

Markers of distributivity in Czech

16-04-2019, Humboldt-Universität zu Berlin

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Outline

- 1) distributivity
- 2) four distributive markers in Czech
- 3) typology of distributive markers: Zimmermann (2002)
- 4) Czech binominal *each*

Semantics preliminaries

- distributive readings: quantification over atoms
- distributive markers are incompatible with cumulative interpretation

- (1) Two singers performed ten songs.
- a. cumulative: singer 1 – 6 songs, singer 2 – 4 songs
 - b. distributive: $\exists X[singers(X) \wedge \#(X) = 2 \wedge \forall y \in X[performed(y, TenSongs)]]$

- English distributive markers:

- (2)
- | | | |
|----|---|------------|
| a. | Each of the two singers performed ten songs. | determiner |
| b. | The two singers performed each ten songs. | binominal |

- Czech much more expressive
- sentence with Czech “and” and cardinal numeral:

(3) a. Petr a Karel zazpívali deset písní.
 Petr and Karel sang ten songs
 ‘cumulative/distributive/collective/...’

① the conjunction strategy:

(4) a. Petr i Karel zazpívali deset písní.
 Petr and Karel sang ten songs
 ‘distributive’

Three sub-types of *i*

① focus particle with:

- scalar (least-likely) presupposition: (5-a)
- additive presupposition: (5-b)

(5) Petr přečetl *i* třetí díl Pána-prstenů.
Petr read even third volume LOTR.GEN
'Petr read even the third volume of LOTR.'

- a. scalarity: ?? Petr read *i* first volume LOTR
- b. additivity: ?? Petr read *i* third volume LOTR but not the first two

② obligatory distributive conjunction (boolean \wedge)

- (6) V Praze se sešli anarchisti i skinheadi.
in Prague SE gathered anarchists i skinheads
'Anarchists gathered in Prague \wedge skinheads gathered in Prague.'
a. $\#Gathered(Anarchists \sqcup Skinheads)$

③ additive particle (without scalar presupp.)

- (7) Na náměstí přišli anarchisti. A pak přišli i skinheadi.
to square arrived anarchists and then arrived i skinheads
'Anarchists arrived to the square and then skinheads arrived too.'
- (8) ??The square was empty and then arrived i skinheads.

Czech National Corpus (CNK) survey (Šafratová 2018)

- 1) scalar *i* (47%)
- 2) additive *i* (41%)
- 3) conjunction *i* (12%)

Second strategy: “po Num N”

- the dependent indefinites strategy

- (9) a. Petr a Karel zazpívali po deseti písních.
Petr and Karel sang P ten songs
'distributive'

- similar to adverbial German *jeweils* (vs. English *each*):

(10) Die Mädchen haben jeweils zwei Hunde gesehen.

- a. #cumulative
- b. individual distributivity (each girl ... two dogs)
- c. occasional distributivity (each time ... two dogs)

(11) The girls saw two dogs each.

- a. #cumulative
- b. individual distributivity
- c. #occasional distributivity

- in many languages (sign languages, Hungarian, Telugu) is the dependent indefinites strategy grammaticalized via reduplication
- participant, temporal and spatial keys are grammatical with reduplication (Telugu)

(12) prati pilla-vaaDu renDu renDu kootu-lu-ni cuus-ee-ru
 every kid two two monkey.pl.acc see.past.3pl
 lit. 'every kid saw two two monkeys'

- (13) a. Every kid saw two monkeys each. Participant-key
 b. Every kid saw two monkeys in each interval. Temporal-key
 c. Every kid saw two monkeys in each location. Spatial-key

- but also languages which allow only participant-key readings with reduplication (Hungarian):

(14) A gyerekek két-két majmot láttak.
the children two-two monkey.acc saw.3pl
'The children saw two monkeys each'

Zimmermann (2002)

(15) Zimmermann's Generalization: If a distance distributivity item can also be used as a distributive determiner, it lacks the occasion reading.

- reported data from Dutch, Norwegian, Italian, Russian, French, Turkish, Czech, Bulgarian, and Korean
- Czech seems to fit

Sidenote

- very dubious data reported in Zimmermann (2002)

(16) Chlapci koupili po dvou párcích/párkách.
boys bought Dist two sausages.loc
'The boys bought two sausages each.'

- “po” cannot be used as a determiner:

(17) Každý/*Po chlapec koupil dva párky.
Dist boy bought two sausages
'Each boy bought two sausages.'

