Discourse Anaphora

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CLEAR

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

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.*

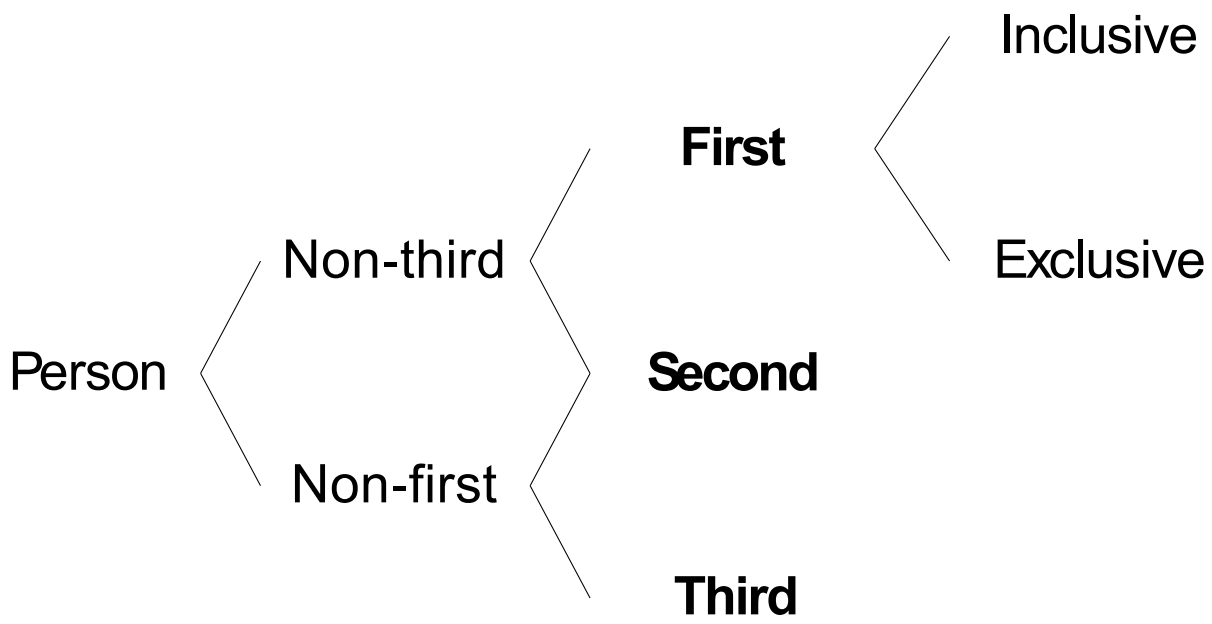
```
(a / add-02 :mode imperative
      :ARG0 (y / you)
      :ARG1 ( b /  block)
      :ARG2 ( i3 /  implicit-thing-being-added-to)
```

