
Towards Uniform Meaning Representations

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Reviewing AMR's

- A more abstract labeled dependency tree
 - w/out function words
 - many nouns/adjectives have predicate-argument structures as well as verbs
 - wikified NE's
 - abstract discourse relations (& have-rel...)
 - interpretation of modality and negation
 - “some” implicit arguments/relations
 - AND equivalence relations for coreference – makes it a graph.

Challenges AMR doesn't address

- Sense distinctions and semantic similarity
- Metonymy, Metaphors, new usages
- Implicit arguments
- Tense and Aspect
- Logic
 - Singular/Plural, Definite/Indefinite
- Temporal and causal relations between events

Sense Distinctions AMR makes

- call.02 *He calls me every day at 8am and 5pm.*
- call.03 *Secretary of State Baker , in a foreign policy speech , called for the reunification of Germany.*
- AMR makes the same distinctions PropBank makes.

AMR=PB: Single rooted structures, abstracts away from surface syntax

- [T] *A little girl looks like a woman.*

(s / look-02

:ARG0 (g / girl)

:ARG1 (w / woman)

- [H] *A little girl looks at a woman.*

(s / look-01

:ARG0 (g / girl)

:ARG1 (w / woman)

Trickier distinctions...

- *take-vpc-v*
 - take.11: *obtain* (“take out a pencil, take out an ad”)
 - **take.26: *project anger*** (“take it out on her”)
 - take.27: *kill* (“take out the enemy”)
 - take.28: *vacation* (“take out a year”)
- *take* has 256 multi-word expressions

39 more MWE's for "take"

- TAKE A CHILL
- TAKE A HIT
- TAKE A POWDER
- TAKE ABACK
- TAKE ADVANTAGE
- TAKE AFTER
- TAKE BACK
- TAKE CARE
- TAKE DOWN
- TAKE FOR GRANTED
- TAKE HOME
- TAKE IN VAIN
- TAKE IN CHARGE
- TAKE ISSUE
- TAKE IT EASY
- TAKE ITS/HIS/HER TOLL

Semantic similarity

Stock prices rose precipitously.

The stock market leapt ahead.

- Rise can refer to an increase of a scalar value
- Leaping ahead can metaphorically do the same.
- Stock market comprises stocks with prices.

- Vector representations as feature values?

Metonymy

- 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))))

When to do it?

Multi-sentence AMRs

- We 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.

::id bolt-eng-DF-170-181103-8887769_0066.14 :snt Yeah,there are a few rabid loyal Obama/OWS supporters who routinely come here crowing about how well Wall Street is doing.

(p / person

:ARG0-of (s / support-01

:ARG1 (s2 / slash :op1 (p3 / person :wiki "Barack_Obama"

:name (n / name :op1 "Obama")) :op2 (p2 / political-movement :wiki "Occupy_Wall_Street"

:name (n2 / name :op1 "OWS"))))

:ARG1-of (l / loyal-01

:ARG2 (i3 / implicit--recipi

i3 / implicit--recipient_of_loyalty

:mod (r / rabies)

IdentityChain[Mentions: p3 / person, i3 / implicit--recipient_of_loyalty, g5 / guy

:quant (f / few)

:ARG1-of (c / come-01

:ARG4 (h / here)

:mod (r2 / routine)

:manner (c2 / crow-01 :ARG0 p

:ARG1 (g / good-02

:ARG1 (d / do-02

:ARG0 (m / market-sector :wiki "Wall_Street"

:name (n3 / name :op1 "Wall" :op2 "Street"))

:ARG1 (i2 / implicit--thing_done))

Type

IdentityChain [Mentions: p / person, t / they, t / they, t / they, t / they, t / they, t / they, t / they, i3 / im

IdentityChain [Mentions: p3 / person, i3 / implicit--recipient_of_loyalty, g5 / guy]

IdentityChain [Mentions: c2 / crow-01, d / do-02]

IdentityChain [Mentions: g / good-02, g4 / good-02]

More on implicit arguments

::id bolt-eng-DF-170-181103-8887769_0066.14 :snt Yeah,there are a few rabid loyal Obama/OWS supporters who routinely come here crowing about how well Wall Street is doing.