- totally unacceptable in Czech:

(18) Po třech ženách vstupovalo do místnosti.
Dist three.loc women.loc entered.3sg into room
'Three women entered the room [i.e., one triplet after another]'

- individual distribution vs. (possible) occasion distribution with Czech dependent indefinites is possible though:

- (19) Mojmírek a Mariánka si dali po dvou zmrzlinách.
Mojmírek and Mariánka SE consumed po two ice-creams
'Mojmírek and Mariánka consumed two ice creams each/each time'
- a. each of two children ...2 ice creams
 - (i) Ma ... 1 ice cream + 1 ice cream
 - (ii) Moj ... 1 ice cream + 1 ice cream
 - b. each time ...2 ice creams
 - (i) Ma ... 1 ice cream
 - (ii) Moj ... 1 ice cream

Contrast with binominal *každý* 'each':

- (20) Mojmírek a Mariánka si dali každý tři zmrzliny.
Mojmírek and Mariánka SE consumed each three ice-creams
'Mojmírek and Mariánka consumed each three ice-creams.'
- a. *cumulative reading: Mo ...1, Ma ...2+3
b. distributive: Mo 1+2+3, Ma 1+2+3

- with singular NPs only the occasion reading: (21)
- singular NP + adnominal DD → doubling of distributivity
...ungrammaticality
- can be used as a test: adverbial distributivity with proper name in sg. should be acceptable

(21)???Mojmírek si každý dal dvě zmrzliny.
 Mojmírek SE each consumed two ice-creams
 '???Mojmírek consumed each two ice-creams.'

(22) Mojmírek si dal po dvou zmrzlinách.
 Mojmírek SE consumed po two ice-creams
 'Mojmírek consumed two ice creams each time.'

i behaves more like dependent indefinites allowing occasional distributivity:

(23) Petr zamíchal červenou i zelenou barvu.
Petr mixed red i green color
'*Mixed(Green) ∧ Mixed(Red)*'

(24) Mariánka i Mojmírek si dávali dvě zmrzliny.
Mariánka i Mojmírek SE consumed two ice-creams
'individual distributive/occasional reading'

3 binominal/determiner strategy

(25) Každý z těch dvou zazpíval deset písní.
each of the two sang ten songs
'distributive'

(26) Petr a Karel zazpívali každý deset písní.
Petr and Karel sang each ten songs
'distributive'

Terminology

- data: binominal *each* vs. distributive *each*
- diagnosis of the distributive reading: lack of the cumulative reading

(27) Two boys bought three books.

(28) a. *Each* of the two boys bought three books.

b. Two boys bought [three beers *each*].

determiner
binominal

- (28-a): determiner *each*, *two boys* restriction, VP nuclear scope
- (28-b): binominal *each*, *two boys* key, *three books* share
- syntactic structure: Safir and Stowell (1988)
- joint work with Radek Šimík

4) Pluractional strategy

- plurality of events
- Upriver Halkomelem: the verb yáleq' is the pluractional form
- many trees fell down at the same time/the same tree fell down multiple times
- but not one tree once

(29) yáleq' -et -es te theqát
fall.pl -tr. -3S det. tree
'He/they felled the tree(s).'

Kuhn's typology:

- 1) Pluralizing operators sum together the objects in a set $\{a, b, c\} \rightarrow \{a, b, c, a \sqcup b, a \sqcup c, b \sqcup c, a \sqcup b \sqcup c\}$
 - 2) Plural filters restrict a set to only its plural objects $\{a, b, c, a \sqcup b, a \sqcup c, b \sqcup c, a \sqcup b \sqcup c\} \rightarrow \{a \sqcup b, a \sqcup c, b \sqcup c, a \sqcup b \sqcup c\}$
- dependent indefinites and pluractional markers: plural filters

Diagnostics

① No variation of plain indefinites

- French Sign Language:

(30) EVERY-DAY JEAN ONE WORD FORGET. ✓ many words ✓ one word
word

‘Every day, Jean forgot one word.’

(31) JEAN ONE WORD FORGET-rep. *many words ✓ one word

‘Jean forgot one word repeatedly.’

② Innocent redundancy

- pluralizing operators: double distributivity (3 dogs x 7 evenings)

(32) John walked each of his dogs every evening.

- two filters (pluractional marker and dependent indefinite) don't multiply: vary with respect to a single key
- Kaqchikel: pluractional marker (-*ala'*) and an dependent indefinite

(33) Xinkan-*ala'* ju-jun wuj.
I-search-LA' one-one book
'I looked for a book on each occasion.'

- distributive operators license pluractionals and distributive numerals:
- Kaqchikel

(34) Chikijujunal ri tijoxela' xkiq'etej ju-jun tz'i'.
 each the students hugged one-one dog
 'Each of the students hugged a dog.'

- Czech pluractional *-(o)va* seems to fit:
- no variation:

- | | | |
|------|--|------------|
| (35) | Každý student po-líbil maminku.
'Every student kissed a mother.' | ✓ 1 ✓ many |
| (36) | Petr líb-áva-l maminku.
'Petr kissed a mother (on many occasions).' | ✓ 1 * many |

- can be licensed by distributivity operator and doesn't multiply distr.

- (37) Petr každý den vyčistil každé kolo.
'Petr cleaned each of his bikes every day.'
- (38) Petr každý den čistíval kola.
'Petr cleaned his bikes every day.'
- (39) Každý student líbával maminku.
'Every student kissed the mother.'

Basic properties of Czech binominal *each* I

Expected properties of Czech binominal *each*

seminal discussion (English binominal *each*): Safir and Stowell (1988), recently Dotlačil (2012), Zimmermann (2002), a.o.

