

Unsupervised Learning of Narrative Schemas and their Participants

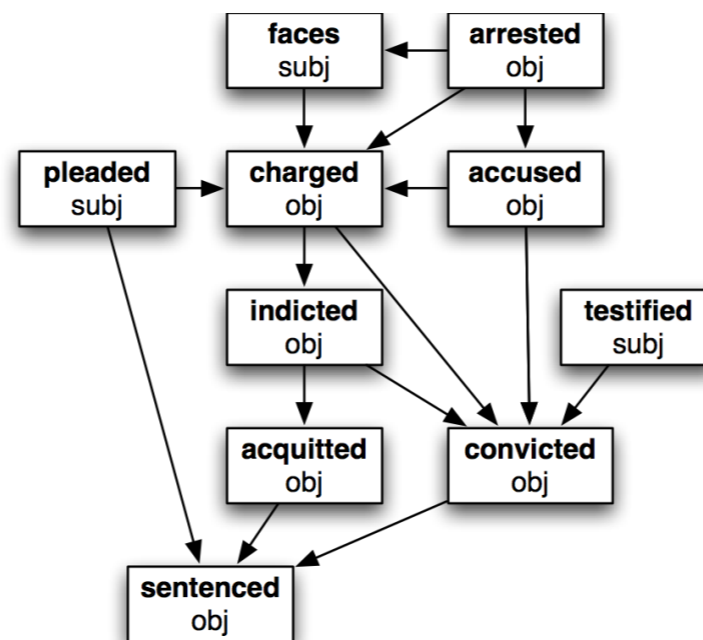
Nathanael Chambers and Dan Jurafsky



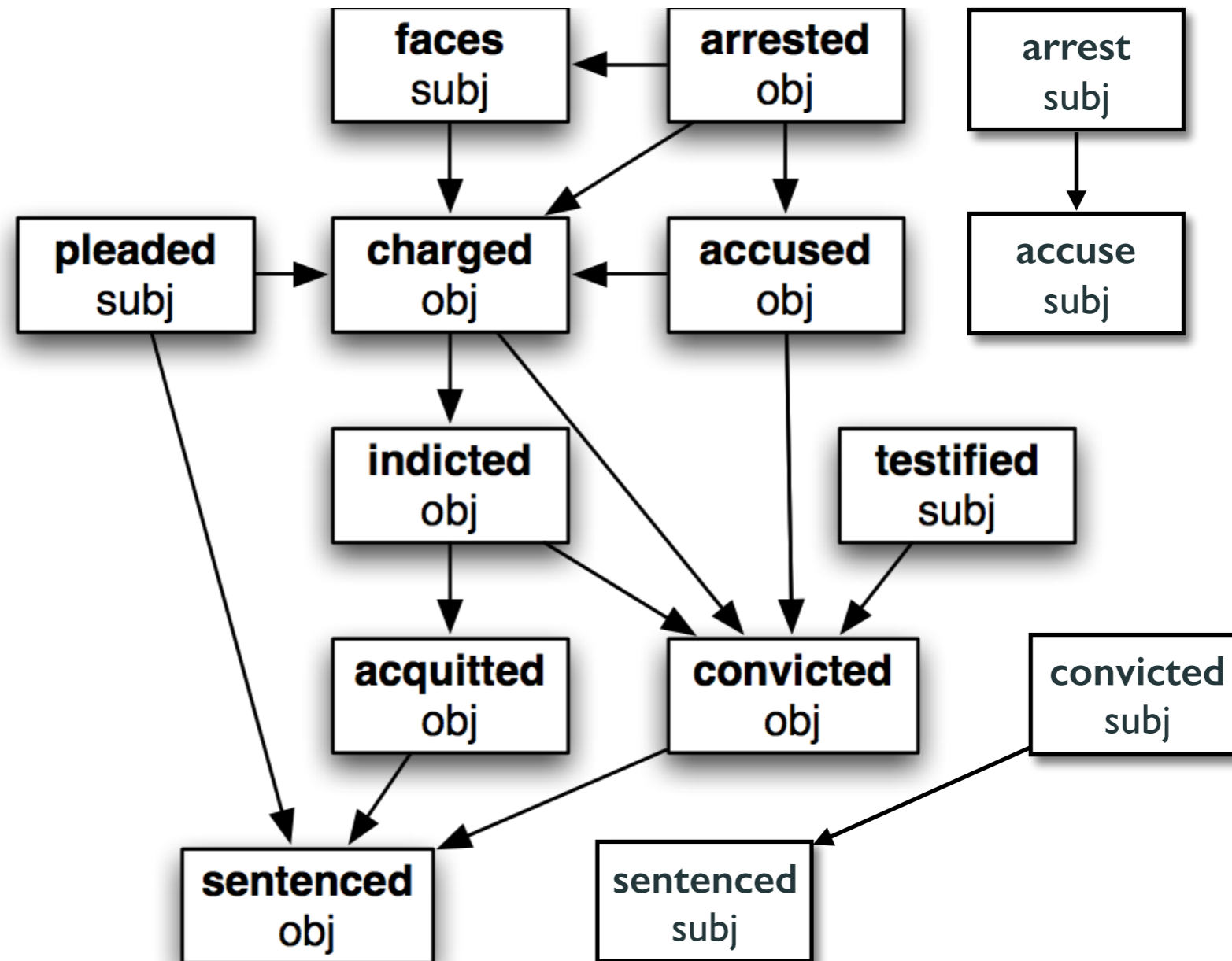
Presentation by Jonathan Poitz - 18.11.2015
Selected Topics of Semantics and Discourse - Prof. Manfred Pinkal