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□ i3 / implicit--recipient_of_loyalty

□ IdentityChain[Mentions: □ p3 / person, □ i3 / implicit--recipient_of_loyalty, □ g5 / guy

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:name (n / name :op1 "Obama")) :op2 (p2 / political-movement :wiki "Occupy_Wall_Street"

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:ARG2 (i3 / implicit--recipient

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IdentityChain[Mentions: p3 / person, i3 / implicit--recipient_of_loyalty,

g5 / guy

Adding Tense and Aspect – *English*

UMR NSF proposal – Uniform Meaning Representation

Xue, Croft, Palmer, Pustejovsky

- Iterative Aspect – occurs repeatedly
 - *The light was flashing in the distance.*

- Semelfactive Aspect – occurs once*
 - *The light flashed in the distance.*

*can also have an iterative interpretation

Adding Tense and Aspect

Xue, et. al., UMR PIRE Proposal

Semelfactive and Iterative Aspect in 8 languages

language	Semelfactive (* Iterative also possible)	Iterative only
English	The light flashed in the distance *	The light was flashing in the distance
Spanish	La luz destelló a lo lejos.* the light flash. PERF in the distance	La luz destellaba a lo lejos. the light flash. IMPF in the distance
Mandarin	灯 在 远处 闪 了 * light in far_away_place flash ASP	灯 在 远处 一闪一闪 的 light in far_away_place flash. RDP DE
Arabic	baraqa Al-D~aw'u Ean buEodK flash. PERF the-light.nom about distance.gen	yaboruqu Al-D~aw'u Ean buEodK flash.IMPF the-light.NOM about distance.GEN
Hindi	bijili door per chamki light distance LOC flash	bijili doori per chamak rahi thi light distance LOC flash PROG be.PST
Czech	Světlo bliklo v dálce light flash. SML in distance	Světlo blikalo v dálce light flash. IMPF in distance
Kukama	kanata tsene amutse light flash far_away	kanata tsene-ka amutse light flash. ITER far_away
Arapaho	3eb-iihi' nih-be'e-3ee-noo'oo-' distance-PART PST-red-light-INCH-0s	3eb-iihi' nih- bee -be'e-3ee-noo'oo-' distance-PART PST- RDP -red-light-INCH-0s

Adding Tense and Aspect

Xue, et. al., UMR PIRE Proposal

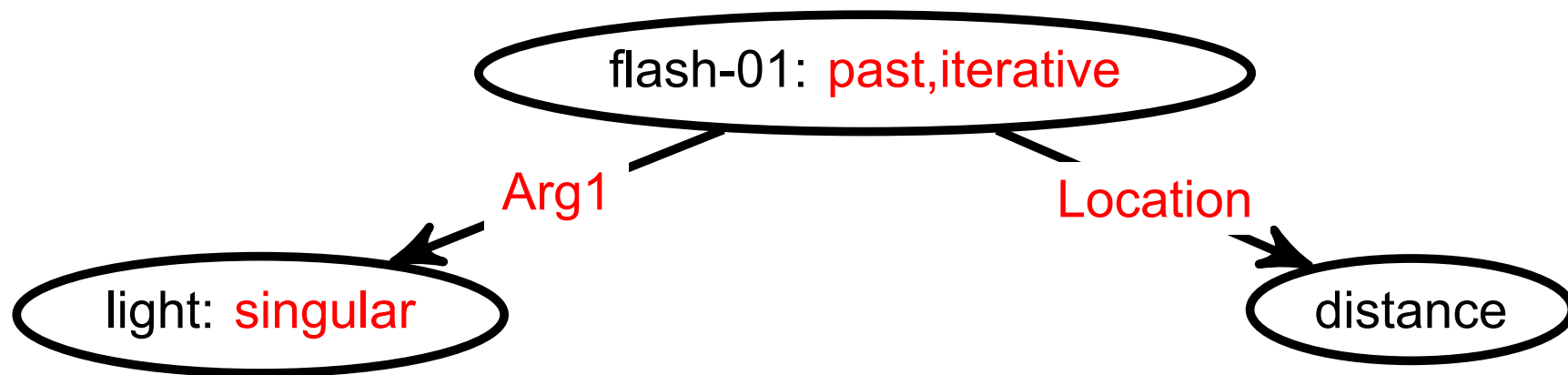
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Adding Iterative Aspect w/ Features

