

Each vs. all:
distributivity, cumulativity,
and two types of collectivity

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1 Cumulativity and *all*

- Cumulative (scopeless) readings involve a “cross-product” interpretation:

(1) 600 Dutch firms use 5000 American computers. (Scha, 1981)
Cumulative reading: 600 Dutch firms each use at least one American computer and
5000 American computers are each used by at least one Dutch firm.

- Cumulative readings also occur with definite plurals:

(2) The men in the room are married to the girls across the hall. (Kroch, 1974)
Cumulative reading: Each man in the room is married to a girl across the hall, and
each girl across the hall is married to a man in the room.

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- Zweig (2008, 2009) notes that *all* cannot give rise to cumulative readings:
 - (3) a. Three safari participants saw thirty zebras.
Available cumulative reading: Three safari participants saw at least one zebra each, and thirty zebras were seen overall.
 - b. All the safari participants saw thirty zebras.
Unavailable cumulative reading: Each safari participant saw at least one zebra, and thirty zebras were seen overall.
Available distributive reading: Each safari participant saw thirty zebras.
- Exception: dependent-plural readings, which can be seen as cumulative (Zweig, 2008):
 - (4) a. Three safari participants saw zebras.
Available cumulative reading: Three safari participants saw at least one zebra each, and at least two zebras were seen overall.
 - b. All the safari participants saw zebras.
Available cumulative reading: Each safari participant saw at least one zebra, and at least two zebras were seen overall.
- The word *each* is never compatible with cumulative readings but only with distributive readings:
 - (5) a. Each safari participant saw thirty zebras.
Unavailable cumulative reading: Each safari participant saw at least one zebra, and thirty zebras were seen overall.
 - b. Each safari participant saw zebras.
Unavailable cumulative reading: Each safari participant saw at least one zebra, and at least two zebras were seen overall.
- **Dependent Plural Puzzle:** Why can *all* license dependent plurals but not *each*? (Answer in Zweig (2008), extended in Champollion (2010). Not today.)

Thirty-Zebras Puzzle: What is the relevant semantic distinction between *see zebras* and *see thirty zebras* so that the former is more permissive wrt. cumulative readings?

2 Collectivity and *all*

- *All* is incompatible with some collective predicates (Kroch, 1974; Dowty, 1987), which I will call *numerous-type*:

- (6) a. The students who came to the rally are numerous.
- b. The boys surrounded the table.
- c. The soldiers in this bataillon sufficed to defeat the army.
- (7) a. *All the students who came to the rally are numerous.
- b. *All the boys surrounded the table.
- c. *All the soldiers in this bataillon sufficed to defeat the army.

• But it is compatible with others, which I will call *gather-type*:

- (8) a. The students gathered in the hallway.
- b. The professors met in the garden.
- c. The soldiers dispersed.
- (9) a. All the students gathered in the hallway.
- b. All the professors met in the garden.
- c. All the soldiers dispersed.

The word *each* is incompatible with any of these.

- (10) a. *Each student who came to the rally is numerous.
- b. *Each boy surrounded the table.
- c. *Each student gathered in the hallway.
- d. *Each professor met in the garden. etc.

Numerous-Gather Puzzle: What is the relevant semantic distinction between *be numerous* and *gather* so that only the latter is compatible with *all*?

Each-All Puzzle: What is the relevant semantic distinction between *each* and *all* so that only the latter is compatible with *gather-type* predicates?

• We will look for an answer in *for*-adverbials and the telic/atelic opposition.

- (11) a. John **talked** for ten minutes. *atelic*
- b. *John **finished talking** for ten minutes. *telic*
- (12) a. John **ate apples** for ten minutes. *atelic*
- b. *John **ate three apples** for ten minutes. *telic*
- (13) a. John **wore yellow neckties at night** for a week. *dependent plural ok*
- b. #John **wore two yellow neckties at night** for a week. *funny*

Aspect Puzzle: What is the relevant semantic distinction between *eat apples* (atelic) and *eat three apples* (telic) so that only the former is compatible with *for*-adverbials?

- A *for*-adverbial cannot enter cumulative relation with an indefinite:
 - (14) a. John saw thirty zebras for three hours.
Unavailable cumulative reading: John saw a total of thirty zebras over the course of a three-hour timespan.
 - b. John saw thirty zebras in three hours.
Available cumulative reading: John saw a total of thirty zebras over the course of a three-hour timespan.

3 Explaining the similarities between *for* and *all*

- *For*-adverbials work like this (Dowty, 1979; Champollion, 2010):
 - (15) **Presupposition of *for three hours*:** Every VPing event consists of one or more VPing events whose runtimes are very short.
 - *John talked for three hours* requires something **true**: that every talking event consists of one or more talking events whose runtimes are very short.
 - **John finished talking for three hours* requires something **false**: that every finish-talking event consists of one or more finish-talking events whose runtimes are very short.
 - Claim: *all* imposes a constraint on the verb phrase predicate which is analogous to the presupposition of *for*-adverbials, except that the “dimension” involved is not runtime but the thematic role of the *all*-phrase, usually *agent*.
 - Assume that *all* distributes the VP down to sums that are very small in number.
 - (16) **Presupposition of *all*:** Every VPing event consists of one or more VPing events whose agents are very small in number.
 - *All the children smiled* presupposes that every smiling event consists of one or more smiling events whose agents are very small in number.
- More formally: $x \in *(\lambda y.B(y))$ means: x consists of one or more parts of which B holds

- (17) **Presupposition of *for 1h***: $\forall e[\text{VP}(e) \rightarrow e \in {}^*\lambda e'(\text{VP}(e') \wedge \varepsilon(\text{runtime}(e')))]$
 (Every VPing event consists of one or more VPing events whose *runtimes* are *very short*)
- (18) **Presupposition of *all***: $\forall e[\text{VP}(e) \rightarrow e \in {}^*\lambda e'(\text{VP}(e') \wedge \varepsilon(\text{ag}(e')))]$
 (Every VPing event consists of one or more VPing events whose *agents* are *very small in number*.)

