

Discourse Anaphora

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ESSLI 2023

August 7-11, 2023



From AMR to UMR Gysel et al. (2021)

- ▶ At the sentence level, UMR adds:
 - ▶ An *aspect* attribute to eventive concepts
 - ▶ *Person* and *number* attributes for pronouns and other nominal expressions
 - ▶ Quantification scope between quantified expressions
- ▶ At the document level UMR adds:
 - ▶ Temporal dependencies in lieu of tense
 - ▶ Modal dependencies in lieu of modality
 - ▶ Coreference relations beyond sentence boundaries
- ▶ To make UMR cross-linguistically applicable, UMR
 - ▶ defines a set of language-independent abstract concepts and participant roles,
 - ▶ uses lattices to accommodate linguistic variability
 - ▶ designs specifications for complicated mappings between words and UMR concepts.

Participants of the UMR project

- ▶ UMR stands for Uniform Meaning Representation, and it is an NSF funded collaborative project between Brandeis University, the University of Colorado, and the University of New Mexico, with a number of partners outside these institutions



Faculty



Students



Partners

Table: The UMR team

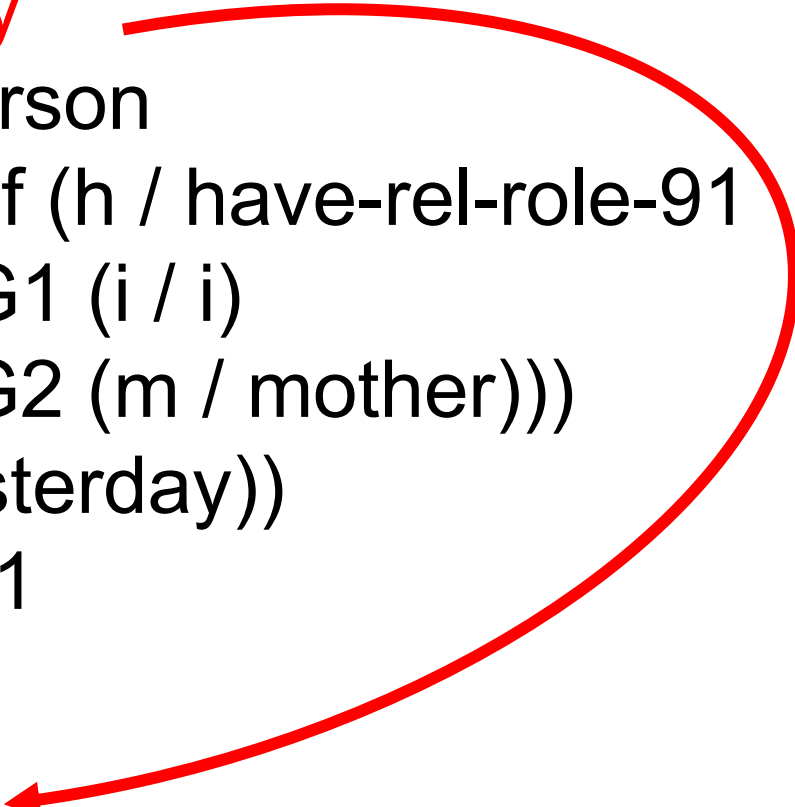
Coreference Relations

How do we capture implicit arguments? AMR

- *My mother's birthday was yesterday and I forgot!*

- (a / and

:op1 (b / birthday
:poss (p / person
:ARG0-of (h / have-rel-role-91
:ARG1 (i / i)
:ARG2 (m / mother)))
:time (y / yesterday))
:op2 (f / forget-01
:ARG0 i
:ARG1 b))



Examples of implicit arguments

- *Let's build a tower.*
- *Start by stacking 4 blue blocks.*
- *Add a block.*

**Roleset id: add.02 , *mathematics,*
mixing, add something to something
*else, increase***

Arg0-PAG: *adder* (vnrole: 22.1-2-agent, 108-agent)

Arg1-PPT: *thing being added* (vnrole: 22.1-2-patient, 108-theme)

Arg2-PPT: *thing being added to* (vnrole: 22.1-2-co-patient, 108-co-theme)

Arg3-PRD: *resulting sum*

Palmer, et. al, Recovering Implicit Information, ACL 1986,

Gerber & Chai, Beyond NomBank: A Study of Implicit Arguments for Nominal Predicates,
ACL 2010, CL 2012