What do we know already?

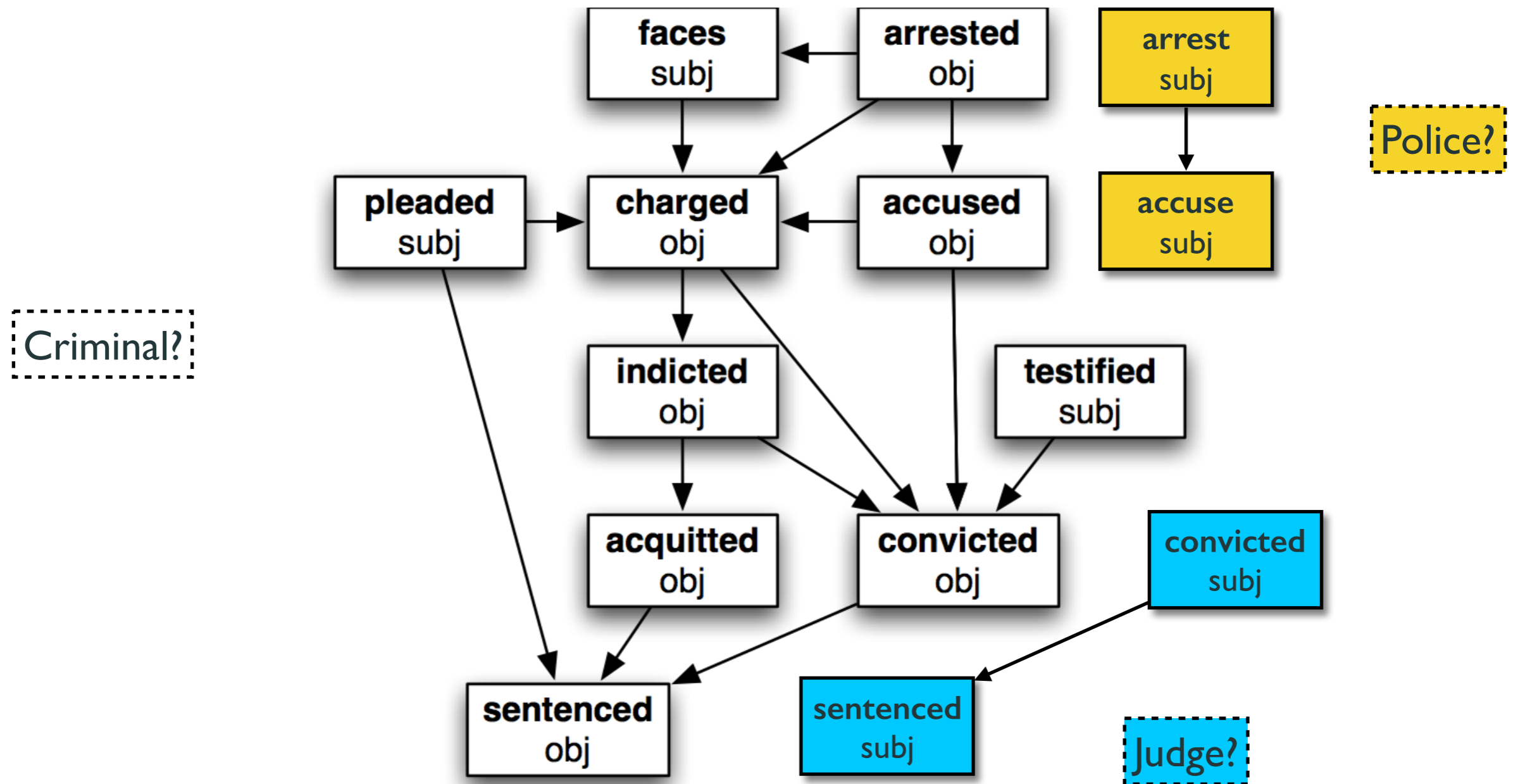
- **Ordered Narrative Chains** by Chambers & Jurafsky 2008 (C&J08)
 - Key Properties:
 - event relations centered around one entity - *protagonist*
 - partially ordered temporally
 - for evaluation, clustered to form discrete chains



