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Exclusive (Dis)harmonies in Mandarin Chinese

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Abstract
The paper discusses two types of exclusive (dis)harmonies in Mandarin. Exclusive-(dis)harmony-A—only is compatible with few but not many, and exclusive-(dis)harmony-B—only is compatible with less than n but not more than n. We suggest Exclusive-(dis)harmony-A can be explained along the lines of Chen 2005. We further propose that Exclusive-disharmony-B can be ex- plained by Maximization failure (Fox 2007). But Maximization failure rules out Exclusive-harmony-B as well. We then propose to use a scalar presupposition of jiu/zhi/only to restrict the standard Rooth-style focus alternative set. This presupposition achieves two things: it captures the scalar meaning of only, and it allows maximization to work with less than n, by filtering out problematic alternatives.

Exclusive (dis)harmonies in Mandarin Chinese

Mingming Liu*

1 *Dou* (Dis)Harmony

Chen (2005) observes that the distributive operator *dou* (Lin 1998) in Mandarin is compatible with quantifiers describing large quantities such as *henduo* 'many' (1a), but not with small-quantity quantifiers such as *henshao* 'few' (1b).

(1) ***Dou*-(dis)harmony**

a. *Zuotian juhui,* ***henduo*** *ren* ***dou*** *lai le.*
yesterday party, many people DOU come ASP
'Yesterday, many people came to the party.'

b. **Zuotian juhui,* ***henshao*** *ren* ***dou*** *lai le.*
yesterday party, few people DOU come ASP
Intended: 'Yesterday, few people came to the party.'

Chen names this phenomenon *dou*-(dis)harmony and offers an explanation based on a context-dependent expected value s_c. Specifically, *dou* carries a presupposition that the number of 'NPs' (*people* in (1)) that 'VP' (*came to the party* in (1)) falls above the expected value s_c.

Since "*few* NP VP" is true iff the number of 'NPs' that 'VP' falls below s_c (Partee 1988), contradicting the high-rank presupposition of *dou*, *dou* is incompatible with *few*.

In a parallel manner, the compatibility of *dou* and *many* is explained by taking "*many* NP VP" to be true iff the number of 'NPs' that 'VP' falls above s_c.

2 Exclusive (Dis)Harmonies

2.1 Exclusive (Dis)Harmony-A

Mandarin exclusive particles (*jiu*, *zhi(you)* 'only') exhibit the opposite pattern from *dou* (already mentioned in Chen (2005)). Specifically, they are compatible with quantifiers denoting small quantities such as *few* (2a) but not with those denoting large quantities such as *many* (2b). We call this *exclusive (dis)harmony-A*.

(2) **Exclusive-(dis)harmony-A**

a. *Zuotian juhui,* ***jiu/zhi*** ***henshao*** *ren lai.*
yesterday party, only/only few people come
'Yesterday, only few people came to the party.'

b. **Zuotian juhui,* ***jiu/zhi*** ***henduo*** *ren lai.*
yesterday party, only/only many people come
Intended: '*Yesterday, only many people came to the party.'

An analysis based on Chen (2005) is conceivable for exclusive (dis)harmony-A. All we have to assume is that Chinese exclusives carry a low-rank presupposition that its 'NP'-associate that 'VP' falls below the expected value s_c. This is actually the *mirative particle* analysis of English *only* in Zeevat (2009), where the core meaning of *only* is 'less than expected'.

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2.2 Exclusive (Dis)Harmony-B

We further discover Exclusive (dis)harmony-B: Mandarin exclusives are compatible with modified numeral *budao n* "less-than *n*" (3a), but not with *chaoguo n* "more-than *n*" (3b).

(3) **Exclusive-(dis)harmony-B**

a. ***jiu/zhi(you)*** *budao shi ge ren lai.*
only/only less-than 10 CL people come
Only less than 10 people came to the party.

b. ****jiu/zhi(you)*** *chaoguo shi ge ren lai.*
*only/only more-than 10 CL people come
Intended: '*Only more than 10_F people came to the party.'

