

ENCODING EXHAUSTIVITY*

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From a cross-linguistic perspective, this paper reports the existence of the morpho-syntactic feature exhaustivity, which is independent of the well-recognized features of distributivity and plurality. It also argues that the super-ordinate feature for [+ exhaustive] and [- exhaustive] is [measurable]. Furthermore, it claims that the absence of collective readings of sentences with exhaustive expressions is related to the focus marker function of the expressions.

Keywords: exhaustivity, distributive, coordinator, measurable, Mandarin Chinese, Japanese

1. Introduction

This short paper presents new arguments to show that exhaustivity is an attested morpho-syntactic feature, independent of the well-recognized features of distributivity and plurality, and argues that the super-ordinate (or hyperonymy) feature for [+ exhaustive] and [- exhaustive] is [measurable].

The feature [+ gradable] has been well-recognized to specify a type of property-denoting expressions, such as the adjective *long*. One subordinate feature of [+ gradable] is [+ superlative], which has been identified for property-denoting expressions (e.g. *the longest*). We will show that the feature [+ exhaustive] is the counterpart of [+ superlative] in eventuality-denoting contexts (including both states and events), beyond the property-denoting contexts. Both [+ superlative] and [+ exhaustive] mean the highest degree of a [gradable/measurable] x, which is a property or eventuality.

I report the existence of exhaustive expressions in section 2, and non-exhaustive expressions in section 3, and then discuss the relationship between exhaustivity and measurability in section 4. In section 5, I probe the issue why the exhaustive marker *dou* may sometimes reject collective readings. Section 6 is a summary.

2. The existence of exhaustive expressions

In this section, I demonstrate that Mandarin Chinese *dou* ‘all’ is a [+ exhaustive]

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marker.

It has been generally realized that *dou* in Mandarin Chinese occurs in three main contexts. First, it is used as a temporal phase quantifier, in construal with both an explicit or implicit adverb *yijing* ‘already’ and the sentence-final realis particle *le*, as in (1a). Second, it encodes an additive focus, in construal with *lian* ‘even’, as shown by (1b). In all other contexts, *dou* has been generally assumed to be a plural or distributive marker, as in (1c) (Li 1995, Lin 1996, among others).¹

- (1) a. Dou (yijing) shi dian le, kuai qi-chuang!
already already ten o'clock PRT quick get-up
‘It’s already ten o’clock. Get up quickly!’
b. Lian wo dou xiang qu.
even I even want go
‘Even I want to go.’
c. Tamen dou kanjian-le wo.
they all see-PRF I
‘They all saw me.’

I will discuss the *dou* constructions in the last context only.² Five facts will be presented to separate the exhaustivity reading of *dou* from either plural or distributive readings.

2.1. Fact 1 of *dou*: mass nouns

It is generally recognized that plurality makes sense for countable nouns, but not mass nouns (see Chierchia 1998 for a different claim). *Dou* may occur with mass nouns, indicating that it is not a plural marker, which is not compatible with mass nouns.

- (2) a. Lulu ba niunai dou he-le.
Lulu BA milk all drink-PRF
‘Lulu drank all the milk.’
b. Mifan dou bian sou-le.
rice all become spoil-PRF
‘The rice has spoiled completely.’

In examples like (2), *dou* is not related to any plural entities, and it thus cannot be a plural marker. Such examples do not have to encode any plural event, either. It is possible for (2a) to mean that Lulu drank the milk in a single event and for (2b) to mean that the rice got spoiled also in a single event. Since distributivity is event plurality (Landman 2000), *dou* cannot be a distributivity marker.

¹ The abbreviations used in the Mandarin Chinese examples are: EXP: experience aspect, PRF: perfect aspect, PRG: progressive aspect, PRT: sentence-final aspect particle, CL: classifier, BA: causee marker.

² Sybesma (1996) and Zhang (1997: Section 7.5) report many differences between the *dou* in examples like (1c) and the *dou* in other contexts. The differences do not support a unified approach (cf. Xiang 2008).

