar to a circumstantial necessity modal except that it involves the additional scalar ONLY component, which one can safely take to have the same semantics as English *only*.

For reasons to be made clear shortly, I will distinguish two different but related types of *jiu*: *jiu$_1$* is a marker of ONLY HAVE-TO and is the *jiu* seen in (3), whereas *jiu$_2$* is itself the ONLY HAVE-TO operator and is the one seen in (4). As these two instances of *jiu* are distinct syntactically, they interact with focus expressions in distinct syntactic positions.

3.2. The syntax-semantics mapping of jiu$_1$

I propose that (3), repeated below as (10a), has the LF in (10b) and basic conditional semantics in (10c), where *NEC* is a goal-oriented necessity modal binding the variable *x*.

(10)   a. [Liangge$_F$ laoshi] jiu$_1$ ba naxie xiaohai kongzhi-zhu le.
           two   teacher JIU BA those children control-hold ASP
           'Two teachers (sufficed to have) held controlled over those kids.'
       b. [ONLY HAVE-TO [two$_F$ teachers]] [held controlled over those kids]
       c. NEC_x [x held control over those kids] [ONLY HAVE-TO [x = two$_F$ teachers]]

As mentioned, *jiu$_1$* is a marker of ONLY HAVE-TO, perhaps an agreement marker. Its presence indicates this sentence contains the ONLY HAVE-TO operator attaching to the focus phrase, here 'two teachers.' Another silent modal, *NEC*, takes the *jiu*-clause as the first argument and ONLY HAVE-TO + focus phrase as the

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[2]   The meaning of *jiu* did not go unnoticed in the literature; a few previous studies include Biq (1984), Paris (1985), Lai (1995), Hole (2004), and Zhang & Lee (2013).

second argument, as in (10c).[3] That is, (10a) has a *nested* modal structure, in which the number phrase gets mapped to (part of) the nuclear scope of *NEC* and the *jiu*-clause to the restriction of *NEC*.

Following the standard view for modality, I assume the necessity modal *NEC* quantifies over a (restricted) set of possible worlds. In the case of (10a), these are the worlds maximally similar to the actual world in the past where some individual(s) held control over those kids. The nuclear scope, ONLY HAVE-TO + 'two teachers,' states that in every such world the individual(s) only had to be two teachers. In other words, the existence of two teachers (but nothing more) is required to make the proposition in the restriction (i.e. the *jiu*-clause) true. Analyzed this way, a rough paraphrase of (10c) can be given as (11):

(11)　'If the individual(s) *x* held control over those kids, *x* only had to be two teachers.'

Under this proposal, (10c) is rendered quite similar to a *sufficiency modal construction* such as (12a) (von Fintel & Iatridou, 2007), or an *anankastic conditional* such as (12b) (von Fintel & Iatridou, 2005).

(12)　a.　To get good cheese, you only have to go to the North End.
　　　　b.　If you want good cheese, you only have to go to the North End.

Our example (10c) is comparable to (12a)/(12b) in that the *jiu*-clause resembles the purpose *to*-clause or the *if*-clause and both examples engage a scalar focus operator coupled with a necessity modal. I suggest that one should think of the meaning of (10c) as involving some kind of "goal-oriented," "sufficiency" modality on a par with (12a)/(12b), the goal being to satisfy the requirement for the *jiu*-clause to be true. The *only* and *have to* ingredients, whilst overtly spelled out in (12), are brought out by jiu_1 in (10c) through possibly a syntactic agreement relation.

Note that the *jiu*-clause in (10c) denotes a proposition about a *past* event, unlike the tenseless purpose *to*-clause in (12a) or the *if*-clause in (12b). Thus (12a)/(12b) stands true even if you never go to the North End, but (10c) sounds false if the hold-control-over-kids situation never happened in the actual world. The current proposal may therefore seem problematic, since a conditional clause should not entail the truth of itself. But it is not. The key idea here is that the use of an *if*-conditional clause is independent of the truth of the event/state the conditional clause describes. There is no contradiction in analyzing (10c) as a conditional construction when in fact the hold-control-over-kids situation occurred, just as it's fine to utter *if John bought a suit, it had to be expensive* when ones knows for sure that in reality John did buy suits and the suits he bought were always expensive.

