Challenges for a Theory of Plurality

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Overview

Presentation Outline

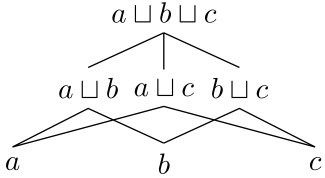
1. Classic approaches
2. Challenges
3. Towards a solution
4. ThS
5. Example

Link (1983)

- Distinction: atomic and non-atomic individuals, both of type e.
- Non-atoms are generated by the Boolean sum operator ($\sqcup$).
- Two atomic individuals a and b can generate a plural individual $a \sqcup b$.
- $\sqsubseteq$ defines an algebra which is ordered by the partial order $\sqsubseteq$.
- $a, b \sqsubseteq a \sqcup b$
- Singular definites: atomic individuals.
- Plural definites: non-atomic individuals (or sums).

Boolean structures

- Plural P: the closure under $\sqcup$ of P
- Three boys, a, b and c.
- $[\![\textit{the boys}]\!] = a \sqcup b \sqcup c$
- The corresponding structure:



- A line from node x to node y - $x \sqsubseteq y$.
- The predicate *boy* - $\{a, b, c\}$ (atomic boys).
- The predicate *boys* - $\{a, b, c, a \sqcup b, b \sqcup c, a \sqcup c, a \sqcup b \sqcup c\}$.

Distributive vs. collective readings

(1) The TAs made 14,000$ this year.
Reading 1 (dist.): Each TA separately made 14,000$.
Reading 2 (coll.): The TAs between them made 14,000$ (as a group).

- See e.g. Lasersohn (1995), Champollion (2014) for overviews.

Groups and sums

- Landman (1989a;b): Pluralized noun phrases are ambiguous between group and sum readings.
- Groups: atomic individuals which represent a sum.
- Sums: the Boolean sums pf plural individuals (e.g. $a \sqcup b$).
- For a plural term X, $\uparrow(X)$ is the group reading and $\downarrow(X) = x_1 \sqcup ... \sqcup x_n$ is the sum reading.
- Sums have internal structure; groups do not.

Back to (1)

- We may now formalize the ambiguity in (1):

  (1) The TAs made 14,000$ this year.
  Reading 1 (dist.): $ta_1 \sqcup ... \sqcup t_n \in *14K$
  Reading 2 (coll.): $\uparrow(the\ TAs) \in *14K$

- Reading 1: the predicate *made 14,000$ this year* applies to each atom of the sum of TAs.
- Reading 2 says that the group of TAs is in the extension of the predicate *made 14K this year.*

The Universal Grinder

- Gillon (1987) observes that distributivity can sometimes apply to overlapping subsets of a term.
- (2) can mean: John and Mary cooked one meal, and Mary and Bill cooked another meal.

(2) John, Mary and Bill cooked 2 meals.

- This is not the distributive reading, but it is also not the collective reading.
- This is the cover/intermediary reading.

The Cover Approach

- Developed by e.g. Schwarzschild (1996).
- Plurals denote sets.
- Verbs induce covers over sets.
- A cover C of set A is a set of subsets of A such that every $a \in A$ is in some $c \in C$.
- Thus, in (2), the verb can induce the covers $\{\{John, Mary\}, \{Mary, Bill\}\}$ and $\{\{meal_1\}, \{meal_2\}\}$.

Restrictions

- Covers are restricted by contextual limitations.
- For instance, in (3), since we know that shoes come in pairs, the context imposes a cover of the shoes into pairs.

  (3) The shoes cost $50.

- However, this is too vague.

The Universal Grinder

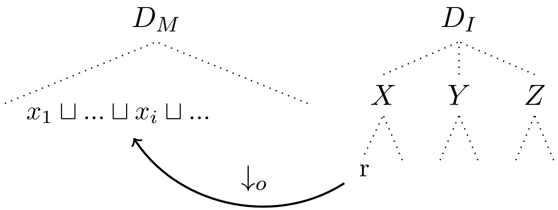
- In certain contexts, count nouns can be interpreted as mass nouns. E.g.:

  (4) After the accident there was rabbit all over the wall.