- Both **pre-** and **post-**position wrt **share NP** (*jednu čepici*) possible:

(40) Chlapci si koupili **každý** jednu čepici.
boys.NOM.PL REFL bought.PL each.NOM.SG one cap.ACC
'The boys bought each one cap.'

(41) Chlapci si koupili jednu čepici **každý**.
boys.NOM.PL REFL bought.PL one cap.ACC each.NOM.SG
'The boys bought one cap each.'

Basic properties II

- **Bare** (non-determined) **share NP not allowed**; cf. VP-related *each* (44):

(42) ??Chlapci si koupili **každý** čepici.
boys.NOM.PL REFL bought.PL each.NOM.SG cap.ACC
Intended: 'The boys bought each one cap.'

(43) ??Chlapci si koupili čepici **každý**.
boys.NOM.PL REFL bought.PL cap.ACC each.NOM.SG
Intended: 'The boys bought one cap each.'

(44) Chlapci si **každý** koupili čepici.
boys.NOM.PL REFL each.NOM.SG bought.PL cap.ACC
'The boys each bought a cap.'

Clause-mate restriction

- (45) *Chlapci říkali, že Marie koupila každý jednu čepici.
boys.PL said that Marie bought each.SG.M one cap.ACC
Intended: 'Each of the boys said that Mary bought one cap.'

- **Key** can be **any argument**, not just subject.

- (46) Marie přinesla chlapcům každému jednu čepici.
Marie brought boys.DAT.PL each.DAT.SG one cap.ACC
'Marie bought each of the boys one cap.'

- (47) Marie přinesla ty čepice každou jednomu chlapci.
Marie brought the caps.ACC.PL each.ACC.SG one boy.DAT
'Marie brought each of caps to one boy.'

- Share can be non-accusative

(48) Těm chlapcům se líbila každému jedna dívka.
the boys.DAT.PL REFL liked each.DAT.SG one girl.NOM
'The boys liked one girl each.'

Underlying structure of Czech binominal *each* I

Language specific properties: agreement with the key

Idea: Czech binominal *each* contains a covert singular definite description referring back to / bound by a plural antecedent.

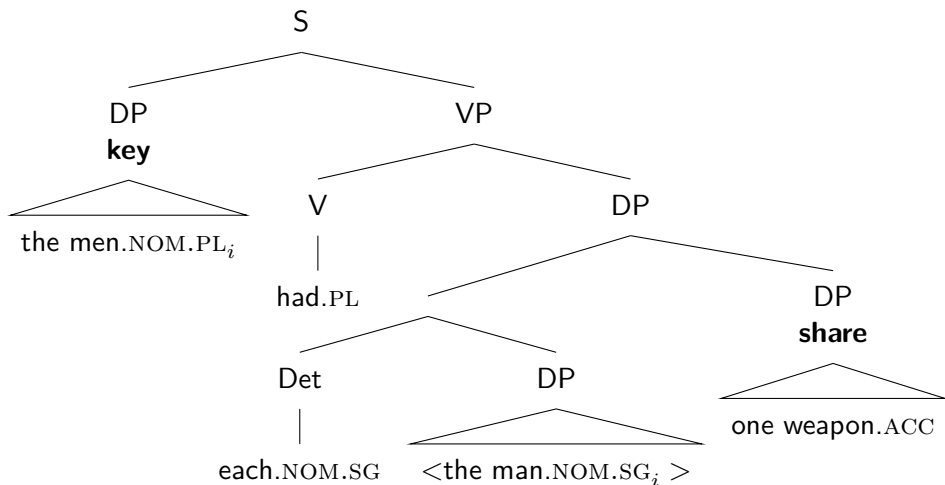
- Example with discourse anaphora:

- (49) Přišli nějací muži_i. Každý / Jeden (ten muž_i) měl
came some men.PL each one the man.SG had.SG
zbraň.
weapon
'Some men came. (Each) one of them (lit. each/one the man) had
a weapon.'

- Hypothesized structure of binominal *each*, where $\langle \text{ten muž} \rangle$ is obligatorily deleted under (partial) identity with its antecedent; cf. Sauerland (1998), Fox (2003), Johnson (2012), a.o., for a similar treatment of traces

(50) Ti muži_i měli každý $\langle \text{ten muž}_i \rangle$ jednu zbraň.
 the men.PL had.PL each the man.SG
 'The men had one weapon each.'

Proposed constituent structure



Argument: Movement

- Binominal *each* vs. floating *all*: Binominal *each* forms a constituent together with the share.

(51) [Každý /* Všichni 3 medaile] jsme vyhráli jen
 each.SG.MASC all.PL.MASC 3 medals be.1PL won.PL only
my.
we
(Intended:) 'We were the only ones to win three medals each.'

Semantic properties

- distributivity over atoms in key's denotation
- → prevents (usually) cumulative and collective interpretation
- pseudoCzech

(52) two professors examined three students.

- a. cumulative: 2 professors ... 3 students
- b. distributive: 2 professors ... 6 students
- c. collective: 2 professors (cooperating) ... 3 students

(53) two professors examined [each three students].