This analysis provides a straightforward explanation for one prominent reading of (10c), namely that 'two teachers' are considered an "easy-to-achieve" requirement for the purpose of holding control over those kids. The source of the "easy" reading, according to my analysis, is the ONLY scalar operator, which evokes and excludes the alternative propositions "*x* had to be *n* teachers" where *n* is greater than two.[4] Moreover, since ONLY can associate with other scalar items than numbers, we predict that a sentence that resembles the structure of (10c) can also receive a reading similar to the "quantity-denoting" one, in Li's (1998) terms, without bearing any number expression. (13) is one such example:

(13)　Nan_F-laoshi jiu_1 ba naxie xiaohai　kongzhi-zhu le.
　　　　male-teacher JIU　BA those children control-hold ASP
　　　　'Male teachers (sufficed to have) held controlled over those kids.'

When focus is added on the modifier *nan* 'male,' (13) delivers a reading according to which male (as opposed to female) teachers represent the little effort needed to hold control over those kids. We certainly would not want to posit a "GenderP" for the nominal preceding jiu_1 in (13). For the very same reason, we should not posit a "NumP" for that in (10a) that carries a stipulated "quantity" interpretation. It is only the scalar meaning of jiu_1 that matters.

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[3]　I will assume that *NEC* is introduced by jiu_1 as well.
[4]　Note that the case where $n = 1$ cannot be excluded because it is entailed by the prejacent of ONLY, i.e., if *n* had to be two, then *n* could not be fewer than two.

3.3. The syntax-semantics mapping of jiu$_2$

Let me turn now to (4), repeated below as (14a). Notice, first of all, the focus associated with the implicit 'only' in this case is not the subject 'three babysitters' but instead the object 'one child,' as Li's (1998) original translation indicates. I argue that *jiu* in this case is itself the ONLY HAVE-TO operator (*jiu$_2$*), not the marker thereof (*jiu$_1$*), and that it requires a different syntax-semantics mapping algorithm than *jiu$_1$*. The LF of (14a) is shown in (14b) and its semantics can be depicted as in (14c).

(14) a. [Sange baomu]   jiu$_2$ zhaogu yige$_F$ xiaohai.
          three   babysitter JIU care   one   child
          'Three babysitters took care of only one child.'

      b. ONLY HAVE-TO [three babysitters took care of one$_F$ child]

      c. *NEC* [HAVE-TO [∃*x*. three babysitters took care of *x*]] [ONLY HAVE-TO [three babysitters took care of one$_F$ child]]

In contrast to (10a), ONLY HAVE-TO is located at a high syntactic position scoping over the entire sentence of (14a) at LF, and is associated with 'one child' to its *right*, as shown in (14b).[5] The tripartite structure headed by *NEC* is obtained via copying the sentence, including the necessity modal HAVE-TO but excluding ONLY, into the restriction of *NEC*, with the focus 'one child' substituted by a variable of the same type that is existentially closed, as in (14c); cf. (10c).[6] The process of replacing the focused expression with a variable of the same type is similar to the way Rooth (1992) obtains alternatives (the "focus semantic value") of a focused sentence. Existential closure over the focus variable yields a proposition that can restrict the modal base of *NEC*.

This proposal captures the fact that, unlike (10a), the preverbal number phrase 'three babysitters' is considered unnecessarily large effort for the purpose of taking care of one child. This semantic difference in *scalarity* does not follow from Li's (1998) analysis, but it does follow from the current treatment, as the ONLY operator can exclude the set of propositions in (15). I argue this is how the "only one child" reading comes about for (14a).

(15) {*p* = have-to [that three babysitters took care of *x*] : *x* ≠ one child}

On the other hand, there is no "only those kids" reading for (10a) because what is excluded by the ONLY operator in this case is the set of propositions "*x* had to be *n* teachers" where *n* > 2, as mentioned above. The proposal correctly predicts that in (10a) it is the number phrase to the *left* of *jiu$_1$* that is associated with the "fewer than expected" reading, a reversed scalar inference of (14a).

Moreover, the current treatment nicely accounts for the fact that the exclusive focus adverb *zhi* 'only' can be naturally inserted into (14a) without leading to semantic redundancy, as evidenced by (16). Since *jiu$_2$* is the realization of the ONLY HAVE-TO complex operator, rather than *only* (contra Li 1998), there is no clash when *jiu$_2$* and *zhi* cooccur.

(16) [Sange baomu]   jiu$_2$ **zhi** zhaogu ta yige xiaohai$_F$.
      three   babysitter JIU only care   he one child
      'Three babysitters only took care of him, only one child.'