Exclusive (dis)harmony-B cannot be explained by Chen (2005)'s analysis which crucially relies on the expected value s_c. This is because the standard semantics (Hackl 2000, Nouwen 2010) of modified numerals such as *more/less-than n* does not involve a context-dependent s_c.

(4) $[\![\text{more than } 10]\!] = \lambda D.\max(D) > 10$
$[\![\text{less than } 10]\!] = \lambda D.\max(D) < 10$ (cf. Nouwen 2010, (13))

Compare (4) with a recent proposal for *many/few* in Solt (2014): s_c is encoded in the latter but not in the former, and thus Chen's analysis cannot be extended to (3).

(5) $[\![\text{many}]\!] = \lambda D.\max(D) > s_c$
$[\![\text{few}]\!] = \lambda D.\max(D) < s_c$ (cf. Solt 2014, (9))

3 Towards an Explanation

3.1 Universal Density of Measurement and Maximization Failure

Based on their Universal Density of Measurement (UDM), Fox and Hackl (2006) provide an analysis for *only*'s incompatibility with *more than n* (cf. (3b)), which we adopt to explain half of our Exclusive (dis)harmony-B puzzle.

(6) **The UDM**
Measurement scales needed for natural language semantics are always dense.

(7) **Density**
A scale S is dense iff for any two degrees d_1 and d_2 on S, there is a degree d_3 between d_1 and d_2:
$\forall d_1 \forall d_2((d_1 < d_2) \rightarrow \exists d_3(d_1 < d_3 < d_2))$

Specifically, we take the standard semantics of *only* (Horn 1969, Schwarzschild 1994), as in (8);[1] with UDM, we will run into contradiction when we combine *only* with *more than* n_F, and contradiction like this gives rise to ill-formedness (Gajewski 2002).

(8) **Semantics of *only***
$only_C(p)$ presupposes $p(w) = 1$[2] Prejacent presupposition
if defined, it asserts $\lambda w \forall q \in C[q(w) \rightarrow p \subseteq q]$ Exclusive assertion

(9) **Fox and Hackl's reasoning**: **only more than 10_F people came* = (3b)
a. (3b) presupposes p: more than 10 people came

[1] C in (8) is the quantificational domain of *only* and it is restricted by focus: focus on an expression a triggers alternatives which share with a the same semantic type (Rooth 1985). C is required to be a subset of the set of propositions obtained by replacing the focus part of the prejacent with its alternatives (Rooth 1992).

[2] Neither Fox & Hackl's reasoning nor my reformulation needs to assume that the prejacent is presupposed. The reasoning goes through as long as the prejacent is entailed, that is, it could be asserted instead.

b. (3b) asserts q: it's not the case that more than n people came, with $n > 10$;
c. p entails r: there were $10 + \varepsilon$ people coming;
d. because of UDM and r: more than $10 + \varepsilon/2$ people came;
e. but according to q and the fact that $10 + \varepsilon/2 > 10$: it's not the case that more than $10 + \varepsilon/2$ people came;
f. contradiction.

There is a simpler way of looking at the above reasoning (cf. Chierchia 2013 on NPI): first, it is a fact that for any $n > 10$, *more than n people came* entails *more than 10 people came*; next, because of *only*, it's not the case that more than n people came, for any $n > 10$; but negating all these stronger alternatives means that exactly 10 people came, which contradicts the prejacent.

There is also a more general way of looking at this, which sees (3b) as an instance of *maximization failure* (Fox 2007, cf. the negative island literature).

Roughly, maximization failure happens when a maximization operator (*only* in our case) fails to pick out the correct greatest element (the prejacent of *only* in our case when applied to a (algebraic) set.)[3] Consider (3b). *Only* says that its prejacent is the strongest true proposition (=all non-weaker alternative propositions are false), but this requirement cannot be satisfied: supposing that 14 people came (based on what the prejacent in (3b) means), the set of true alternative propositions is {... more than 9 people came⊃ more than 10 people came ⊃ more than 11 people came ...}.[4] Because of density, this set (interval) is not right bounded, thus no greatest element exists and maximization fails. Since 14 is arbitrarily chosen, maximization always fails and using *only* is infelicitous.