Xue, et. al., UMR PIRE Proposal

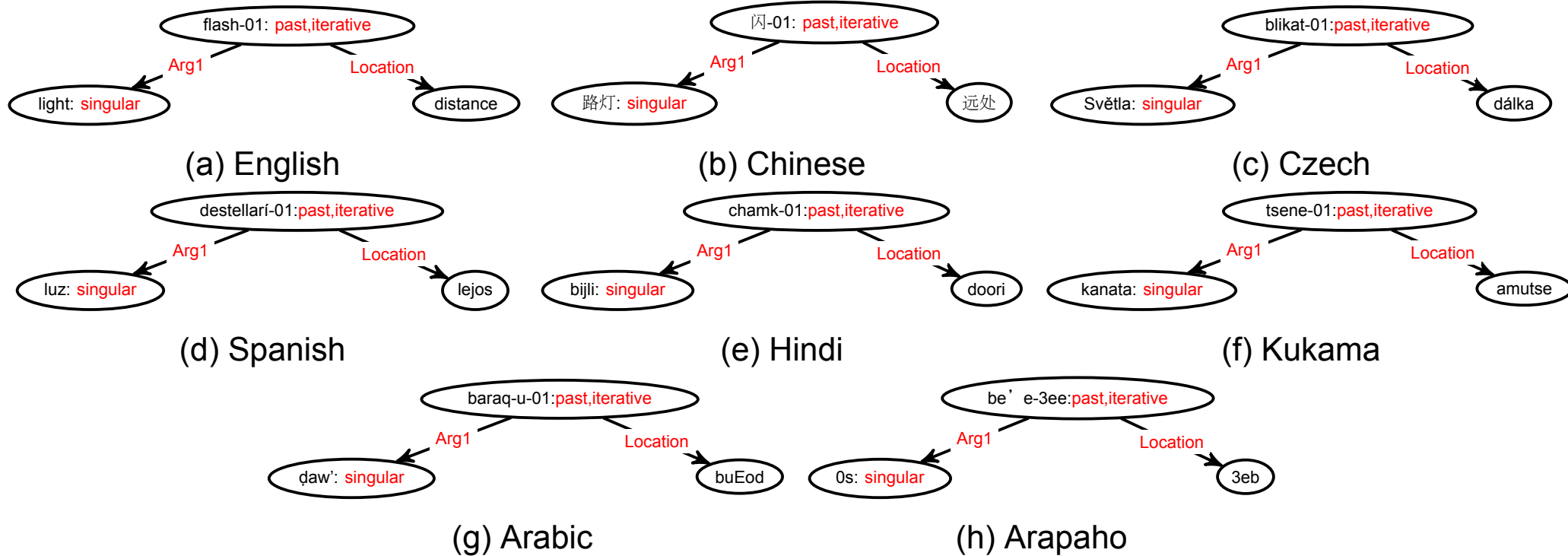
Iterative Aspect in English



Adding Iterative Aspect w/ Features

Xue, et. al., UMR PIRE Proposal

Iterative Aspect in 8 languages



Formal Logic – *thanks to Lauri Karttunen,* *AMR-CCG 2015 workshop at Boulder* *not every*

191. *Not every one has had a friend . (lpp_1943.191)*

```
(h / have-03 :polarity -  
  :ARG0 (e / everyone)  
  :ARG1 (p / person  
    :ARG0-of (h2 / have-rel-role-91  
      :ARG1 e  
      :ARG2 (f / friend))))
```

Formal Logic -

191. *Not every one has had a friend* . (lpp_1943.191)

AMR gives us:

$\forall e, \exists f$ s.t.

