Ways of decomposing events:
Structural differences between adnominal and adverbial distributive numerals
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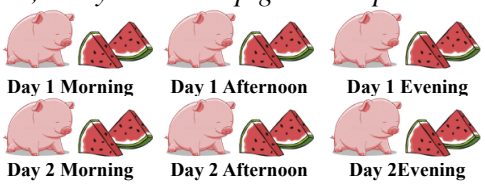
Overview We present novel data from Mandarin that suggests truth conditional differences between adnominal and adverbial distributive numerals (DistNums). Our proposal defends a unified semantics for DistNums couched in a neo-Davidsonian framework *à la* Schein (1993).

Background DistNums are numeral constructions that force a distributive reading of the sentence by taking a plural NP and distributing it over nonoverlapping subevents. Mandarin DistNums involve reduplicating a numeral-classifier combination; they can be adnominal or adverbial, marked by $de_{\textbf{adn}}$ (的) and $de_{\textbf{adv}}$ (地) in addition to being prenominal and preverbal respectively. A basic example in (1) suggests that the two types of DistNums are truth conditionally **equivalent**:

(1) (**Liang-duo.liang-duo.de**) yanhua (**liang-duo.liang-duo.de**) zai zhanfang.
two-cl.two-cl.de$_{\textbf{adn}}$ firework two-cl.two-cl.de$_{\textbf{adv}}$ PROG explode
'The fireworks is exploding in twos/two at a time.'

The Puzzles Within event semantics, one approach -- that of Balusu (2006) and Cable (2014) -- treats DistNums as specifying the cardinality of the participant of a subevent of the topical event. DistNums themselves are taken to be responsible for decomposing the topical event into subevents. This predicts that if a sentence contains two DistNums, they should be able to decompose the topical event in **different** ways. Interestingly, it is in such cases that the equivalence of adnominal and adverbial Mandarin DistNums breaks down. Consider (2) which offers two salient ways of decomposing the topical event:

(2) *Scenario: During a two-day festival, on each day, a pig ate two pieces of watermelons at breakfast, another pig ate two pieces at lunch, and yet another pig ate two pieces at dinner.*



The topical event (= the festival) may be decomposed into **days** (Agent = 3 pigs, Theme = 6 pieces of watermelon), or **meals** (Agent = 1 pig, Theme = 2 pieces of watermelon). Note that (3a) with two adverbial DistNums is false; only (3b) with an adnominal and an adverbial DistNum is true:

(3) a. Zhu **san-tou.san-tou-de** ba xigua **liang-kuai.liang-kuai-de** chi-wan le
pig three-cl.three-cl$_{\textbf{ag}}$-de$_{\textbf{adv}}$ BA watermelon two-cl.two-cl$_{\textbf{th}}$-de$_{\textbf{adv}}$ eat-finish PFV
'The pigs, three by three, ate the watermelons two pieces at a time.' (False)
b. **San-tou.san-tou-de** zhu ba xigua **liang-kuai.liang-kuai-de** chi-wan le
three-cl.three-cl$_{\textbf{ag}}$-de$_{\textbf{adn}}$ pig BA watermelon two-cl.two-cl$_{\textbf{th}}$-de$_{\textbf{adv}}$ eat-finish PFV
'The pigs in threes ate the watermelons, two pieces at a time.' (True)

To make (3a) true, the scenario would have to be such as to allow the topical event to be decomposed in a way such that each subevent has 3 pigs as Agent and 2 pieces of watermelon as Theme. The data suggests that two adverbial DistNums must decompose the event in the **same** way, and presents a challenge to a unified analysis adnominal and adverbial DistNums. Two questions arise: *Question (1)* Why must the two adverbial DistNums in (3a) match in the subevents they modify? *Question (2)* Why do adnominal and adverbial DistNums behave differently here?

Analysis We assume that the domain of individuals D_e and that of events D_v are composed of singularities and pluralities, which are closed under sum formation and are partially ordered by a 'plural-part' relation ($\sqsubseteq_{PL}$) induced by the sum formation operation. **Singularities** are entities that don't have any other entities as a proper plural-part of them, but nothing in this definition implies that singularities don't

spatiotemporally overlap (e.g. the singular event of John moving a leg is a spatiotemporal part but not a plural-part of the singular event of him running).

Following Schein (1993), we adopt a neo-Davidsonian syntax in which verbs are predicates of events and verbal arguments are introduced via thematic roles. We propose that each conjunct of a neo-Davidsonian is true of its own event, which are then stitched together by the complete overlap relation **O**.