- Pelletier (1975): the Universal Grinder.
- The rabbit is interpreted as a cumulative sum of Boolean parts.

The ground domain

- Landman (2011): $\downarrow_o$ maps count entities into the set of their Boolean parts.
- Count entities are in the domain of individuals.
- D_I. $\downarrow_o$ maps them into sums in the mass domain, D_M:



Group nouns

- The status of group nouns (such as *army*, *committee*, *team*, etc') is debatable in this framework.
- On the one hand, such nouns are morphologically singular (both in Hebrew and English).
- On the other hand, they denote non-atomic individuals (i.e. groups).
- Landman (1989a), Barker (1992), among others: groups can shift into sums.
- Analogous to the universal grinder.
- Problem: when can they shift into sums and when they cannot?

Presentation Outline

Mass vs. Individual Predicates

(5) 3 women gave birth to 5 children (assume no twins etc').
$\Rightarrow$ Every boy was given birth.
$\Rightarrow$ Every boy was given birth by some woman.
$\Rightarrow$ Every woman gave birth to a boy.
$\not\Rightarrow$ *Every woman gave birth to boy.

(6) 3 boys ate 5 pizzas.
$\Rightarrow$ Every pizza was eaten.
$\not\Rightarrow$ Every boys ate some pizza.
$\not\Rightarrow$ Every pizza was eaten by some boy.
$\Rightarrow$ Every boy ate pizza.

Individual vs. Intermediate Predicates

(7) 3 women gave birth to 5 children (assume no twins etc').
$\Rightarrow$ Every boy was given birth.
$\Rightarrow$ Every boy was given birth by some woman.
$\Rightarrow$ Every woman gave birth to a boy.
$\not\Rightarrow$ *Every woman gave birth to boy.

(8) 3 knoghts defeated 5 highwaymen.
$\not\Rightarrow$ Every highwayman was defeated.
$\not\Rightarrow$ Every highwayman was defeated by some knight.
$\not\Rightarrow$ Every knight defeated some highwayman.

Groups vs. Plurals

(9) a. The committee met in 3 rooms (?simultaneously).

b. The boys met in 3 rooms (✓simultaneously).

(10) a. The crew is heaving a sail.
$\Rightarrow$ Probably one sail.

b. The sailors are heaving a sail.
$\Rightarrow$ One sail per sailor? I think at least more likely.

Singular Partitives

(11) The family is seated on a couch.
$\Rightarrow$ Probably one couch.

(12) Some of the family is seated on a couch (the rest are sitting on a chair).
$\Rightarrow$ Maybe more than one couch.

Presentation Outline

Domains and Operators

- Each argument a of each relation R is associated with a tuple $\langle D_{R,a}, \Pi_{R,a} \rangle$.
- $D_{R,a}$ is the domain for which a is defined.
- $\Pi_{R,a}$ is a set of shifting operators (repair mechanisms) which can apply to a and attempt to shift it to $D_{R,a}$.

Clusters

- Clusters are atoms which correspond to sums of individuals, groups or mass entities.
- A generalization of Landman's notion of 'groups'.
- For instance, plurals can shift from sums of individuals into sums of clusters.
- This is the intermediary reading.
- Groups usually cannot shift into sums of clusters. Sometimes they can. It depends on the relation and its Π.

Background assumptions

- $D_{R,a}$ and $\Pi_{R,a}$ can change according to context.