- a. #cumulative: 2 professors ... 3 students
- b. distributive: 2 professors ... 6 students
- c. #collective: 2 professors (cooperating) ... 3 students

Collectives

- predicates like *gather*, *be a good team*, *be a group (of NP)*
- usually enforce collective reading

(54) The group of two authors wrote three books.

- a. *distributive: 2-6
- b. *cumulative: 2-3
- c. ✓ collective: 2(together)-3

- usually collectives and distributivity markers clash:

(55) *The group of two authors wrote three books each.

Dowty (1987), Brisson (2003), Winter (2002), Dočekal (2012)

Two types of collectives

- two types of collective predicates (Dowty (1987), Winter (2002), Brisson (2003), ...):
 - ① *gather, meet, sing together, ...* **set predicates**
 - ② *be a good team, outnumber NP, ...* **atom predicates**
 - ▶ the criterion (compatibility with *all* – Dowty, sg/pl Winter):
- (56) a. all the boys gathered
b. *all the boys are a good team

- collective Czech numerals like *dvojice* ‘twosome’ (parallel data in other Slavic languages: Polish, Russian, ...) enforce the **collective reading**

- (57) a. **Dva** sportovci vyhráli 2 medaile, ✓ první zlato a stříbro,
 two athletes won.PL 2 medals first gold & silver
 druhý stříbro a bronz.
 second silver & bronze
 ‘Two athletes won 2 medals, the first one G & S, the second
 one S & B.’
- b. **Dvojice** sportovců vyhrála 2 medaile, # první zlato a stříbro,
 druhý stříbro...twosome athletes.gen won.sg.fem 2 medals

- collective set predicates allow limited distributivity (Dotlačil (2012))
- collective Czech numerals can distribute over reciprocals like set collectives

(58) [Bill and Peter, together],/#[the team of students] carried the piano across each other's lawns.

(59) **Dvojice** /# **Skupina** podezřelých zradila jeden druhého.
 twosome group suspects.GEN betrayed one other.
 (Intended:) 'The people within the twosome / group of suspects betrayed one another.'

- provisional assumption: collective numerals are set collectives

The contrast

binominal *each* + set collectives

(60) **Dvojici** detektivů byly předány [každému **tři**
twosome.dat detectives.gen were given [each.dat three.nom
ceny].

prizes.nom]

'Three prizes each were given to twosome detectives.'

a. only distr.: 2 detectives ... 6 prizes (3 each)

- binominal *each* can distribute 'into' set collectives

determiner *each* + set collectives

(61) [Každé **dvojici** detektivů] byly předány **tři**
[each.dat twosome.dat detectives.gen] were given three.nom
ceny.

prizes.nom

'Three prizes were given to each twosome of detectives.'

a. only distr. over twosome: (each) 2 detectives ... 3 prizes

- determiner *each* can distribute only over groups, not 'into'

binominal *each* + atom collective predicate

(62)???'**Týmu** detektivů byly předány každému **tři** ceny.
team.dat detectives.gen were given each.dat three prizes
'???'Three prizes each were given to the team of detectives.'

- binominal *each* clashes with atom collectives

determiner *each* + atom collective predicates

- (63) [Každému **týmu** detektivů] byly předány **tři**
each.dat team.dat detectives.gen were given three.nom
ceny.
prizes.nom
'Three prizes were given to each team of detectives.'
a. only distr. over teams (each 2 prizes)

- determiner *each* can distribute only over group atoms

Cumulative readings with binominal *každý* 'each'

- distributivity can survive with operators normally contradicting it (collective or cumulative) if the distributivity and the other operator don't compete for the same argument

(64) Dva zelináři prodali deseti zákazníkům tři
two greengrocers sold ten.dat customers.dat three.acc
řepy každému.
beets.acc each.dat
'Two greengrocers sold to ten customers three beets each.'

- (65) Dva zelináři prodali deseti zákazníkům tři
two greengrocers sold ten.dat customers.dat three.acc
řepy každému.
beets.acc each.dat
'Two greengrocers sold to ten customers three beets each.'

- (65): subject (*dva zelináři* 'two greengrocers') and the indirect object (*deseti zákazníkům* 'ten customers') allow a cumulative interpretation
- direct object (*tři řepy* 'three beets') is interpreted obligatorily distributively w.r.t indirect object

Agreement confound

- subject vs. non-subject asymmetries

- (66) a. Dva detektivové dostali [každý 3 ceny].
two.nom detectives.nom received [each.nom 3 prizes.acc]
'Two detectives received [each three prizes].'
- b. Deset detektivů dostalo [*každý/*každého 3
ten.nom detectives.gen received.sg [*each.nom/*each.gen 3
ceny].
prizes.acc]

- provisional generalization

- (67) Czech (Slavic?) binominal *each* cannot take as its antecedent genitive complement of a numeral.
- (68) Generál dal deseti detektivům [dvě ceny
general.nom gave.sg three.dat detectives.dat [two.acc prizes.acc
každému].
each.dat]
'The general gave ten detectives [three prizes each].'