*Roth & Frank, *SEM, 2013, and so on...*

Examples of implicit arguments

- *Let's build a tower.*
- *Start by stacking 4 blue blocks.*
- *Add a block.*

(a / add-01
:ARG0 (y / you)
:ARG1 (b/ block)
:mode imperative)

Examples of implicit arguments

- *Let's build a tower.*
 - *Start by stacking 4 blue blocks.*
 - *Add a block.*
- (a / add-02 :mode imperative
:ARG0 (y / you)
:ARG1 (b / block)
:ARG2 (i3 / implicit-thing-being-added-to)

i3 / implicit-thing-being-added-to
identity-chain(Mentions: t / tower)

Implicit argument examples*

- *She found out [?].*
- *He signed [?].*
- *They won [?].*
- *My proposal is similar [to ?].*
- *She explained [?].*
- Dropped subjects in Chinese
- Clitics in Romance languages,...

**Thanks to Tim O’Gorman and Chuck Fillmore*

Multi-sentence AMRs – situating w/re context

- Add information about which words refer to the same thing, how events relate to each other on a timeline, chains of cause and effect between events, and other kinds of rich information needed for understanding.
- Focus here on referring expressions, inter-sentential coreference

Tim O'Gorman, et. al., AMR Beyond the Sentence: the Multi-sentence AMR corpus, COLING 2018



How do we capture Metonymy? AMR

- Introduction of understood, but not explicitly mentioned concepts:
Gas could go to \$ 10 a gallon

(p / possible

:domain (g / go.01

:**ARG1** (t / **thing**

:**ARG2-of** (p2 / **price-01**

:ARG1 (g4 / gas

:quant (v2 / volume-quantity

:unit (g5 / gallon)

:quant 1))))

:ARG4 (m2 / monetary-quantity

:unit (d2 / dollar)

:quant 10)))

Examples of Metonymy*

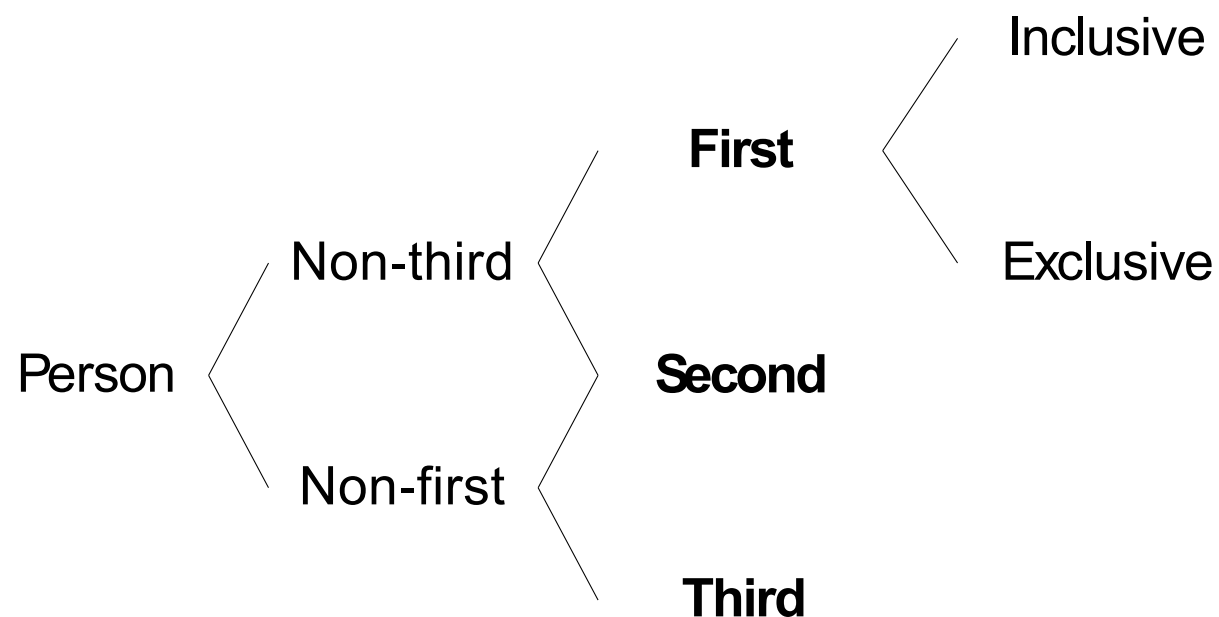
- *Joakim drank another glass (of wine).*
- *Boston ('s football team) won the SuperBowl.*
- *London ('s financial center) is frightened of a no-deal Brexit.*
- *Supreme Court rejects Texas (AG's) suit.*
-