(13) Even without intending to do it, I used my swarm to carry my voice. His head craned around, as if to look at the swarming bugs who had just, for all intents and purposes, spoken.[1]

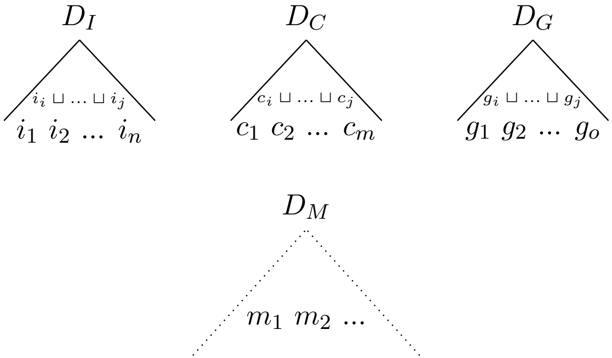
[1] Found in: *Worm* (an online novel), Chapter 12.6
URL: https://parahumans.wordpress.com/category/stories-arcs-11/arc-12-plague/12-06/

Presentation Outline

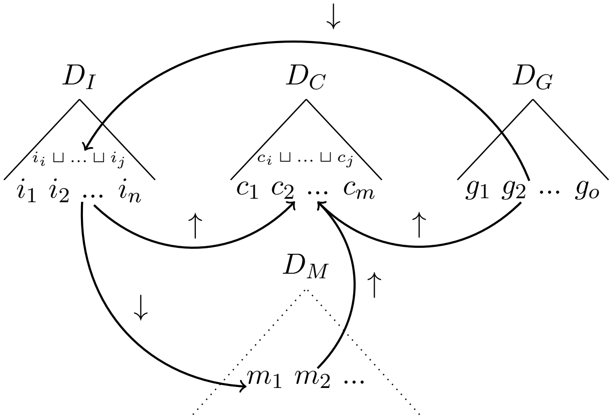
The Domains

- Each domain is an algebraic structure in the sense of Link (1983).
- D_I - individuals; D_G - groups; D_M - mass; D_C - clusters.
- D_M is the only one which is non-atomic.
- Clusters are atoms which correspond to a collective perception of a sum (like Landman (1989a)'s notion of 'group').
- When a sum of atoms participates in an event collectively, they are perceived as a cluster.

Graphically



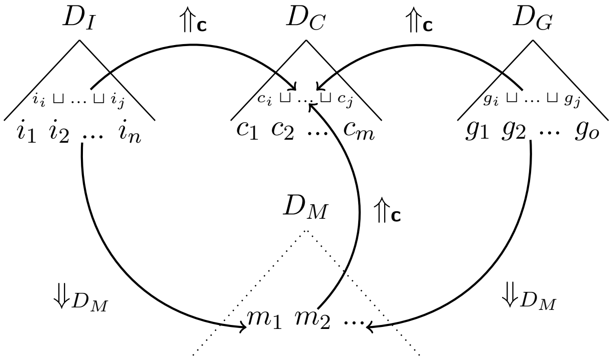
Graphically



Double Arrows

- $\Uparrow_{\mathsf{c}}$ maps every sum into a sum of clusters which correspond to a cover of its parts.
- A cover (as in Schwarzschild (1996)) c of a set X: a set of subsets of X such that each $x \in X$ is also in some $c \in \mathsf{c}$.
- Thus, if s is a sum, then $\Uparrow_{\mathsf{c}} (s)$ is $c_1 \sqcup ... \sqcup c_n$ such that there is some cover c of the parts of s and every $c \in \{c_1 ... c_n\}$ is a cluster, and there is some $c' \in \mathsf{c}$ such that $\uparrow (c') = c$.
- $\Downarrow_{D_M}$ just shifts anything into the sum of its material parts.

Graphically



Conceptually

- Each predicate P, in each context c, is associated with a chart $\mathscr{C}_{P,c}$.
- Charts represent what speakers assume about language and about the world.
- Charts encode facts such as "if something is eaten, then its parts are eaten as well", and "it is impossible to give birth collectively".

Formally

- $\mathscr{C}_{P,c}$ maps every argument position P_i of P into a tuple $\langle D', \Pi \rangle$ such that D' is a subset of the nominal domain and Π is a set of shifting operators.
- D' is the set for which the atoms of P_i is defined.
- Π is the set of semantic shifts available for P.