- similarly for collective numerals:

(69) Dvojice detektivů chytla [*každý/*každého
twosome.nom detectives.gen caught.sg [*each.nom/*each.gen
tři zloděje.]
three.acc thieves.acc]
'Twosome of detectives caught [three thieves each].'

binominal + set collectives perfectly fine in dativ

- (70) Dvojici detektivů byly předány [každému tři
twosome.dat detectives.gen were given [each.dat three.nom
ceny].
prizes.nom]
'Three prizes each were given to twosome detectives.'
a. only distr.: 2 detectives ... 6 prizes (3 each)

Dotlačil (2012), Dotlačil (2012), Brasoveanu (2008)

(71) Prediction: expected difference between binominal and determiner *each*. Both supply distributivity but binominal distributes locally over the share (it is anaphoric to key but don't scope over it). Determiner *each* scopes over the whole nuclear scope. Predicted inertia of binominal *each* w.r.t. colectivity (and cumulativity) outside of its share.

- main point: illustrate the prediction (Czech data)
- byproduct: semantic and syntactic description of Slavic binominal *each*
- and interaction of determiner/binominal *each* with collectives

Cumulative readings in PCDRT

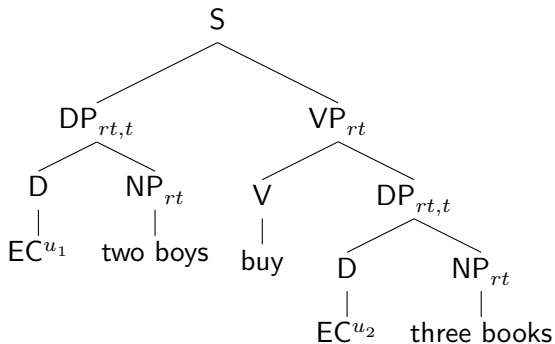
(72) Two boys bought three books.

- essentials: PCDRT works with sets of assignments

Info state J	u_1	u_2
j_1	boy ₁	book ₁
j_2	boy ₁	book ₂
j_3	boy ₂	book ₃

- columns: values of discourse referents, rows: assignments to drefs
- cumulative reading, fully compositional

- E(existential) C(losure): shifts predicates into arguments



$$(73) \quad [u_1, u_2 | \#(u_1) = 2 \wedge \text{BOYS}\{u_1\} \wedge \#(u_2) = 3 \wedge \text{BOOKS}\{u_2\} \wedge \text{BUY}\{u_1, u_2\}]$$

Determiner and binominal *each* in PCDRT

$$(74) \quad \begin{array}{l} \text{a. } \llbracket \text{DET-každý}^{u_n} \rrbracket = \lambda P_{rt} \lambda Q_{rt} . \delta_{u_n} (P(u_n)) \wedge Q(u_n) \\ \text{b. } \llbracket \text{BINOM-každý}^{u_m} \rrbracket = \lambda v_r . \lambda P_{rt} \lambda Q_{rt} . [u_m \text{ ||}] \wedge \delta_v (P(u_m)) \wedge Q(u_m) \end{array}$$

- distributivity operator δ in both
- but binominal *each* introduces discourse referents
- binominal: anaphoric to the key but scopes locally over the share
- determiner: distributes over the nuclear scope

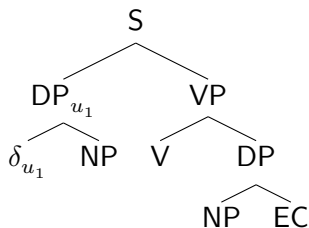
Types in PCDRT: r ... drefs, t ... truth value

Determiner *each*

(75) Each of the two boys bought three books.

Info state J	u_1	u_2
j_1	boy ₁	book ₁
j_2	boy ₁	book ₂
j_3	boy ₁	book ₃
j_4	boy ₂	book ₄
j_5	boy ₂	book ₅
j_6	boy ₂	book ₆

Determiner *each*



- existential closure of the subject (predicative semantics: $\langle r, t \rangle$)
- distributes over the nuclear scope

$$\delta_{u_1}([u_2] \wedge [|\#(u_2) = 3 \wedge \text{BOOKS}\{u_2\}] \wedge [|\text{BUY}\{u_1, u_2\}])$$

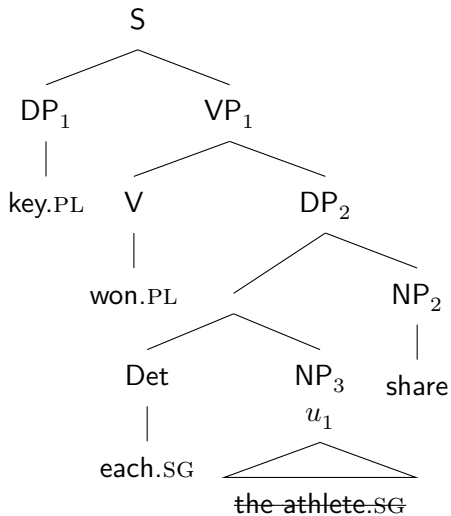
$$(76) \quad [u_1 | \#(u_1) = 2 \wedge \text{BOYS}\{u_1\}] \wedge \delta_{u_1}([u_2] \wedge [|\#(u_2) = 3 \wedge \text{BOOKS}\{u_2\}] \wedge [|\text{BUY}\{u_1, u_2\}])$$