2.2. Fact 2 of *dou*: singular nouns

Dou occurs not only with a plural nominal, such as *tamen* ‘they’ in (1c), and a mass nominal, such as *niunai* ‘milk’ in (2a), but also with a singular nominal, such as *zhe ben shu* ‘this cl book’ in (3a), *na zhang zhuozi* ‘that cl table’ in (3b), and *zheng zuo qiao* ‘whole cl bridge’ in (3c):

- (3) a. Zhe ben shu, wo dou kan-le.
This CL book I all read-PRF
‘This book, I have read all of it.’
- b. Lulu ba na zhang zhuozi dou nong-shi-le.
Lulu BA that CL table all make-wet-PRF
‘Lulu made that whole table wet.’
- c. Zheng zuo qiao dou dao-xialai le. (Lin 2007)
whole CL bridge all fall-down PRT
‘The whole bridge collapsed.’

Such examples do not have to encode any plural event. For instance, it is possible for (3a) to mean that I read the book in a single event. Therefore, *dou* is neither a plural nor a distributive marker.

2.3. Fact 3 of *dou*: collective predicates

Dou may occur with collective predicates, unlike distributive markers. *Dou* occurs with the collective predicate *jihe* ‘gather’ in (4a), the collective predicate *jian-le-main* ‘meet’ in (4b), the collective predicate *zhangde hen xiang* ‘grow very alike’ in (4c), and the collective predicate *hen jiejin* ‘very close (to each other)’ in (4d).³

- (4) a. Zhexie ren dou bixu zai cao-chang jihe.⁴
these people all must at sports-ground gather
‘All of these people must gather in the sports-ground.’
- b. Wanglu-shang de xujia, bixu zai liang ge ren dou
internet-on DE illusion must at two CL person all
jian-le-mian zhihou, cai neng tupo (Googled; also Xiang 2008: 231)
meet-PRF-face after then able see.through
‘The illusion of the internet (dating) can be seen through only after the two persons have met each other.’

³ (i) allows a collective reading, i.e., they ate a single watermelon together. The availability of the collective readings for (i) and examples like (4b) does not support Xiang’s (2008:232, 235) claim that such examples could not have a collective reading.

(i) Tamen dou chi-le xigua.
they all eat-PRF watermelon
‘They all ate {the watermelon/watermelons} (together or independently).’

⁴ Examples like (4a) are counter-examples to Anand & Tang’s (2004:18) claim that pre-deontic modal *dou* must be distributive.

- c. Tamen dou zhangde hen xiang.
 they all grow very alike
 ‘They all look alike.’
- d. Xuesheng-men de chengji dou hen jiejin. (Lin 2007)
 student-PL DE score all very close
 ‘All of the scores of the students’ are very close to each other.’

2.4. Fact 4 of *dou*: collective adverbs

Dou may occur with collective adverbs, unlike distributive markers. In (5), *dou* occurs with the collective adverb *yiqi* ‘together’.

- (5) Tamen dou yiqi lai-le. (Cheng 2006:7)
 they all together come-PRF
 ‘All of them came together.’

Reciprocals are also adverbs in Mandarin Chinese. They occur in collective contexts only. *Dou* may occur with them:

- (6) a. Liang ge ren dou huxiang dao-le qian.
 two CL person all mutual say-PRF apology
 ‘The two persons apologized to each other.’
- b. Baoyu he Daiyu bici dou renshi.
 Baoyu and Daiyu mutual all know
 ‘Baoyu and Daiyu know each other.’

2.5. Fact 5 of *dou*: exhaustiveness in answering wh-questions

As noted by Li (1995:318), in dialogues like the following, if Speaker B also saw other people, in addition to Baoyu and Lulu, the answer is not appropriate.

- (7) Speaker A: Ni zuotian dou kanjian-le shei?
 you yesterday all see-PRF who
 ‘Who exactly did you see yesterday?’
- Speaker B: Wo kanjian-le Baoyu he Lulu.
 I see-PRF Baoyu and Lulu
 ‘I saw Baoyu and Lulu.’

The effect is not seen in the absence of *dou*. The appropriateness contrast between (8) and (9) shows the difference.

- (8) Speaker A: Zhe zuo dalou naili you cesuo?
 this CL building where have toilet
 ‘Where is a toilet in this building?’
- Speaker B: Er-lou jiu you liang ge.
 two-floor just have two CL
 ‘There are two on the second floor alone.’

- (9) Speaker A: Zhe zuo dalou dou naili you cesuo?
 this CL building all where have toilet
 ‘Where are all the toilets in this building?’
 Speaker B: # Er-lou jiu you liang ge.