3.4. More on jiu$_1$ and jiu$_2$

It has been pointed out by Biq (1984) and subsequent literature that *jiu* may associate with a focused element that either precedes or follows it, but resulting in different interpretations. Two sets of examples from Biq (1984) are given below for illustration, where focused phrases are capitalized.

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[5] I am assuming 'three babysitters' is base-generated inside the *jiu*-clause before moving to the surface position preceding *jiu* for syntactic requirements.
[6] Strictly speaking, since focus lands on the number 'one' the relevant focus alternatives here should be a set of numbers rather than a set of individuals. I will set this issue aside.

(17)   a. Wo XINGQITIAN jiu qu diao yu.
           I   Sunday   JIU go fish fish
           'I go fishing (whenever it is)/on SUNDAYS.'

        b. Wo jiu XINGQITIAN qu diao yu.
           I   JIU Sunday   go fish fish
           'I go fishing only on SUNDAYS.'   (Biq, 1984:92)

(18)   a. Ta XINLISHANG jiu you wenti.
           he mentally   JIU have problem
           'MENTALLY he has (already) had problems. (Let alone other aspects).'

        b. Ta jiu XINLISHANG you wenti.
           he JIU mentally   have problem
           'He has problems only MENTALLY.'   (Biq, 1984:93)

There is a prominent inference in (17a) contributed by *jiu*: I go fishing as frequently as once every week on Sundays.[7] (17b), in contrast, infers something quite difference: I do not go fishing much, and only do so on Sundays. Only (17a) is a felicitous continuation of the claim that I go fishing very often. Likewise, (18a) sounds like the speaker is suggesting that he might have other problems in addition to mental ones, whereas (18b) conveys the opposite, namely that he does not have problems aside from mental ones.

   I maintain that the compositional analysis presented for (10a) and (14a) can be generalized to the data above, and can be potentially extended to other previous observations on *jiu* (but I will not attempt to do this here). Specifically, I assign (17a) the tripartite structure in (19a) and (17b) the one in (19b).

(19)   a. NEC_t [I go fishing on t] [**ONLY HAVE-TO** [t = Sundays$_F$]]
        b. NEC [**HAVE-TO** [$\exists t$. I go fishing on t]] [**ONLY HAVE-TO** [I go fishing on Sundays$_F$]]

While (19a) and (19b) both stand true if in the actual world I go fishing on and only on every Sunday, the alternatives evoked by **ONLY** in these two cases are different. Those evoked in (19a) are a set of worlds involving the times that are more than one week apart from each other, e.g., the Sunday this week and Tuesday next week. Hence (19a) conveys that I go fishing on Sundays and the time interval between my two fishing activities need not be longer than that between two Sundays (i.e. one week). On the other hand, (19b) evokes the worlds involving the days in a week that are not Sunday. Thus this sentence negates the necessity that I go fishing on any day during a week other than Sunday. The *jiu* in (19a) is *jiu*₁ and that in (19b) is *jiu*₂. Once again, the focus adverb *zhi* 'only' is possible in (17b), as shown in (20), suggesting that *jiu* itself does not equate to 'only.'

(20)   Wo jiu **zhi**   zai XINGQITIAN qu diao yu.
       I   JIU only at Sunday   go fish fish
       'I go fishing only on SUNDAYS.'

   The difference between (18a) and (18b) can be analyzed in a parallel fashion by taking the instance of *jiu* in the former to be *jiu*₁ and the one in the latter *jiu*₂. The semantics of (18a) is given in (21a) and that of (18b) is shown in (21b) below.

(21)   a. NEC_P [he has P problems] [**ONLY HAVE-TO** [P = mental$_F$]]
        b. NEC [**HAVE-TO** [$\exists P$. he has P problems]] [**ONLY HAVE-TO** [he has mental$_F$ problems]]

   The interpretive difference between (17a) and (17b) and between (18a) and (18b) can therefore be explained on the grounds of the proposed mapping algorithms for *jiu*₁ and *jiu*₂.

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7 (17a) may also be understood as 'I will go fishing as soon as (this) Sunday.'

3.5. Modal sentences

Let me finally turn to the modal sentence (5), repeated below as (22).[8]

(22) [Wuge xiaohai] chi-de-wan   shi-wan fan.
        five   child   eat-MOD-finish ten-bowl rice
        'Five children can finish ten bowls of rice.'

