Lecture IV. Copredication

This lecture

1. Copredication and dot-types: informal ideas
2. Subtyping (necessary for dot-types approach)
3. Formalisation of dot-types in MTTs
4. Copredication in more sophisticated situations (if time permits)

IV.1. Copredication – examples

- Copredication is a special case of logical polysemy.
  - See (Pustejovsky 1995, Asher 2011), among others.
- Examples
  - John picked up and mastered the book.
  - (*) The lunch was delicious but took forever.
  - The newspaper you are reading is being sued by Mary.
- Consider (*):
  - delicious : Food→**t**; take_forever : Process→**t**
  - Their domains Food/Process ≤ **e** do not share any common objects, but they can both apply to the same noun (lunch) …

How to analyse it formally?

- Very interesting issue
  - Easy to understand, but intriguing (nice research topic)
  - Numerous papers in the literature
- Many approaches, including (just to name a few):
  - Dot-types and related approaches
    - E.g., Pustejovsky 95, Asher 2011, Luo 2010, …
  - Mereological approaches
    - E.g., Gotham 2014, 2017
  - Others
    - E.g., Retoré 2013, Liebesman & Magidor 2023, …

Dot-types

- Dot-types – idea by Pustejovsky (1995)
  - Objects of type A•B have two aspects: being both A and B.
  - Informally, sentences with copredication can now be interpreted.
- How to formalise? – subtyping crucial
  - Formalise dot-types in Montagovian setting?
    - Introducing subsumptive subtyping – similar to Montague+DETs – Lecture II.2.
  - Formalise dot-types in MTTs?
    - Using coercive subtyping – Luo 2010 (SALT20 paper)
- Examples – subtyping is crucial for the correct analysis. We'll try to explain this informally, by examples.

Example in the Montagovian setting

[heavy] : $Phy \rightarrow t$

[book] : $Phy \bullet Info \rightarrow t$

[heavy book] : $Phy \bullet Info \rightarrow t$

[heavy book](x) = [heavy](x) & [book](x)

For this to be well-typed, we need

$$Phy \bullet Info \leq Phy$$

How to formally define $A \bullet B$?

[No such defn in literature for Montague, but its subtyping aspect is similar to Montague+DETs in Lecture II.2 (omitted here)]

An example in MTT-semantics

"John picked up and mastered the book.

$[\![book]\!] \leq$ PHY•INFO [Characterising book's copredication]

PHY•INFO ≤ PHY and PHY•INFO ≤ INFO [by defn of dot-types]

$[\![pick\ up]\!]$: Human → PHY → Prop

≤ Human → PHY•INFO → Prop

≤ Human → $[\![book]\!]$ → Prop

$[\![master]\!]$: Human → INFO → Prop

≤ Human → PHY•INFO → Prop

≤ Human → $[\![book]\!]$ → Prop

Hence, both have the same type and therefore can be coordinated by "and" to form "picked up and mastered" in the above sentence.

Question: How to introduce dot-types like PHY•INFO in an MTT?

Dot-types in MTTs

- What is A•B?
  - Inadequate accounts, as summarised by Asher (2008):
    - Intersection type
    - Product type
- Proposal (Luo, 2010)
  - A•B as type of pairs that do not share components
  - Both projections as coercions
- Implementations
  - Coq implementations (Luo 2011, LACL11)
  - Implemented in proof assistant Plastic by Xue (2012, 2013)

Key points of a dot-type

- A dot-type is not an ordinary type
  - E.g., It is not an inductive type in MTTs.
- To form A•B, A and B cannot share components:
  - E.g., "Phy•Phy" and "(Phy•Info)•Phy" are not dot-types.
  - This is in line with Pustejovsky's view that dot-objects "*appear in selectional contexts that are contradictory in type specification*."
- A•B is like AxB but both projections are coercions:
  - A•B $\leq_{\pi_1}$ A and A•B $\leq_{\pi_2}$ B
  - This is OK because of the non-sharing requirement. (Note: to have both projections as coercions would not be OK for product types AxB since coherence would fail.)

$$\frac{A : Type \quad B : Type \quad \mathscr{C}(A) \cap \mathscr{C}(B) = \emptyset}{A \bullet B : Type}$$

$$\frac{a : A \quad b : B}{\langle a, b \rangle : A \bullet B} \qquad \frac{c : A \bullet B}{p_1(c) : A} \qquad \frac{c : A \bullet B}{p_2(c) : B} \qquad \frac{a : A \quad b : B}{p_1(\langle a, b \rangle) = a : A} \qquad \frac{a : A \quad b : B}{p_2(\langle a, b \rangle) = b : B}$$

$$\frac{A \bullet B : Type}{A \bullet B <_{p_1} A : Type} \qquad \frac{A \bullet B : Type}{A \bullet B <_{p_2} B : Type}$$

Another example: “heavy book”

In MTT-semantics:

- [heavy] : Phy $\rightarrow$ Prop
  $\leq$ Phy•Info $\rightarrow$ Prop
  $\leq$ Book $\rightarrow$ Prop
- So, the following is well-formed:

  [heavy book] = Σ(Book, [heavy])
- One may compare this with earlier example for “heavy book” in the Montagovian setting.

Copredication in more complicated contexts

- What happens when copredication interacts with …?
  - Interacting with quantification ➔ identity criteria of CNs (Luo 2012)
  - See (Chatzikyriakidis and Luo 2018, Luo 2023)
  - (Left open for now …)