$\sim \text{have}(e,f) \wedge \text{friend}(e,f) \wedge \text{person}(e) \wedge \text{person}(f)$

Should Be:

$\exists e, \forall f$ s.t.

$\sim \text{have}(e,f) \wedge \text{friend}(e,f) \wedge \text{person}(e) \wedge \text{person}(f)$

Have a friend?

- But really, “have a friend” is a type of light verb construction, = Not everyone has been befriended.
- $\exists e, \forall f$ s.t.
 $\sim \text{befriend}(f,e) \wedge \text{person}(e) \wedge \text{person}(f)$

Adding Scope for UMR's – James Pustejovsky, TLT, Jan, 2017

- Scope
- Negation raising
- Negation Lowering
- Interactions between quantifiers and negation
 - scope ambiguities

Discussion about argument instantiation

- Predicates applied to arguments where the arguments are existentially quantified variables with widest possible scope, ranging over a universe of possible individuals.
- Singular/Plural, Definite/Indefinite
- Skolemization?

Negation Raising – argument to predicate

Pustejovsky, TLT, 2017

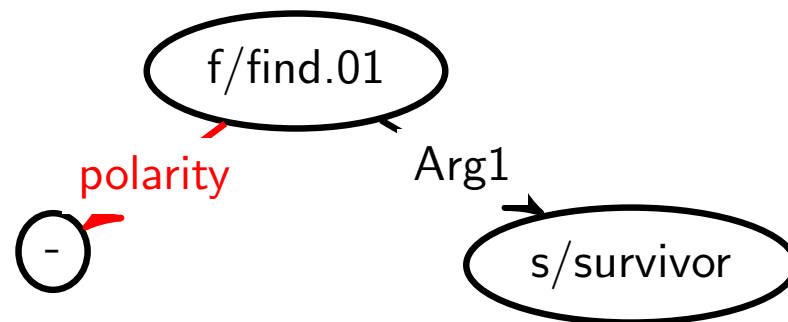


Figure: Negation raising: "No survivors were found"