3.2 Problem With *Less than n*

Exclusive-(dis)harmony-B as in (3) has two parts, the harmony part (3a) and the disharmony part (3b). We have looked at how Fox and Hackl (2006) and Fox (2007) explain the disharmony part, but what about the harmony part?

It turns out that they predict exclusives are equally bad with *less than n*, thus failing to explain their compatibility in Mandarin, illustrated again in (10).

(10) **Exclusive-harmony-B**
jiu/zhi(you) *budao shi ge ren lai.*
only/only less-than 10 CL people come
Only less than 10 people came to the party.

The reasoning sketched in (11) is exactly parallel to the case of *more than n*.

(11) **An incorrect prediction**
a. *only* in (10) says that *less than 10 people came* is the strongest proposition;
b. (10) also presupposes that less than 10 people came; let's say actually 8 people came.
c. now the set of true alternative propositions is
{... less than 9 people came⊂ less than 10 people came ⊂ less than 11 people came...}
d. Because of density, this set (interval) is not left bounded; thus no greatest element.
e. since 8 is arbitrarily chosen, maximization always fails.
f. (10) is incorrectly predicted to be bad.

The rest of the paper is devoted to tackling this problem. Here is a preview of how we are going to do it: we will propose that *only/jiu/zhi(you)* can restrict an alternative set (interval) $C = \{$ ... less than 9 people came⊂ less than 10 people came ⊂ less than 11 people came... $\}$ into a Restricted alternative set $C' = [$less than 10 people came ⊂ less than 11 people came... $\}$. The new set (interval) has a strongest element, i.e., the prejacent; thus no maximization failure.

Before we explain why exclusives can do this with *less than n* but not with *more than n*, let's look at the scalar/evaluative component of *only/jiu/zhi(you)*. It turns out that the restricting function of exclusives mentioned above are independently needed for analyzing their scalarity.

[3] Following Horn 1996, we call the *only*-less part of an *only*-sentence the prejacent of *only*.

[4] Underlining singles out the prejacent.

3.3 *Only*'s Scalar Presupposition

Only and its Mandarin counterparts *jiu/zhi* trigger scalar inferences (cf. Zeevat 2009, Klinedinst 2005, Alxatib 2013, Coppock and Beaver 2013), illustrated by (12) for English *only* and (13) for Mandarin *jiu/zhi(you)*.

(12) **The scalar inference of *only***
   a. 10 people came, which were a lot.
   b. #Only 10 people came, which were a lot.

(13) **The scalar inference of *jiu/zhi***
   a. *you shi ge ren lai, zhen duo!*
   HAVE ten CL people come, really many
   '10 people came, which were a lot.'
   b. *#jiu/zhi you shi ge ren lai, zhen duo!*
   only/only HAVE ten CL people come, really many
   Intended: #only 10 people came, which were a lot.

Sentences (12a) and (13a) are good because 10 people can either be many or few, depending on the context. But (12b) and (13b) sound contradictory because the *only/jiu/zhi(you)* carry a scalar meaning that the people that came were few, which contradicts the content of the following relative clause.

To formally represent the scalar reading, we propose to assign *only/jiu/zhi(you)* a presupposition that requires the focus associated with *only/jiu/zhi(you)* to be ranked lower on a scale R than its any other alternatives. Formally, this is represented in (14).