A new structure?



A new structure?

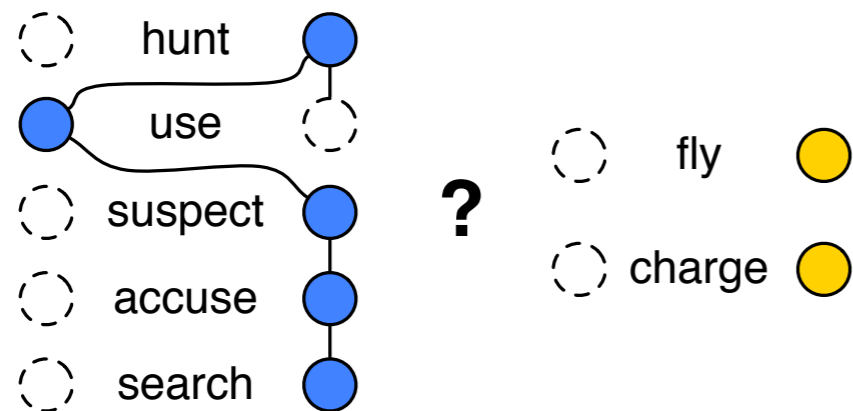


Overview

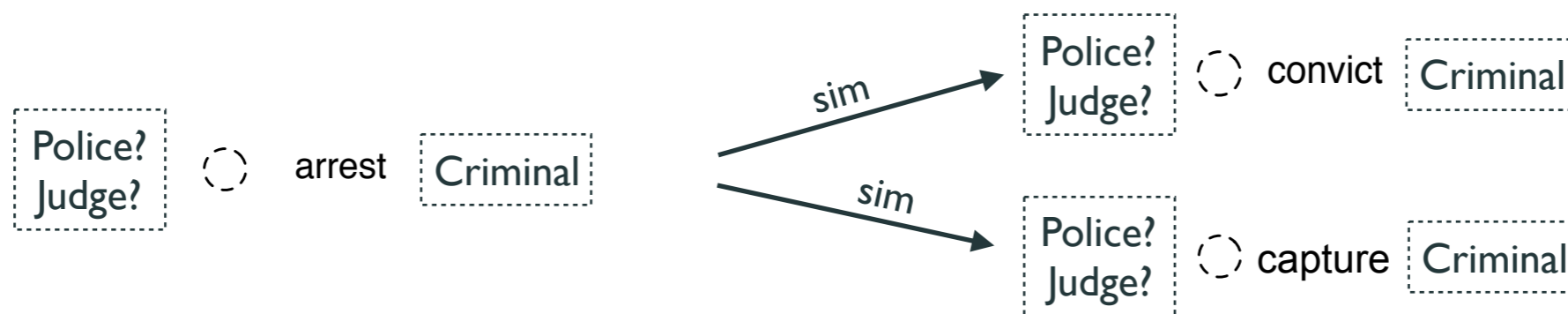
- Motivation
- Narrative Schemas
 - Typed events
 - Similarity between events and event slots
 - From chain to schema
- Evaluation
 - Quantitative evaluation using Narrative Cloze
- Conclusion