Negation Lowering – argument to predicate

Pustejovsky, TLT, 2017

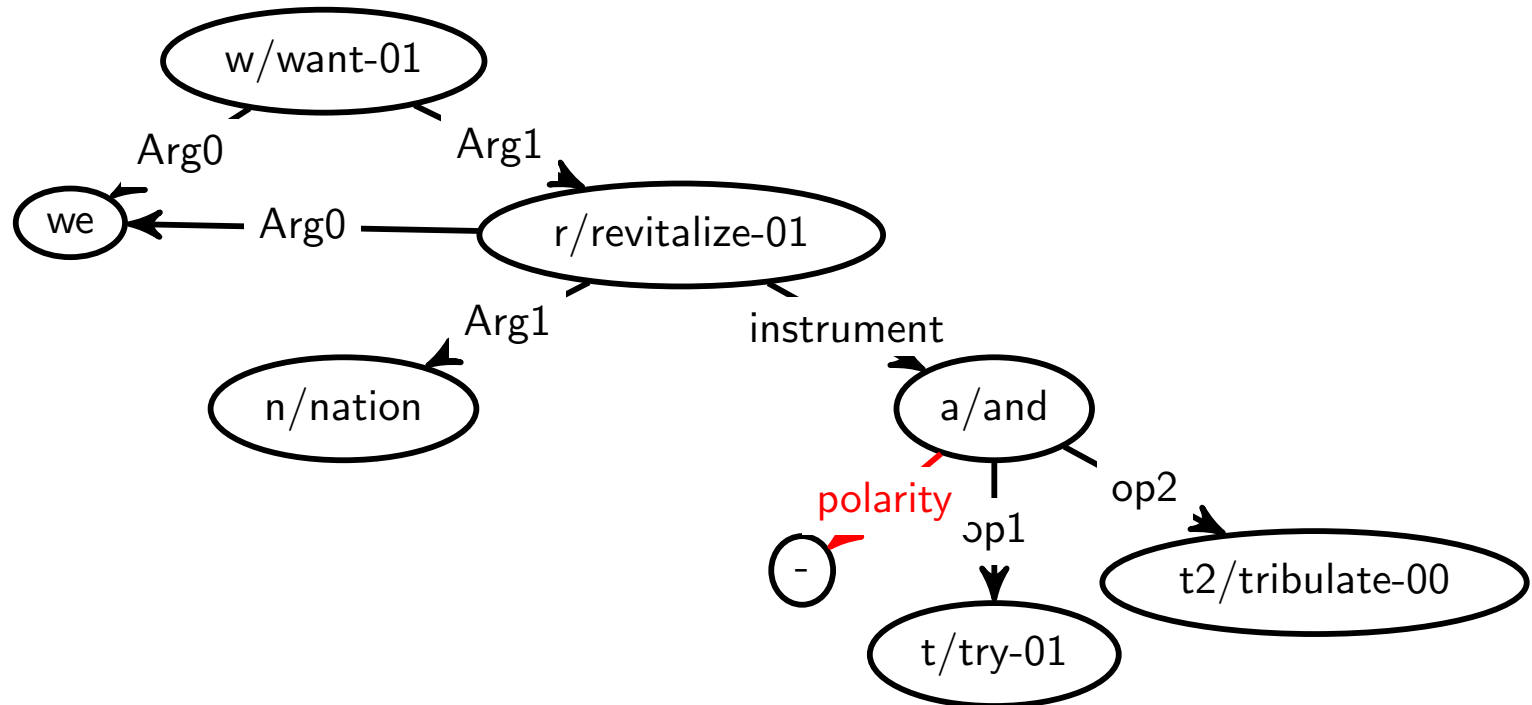


Figure: "We don't want to revitalize the nation through trials and tribulation"

Quantifier/Negation Interaction

Pustejovsky, TLT, 2017

$\forall x$ [student (x)

→

$\neg \exists e$ [fail(e, x)]