(14) Scalar Presupposition of *only/jiu/zhi(you)*
$\forall x \in C[x \neq [\![\text{focus}]\!] \rightarrow [\![\text{focus}]\!] <_R x]$

(15) Scalar Presupposition of *even*
$\forall q \in C[q \neq [\![\text{prejacent}]\!] \rightarrow [\![\text{prejacent}]\!] <_{likely} q]$

Sentence (14) follows a common way of capturing the scalar presuppositions of scalar FPs like *even* (Karttunen and Peters 1979) and *already/still* (Krifka 2000).[5] Take *even* as an instance. The only difference between (14) and (15) is that the former ranks individuals while the latter propositions. By ranking the prejacent of *even* as the bottom of a likelihood scale we obtain the inference that the prejacent is the least likely. Similarly, by ranking 10 as the bottom of the *number* scale, we obtain the inference that 10 is a small number.[6] The contrast shown in (12) and (13) is thus captured.

3.4 Restricted Alt

To capture the scalar component of *only*, we virtually restrict the Rooth-style alternative set triggered by focus to an (ordered) subset C' of which the focus value is the bottom. Restricted Alt is the key to the above-mentioned exclusive-harmony-B puzzle.

[5] Krifka 2000 is interested in German *schon/noch* 'already/still', which contribute *early/late* scalar inferences. Krifka's way of capturing these scalar inferences is exactly like our (14). For example, *schon* is truth-conditionally vacuous but presupposes that its associate is ranked earlier than all the other alternatives.

[6] We are here actually using a superlative semantics to capture an evaluative intuition, which is not quite right. To witness, that John is lower than any of its alternatives on an effort scale does not mean getting hold of John is easy (perhaps all of them are difficult to get hold of), just as John is the tallest does not mean John is tall. To fix this, we posit a requirement (i) which says that the context dependent expected value s_c (Kennedy 1999) should always be included in the restricted alternative set induced by *jiu*. Intuitively, this is plausible, since the restricted alternative set tries to capture the idea of *alternatives under consideration* (Krifka 2000), and the expected value seems to always qualify as one of them.

(i) *Expected value is always under consideration*
$\exists x \in C[x \neq [\![\alpha]\!] \wedge \mu_{\mathrm{R}}(x) = s_c]$

Consider *jiu/zhi* with *less than* n_F in (16).

(16) *jiu/zhi* less than 10_F people came.
Restricted Alt: $10 < 11 < 12 < \ldots$
C: [less than 10 people came$\subset$ less than 11 people came,...}
Maximization applies successfully; the prejacent is the strongest proposition.

In (16), the presupposition of *jiu/zhi* in (14) restricts the alternative set of 10_F into $\{10,11,12,\ldots\}$. Because *less than 10 people came* entails *less than n people came* for every $n \geq 10$, the prejacent is indeed the strongest proposition in the new set; thus *jiu/zhi*'s requirement (its assertion (8)) is satisfied and *jiu* and *zhi* are compatible with *less than* n_F.

More than n_F behaves differently, illustrated in (17).

(17) **jiu/zhi* more than 10_F people came.
Restricted Alt: $10 < 11 < 12 < \ldots$
C: [more than 10 people came$\supset$ more than 11 people came,...}
Maximization fails, because the problematic alternatives are still in the set.

In (17), the presupposition of *jiu/zhi* in (14) again restricts the alternative set of 10_F into $\{10,11,12,\ldots\}$. However, in this case *more than 10 people came* is entailed by *more than n people came* for every $n \geq 10$. Thus, the prejacent can never be the strongest proposition due to density. As a result, *jiu/zhi*'s requirement is not satisfied and exclusive disharmony B follows.

3.5 Trivialization

The essence of our story is that we allow the exclusive component of *jiu/zhi* to be trivialized/vacuous.

(18) *jiu/zhi* less than 10_F people came.
Restricted Alt: $10 < 11 < 12 < \ldots$
C: [less than 10 people came$\subset$ less than 11 people came,...}
Exclusive Assertion in (8) applies vacuously.

This is correct, since *jiu* and *zhi*, when associated with *less than* n_F, are indeed nonexclusive. Consider the following dialogue.

(19) A: *Zuotian Yuehan **jiu/zhi** chi le **budao** [san]$_F$ ge pingguo?*
yesterday John only/only eat LE less-than 3 CL apple
'Yesterday, did John eat only less than 3 apples?'
B: *Dui. qishi lian liang ge dou budao.*
Right. actually even 2 CL even less-than
'Yes, actually he ate even less than 2.'