Motivation

- **Problem 1:** Arguments in chains in C&J08 are untyped



- **Problem 2:** Only protagonist contributes to event similarity, no other role



Narrative Schemas

Solving problem 1: Typed arguments

- Extend the definition of a narrative chain to include argument types
- C&J08: Definition of a untyped narrative chain:
 - tuple (L, O) with $L =$ set of event slots and $O =$ partial ordering of L
- C&J09: Typed narrative chains:
 - tuple (L, P, O) with L, O and $P =$ set of argument types (using the CBC clustering method to cluster argument roles)

$L = \{(\text{hunt } X), (X \text{ use}), (\text{suspect } X), (\text{accuse } X), (\text{search } X)\}$

$P = \{\text{person, government, company, criminal, ...}\}$

$O = \{(\text{use, hunt}), (\text{suspect, search}), (\text{suspect, accuse}) \dots \}$

- An argument is a role of a set of types R (clusters of head words)

But for a growing proportion of **U.S. workers**, the troubles really set in when **they** apply for unemployment benefits. Many **workers** find **their** benefits challenged.

Narrative Schemas

Similarity between event slots

- Scoring a new event slot in C&J08:

$$\text{chainsim}(C, \langle f, g \rangle) = \sum_{i=1}^n \text{sim}(\langle e_i, d_i \rangle, \langle f, g \rangle) \text{ with } \text{sim}(e, e') = \text{pmi}(e, e').$$

- Extension of sim function to include argument a

$$\text{sim}(\langle e, d \rangle, \langle e', d' \rangle, a) = \text{pmi}(\langle e, d \rangle, \langle e', d' \rangle) + \lambda \log \text{freq}(\langle e, d \rangle, \langle e', d' \rangle, a)$$

- Scoring entire chain for argument a

$$\text{score}(C, a) = \sum_{i=1}^{n-1} \sum_{j=i+1}^n \text{sim}(\langle e_i, d_i \rangle, \langle e_j, d_j \rangle, a)$$

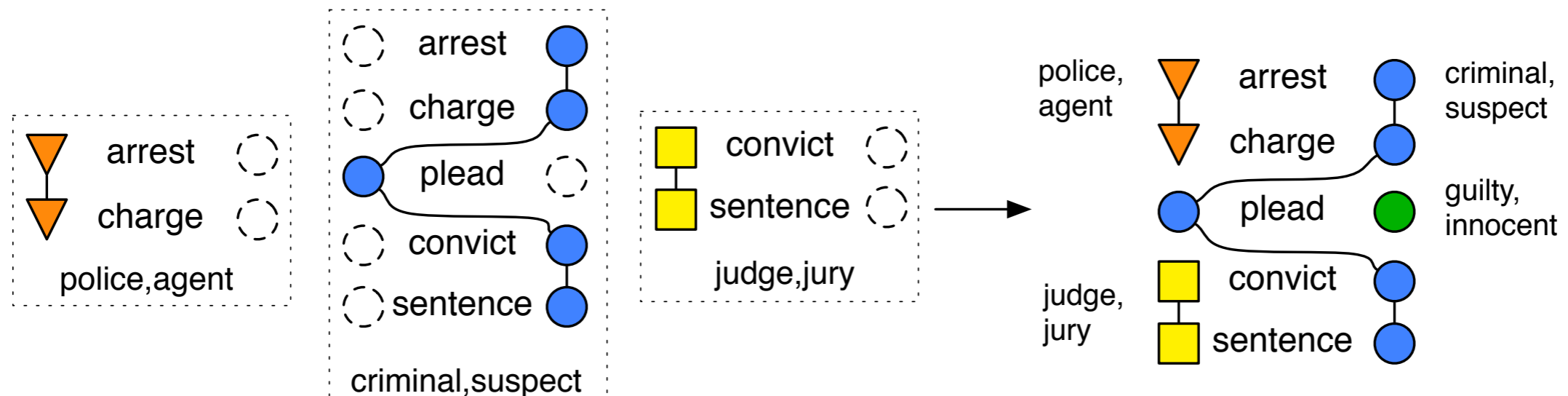
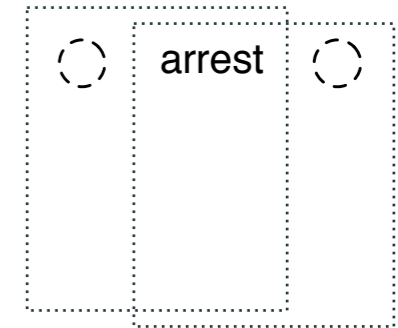
- Score a new event slot based on the arg that max. the chain's score

$$\text{chainsim}'(C, \langle f, g \rangle) = \max_a (\text{score}(C, a) + \sum_{i=1}^n \text{sim}(\langle e_i, d_i \rangle, \langle f, g \rangle, a))$$