(4) a. The boys danced. b. $\exists e_1(\exists e_2(\text{theme}(e_2) = \textbf{the.boys} \ \& \ \textbf{O}(e_2,e_1)) \ \& \ \text{dance}(e_1))$

c. $\textbf{O}(e,e')$ iff $\forall e''(e''$ spatiotemporally overlaps with $e \leftrightarrow e''$ spatiotemporally overlaps with $e')$

We propose a uniform meaning for Mandarin adnominal and adverbial DistNums in (5). Following Champollion (2016), distance distributive items like DistNums associate with an NP via co-indexation with its thematic role. We analyze the differences between adnominal and adverbial DistNums **not as a lexical difference, but as a structural one**: they differ from each other only with respect to where they attach in the structure of the sentence.

(5) $[[\text{DistNum}_\theta]] = \lambda e_v.\ e \in {}^*\lambda e'(|\theta(e')| = n \ \& \ \text{SG}(e'))$

Question (1) The falsity of (3a) follows from two key ingredients of the analysis (i) the two adverbial DistNums decompose the topical event into singular subevents and (ii) they modify the same event -- that of the verb. In scenario (2), there are 9 salient singular events: 6 meals, 2 days, and 1 festival. Although both the sum of days and the sum of meals satisfy the first line in (6), only the former satisfies the agent DistNum and only the latter satisfies the theme DistNum. This conflict leads to the falsity of (3a).

(6) $\exists e_1(\exists e_2(\text{agent}(e_2) = \textbf{the.pigs} \ \& \ \textbf{O}(e_2,e_1)) \ \& \ \text{eat}(e_1) \ \& \ \exists e_3(\text{theme}(e_3) = \textbf{the.wtmls} \ \& \ \textbf{O}(e_3,e_1))$
$\& \ e_1 \in {}^*\lambda e_1'(|\text{agent}(e_1')| = 3 \ \& \ \text{SG}(e_1')) \ \& \ e_1 \in {}^*\lambda e_1'(|\text{theme}(e_1')| = 2 \ \& \ \text{SG}(e_1')))$

Question (2) In (3b), the adverbial and adnominal DistNums do not have to match because they modify different events: the former modifies the verb event, whereas the latter modifies the event of the thematic role of its NP host. The truth conditions we assign for (3b) are the following:

(7) $\exists e_1(\exists e_2(\text{agent}(e_2) = \textbf{the.pigs} \ \& \ e_2 \in {}^*\lambda e_2'(|\text{agent}(e_2')| = 3 \ \& \ \text{SG}(e_2')) \ \& \ \textbf{O}(e_2,e_1)) \ \& \ \text{eat}(e_1)$
$\& \ \exists e_3(\text{theme}(e_3) = \textbf{the.wtmls} \ \& \ \textbf{O}(e_3,e_1)) \ \& \ e_3 \in {}^*\lambda e_3'(|\text{theme}(e_3')| = 2 \ \& \ \text{SG}(e_3')))$

These truth conditions are satisfied in the scenario because the sum of days is a witness to the agent event, the sum of meals is a witness to the verb event.

Extension to other distance distributive items Our analysis can be extended to account for the interaction between DistNums and other distance distributive items within Mandarin and beyond (e.g. Japanese). For instance, the Mandarin particle *dou* has a distributive use that behaves like English *each*. Assuming again the scenario in (2), (8a) below is false yet (8b) is true. In (8a), we see that, if a DistNum decompose the topical event into days, *dou* cannot further decompose the days into meals. Assuming that *dou* is also modifier of the verb event, this follows from the fact that DistNums decompose events into **singular** subevents, which cannot be further decomposed. The truth of (8b) is also captured in our proposal, given that adnominal NumNum modifies a different event from *dou*.

(8) a. Zhu **san-tou.san-tou-de** **dou** ba liang-kuai xigua chi-wan le
pig three-cl.three-cl$_{\textbf{ag}}$-de$_{\textbf{adv}}$ DOU BA two-cl$_{\textbf{th}}$ watermelon eat-finish PFV
'The pigs, three by three, ate two watermelons at a time.' (False)

b. **San-tou.san-tou-de** zhu **dou** ba liang-kuai xigua chi-wan le
three-cl.three-cl$_{\textbf{ag}}$-de$_{\textbf{adn}}$ pig DOU BA two-cl$_{\textbf{th}}$ watermelon eat-finish PFV
'The pigs in threes all ate two watermelons.' (True)

References Balusu, R. (2006). Distributive reduplication in Telugu. *Proceedings of the 36th NELS conference* Cable, S. (2014). Distributive numerals and distance distributivity in Tlingit (and beyond). *Language, 90*(3), 562-606. Champollion, L. (2016). Covert distributivity in algebraic event semantics. *Semantics and Pragmatics, 9*(15), 1-65. Schein, B. (1993). *Plurals and events*. MIT Press.