Presentation Outline

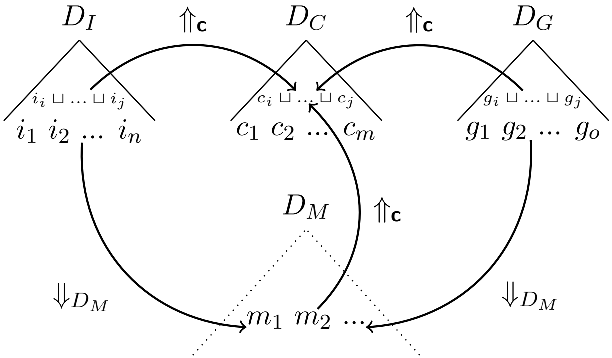
Give birth vs. *defeat*

- Giving birth is a relation between individuals. Therefore it is only defined for D_I.
- No repair mechanisms (for simplicity).
- Defeating is a relation between individuals or clusters of individuals.
- It is therefore defined for $D_I \cup D_C$

Formally

- Ignoring contexts, $\mathscr{C}_{gbirth}$ maps both subject and object to $\langle D_I, \emptyset \rangle$.
- $\mathscr{C}_{defeat}$ maps the subject and object to $\langle D_I \cup D_C, \{\Uparrow_{\mathsf{c}}\} \rangle$.

Graphically



Give birth vs. *eat*

- Giving birth is a relation between individuals. Therefore it is only defined for D_I.
- No repair mechanisms (for simplicity).
- The subject of *eat* must be an individual.
- No repair mechanisms (for simplicity).
- The object must be a sum of mass-clusters.
- Any kind of entity can be eaten, so the repair mechanism would be $\Uparrow_{\mathsf{c}} \circ \Downarrow_{D_M}$.

Formally

- Ignoring contexts, $\mathscr{C}_{gb}$ maps both subject and object to $\langle *D_I, \emptyset \rangle$.
- $\mathscr{C}_{eat}$ maps the subject to $\langle *D_I, \emptyset \rangle$.
- It maps the object to $\langle *D_{Ch}, \{\Uparrow_{\mathsf{c}} \circ \Downarrow_{D_M}\} \rangle$, where D_{Ch} is the set of chunks (mass clusters).

Events

- Following Landman (2000), I assume that verbs describe plural events.
- Every plural event is a sum of atomic events.
- Every atomic part of each argument is assigned exactly one thematic role by some atomic event.

Derivation (sketchy)

$[\![\text{The boys ate the pizzas}]\!] =$

$[\![\text{eat}]\!](\sqcup Boy)(\sqcup Pizza)$

$\sqcup Boy \in *D_I$, so no shift is required.

$\sqcup Pizza \notin *D_{Ch}$, so $\Uparrow_{\mathsf{c}} \circ \Downarrow_{D_M}$ tries to repair.

$\Downarrow_{D_M} (\sqcup Pizza) = Pizza_{\downarrow}$ is just the material parts of all pizzas.

$\Uparrow_{\mathsf{c}} (Pizza_{\downarrow})$ is a sum of chunks which together cover all pizas.

Graphically

$$\underbrace{\overbrace{\begin{array}{ccccc} boy_1 & boy_2 & boy_3 & \cdots & boy_n \\ \big| \,\textbf{ag} & \big| \,\textbf{ag} & \big| \,\textbf{ag} & & \big| \,\textbf{ag} \\ e_1 & e_2 & e_3 & \cdots & e_n \\ \big| \,\textbf{th} & \big| \,\textbf{th} & \big| \,\textbf{th} & & \big| \,\textbf{th} \\ chunk_1 & chunk_2 & chunk_3 & \cdots & chunk_n \end{array}}^{\textit{the boys}}}_{\textit{the bread}}$$

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