Narrative Schemas

From chain to schema

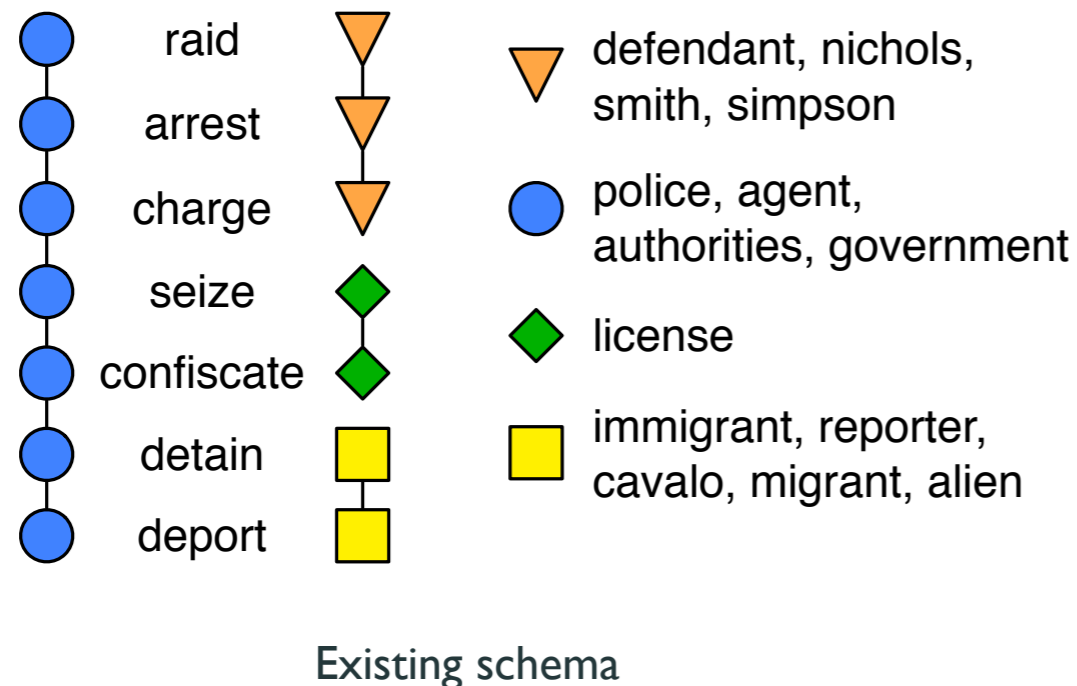
- A narrative schema models all actors of a narrative
 - all event slots are part of one (and only one) chain
- Definition:
 - $N = (E, C)$ with $E =$ set of events and $C =$ set of typed chains over event slots, not explicitly ordered



Narrative Schemas

Building schemas

- Schemas are built from set of events instead of event slots
- Before, the highest similarity yielding event slot would be merged with the chain
- Now, a verb is added if both its slots can be added to schemas with high confidence



Narrative Schemas

Solving problem 2: *narsim*

- Score a new event slot based on the arg that max. the chain's score

$$chainsim'(C, \langle f, g \rangle) = \max_a (score(C, a) + \sum_{i=1}^n sim(\langle e_i, d_i \rangle, \langle f, g \rangle, a))$$

- Now, all event slots play a role

$$narsim(N, v) = \sum_{d \in D_v} \max(\beta, \max_{c \in C_N} chainsim'(c, \langle v, d \rangle))$$

- Remember, C&J08, building a chain using event slots

$$\max_{j: 0 < j < m} chainsim(c, \langle v_j, g_j \rangle)$$

- Using *narsim*, we can now build schemas from set of events instead of event slots

$$\max_{j: 0 < j < |v|} narsim(N, v_j)$$

Qualitative Evaluation

FrameNet

Prof. Pinkal's turn!

