Czech binominal *each* and collective set predicates

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Intro

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

(1)   Two boys bought three books.

(2)   a.   *Each* of the two boys bought three books.   **determiner**
      b.   Two boys bought [three beers *each*].   **binominal**

- (2-a): determiner *each*, *two boys* restriction, VP nuclear scope
- (2-b): binominal *each*, *two boys* key, *three books* share
- syntactic structure: Safir and Stowell (1988)

PCDRT

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

(3)   Prediction: expected difference between binominal and determiner
       each. Both supply distributivity but binominal distributes non-locally.
       Technical implementation: percolation of distributivity.

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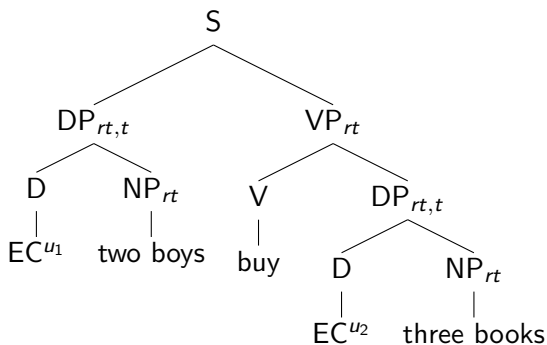
Cumulative readings in PCDRT

(4)   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

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

Determiner and binominal *each* in PCDRT

(6) a. $\llbracket \text{DET-každý}^{u_n} \rrbracket = \lambda P_{rt} \lambda Q_{rt}. \delta_{u_n}(P(u_n)) \wedge Q(u_n)$

b. $\llbracket \text{BINOM-každý}^{u_m} \rrbracket = \lambda v_r \lambda P_{rt} \lambda Q_{rt}.[u_m \mid] \wedge \delta_v(P(u_m)) \wedge Q(u_m)$

- distributivity operator δ in both
- but binominal *each* introduces discourse referents
- binominal: semantic percolation of distributivity
- determiner: in-situ application of distributivity
- **main difference**: binominal *each* – EC of the object
- determiner *each*: EC of its argument (subject)

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

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

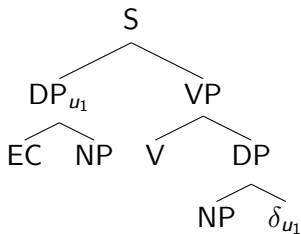| Info state J	u_1	u_2
j_1	boy_1	$book_1$
j_2	boy_1	$book_2$
j_3	boy_1	$book_3$
j_4	boy_2	$book_4$
j_5	boy_2	$book_5$
j_6	boy_2	$book_6$

Determiner *each*
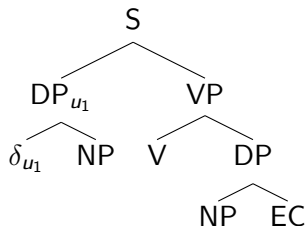
- existential closure of the subject (predicative semantics: $\langle r, t \rangle$)
- distributes over the atomic drefs

(8) $[u_1 | \#(u_1) = 2 \wedge \text{BOYS}\{u_1\} \wedge \delta_{u1}([u_2] \wedge [|\#(u_2) = 3 \wedge \text{BOOKS}\{u_2\}] \wedge [|\text{BUY}\{u_1, u_2\}])]$

Binominal *each*

(9)   Two boys bought three books each.

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	$book_6$

$$
\begin{array}{c}
\text{S} \\
\diagup \quad \diagdown \\
\text{DP}_{u_1} \qquad \text{VP} \\
\diagup \diagdown \qquad \diagup \diagdown \\
\text{EC} \quad \text{NP} \quad \text{V} \quad \text{DP} \\
\diagup \diagdown \\
\text{NP} \quad \delta_{u_1}
\end{array}
$$

- the same verification info state
- different computation
- existential closure of the object
- distributes over the subject argument ($\langle\langle r, t\rangle, t\rangle$)

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

- distributivity percolates through the semantic computation
- the same truth conditions but:

1. determiner *each*: distributivity in-situ with predicative meaning of the subject ($\langle r, t \rangle$)
2. binominal *each*: distributivity over u_1 at a distance, with referential meaning of the subject (type $\langle r \rangle$)

- predicted difference: local vs. distance distributivity

Main data puzzle

- pseudoCzech:
- binominal *each* and collective numerals

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

(12)   Two from athletes won three medals each.   num+bin ok

Collectives

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

(13)   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:

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

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

Collectives

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

(15)   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. . .

Basic properties of Czech binominal *each* I

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

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

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

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

Underlying structure of Czech binominal *each* I

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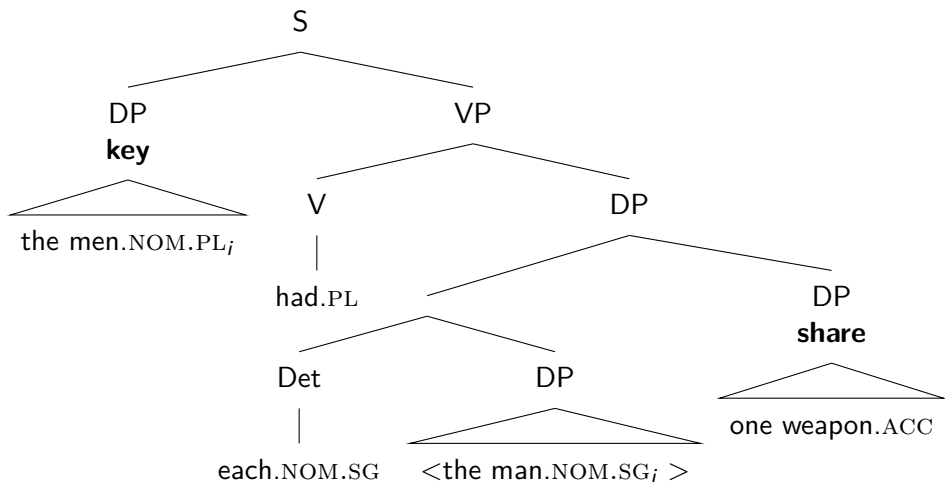
- Example with discourse anaphora:

(18) Přišli nějací muži$_i$. Každý / Jeden (ten muž$_i$) měl   zbraň.
      came some men.PL each   one   the man.SG had.SG weapon
      'Some men came. (Each) one of them (lit. each/one the man) had
      a weapon.'