In (8), Speaker A does not specify whether he wants to know the locations of all toilets in the building, so the answer given by Speaker B is appropriate. The answer does not exclude the possibility that there are more toilets on other floors. In (9), however, when *dou* occurs, Speaker A does want to know the locations of all toilets in the building. Therefore, addressing the toilets on the second floor alone is not appropriate. Speaker B should tell Speaker A the locations of all toilets in the whole building. If *dou* is simply related to plurality or distributivity, this effect cannot be explained.

Summarizing, I have reported the facts that *dou* is compatible with mass nouns, singular nouns, and collective events (contra Lin 1996). I have also shown that the occurrence of *dou* requires an exhaustive reading. These facts show that *dou* is an exhaustive expression, rather than a plural or distributive expression.

Such an expression can also be found in other languages. As seen in the translations of the Mandarin Chinese examples above, the exhaustive readings with mass nouns, singular nouns, and collective predicates, are also found for English *all*.

3. The existence of non-exhaustive expressions

The existence of the so-called enumeration coordinators indicates that non-exhaustiveness may also be represented lexically.

In many languages, one can find special coordinators to conjoin items of an open list. Such coordinators are called “A and B (for example)” coordinators in Payne (1985:23), enumeration coordinators in Stassen (2000:5), and representative coordinators in Haspelmath (2007). The correlative coordinators *-a...-a* in Mandarin Chinese are such coordinators, as seen in (10a) and (10b). If the conjuncts do not form an open set, as in (10c), the coordinators may not be used (In Shanghai Chinese, the correlative coordinators *-lo...-lo* have the same property as *-a...-a* in Mandarin Chinese; examples can be found in Qian 1997:185, Liu 2000:142).

- (10) a. Shu-a, baozhi-a, bai-man-le zhengge shujia.
 book-and newspaper-and put-full-PRF whole bookshelf
 ‘Books and newspapers, among other things, occupied the whole bookshelf.’
 b. Tamen tiao-a chang-a, huanqing shengli.
 they dance-and sing-and celebrate victory
 ‘They sang, danced, among other activities, to celebrate the victory.’
 c. Yin-(*a) yang-(*a) duili.
 yin-and yang-and opposite
 ‘Yin and yang are opposites.’

According to Kuno (1973:115), the coordinator *-to* in Japanese is used for

“exhaustive-listing,” whereas *-ya* is not (also see Hinds 1986:94, Martin 1987:154).

- (11) a. Taroo-to Akiko-wa Nara-e ikimahsita.
 Taro-and Aikiko-TOP Nara-to went
 ‘Taro and Akiko went to Nara.’
 b. Taroo-ya Akiko-wa Nara-e ikimahsita.
 Taro-and Aikiko-TOP Nara-to went
 ‘Taro and Akiko among others went to Nara.’
- (12) a. Biiru-to sake-o takusan nomimashita.
 beer-and sake-ACC lots drank
 ‘[I] drank lots of beer and sake.’
 b. Biiru-ya sake-o takusan nomimashita.
 beer-and sake-ACC lots drank
 ‘[I] drank lots of beer and sake and stuff’

Summarizing, the Mandarin Chinese coordinators *-a...-a*, the Shanghai Chinese coordinators *-lo...lo*, and the Japanese coordinators *-ya* all have the feature [-exhaustive].

4. Exhaustivity and Measurability

If the contrast between singularity and plurality makes sense for countable nominals only, and thus countability is the superordinate feature of the two values of the number feature, what is the superordinate feature of [+exhaustive] and [-exhaustive]? I will search for an answer by examining the licenser of the exhaustive marker *dou* in Mandarin Chinese.

Realizing that *dou* may denote concepts other than plurality, Zhang (1997:170) claims that the real licenser of *dou* is a nominal that denotes a measurable entity with respect to the relevant event.

What is measured exactly in *dou* sentences? As we know, only a gradable or measurable *x* can be measured. Accordingly, I claim that the nominal associated with *dou* must be measurable for the related event. For instance, a single book is measurable with respect to a reading event, in the sense that one may read it partially, and thus (13a) is fine. But a single book is not measurable with respect to a book-borrowing event (no one can borrow a book partially), and thus *dou* may not occur in (13b).

- (13) a. Zhe ben shu, wo dou kan-le. (= (3b))
 this CL book I all read-PRF
 ‘This book, I have read all of it.’
 b. Zhe ben shu, wo (*dou) jie-le.
 this CL book I all borrow-PRF
 ‘This book, I borrowed.’