Binominal *each*

- (77) **Dva** sportovci vyhráli **každý** 3 medaile.
two athletes won.PL.MASC each.SG.MASC 3 medals
✓ **distributive**

the same info state as for (93)

Info state J	u_1	u_2
j_1	athlete ₁	medal ₁
j_2	athlete ₁	medal ₂
j_3	athlete ₁	medal ₃
j_4	athlete ₂	medal ₄
j_5	athlete ₂	medal ₅
j_6	athlete ₂	medal ₆



$$(78) \quad [u_1 | \#(u_1) = 2 \wedge \text{ATHLETES}\{u_1\}] \wedge [u_2 | \delta_{u_1}([\#(u_2) = 3 \wedge \text{PRIZES}\{u_2\}])] \wedge \text{WIN}\{u_1, u_2\}$$

- distributivity percolates through the semantic computation
- the same info state but:
- ① determiner *each*: distributes over the nuclear scope + closes the predicative meaning of the subject ($\langle r, t \rangle$)
- ② binominal *each*: scopes only over share ($\delta_{u_1}([\#(u_2) = 3 \wedge \text{PRIZES}\{u_2\}])$) and is anaphoric to the key (u_1)
- predicted difference: local (binominal) vs. global (determiner) distributivity

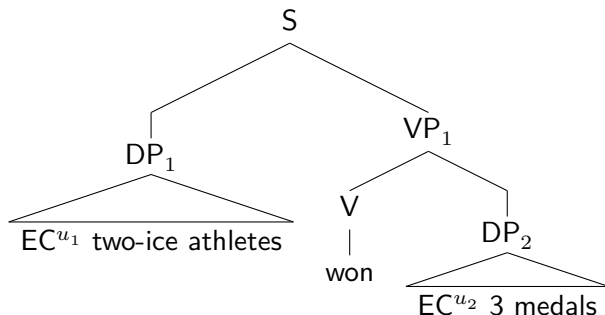
Main data puzzle

- binominal vs. determiner *each* vs. set and atom collectives
- pseudoCzech:

- (79)
- binominal *each* + set collective
[Three prizes each] were given twosome detectives.
 - *binominal *each* + atom collective
#[Three prizes each] were given team detectives.
 - determiner *each* + set/atom collective
Three prizes were given [each twosome/team detectives] only
distribution over groups

The set collective formalization

- (80) **Dvojice** sportovců vyhrála 3 medaile.
twosome athletes.GEN won.SG.FEM 3 medals. ***distributive**



- (81) a. $\llbracket S \rrbracket = [u_1, u_2 | \#(u_1) = 2 \wedge \text{ATHLETES}\{u_1\} \wedge \#(u_2) = 3 \wedge \text{MEDALS}\{u_2\} \wedge \text{WIN}\{\bigcup u_1, u_2\}]$
- b. $\llbracket DP_1 \rrbracket = \lambda Q_{rt}. [u_1 | \#(u_1) = 2 \wedge \text{ATHLETES}\{u_1\}] \wedge Q(\bigcup u_1)$
- c. $\llbracket VP_1 \rrbracket = \lambda v_r [u_2 | \#(u_2) = 2 \wedge \text{MEDALS}\{u_2\} \wedge \text{WIN}\{v, u_2\}]$
- d. $\llbracket DP_2 \rrbracket = \lambda Q_{rt}. [u_2 | \#(u_2) = 3 \wedge \text{MEDALS}\{u_2\}] \wedge Q(u_2)$

- our addition to PCDRT: treatment of numeral collectives as imposing the collectivity on its argument (gets propagated into the verb external argument slot)
- technically (81-b)

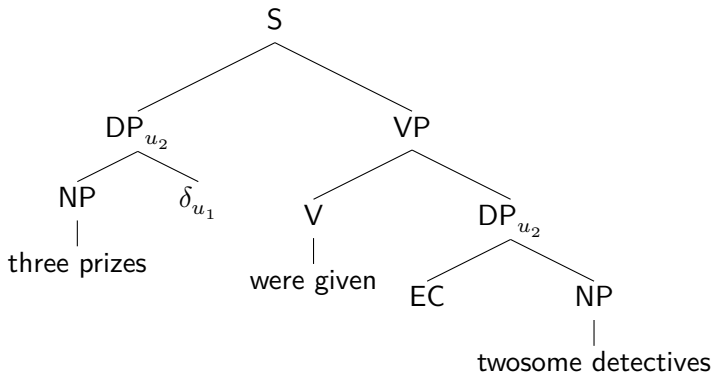
$$(82) \quad [u_1, u_2 | \#(u_1) = 2 \wedge \text{ATHLETES}\{u_1\} \wedge \#(u_2) = 3 \wedge \text{MEDALS}\{u_2\} \wedge \text{WIN}\{\bigcup u_1, u_2\}]$$

- one verifying info state:
- collective on the subject
- all the athletes won together the three medals (technically $\text{WIN}\{\bigcup u_1, u_2\}$)

Info state J	u_1	u_2
j_1	athlete ₁	medal ₁
j_2	athlete ₂	medal ₂
j_3	athlete ₁	medal ₃

Binominal *each* + set collective

(83) [Three prizes *each*] were given twosome detectives.



