Class 3

Plurals and Distributivity

Yoad Winter

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Challenges

I Plural individuals in the entity domain

II Distributive vs. collective predication

III Structured individuals

IV Non-atomic distribution

Challenge I - the entity domain

(1) The girl is/*are singing.

(2) The girls are/*is singing.

(3) Mary is/*are singing.

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"arbitrary entities" = besides (non-)identity, no relation is given between entities

$\longrightarrow$ no entity represents a collection of other entities

Changing the domain of entities

Let E be a non-empty arbitrary set of entities. D_e is defined by:

$$\begin{aligned} D_{SG} &= \{\{x\} : x \in E\} \\ D_{PL} &= \{A \subseteq E : |A| \geq 2\} \\ D_e &= D_{SG} \cup D_{PL} = \{A \subseteq E : A \neq \varnothing\} \end{aligned}$$

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Lattice-theoretical notation:

i. Instead of '$\{x\}$' for atomic elements of D_{SG}, write 'x'.
ii. Instead of '$A \cup B$' for the union of sets $A, B \in D_e$, write '$A + B$'.
iii. Instead of '$\bigcup \mathcal{A}$' for the union of sets in $\mathcal{A} \subseteq D$, write '$\oplus \mathcal{A}$'.
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$\rightarrow$ no intersection and complementation $\rightarrow$ D_e is a **join semi-lattice**.

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Collective predicates:

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Note: the group/#girl met – $\mathbf{meet}(g)$, where $g \in D_{SG}$

Plural nouns and definites

Singular nouns	–	*girl, group*	–	denote in $D_t^{D_{SG}}$
Singular def. NPs	–	*the girl/group*	–	denote in D_{SG}
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- **the**(**girls**) $= G = t{+}m{+}s$

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For every singular noun N_{sg} denoting a predicate $P_{et} \in {D_t}^{D_{SG}}$, the plural form N_{pl} denotes the predicate $*P \in {D_t}^{D_{PL}}$, defined by:

$$*P \;=\; \lambda y_e.\; y \in D_{PL} \wedge y \leq \oplus\{x \in D_e : P(x)\}$$

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cons: *no girls arrived*, *either the girls or Dan are thieves*

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$*$**girl** characterizes $\{t{+}m{+}s,\ t{+}m,\ t{+}s,\ m{+}s\}$	→	**the**($*$**girl**) = $t{+}m{+}s$
$*$**girl** characterizes $\{t{+}m\}$	→	**the**($*$**girl**) = $t{+}m$
$*$**girl** characterizes the empty set	→	**the**($*$**girl**) is undefined
girl characterizes $\{t,\ m,\ s\}$	→	**the**(**girl**) is undefined
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Lexical distributivity – alternative approach

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Challenge: the townspeople are asleep

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$\Leftrightarrow\;\; \forall y \in D_{SG}.\; y \leq G \rightarrow (\textbf{sing}(y) \vee \textbf{dance}(y))$

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(1) Dylan wrote many hits.

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accounted for by the ambiguity that the D-operator introduces

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"I looked for a book several times"

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"Pluractional adverbials": *Sue ate the cake piece by piece.*

Challenge III – structured individuals?

Problem 1:

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(1) and (2) do not seem equivalent under these conditions

the girls and the boys are just the children; the girls and the boys were separated
$\overset{?}{\Rightarrow}$ the young children and the other children were separated

Tentative conclusion 1: there are models such that $\textbf{girl} \cup \textbf{boy} = \textbf{child}$
but $[\![\textit{the girls and the boys}]\!] \neq [\![\textit{the children}]\!]$.

Challenge III – structured individuals? (cont.)

Problem 2:

(1) a. The girls are group A.
    b. The boys are group B.

(2) Group A and group B are of the same size.
    a. Group A is of the same size as group B.
    b. Group A and group B (together or separately) are of the same size mentioned earlier.

(3) The children are of the same size.
    a. Each child is of the same size.
    b. The children (together or separately) are of the same size mentioned earlier.

Tentative conclusion 2: there are models such that **girl**$\cup$**boy** = **child**, and groups A and B have the members in **girl** and **boy** (pre-theoretically), but $[\![$*group A and group B*$]\!] \neq [\![$*the children*$]\!]$.

Impure atoms

Impure atom principle: An NP denotation like $[\![\text{the girls}]\!]$ is a plural individual $G \in D_{PL}$, which can be freely mapped to a contextually determined member of the set of *"impure" atoms* in D_{SG} (groups, teams, committees, bands etc.) made of the members of G. We denote this selected impure atom by $\uparrow G \in D_{SG}$.

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$\uparrow$ is used with precedence over other operators: $\uparrow A + B = (\uparrow A) + B$.

Impure atoms (cont.)

Example 1:

(1) The girls and the boys were separated.

a. **separated**$(G+B)$ "the children were separated"

b. **separated**$(\uparrow G+\uparrow B)$ "an impure atom made of G and an impure atom made of B were separated"

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(2) The young children and the other children were separated.

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Readings (1b) and (2b) are prominent for (1) and (2), hence the perceived lack of equivalence.

Impure atoms (cont. 2)

Example 2:

(1) a. The girls are group A. $\uparrow G$ = **group_A**

b. The boys are group B. $\uparrow B$ = **group_B**

Impure atoms (cont. 2)

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(1) a. The girls are group A. $\uparrow G = \textbf{group\_A}$

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$[\![\textit{be of the same size}]\!] = \lambda x_e.\forall y, z \in D_{SG}.\ y, z \leq x \rightarrow size(y) = size(z)$

(2) Group A and group B are of the same size.

$\forall x, y \in \textbf{group\_A}+\textbf{group\_B}.size(x) = size(y)$

$\Leftrightarrow\ size(\textbf{group\_A}) = size(\textbf{group\_B})$

Impure atoms (cont. 2)

Example 2:

(1) a. The girls are group A. $\uparrow G = \textbf{group\_A}$

b. The boys are group B. $\uparrow B = \textbf{group\_B}$

$[\![\textit{be of the same size}]\!] = \lambda x_e.\forall y,z \in D_{SG}.\ y,z \leq x \ \rightarrow \ size(y) = size(z)$

(2) Group A and group B are of the same size.

$\forall x,y \in \textbf{group\_A}+\textbf{group\_B}.size(x) = size(y)$

$\Leftrightarrow \ size(\textbf{group\_A}) = size(\textbf{group\_B})$

(3) The children are of the same size.

$\forall x,y \in C.size(x) = size(y)$

Challenge IV – non-atomic distribution?

See Champollion's article *Distributivity in formal semantics*