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

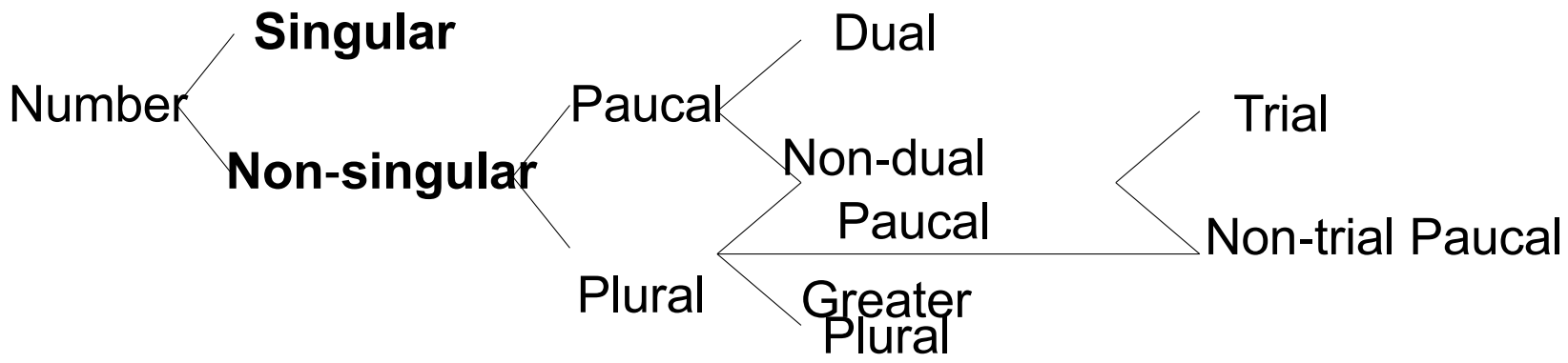
UMR sentence-level additions

- 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



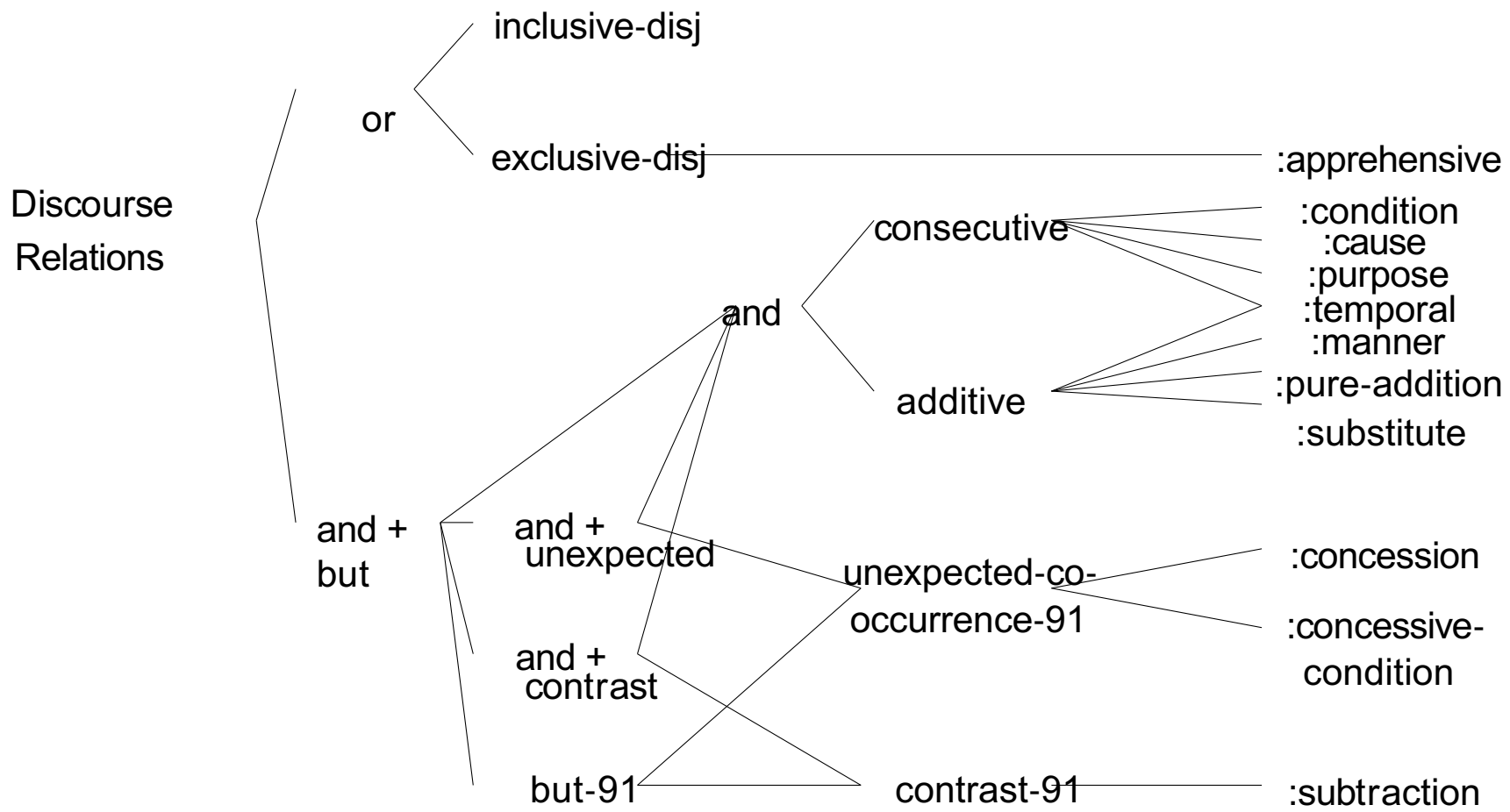
Discourse relations in UMR

- 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
- Many subordinated relationships are represented through participant roles, e.g.:
  - :manner
  - :purpose
  - :condition
- 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 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.
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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

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.