(84) [Three prizes each] were given twosome detectives.

Info state J	u_1	u_2
j_1	detective ₁	prize ₁
j_2	detective ₁	prize ₂
j_3	detective ₁	prize ₃
j_4	detective ₂	prize ₄
j_5	detective ₂	prize ₅
j_6	detective ₂	prize ₆

- collective set numeral checks \cup (cardinality) of $u_1 +$ imposes collectivity on the predicate
 - ▶ binominal *each* distributivity is local: scopes over the share (u_2)

PCDRT formalization

(85) [Three prizes each] were given twosome detectives.

a. $[u_1 | \#(u_1) = 2 \wedge \text{detectives}\{u_1\} \wedge [u_2] | \delta_{u_1} (\#(u_2) = 3 \wedge \text{prizes}\{u_2\})] \wedge \text{given}\{\bigcup u_1, u_2\}$

- the detectives were given collectively (local collectivity: key plus predicate) prizes
- each of them received two prizes (local distributivity over the share)

Binominal *each* plus atom collective

(86) #[Three prizes each] were given team detectives.

Info state J	u_1	u_2
j_1	detective ₁ + detective ₂	prize ₁
j_2	detective ₁ + detective ₂	prize ₂
j_3	detective ₁ + detective ₂	prize ₃

- atom collectivity is horizontal, set collectivity is vertical
- probably bad for the same reason as:

(87) Petr drank *[two beers each].

Determiner *each* + set/atom collective

(88) Three prizes were given [each twosome/team detectives]

Info state J	u_1	u_2
j_1	detective ₁ + detective ₂	prize ₁
j_2	detective ₁ + detective ₂	prize ₂
j_3	detective ₁ + detective ₂	prize ₃
j_4	detective ₃ + detective ₄	prize ₄
j_5	detective ₃ + detective ₄	prize ₅
j_6	detective ₃ + detective ₄	prize ₆

- with the determiner *each* the distributivity scopes over collectives and cannot decompose them

Summary

- both determiner and binominal *each* contribute distributivity
- determiner *each* scopes globally (nuclear scope) and interferes with a collectivity (and cumulativity) of other arguments
- binominal *each* distributes locally over the share and allows set collectivity (and cumulativity) outside of its share

Thanks!

Appendix

Main data puzzle

- pseudoCzech:
- binominal *each* and collective numerals

- (89) a. Each from twosome athletes won three medals. coll+distr ok
b. *Twosome from athletes won each three medals. col+bin-each
- (90) Two from athletes won three medals each. num+bin ok

Repeating the pattern

- pseudoCzech:
- binominal *each* and collective numerals

- (91) a. Each from twosome athletes won three medals. coll+distr ok
b. *Twosome from athletes won each three medals. col+bin-each
- (92) Two from athletes won three medals each. num+bin ok

The determiner distributive sentence

- (93) **Každý z dvojice** sportovců vyhrál 3 medaile.
each of twosome.GEN athletes.GEN won.SG.MASC 3 medals
✓ **distributive**

- verifying info state:

Info state J	u_1	u_2
j_1	athlete ₁	medal ₁
j_2	athlete ₁	medal ₂
j_3	athlete ₁	medal ₃
j_4	athlete ₂	medal ₄
j_5	athlete ₂	medal ₅
j_6	athlete ₂	medal ₆

- needed ingredients:

- (94)
- $\llbracket \text{DET-každý}^{u_n} \rrbracket = \lambda P_{rt} \lambda Q_{rt} \cdot \delta_{u_n} (P(u_n)) \wedge Q(u_n)$
 - z 'from/of' predicates of groups \rightarrow predicates of their parts – $\lambda P_{rt} \lambda v_r \cdot \llbracket v \subseteq P \rrbracket$
 - predicative meaning of CN:
 $\lambda w_r \cdot \llbracket \#(w) = 2 \wedge \text{ATHLETES} \{ \bigcup w \} \rrbracket$
 - whole subject: $\lambda Q_{rt} \cdot [v | \delta_v (\llbracket \lambda v_r \cdot [v \subseteq \lambda w_r \cdot \llbracket \#(w) = 2 \wedge \text{ATHLETES} \{ \bigcup w \} \rrbracket \rrbracket]) \wedge Q(v)$

- determiner *each* quantifies over parts (partitioning z 'from') of the group denotation
- predicative meaning results in:

- (95) $[v, u_2 | \text{ATHLETE} \{v\} \wedge \delta_v (\llbracket \lambda v_r \cdot [v \subseteq \lambda w_r \cdot \llbracket \#(w) = 2 \wedge \text{ATHLETES} \{ \bigcup w \} \rrbracket \rrbracket]) \wedge \#(u_2) = 3 \wedge \text{MEDALS} \{u_2\} \wedge \text{WIN} \{v, u_2\} \rrbracket]$