** Thanks to James Pustejovsky for types*

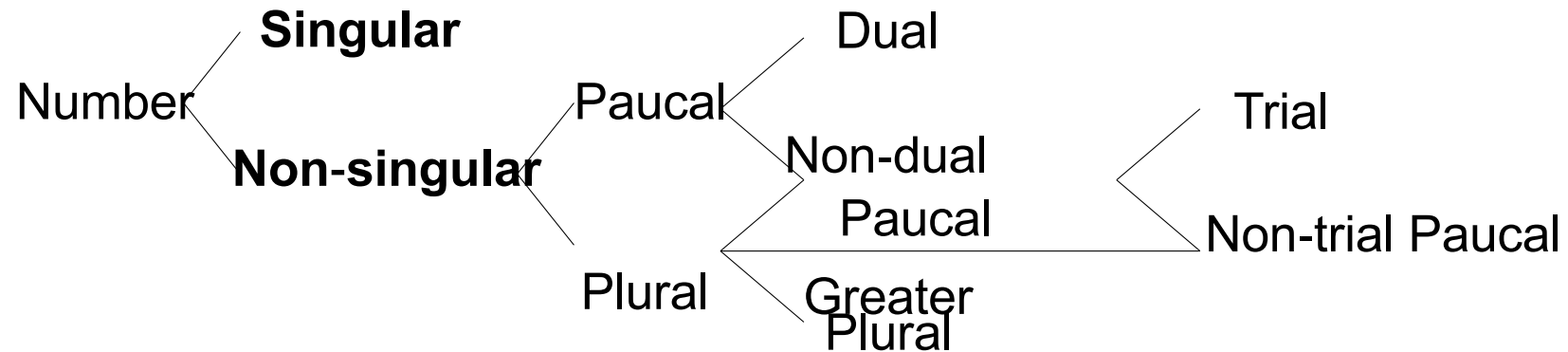
UMR sentence-level additions

- ▶ An *Aspect* attribute to event concepts
 - ▶ *Aspect* refers to the internal constituency of events - their temporal and qualitative boundedness
- ▶ *Person* and *number* attributes for pronouns and other nominal expressions
- ▶ A set of concepts and relations for discourse relations between clauses
- ▶ Quantification scope between quantified expressions to facilitate translation of UMR to logical expressions