Similarly, a single table is measurable with respect to a wetting event, since it is possible to make part of a table wet, and thus (14a) is fine. But a single table is

not measurable with respect to a table-buying event, since it is impossible to buy part of a table, and thus *dou* may not occur in (14b).

- (14) a. Lulu ba na zhang zhuozi dou nong-shi-le. (= (3b))
 Lulu BA that CL table all make-wet-PRF
 ‘Lulu made that whole table wet.’
 b. Lulu ba na zhang zhuozi (*dou) mai-le.
 Lulu BA that CL table all sell-PRF
 ‘Lulu sold that table.’

What is not measured in *dou* sentences? First, it is not the time of an event that is measured. *Dou*-eventualities do not have to be durative. Instantaneous events are also possible:

- (15) a. Ta ba yi ping shui dou reng-le. (Jiang 2007:4)
 he BA one bottle water all throw-PRF
 ‘He threw the whole bottle of water.’
 b. Ta ba yi ping shui dou sa-le.
 He BA one bottle water all spill-PRF
 ‘He spilled the whole bottle of water.’

Since *dou* may also occur in instantaneous events, it is not the time of the eventuality that is measured. Importantly, it is possible to throw or spill part of a bottle of water, therefore, *yi ping shui* ‘one bottle water’ is a measurable element for the events in (15a) and (15b). *Dou* is thus licensed in the examples.

Second, *dou*-eventualities do not have to be plural, therefore, it is not the eventuality quantity that is measured. Examples like (15) do not imply the occurrence of plural eventualities at all. Our observation thus does not support Huang’s (2005) claim that *dou* serves as a sum operator, such that *dou* and the main predicate are jointly associated with the sum/union of minimum events, whose number must be two or above. Also, our observation does not support Xiang’s (2008) claim that *dou* “operates on any plural set and outputs a maximal plural individual” (p. 228) and that “*dou* has a plural presupposition, such as the domain on which it operates has to contain more than one cover” (p. 237) (see our footnote 3 for the possibility of an exhaustively collective reading, i.e., a single cover reading of *dou* sentences).

I conclude that exhaustivity expressions are licensed by measurable elements and thus the super-ordinate feature for exhaustivity is measurability.

5. The source of the distributive reading of *dou*

In this section I answer the question why *dou* sometimes rejects collective readings. (16a) is ambiguous between a default collective reading (only one watermelon was affected) and a distributive reading (two melons were affected), but (16b) has a distributive reading only.

- (16) a. Baoyu he Daiyu chi-le yi ge xigua.
 Baoyu and Daiyu eat-PRF one CL watermelon
 ‘Baoyu and Daiyu ate a watermelon.’ *two readings*
- b. Baoyu he Daiyu dou chi-le yi ge xigua.
 Baoyu and Daiyu all eat-PRF one CL watermelon
 ‘Baoyu and Daiyu each ate a watermelon.’ *one reading*

Such a contrast makes people believe that *dou* is a distributive marker. However, no parallel contrast is seen in (17a) and (17b). Both of them are ambiguous, although the latter contains *dou*: either the two persons are opponents of a single chess game, or each of them is playing a chess game with someone else.

- (17) a. Baoyu he Daiyu zai xia qi.
 Baoyu and Daiyu PRG play chess
 ‘Baoyu and Daiyu are playing chess.’ *two readings*
- b. Baoyu he Daiyu dou zai xia qi.
 Baoyu and Daiyu all PRG play chess
 ‘Baoyu and Daiyu are both playing chess.’ *two readings*

The exclusively distributive reading of *dou* in sentences like (16b) may come from other functions of *dou*. *Dou* can play the role of a focus marker (Shin 2007, among others). Certain focus markers may exclude collectivity. Winter (1998; see Hendriks 2004) shows that the focus particles *too*, *also*, and *as well* all can exclude a collective reading.

- (18) a. The Americans and the Russians too fought each other.
 b. The Americans and the Russians as well fought each other.
 c. The Americans and also the Russians fought each other.

(18a) means that the Americans fought each other and the Russians fought each other. It does not mean that the Americans fought against the Russians. If *too* did not occur, the sentence would have the latter reading. Parallel effects are seen in (18b) and (18c).⁵

But why may focus markers exclude collectivity?