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

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- **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*

Relations: Issues

- Preconditioning: Where do we “draw the line”?
- Sometimes it’s explicit in the text:
  - His license was **suspended** because of a drug **addiction**.
  - [addiction] OVERLAP/PRECONDITIONS [suspended]
- Often it’s not. We don’t want relations like:
  - Christchurch, the first city **established** in New Zealand has endured several earthquakes that have **destroyed** its homes.
  - [established] BEFORE/PRECONDITIONS [destroyed]

Relations: Issues

- But we do want:
  - The rockfall made the **over-full** dam **burst**, flooding the town below.
  - [over-full] OVERLAP/PRECONDITIONS [burst]
- What about:
  - Without notice, the officers **entered** the room and **boxed** up its contents.

Relations: Issues

- WHOLE/PART: What counts as “compositional”?
- [West Papua Province]*WHOLE*, [Manokwari]*PART*
- But not:
  - The refugee [camp] in the neighboring [province]
- What about:
  - A dance [club] in [Berlin]

How do we capture temporal relations? UMR

- s1: *Edmund Pope.... (s1p)*
- s3: *He denied any wrongdoing.*

```
(s3d / deny-01
    :ARG0 (s3h / he)
    :ARG1 (s3t / thing
        :ARG1-of (s3d2 / do-02
            :ARG0 s3h
            :ARG1-of (s3w / wrong-02))))
```

```
(s3 / sentence
    :temporal ((s3d :before DCT)
    :temporal (s3w :before s3d ) )
    :coref ((s3h :same-entity s1p)))
```

Crucial for medical histories (NIH), For identifying IED scenarios (DARPA), etc.