UMR attributes: Person



UMR attributes: number



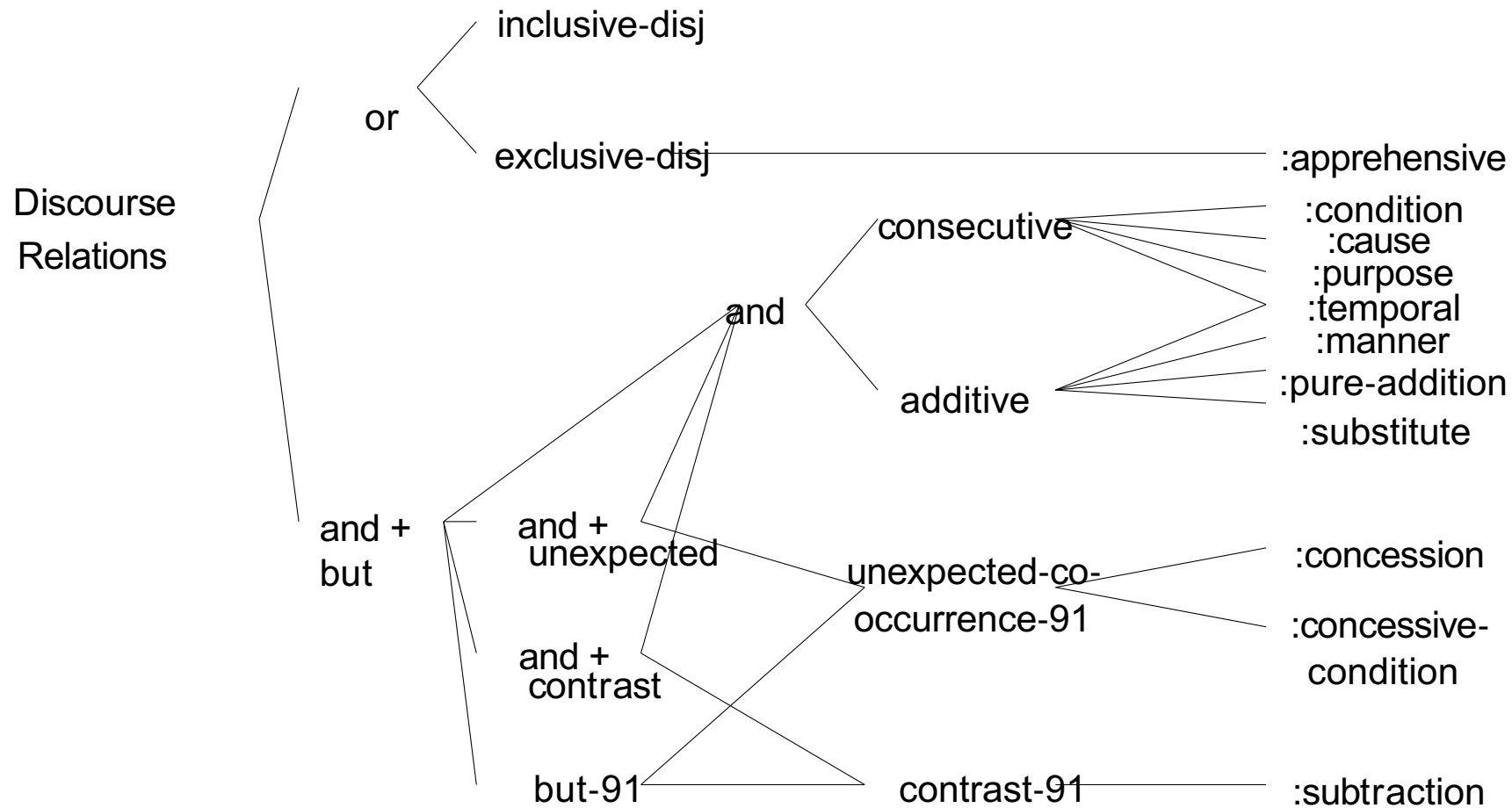
Discourse relations in UMR

- ▶ In AMR, there is a minimal system for indicating relationships between clauses - specifically coordination:
 - ▶ *and* concept and *:opX* relations for addition
 - ▶ *or/either/neither* concepts and *:opX* relations for disjunction
 - ▶ *contrast-01* and its participant roles for contrast
 - ▶ Etc.
- ▶ Many subordinated relationships are represented through participant roles, e.g.:
 - ▶ *:manner*
 - ▶ *:purpose*
 - ▶ *:condition*, etc.
- ▶ UMR makes explicit the semantic relations between (more general) “coordination” semantics and (more specific) “subordination” semantics

Examples of Discourse relations

- Addition of discourse connectives:
 - *But* = contrast: “The House has voted to raise the ceiling to \$ 3.1 trillion , **but** the Senate isn't expected to act until next week at the earliest.”
 - *Even though* = concession: “Workers described ‘clouds of blue dust’ that hung over parts of the factory, **even though** exhaust fans ventilated the area.”
- Penn Discourse Treebank – inter-sentential
- AMR – intra-sentential

Discourse relations in UMR



Temporal and Causal Relations

How do we capture causation? AMR

- *The president pardoned him for health reasons.*

(p3 / pardon-01

:ARG0 (p / president)

:ARG1 (h2 / he)

:ARG1-of (c / **cause-01**

:ARG0 (r / reason

:MOD (h /health))))

Temporal Relations between events

- Each document is annotated for two things:
 - 1) Markables (participants, events, and references to time in the discourse)
 - 2) Relationships between the markables (primarily temporal, causal, and coreference relations)

Markables

- Example:
 - A United Nations assessment team was dispatched to the province after two quakes, measuring 7.6 and 7.4, struck west of Manokwari Jan. 4. Many of the 14,000 refugees have returned home but some are still too fearful to go back Kacong said.
- **EVENTs**: actions, occurrences, eventive states – things you could put on a timeline
- **ENTITYs**: non-eventive, referential markables, such as people and places
- **Temporal Expressions**: explicit references to time

Markables

- Example:
 - A United Nations assessment team was dispatched to the province after two quakes, measuring 7.6 and 7.4, struck west of Manokwari Jan. 4. Many of the 14,000 refugees have returned home but some are still too fearful to go back Kacong said.
- EVENTS: actions, occurrences, eventive states – things you could put on a timeline
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TimeML Event Classes. <http://timeml.org/site/>

- **Occurrence:**
 - die, crash, build, merge, sell, take advantage of, ..
- **State:**
 - Be on board, kidnapped, recovering, love, ..
- **Reporting:**
 - Say, report, announce,
- **I-Action:**
 - Attempt, try, promise, offer
- **I-State:**
 - Believe, intend, want, ...
- **Aspectual:**
 - begin, start, finish, stop, continue.
- **Perception:**
 - See, hear, watch, feel.