My account is that collective readings are lazy readings. Specifically, it is generally recognized that elements that are more readily integrated into the sentence are processed faster than elements that are not so readily integrated into the sentence. For instance, the arguments of a verb are easier to process than adjuncts of the verb. Thus Speer and Clifton (1998) found that readers read the same prepositional phrases faster when they were arguments of a verb than when they were adjuncts. A similar conclusion follows from the finding that

⁵ Note that not all types of focus markers exclude collective readings. The additive focus marker *even* and *lian...dou* ‘even’ in Mandarin Chinese do allow collective readings. I leave the inconsistency between different types of focus markers for future study.

(i) Even the Georgians and the Russians fight each other.
 (ii) Lian Baoyu gen Daiyu dou huxiang chaojiao.
 even Baoyu and Daiyu even mutual quarrel
 ‘Even Baoyu and Daiyu quarreled.’

prepositional phrases that can function either as arguments or as adjuncts tend to be understood as arguments (Schütze and Gibson 1999). Furthermore, an experiment reported by Lin (2007) showed that the possessors of inalienable nouns (including kinship terms and body parts) were read significantly faster than their alienable counterparts.

Conjuncts of collective coordination are more readily integrated into the sentence than conjuncts of distributive coordination, so we expect that the former coordinate constructions should be processed more easily than the latter coordinate constructions. This is indeed the case. Frazier et al. (1999) reported that “[R]eaders clearly exhibited a preference for the collective reading of the ambiguous portion of the sentences in our experiment.” The same result was reported in Yu’s (2008) experimental study of coordination in Mandarin Chinese. We also observe that if a coordinate complex is ambiguous between collective and distributive coordination readings, the default is the former reading. For (19a), in the collective reading, the sentence means that Baoyu has engaged with Daiyu, whereas in the distributive reading, each of them is engaged with someone else. The collective reading is the default one, whereas the distributive reading is marked. For (19b), the consecutive reading of the conjuncts is the default one, whereas the two separate event reading, which is distributive, is marked.

- (19) a. Baoyu {he/gen} Daiyu dingqin-le.
 Baoyu and/and Daiyu engage-PRF
 ‘Baoyu and Daiyu are engaged.’
 b. John went to the store and bought some ice cream.

As pointed out by Carston (1993:29), the collective coordinate reading “is overwhelmingly more likely to be recovered by the hearer, and to have been intended by the speaker,” than the distributive coordination reading. This fact has been discussed from a pragmatic perspective since Grice (1967), and accounted for by the pragmatic notion of relevance by Carston, which she claims minimizes processing effort (p. 29). Also, following Crain and Steedman (1985), one might assume that the distributive reading is not preferred because it presupposes the existence of several separate events.

I claim that focus markers force the speaker and the hearer to be more careful, thus may suppress the lazy reading.

6. Conclusion

I have argued for the existence of the morpho-syntactic feature exhaustivity, which is independent of the well-recognized features of distributivity and plurality. I also argued that the super-ordinate feature for [+ exhaustive] and [- exhaustive] is [measurable]. Furthermore, I claimed that the possible absence of collective readings of sentences with exhaustive expressions is related to the focus marker function of the expressions.

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Define exhaustivity. exhaustivity synonyms, exhaustivity pronunciation, exhaustivity translation, English dictionary definition of exhaustivity. adj. 1. Treating all parts or aspects without omission; thorough: an exhaustive study. 2. Tending to exhaust. ex·haus·tive·ly adv. ex·haus·tive·ness n... Exhaustivity - definition of exhaustivity by The Free Dictionary. <https://www.thefreedictionary.com/exhaustivity>. Printer Friendly. Dictionary, Encyclopedia and Thesaurus - The Free Dictionary 12,670,140,909 visitors served. How to model exhaustivity in clefts is a hotly debated topic in the literature and one that has received much attention in recent years. Generally speaking, there are two main camps in the debate: there are (i) those that take the exhaustive meaning to be conventionally-coded in the cleft structure itself, a hard-wired semantic inference which is predicted to arise robustly and systematically (among others, Atlas & Levinson 1981, Percus 1997, Boring & Krieger 2013; and (ii) those that take exhaustivity to be a non-conventionally-coded. The functional architecture is thought to play a central role in this task, by encoding efficiently complex stimuli and facilitating higher level processing. We demonstrate mathematically here that two natural principles, local exhaustivity of representation and parsimony, would constrain the orientation and spatial frequency maps to display co-located singularities around which the orientation is organized as a pinwheel and spatial frequency as a dipole.