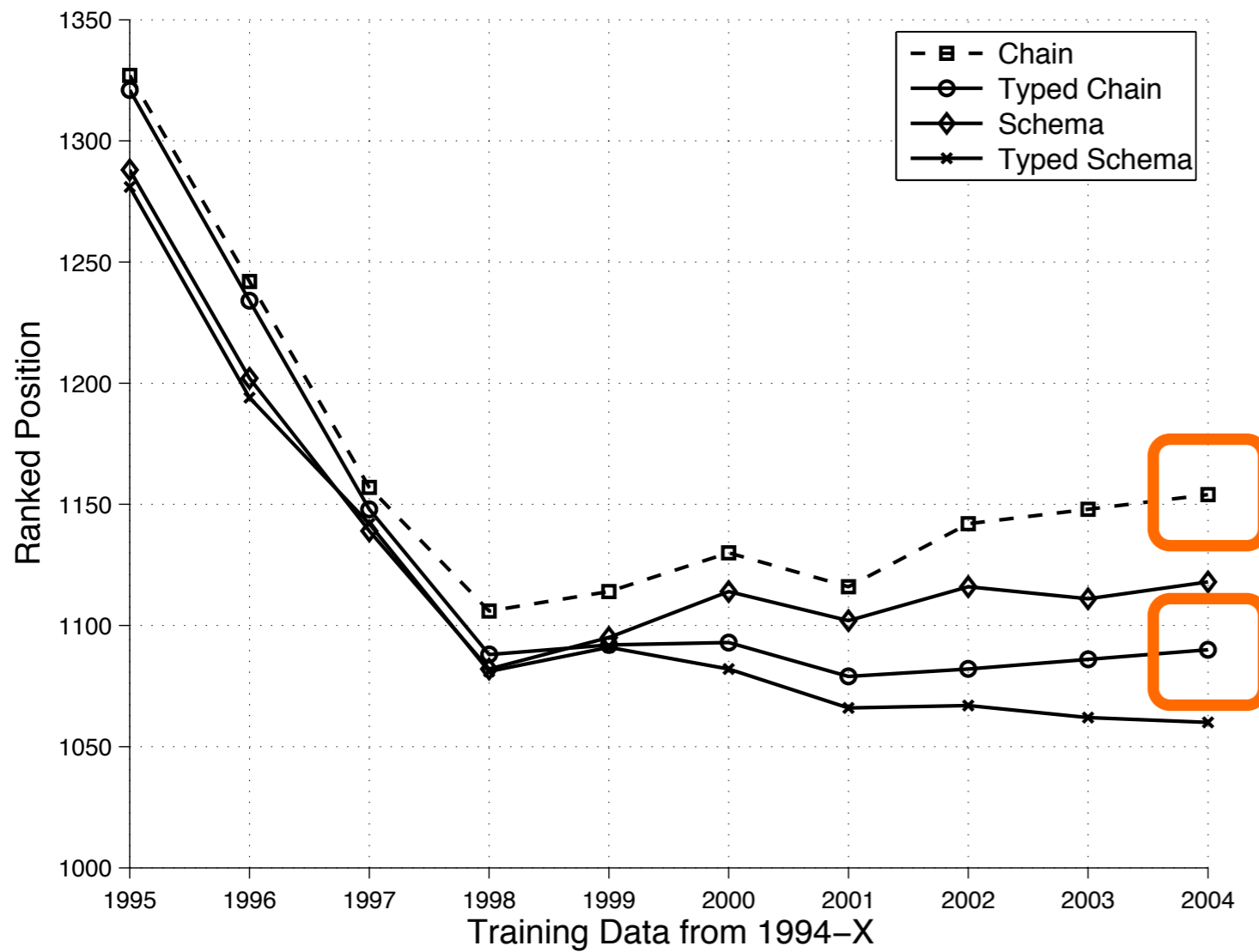
Quantitative Evaluation

Narrative Cloze

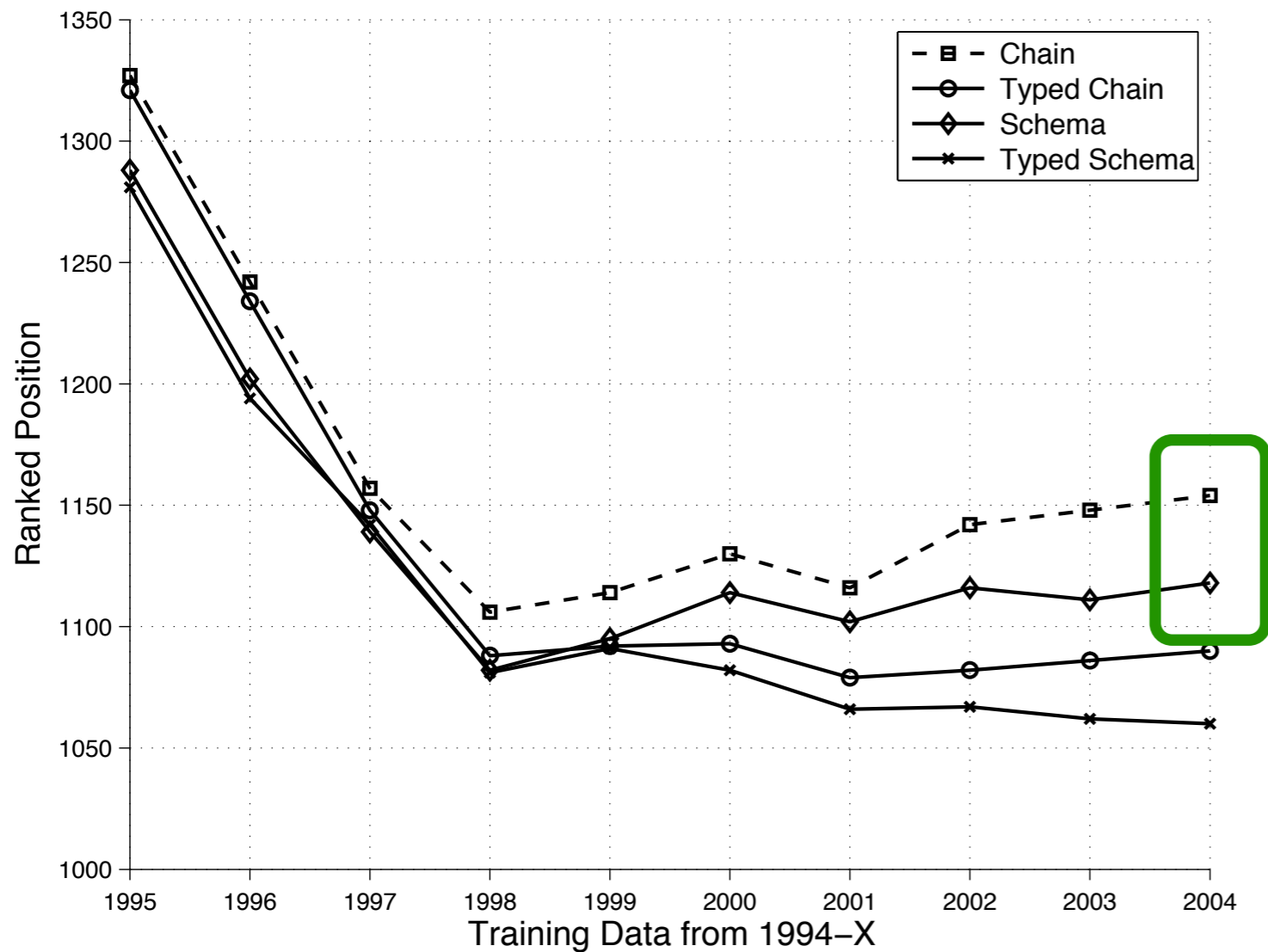
- Similar to C&J08's Narrative Cloze evaluation
- Leave-one-out cross validation on identical test set of 69 articles from NYT with 740 cloze tests, training size appr. 1M words
- Difference to C&J08: Verbs and argument roles are lemmatized
- Different evaluations are conducted:
 - Typed vs. untyped narrative chains
 - Untyped narrative chains vs. untyped narrative schemas
 - Typed narrative schemas