Narrative Containers

Pustejovsky & Stubbs, 2011

- Don't mark the relations between EVENTS.
- Instead, put EVENTS in temporal buckets and relate the buckets





Event Relations Subtypes

- BEFORE and OVERLAP
 - Cause
 - Precondition
- CONTAINS
 - Subevent
- COREF has
 - Identity
 - Set/Member
 - Part/Whole
 - Bridging

Event Mention ITA

		IAA (ann-ann)	Kappa (ann-ann)
Event	DocTimeRel	0.86	0.74
	Polarity	0.99	0.83
	Modality	0.94	0.72
	Span Agreement	0.87 (0.79 in THYME)	
Entity	Polarity	0.999	0.40
	Modality	0.98	0.54
	Span Agreement	0.91 (0.87 in THYME)	

Event Relation ITA

- Given agreement that there is a Relation

	F1
All Event Types	.78
Relations w/out subtypes	.90
CONTAIN vs. SUBEVENT	.87
CAUSE VS. Not CAUSE	.78
CAUSE vs. PRECONDITION	.64

- Agreement on having a Relation is .58 F1

EVENT characteristics

- A United Nations assessment team was **dispatched** to the province after two **quakes**, measuring 7.6 and 7.4, struck west of Manokwari Jan. 4. Many of the 14,000 refugees have **returned** home but some are still too **fearful** to **go** back Kacong **said**.
- EVENT status not based on POS (could be nominals or adjectivals)
- Each EVENT assigned a DocTimeRel (temporal relationship to the time of document creation)
 - [dispatched] – BEFORE
 - [fearful] – BEFORE/OVERLAP
- Can be marked for different features that provide more information (e.g., polarity, modality)
 - [go] – NEG
 - More buildings might **collapse** due to damage
 - [collapse] – HYPOTHETICAL

Markables: Issues

- ❑ A **United Nations** **assessment team** was **dispatched** to the **province** after two **quakes**, measuring 7.6 and 7.4, struck west of **Manokwari** **Jan. 4**. **Many** of the 14,000 **refugees** have **returned home** but **some** are still too **fearful** to **go** back **Kacong** **said**.
- When does a multi-word phrase refer to one EVENT or multiple EVENTS?
 - ❑ Consider: *The patient underwent a hemicolectomy.*
- When is a premodifier referential (and therefore markable)?
 - ❑ *The patient has a brain tumor.*
 - ❑ *The patient had blood work done.*

Temporal expressions

- A United Nations assessment team was dispatched to the province after two quakes, measuring 7.6 and 7.4, struck west of Manokwari Jan. 4. Many of the 14,000 refugees have returned home but some are still too fearful to go back Kacong said.
- We mark explicit references to time: {Jan. 4}

Relations: Types

- A United Nations assessment team was dispatched to the province after two quakes, measuring 7.6 and 7.4, struck west of Manokwari Jan. 4. Many of the 14,000 refugees have returned home but some are still too fearful to go back Kacong said in an interview after the team's arrival.

■ Temporal

- [arrival] BEFORE [interview]
- {Jan. 4} CONTAINS [quakes]
- [interview] CONTAINS-SUBEVENT [said]

■ Causal

- CAUSES: [fearful] OVERLAP/CAUSES [go]*neg*
- PRECONDITIONS: [quakes] BEFORE/PRECONDITIONS [dispatched]

Relations: Types

- A **United Nations** assessment **team** was **dispatched** to the **province** after two **quakes**, measuring 7.6 and 7.4, struck west of **Manokwari** **Jan. 4**. **Many** of the 14,000 **refugees** have **returned home** but **some** are still too **fearful** to **go** back **Kacong** **said** in an **interview** after the **team's** **arrival**.

■ Reporting

- [said] REPORTS [returned], [fearful], [go]*neg*

■ Coreference

- IDENTICAL: two mentions point to the same referent
 - [team] IDENT [team]
- WHOLE/PART: one ENTITY is compositionally part of another
 - [United Nations]*WHOLE*, [team]*PART*
 - [province]*WHOLE*, [Manokwari]*PART*
- SET/MEMBER: a group of things and a member of that group
 - [refugees]*SET*, [Many]*MEMBER*, [some]*MEMBER*