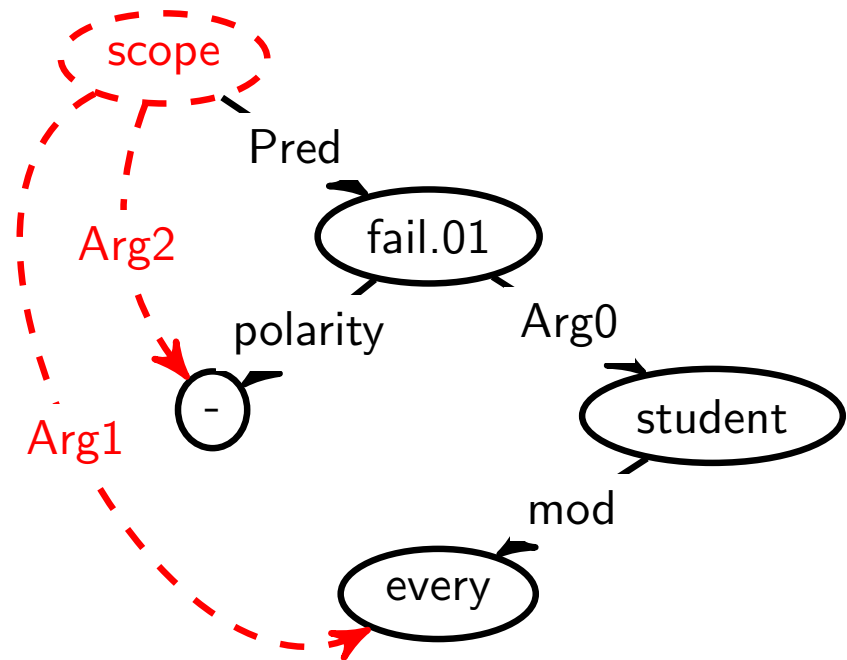


Figure: "every student did not fail"

Quantifier/Negation Interaction

Pustejovsky, TLT, 2017

$\exists e, \exists x$

[student (x)

\wedge

\neg fail(e, x)]

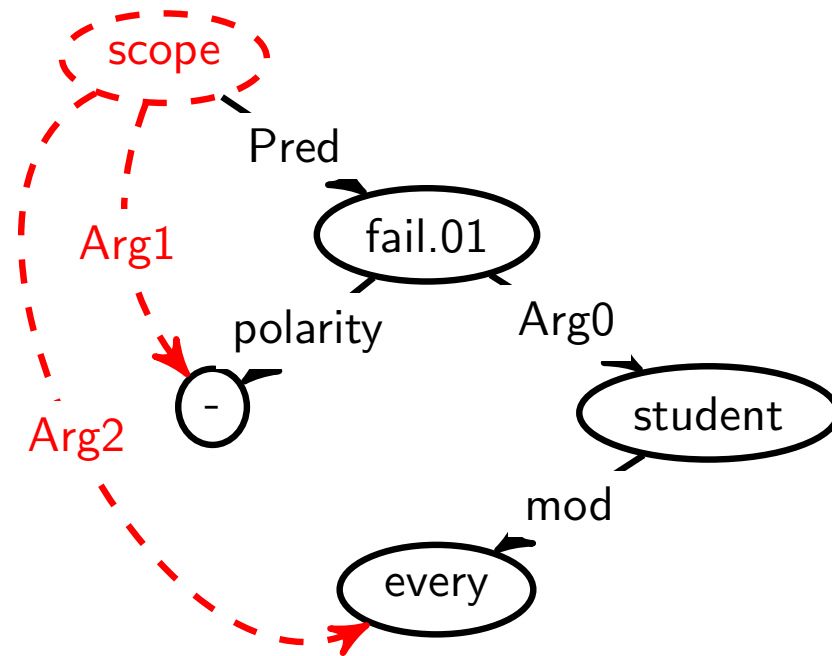
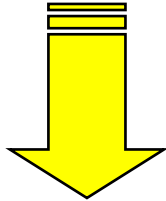


Figure: "every student did not fail"