I claim that (22), like the previous examples (10a)/(14a), is also a concealed conditional construction. I suggest to analyze the meaning of (22) as either (23a), if focus applies to the preverbal number phrase 'five children,' or (23b), if focus applies to 'ten bowls of rice.'[9]

(23)   a. NEC_x [x can finish ten bowls of rice] [$x = $ five$_F$ children]
        b. NEC [$\exists x.\ x = $ five children] [the five children can finish ten$_F$ bowls of rice]

The restriction of NEC in (23a) and that in (23b) are different: in the former, it is a set of (plural) individuals who can finish ten bowls of rice; in the latter, it is a set of (minimal) situations with the presence of five children. Depending on where focus is (and, for that matter, what the context is), (22) can be interpreted either way.

One piece of supporting evidence for this conditional treatment of (22) comes from the fact that its Japanese counterpart employs conditional morphology. As pointed out to me by Kazunori Kikushima (p.c.), (24) below exemplifies the same type of sentence as (22) with a "quantity" interpretation on the numeral subject:

(24) Hutari-**nara**/-**dat-tara**/-**ir-eba**, gohan 5-hai-o   tabe-oe-rare-ru.
        two.people-if/-COP-if/-exist-if, rice   5-bowl-ACC eat-finish-can-NONPST
        'Two people can finish five bowls of rice.'

The "quantity" interpretation, however, is not available if the conditional suffix *nara/dat-tara/ir-eba* is replaced by the nominative case, as indicated in (25).

(25) Hutari-**ga**   gohan 5-hai-o   tabe-oe-rare-ru.
        two.people-NOM rice   5-bowl-ACC eat-finish-can-NONPST
        'Two people can finish five bowls of rice.'   (subject is *specific*; no "quantity" interpretation)

I take the contrast of (24) vs. (25) to be arguing for the current proposal that modal sentences such as (24) have an underlying conditional structure.

In addition, note that on the reading of (23a), (22) is nearly synonymous to (26) where *jiu* appears right after the subject. Such similarity is hardly surprising if (22) is indeed a conditional construction, which differs from (26) only in the contribution of *jiu*.

(26) Wuge$_F$ xiaohai **jiu** chi-de-wan   shi-wan fan.
        five   child   JIU eat-MOD-finish ten-bowl rice
        'If some individuals can finish ten bowls of rice, they only have to be five children.'

I should also mention that the conditionality of (22) is introduced by the implicit necessity modal *NEC*, rather than by the modal infix *-de-*. But what is the source of *NEC* in the absence of *jiu*? I conjecture that *NEC* is effected by number expressions. The crucial observation here is that (27), which differs minimally from (22) in the subject phrase, is unable to form a conditional configuration that is comparable to (23a)/(23b): (27) cannot be understood as "if x can finish ten bowls of rice, then $x = $ Lisi." Hence the modal infix *-de-* alone does not guarantee the existence of *NEC*.

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[8] For a different approach that I cannot address in this paper, see Tsai (2001).
[9] Since (22) does not include the particle *jiu*, its semantics does not include the ONLY HAVE-TO operator.

(27) Lisi chi-de-wan   shi-wan fan.
      Lisi eat-MOD-finish ten-bowl rice
      'Lisi can finish ten bowls of rice.'

On the other hand, if *jiu* is added to the sentence, the conditionality emerges regardless of the form of the subject.

(28) Lisi **jiu** chi-de-wan   shi-wan fan.
      Lisi JIU eat-MOD-finish ten-bowl rice
      'If someone can finish ten bowls of rice, it only has to be Lisi.'

Exactly how and why a number expression is critical to conditional interpretation is not entirely clear to me. One possibility is that number expressions in Mandarin is related to *NEC* in a way similar to how the relative clause in (29) is related to an implicit modal element (Chierchia, 2013) that licenses *any* through *subtrigging* effects (LeGrand, 1975). The validity of this possibility awaits further investigation.

(29) Yesterday John saw any student [that happened to be around].   (Chierchia, 2013:317)

4. Concluding remarks

In this paper I have argued that the "exceptions" to the generalization that subject number phrases in Mandarin as observed by Li (1998) all encode a scalar and modalized structure in which the "subject" is inside the scope of ONLY HAVE-TO. The few examples cited in Li's work thus turn out to showcase the two distinct but intimately related types of *jiu*: *jiu*$_1$, a marker of the ONLY HAVE-TO operator, and *jiu*$_2$, the operator. I have shown that they require different mapping algorithms from the surface syntax to the semantic tripartite structure, but both instances of *jiu* underlie a *nested* modal configuration. Finally, the modal sentences that host "exceptional" number phrases should also be considered conditionals.

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