Clash of CN with binominal *each*

(96) ***Z dvojice** sportovců vyhrál **každý** 3 medaile.
twosome athletes.GEN won.SG.MASC each.SG.MASC 3 medals

- star for the binominal *each*
- can be floated *each* but not the binominal *each*
- the problem is that the percolated distributivity cannot be applied to the subject's argument meaning
- plus argument subject imposes collectivity \leftrightarrow clash:

(97) a. $\llbracket \text{DP}_1 \text{ of (96)} \rrbracket = \lambda Q_{rt}. [u_1 | \#(u_1) = 2 \wedge \text{ATHLETES}\{u_1\}] \wedge Q(\bigcup u_1)$
b. $\llbracket \text{VP}_1 \text{ of (96)} \rrbracket = \lambda v_r [u_2 | \delta_{u_1} ([\#(u_2) = 3 \wedge \text{MEDALS}\{u_2\}]) \wedge \text{WIN}\{v, u_2\}]$

- *Each* can “float” in both cases, even in a position that apparently points to a binominal *each*. Note two differences though: NP (being obligatorily plural) triggers plural verb agreement vs. PP antecedent does not trigger agreement → agreement with the postverbal sg *každý*.

- (98) [NP Ti chlapci] vyhráli { každý } jednu cenu {
 the boys.NOM.PL won.PL each.NOM one prize.ACC
 každý}.
 each.NOM
 ‘The boys won one prize each.’
- (99) [PP Z těch chlapců] vyhrál { každý } jednu cenu
 from the boys.GEN.PL won.SG each.NOM one prize.ACC
 { každý}.
 each.NOM
 ‘Each of the boys won one prize.’

Derived collective numerals

- Czech: group nouns/numerals derived from cardinal numerals with the suffix *-ice*: *tr-oj-ice námořníků*
- properties:
 - 1 both singular and plural: *s troj-icí_{INST.SG} námořníků*, *s troj-ice-mi_{INST.PL} námořníků*
 - 2 incompatible with the singular universal quantifier *všechno* 'all':
**všechna troj-ice námořníků* (not mass)
 - 3 obligatorily non-cumulative: *troj-ice + troj-ice = 2 troj-ice*
 - 4 obligatorily non-divisive: parts of *troj-ice* are not *troj-ice*

- ⑤ can be counted with cardinal numerals: *dvě troj-ice námořníků*
- ⑥ usually enforce the collective interpretation:

Two arguments that PP antecedents cannot antecede binominal *each*, despite the initial appearance:

- Agreement with the *each*-phrase rather than with the antecedent (see above).
- No constituent:

(100) **[Každý jednu cenu] vyhrál(i) jenom [PP z těch chlapců].*

each.NOM one prize.ACC won.SG(PL) only from the boys.GEN.PL

Intended: 'Only the boys were such that each of them won one prize.'

- NP ellipsis of the *each*-restrictor not obligatory:

(101) [PP Z těch chlapců] vyhrál [NP každý chlapec]
 from the boys.GEN.PL won.SG each boy.NOM.SG
 jednu cenu.
 one prize.ACC
 'From the (group of) boys, each boy won one prize.'

- Possibility to combine binominal *each* with distributive *po*:

(102) Ty slepice snesly po třech vajíčkách.
 the hens.NOM.PL layed PO three eggs.LOC
 'The hens layed three eggs each.'

(103) Ty slepice snesly každá tři vajíčka.
 the hens.NOM.PL layed each.NOM three eggs.ACC
 'The hens layed three eggs each.'

(104) Ty slepice snesly každá po třech vajíčkách.
 the hens.NOM.PL layed each.NOM.SG PO three eggs.LOC
 'The hens layed three eggs each.'

Comparison with prepositional restrictors

- The following two have identical truth-conditions in Czech → the singular nominative NP *ten chlapec* can have the same use as a prepositional PP containing a (partitive?) plural genitive *těch chlapců*.

(105) Každý [NP ten chlapec] vyhrál jednu cenu.
each.NOM the boy.NOM.SG won.SG one prize.ACC
'Each of the boys won one prize.'

(106) Každý [PP z těch chlapců] vyhrál jednu cenu.
each.NOM from the boys.GEN.PL won.SG one prize.ACC
'Each of the boys won one prize.'

každý v vs. *každý z*

- the distinction seems to be between non-distinguishing *každý z* vs. plurality non-accepting *každý v*
- partially based on ČNK:
- case distinction: LOC vs. GEN

(107) Každý z

- a. pronouns: *nich, nás, ...*
- b. plural count: *manželů, partnerů, účastníků*
- c. -ice: *trojice*
- d. numerals (indefinite?): *pěti, ...*
- e. collective nouns: *týmu, rodiny*

(108) Každý v

- a. collective nouns: týmu, říši, rodině, nemocnici
- b. entity denoting: Praze, ČR,
- c. *plural count: # každý v účastnících, #každý v manželích, ...
- d. *pronouns: # [každý v nich], ...
- e. *numerals: # [každý v pěti], ...
- f. -ice: každý ve dvojici (dostane do ruky ...)

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