How do we capture temporal relations? UMR

- s1: *Edmund Pope....* *(s1p)*
- s3: *He denied any wrongdoing.*

```
(s3d / deny-01
    :ARG0 (s3h / he)
        :ref-number Singular
        :ref-person 3rd)
    :ARG1 (s3t / thing
        :ARG1-of (s3d2 / do-02
            :ARG0 s3h
            :ARG1-of (s3w / wrong-02))))
```

```
(s3 / sentence
    :temporal ((s3d :before DCT)
    :temporal (s3w :before s3d ) )
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UMR attribute: coarse-grained aspect

- *State*: unspecified type of state
- *Habitual*: an event that occurs regularly in the past or present, including generic statements
- *Activity*: an event that has not necessarily ended and may be ongoing at Document Creation Time (DCT).
- *Endeavor*: a process that ends without reaching completion (i.e., termination)
- *Performance*: a process that reaches a completed result state

Coarse-grained Aspect as an UMR attribute

He wants to travel to Albuquerque.

(w / want
    :aspect State)

She rides her bike to work.
(r / ride
    :aspect Habitual)

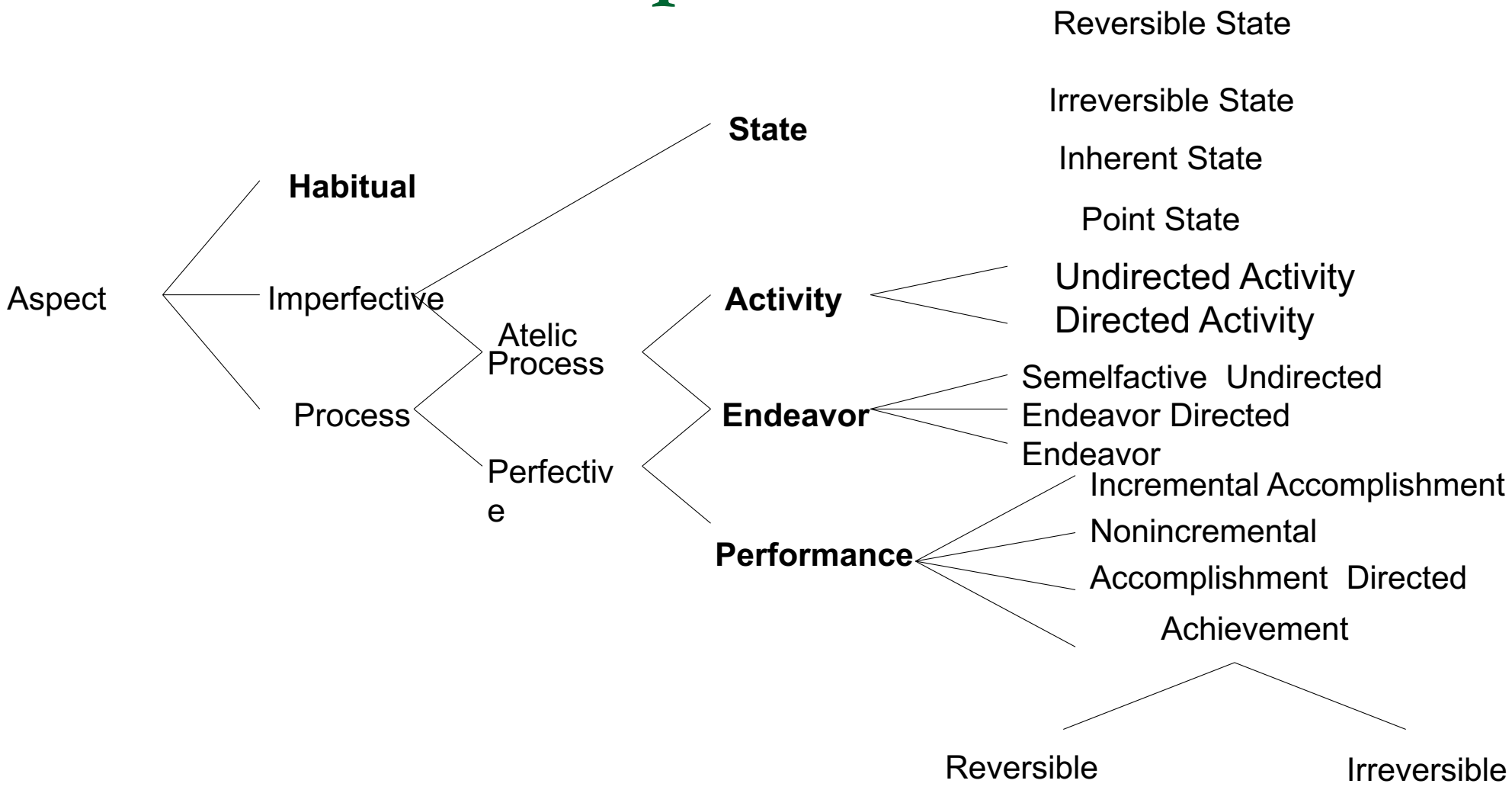
He was writing his paper yesterday.

(w / write
    :aspect Activity)

Mary mowed the lawn for thirty minutes.

(m / mow
    :aspect Endeavor)

UMR attribute: aspect



Fine-grained Aspect as an UMR attribute

My cat is hungry.

(h / have-mod-91
:aspect Reversible state)

The wine glass is shattered.

(h / have-mod-91
:aspect Irreversible state)

My cat is black and white.

(h / have-mod-91
:aspect Inherent state)

It is 2:30pm.

(h / have-mod-91
:aspect Point state)

Adding Modality and Aspect to UMR

- s1: *Edmund Pope…. (s1p)*
- s3: *He denied any wrongdoing.*

(d / deny-01

:Aspect Performance

:ARG0 (h / he)

:ref-number Singular

:ref-person 3rd)

:ARG1 (t / thing

:ARG1-of (d2 / do-02

:Aspect Process

:ARG0 h

:ARG1-of (w / wrong-02))))

(s3 / sentence

:temporal ((s3d :before DCT)

:temporal (s3w :before s3d))

:modal ((s3d :AFF AUTH)

(s3d2 :NEG (s3h :AFF AUTH)))

:coref ((s3h :same-entity s1p)))