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

(19) Ti muži$_i$ měli   každý $<$ten muž$_i>$ jednu zbraň.
      the men.PL had.PL each   the man.SG
      'The men had one weapon each.'

Proposed constituent structure

The tree diagram shows:

- S
  - DP **key**
    - the men.NOM.PL$_i$
  - VP
    - V
      - had.PL
    - DP
      - Det
        - each.NOM.SG
      - DP
        - ⟨the man.NOM.SG$_i$⟩
      - DP **share**
        - one weapon.ACC

Argument: Movement

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

(20) [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.'

- *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*.

(21) [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.'

(22) [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.'

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:

(23) *[Každý   jednu cenu]   vyhrál(i)   jenom [PP z   těch
      each.NOM one   prize.ACC won.SG(PL) only   from the
    chlapců].
    boys.GEN.PL
    Intended: Only the boys were such that each of them won one
    prize.'

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

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

Repeating the pattern

- pseudoCzech:
- binominal *each* and collective numerals

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

(26) Two from athletes won three medals each.   num+bin ok

The collective sentence

(27) **Dvojice** sportovců   vyhrála   3 medaile.
     twosome athletes.GEN won.SG.FEM 3 medals. ***distributive**
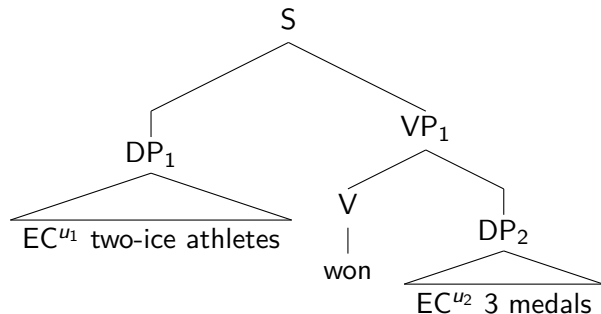
(28)   a. $[\![S]\!] = [u_1, u_2 | \#(u_1) = 2 \wedge \textsc{athletes}\{u_1\} \wedge \#(u_2) = 3 \wedge \textsc{medals}\{u_2\} \wedge \textsc{win}\{\bigcup u_1, u_2\}]$
       b. $[\![DP_1]\!] = \lambda Q_{rt}.[u_1 | \#(u_1) = 2 \wedge \textsc{athletes}\{u_1\}] \wedge Q(\bigcup u_1)$
       c. $[\![VP_1]\!] = \lambda v_r [u_2 | \#(u_2) = 2 \wedge \textsc{medals}\{u_2\} \wedge \textsc{win}\{v, u_2\}]$
       d. $[\![DP_2]\!] = \lambda Q_{rt}.[u_2 | \#(u_2) = 3 \wedge \textsc{medals}\{u_2\}] \wedge Q(u_2)$

- our addition to PCDRT: treatment of numeral collectives as imposing the collectivity on its argument
- technically (28-b)

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

- 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$_3$

The determiner distributive sentence

(30) **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:

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

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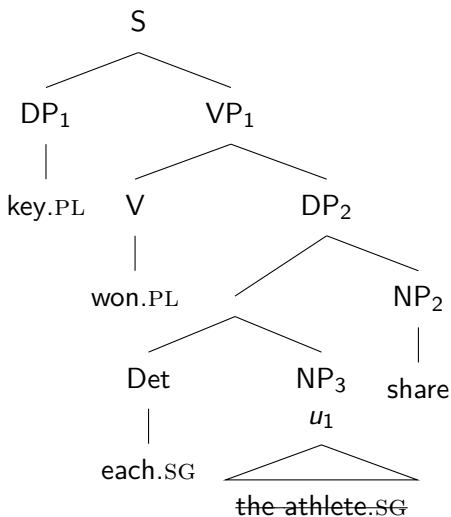- predicative meaning results in:

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

(33)   **Dva** sportovci vyhráli   **každý**   3 medaile.
       two athletes   won.PL.MASC each.SG.MASC 3 medals

✓**distributive**

the same info state as for (30)

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$_6$

S
- DP$_1$
  - key.PL
- VP$_1$
  - V
    - won.PL
  - DP$_2$
    - Det
      - each.SG
    - NP$_3$
      - u_1
      - ~~the athlete~~.SG
    - NP$_2$
      - share

Clash of CN with binominal *each*

(34)   ***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:

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

Thanks!

Appendix

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-ic$í_{INST.SG}$ 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. usualy enforce the collective interpretation:

- Bare (non-determined) share NP not allowed; cf. VP-related *each* (36-c):

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

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

(38) 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

(39)   *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.

(40)   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.'

(41)   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 nominative (subject?)

(42)   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.'

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

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

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

(45) 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*.

(46) 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.'

(47) 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

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

(49)   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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