In (19), B uses *dui* 'right' to affirm the proposition *p* that *John only ate less than 3 apples* but then he adds a proposition *q* that *John ate less than 2 apples*; this is impossible if the *only* in *p* were exclusive: being exclusive, it would negate *q* according to the standard semantics of *only* (8), for *q* asymmetrically entails the prejacent of *p* that *John ate less than 3 apples*.

Sentence (19) contrasts with (20), where the *jiu/zhi* is exclusive, and thus leads to a contradiction.

(20) A: *Zuotian Yuehan **jiu/zhi** chi le [san]$_F$ ge pingguo?*
yesterday John only/only eat LE 3 CL apple
'Yesterday, did John eat only 3 apples?'
B: *# Dui. qishi ta chi le si ge.*
Right. actually he eat LE four CL
'# Yes, actually he ate 4.'

The contrast between (19) and (20) is a consequence of our proposal. While the exclusive component of *jiu/zhi* is trivialized (by their scalar presupposition) in the case of *less than* n_F as in (18), it stays intact in the case of bare numerals, as is illustrated in (21).

(21) John *jiu/zhi* ate 3_F apples.
Restricted Alt: $3 < 4 < 5 < \ldots$
C: [John ate 3 apples$\supset$ John ate 4 apples,...}
Exclusive Assertion: For any $n > 3$, John didn't eat n apples.

Not everyone agrees that the assertion of *only*-like exclusives can be trivialized (see for example, Beaver and Clark 2008, Alxatib 2013). They would have a non-vacuity condition built into the lexical entry of *only*, for example: the prejacent of *only* (or its negation) cannot entail all of its alternatives.

They base their non-vacuity claim on cases like **He only saw* $[$*every student*$]_F$: because *he saw every student* entails all the other alternatives (or its negation), non-vacuity is violated, and thus the sentence is bad.

But scalar presupposition as in (14) can also explain this: *every student* just cannot be the bottom of any alternative set.

Furthermore, it needs to be mentioned that trivialization of a covert *only* is essential in Chierchia (2013) to explain the distribution of weak NPIs like *any* (on its NPI use). Roughly, *any* triggers alternatives and needs a covert *only* to 'exhaustify'/'tame' them. In positive contexts, the covert *only* gives rise to contradiction, and thus *any* is not licensed; on the other hand, in negative contexts, the covert *only* is trivialized, and thus there is no contradiction or ill-formedness for *any*.

Finally, English *only* is not very comfortable with *less than n*.[7] We might take this fact to suggest that English *only* (not the covert one) does not allow its exclusive component to be trivialized. For instance, (22) and (23) are both bad, but for different reasons. This might explain why people tend to feel a difference between (22) and (23).

(22) *Only more than 10_F people came. Contradiction
(23) ??Only less than 10_F people came. Trivialization

But crucially, Mandarin *jiu/zhi* are fully compatible with *less than* n_F, suggesting they do not have a non-vacuity condition built into their semantics.

4 Conclusion

We have discussed two types of exclusive (dis)harmonies in Mandarin. Exclusive-(dis)harmony-A— *only* is compatible with *few* but not *many*, and exclusive-(dis)harmony-B— *only* is compatible with *less than n* but not *more than n*.

We suggest Exclusive-(dis)harmony-A can be explained along the lines of Chen 2005.

We further propose that Exclusive-disharmony-B can be explained by Maximization failure (Fox 2007). But Maximization failure rules out Exclusive-harmony-B as well. We then propose to use a scalar presupposition of *jiu/zhi/only* to restrict the standard Rooth-style focus alternative set. This presupposition achieves two things: it captures the scalar meaning of *only*, and it allows maximization to work with *less than n*, by filtering out problematic alternatives.

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[7] Judgements come from several native speakers I consulted and an anonymous PLC reviewer.

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