Narrative Cloze Results

- Typed vs. untyped narrative chains: 6.9% gain at 2004

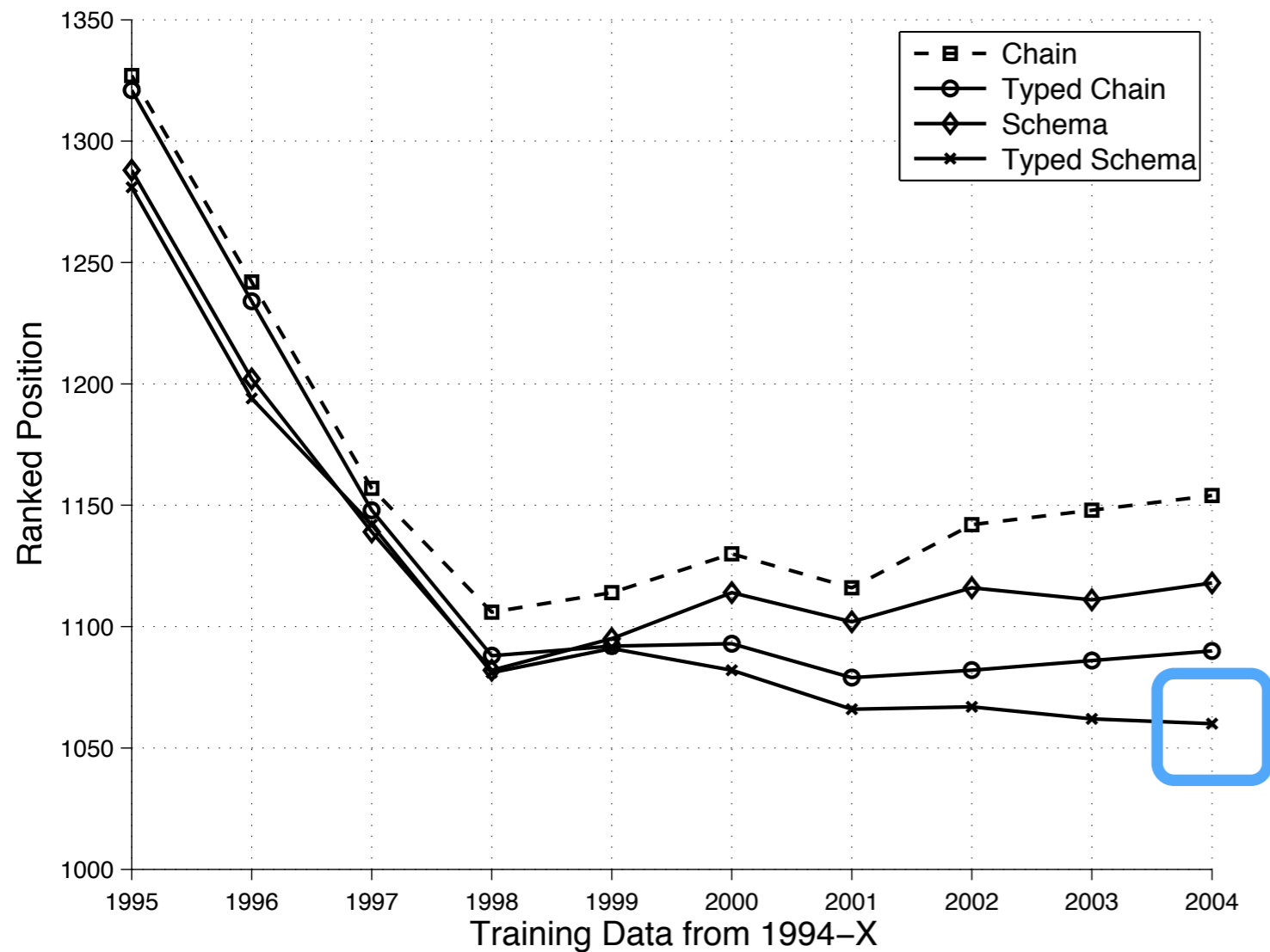


Narrative Cloze Results



- Typed vs. untyped narrative chains: 6.9% gain at 2004
- Untyped narrative schemas vs. untyped narrative chains: 3.3% gain at 2004

Narrative Cloze Results



- Typed vs. untyped narrative chains: 6.9% gain at 2004
- Untyped narrative schemas vs. untyped narrative chains: 3.3% gain at 2004
- Typed narrative schemas: 10.1% improvement over untyped narrative chains in 2004

Conclusion

- Novel, unsupervised method for modeling a narrative's structure
- Narrative event schemas include automatically induced argument roles similar to semantic roles
- Narrative Cloze Evaluation showed the merit of jointly modeling arguments with events
- Future work
 - Representation of arguments → include traditional roles?
 - Solve temporal ordering of schemas

Thanks for your attention!

Questions, feedback, etc.?