• *All* requires distributivity (Dowty, 1987):

- (19) a. All the children smiled. \Rightarrow Each child smiled.
 b. All the juries returned a guilty verdict. \Rightarrow Each jury did.
 c. The juries returned a guilty verdict. \nRightarrow Each jury did.

Baseline example:

- (20) All the children smiled.
 Presupposition: $\forall e[\text{smile}(e) \rightarrow e \in {}^*\lambda e'(\text{smile}(e') \wedge \varepsilon(\text{ag}(e')))]$
 (Every smiling event consists of one or more smiling events whose agents are very small in number. This will be true because *smile* distributes.)

- (21) **Stratified reference (Definition)**
 $\text{SR}_{f,\varepsilon}(P) \stackrel{\text{def}}{=} \forall x[P(x) \rightarrow x \in {}^*\lambda y(P(y) \wedge \varepsilon(f(y)))]$

- (22) a. All the safari participants saw thirty zebras. **cumulative*
 b. All the safari participants saw zebras. \checkmark *cumulative*

We can rule out the cumulative reading of (22a) as a presupposition failure:

- (23) **Failing presupposition**: $\text{SR}_{\text{agent}, \varepsilon}(\llbracket \text{see thirty zebras} \rrbracket)$
 (Every see-thirty-zebras event consists of subevents with small numbers of people as agents and in each of which thirty zebras are seen.)

The cumulative reading of (22b) is available, though:

- (24) **Satisfied presupposition**: $\text{SR}_{\text{agent}, \varepsilon}(\llbracket \text{see zebras} \rrbracket)$
 (Every event in which at least one zebra is seen consists of subevents with small numbers of people as agents and in each of which at least one zebra is seen.)

Aspect Puzzle: What is the relevant semantic distinction between *eat apples* (atelic) and *eat three apples* (telic) so that only the former is compatible with *for*-adverbials?

- Only *eat apples* has stratified reference with respect to time

Thirty-Zebras Puzzle: What is the relevant semantic distinction between *see zebras* and *see thirty zebras* so that the former is more permissive wrt. cumulative readings?

- Only *see zebras* has stratified reference with respect to agents.

4 Explaining the behavior of *numerous* and *gather*

- Kuhn (2014): *gather* has stratified reference; *numerous* doesn't

4.1 *All* distinguishes between *be numerous* and *gather*

- (25) a. *All the boys were numerous / surrounded the table.
b. All the boys gathered / met / held hands / dispersed.

- Presupposition of (25a):

- (26) Every event *e* in the denotation of *be numerous* can be divided into one or more parts each of which is in the denotation of *be numerous* and has a very small agent.

- This fails because these parts don't qualify as *be numerous*.

- Kuhn's observation (though see Winter (2001)): Gather-type predicates have stratified reference down to small numbers of people. Whenever a plurality of people gathers, any subgroup of them also gathers.

- (27) All the boys gathered.

Presupposition: Every event *e* in the denotation of *gather* can be divided into one or more parts each of which is in the denotation of *gather* and has a small number of people as an agent.

4.2 *Gather* distinguishes between *each* and *all*

- Why are *gather*-type collective predicates incompatible with *all* but compatible with *each*?

- (28) a. All the students gathered.
b. *Each student gathered.

- Idea:

- *Every* and *each* distribute over events whose agents are atoms (individual people)
- *All* distributes over events whose agents must be small in number but need not be atomic

- The presupposition of *each* is as follows:

- (29) Every event in VP can be divided into parts which are in VP and whose agents are atoms.

- The presupposition of *all* is as follows:

- (30) Every event in VP can be divided into parts which are in VP and whose agents are small numbers of people.

- *Gather* satisfies the presupposition of *all* but not of *each*.

Numerous-Gather Puzzle: What is the relevant semantic distinction between *be numerous* and *gather* so that only the latter is compatible with *all*?

- Only gather-type collective predicates have stratified reference.

Each-All Puzzle: What is the relevant semantic distinction between *each* and *all* so that only the latter is compatible with *gather*-type predicates?

- *Each* requires stratified reference down to atoms; *all* requires stratified reference down to entities that are small but not necessarily of cardinality one.

5 Conclusion

- *All* is an “almost distributive” determiner: it distributes but not all the way down.
- *Gather*-type predicates are “a bit distributive”; *numerous*-type predicates aren’t.

Broader picture in Champollion (2010): a higher-order property that is general enough to subsume a wide range of semantic oppositions, yet formally precise enough to make testable predictions and to transfer insights across traditional boundaries.

- **telic** - **atelic** (this talk)
- **collective** - **distributive** (this talk)
- bounded - unbounded
- singular - plural
- count - mass

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