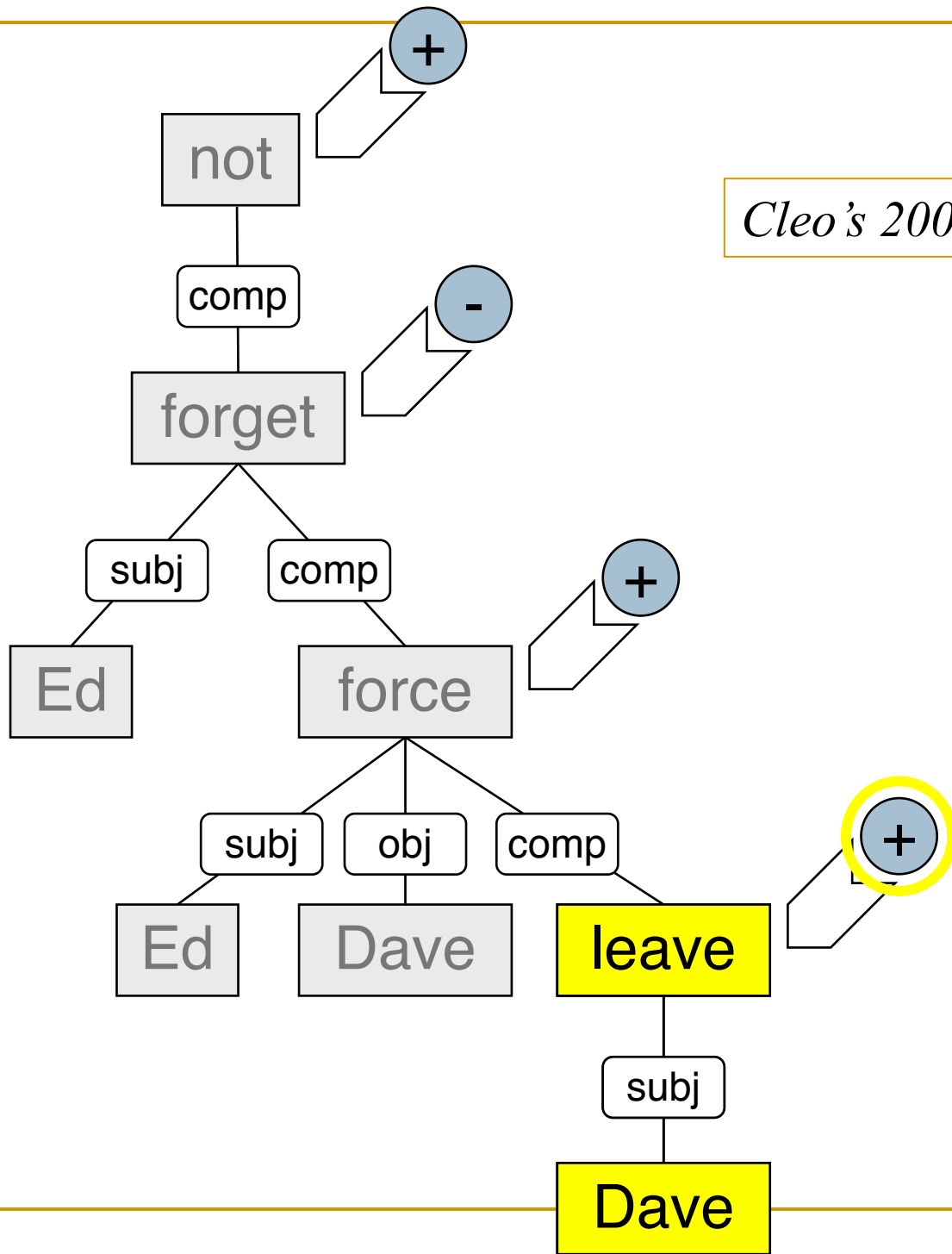
Example: polarity propagation – Cleo’s 2008 Georgetown talk

- “Ed did not forget to force Dave to leave.”



- “Dave left.”

Cleo's 2008 Georgetown talk



“Ed did not forget to force Dave to leave.”

```
(f / forget-01 :polarity -  
  :ARG0 (p / person  
    :name (n / name :op1 "Ed"))  
  :ARG1 (f1 / force-01  
    :ARG0 (p  
      :ARG1 (l / leave-01  
        :ARG1 (p1 / person  
          :name (n / name :op1 "Dave"))
```

Summary

- AMRs provide a useful framework for capturing semantic representations
- They already map readily across languages
- They can be extended to be more compatible with formal logic
- Adding feature values for missing elements such as Singular/Plural and Tense and Aspect can enhance their ability to capture cross-linguistic generalizations

For inferencing, what are the most effective representations for:

- Sense distinctions and semantic similarity?
- Metonymy, Metaphors, new usages?
- Additional implicit arguments?
- Constructions?
- Tense and Aspect?
- Logic [Scope; Sing/Plural; Definite/Indefinite]?
- Temporal and causal relations between events?