Graph Methods for Multilingual FrameNets

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TextGraphs
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Overview

The FrameNet lexical database as a set of graphs

FrameNet annotation as graphs

Syntactico-semantic annotation graphs of parallel sentences

Graph methods and Conclusions

The Multilingual FrameNet Project

- Goals:
  - Organize and align existing FrameNet-like projects in 8-10 languages
  - Provide a multilingual language resource to NLP research, language teachers, etc.
  - Improve access to and understanding of FrameNet data from all languages (both lexicon and annotated texts)
- Research questions:
  - What data structures are appropriate for the new resource?
  - How “universal” are semantic frames? What are implications for MT, cross-linguistic IE & IR, etc.?
  - How can graph methods help us achieve these goals? We hope to receive suggestions from the TextGraph community

Frames, Frame elements, Lemmas and Lexical units

- Frames and Frame Elements (FEs)

Judgement:	Cognizer, Evaluee, Reason, etc.
Placing:	Agent, Theme, Goal, etc.
Take place of:	New, Old, Role, Time, etc.

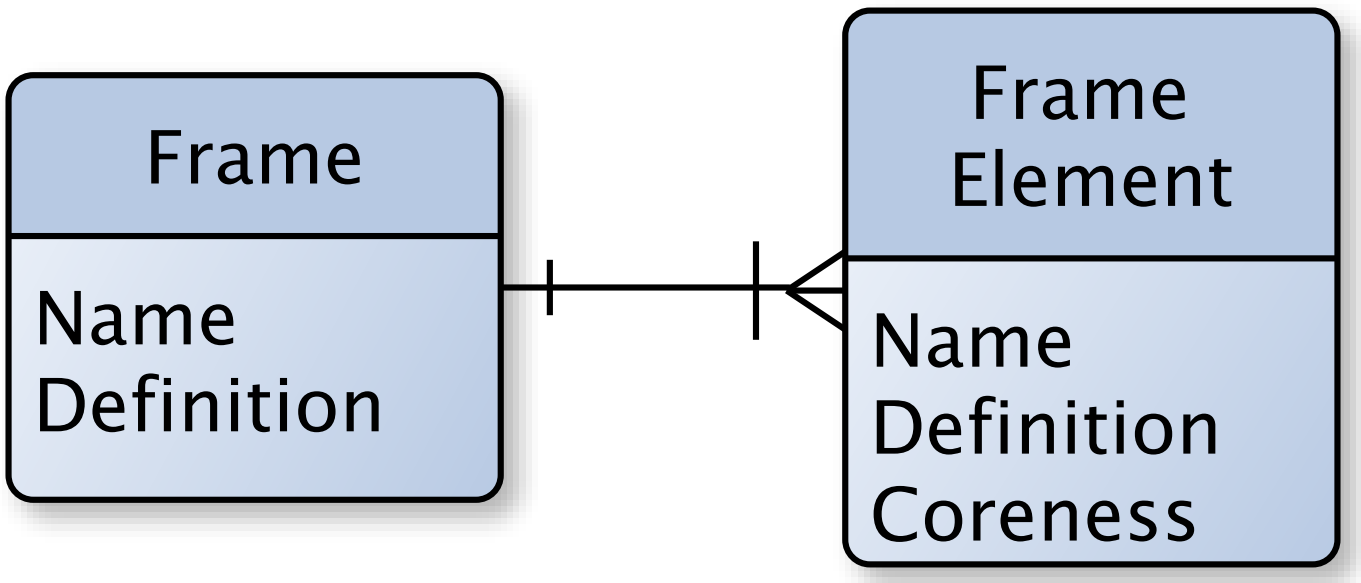
Everyone ADMIRES her for working so hard.
I HANG my clothes in the wardrobe
By 1803 cotton REPLACED wool as Britain's leading export

- Frames and Lexical Units (LUs)

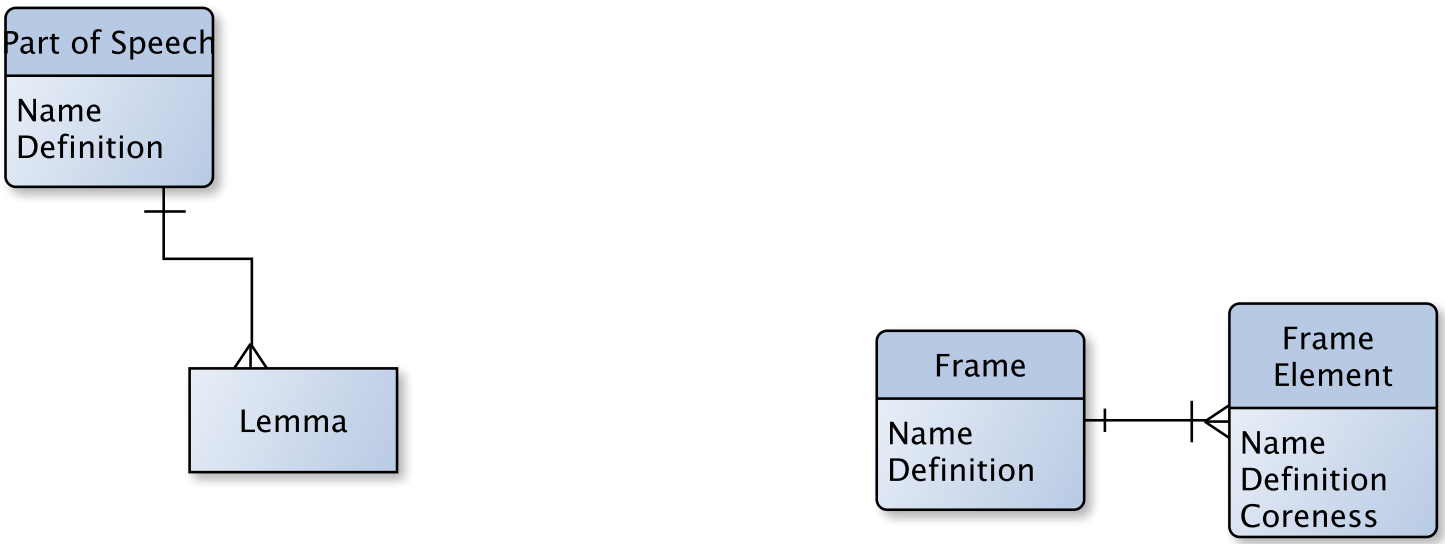
Judgement:	*admire.v, contempt.n, stigmatize.v, reverence.n*
Placing:	*place.v., drape.v, cram.v, file.v*
Take place of:	*replace.v, replacement.n, take place of.v*

- 1,223 frames, 10,542 FEs (9.7/frame), 13,634 LUs (12.5/frame), 202,229 annotation sets

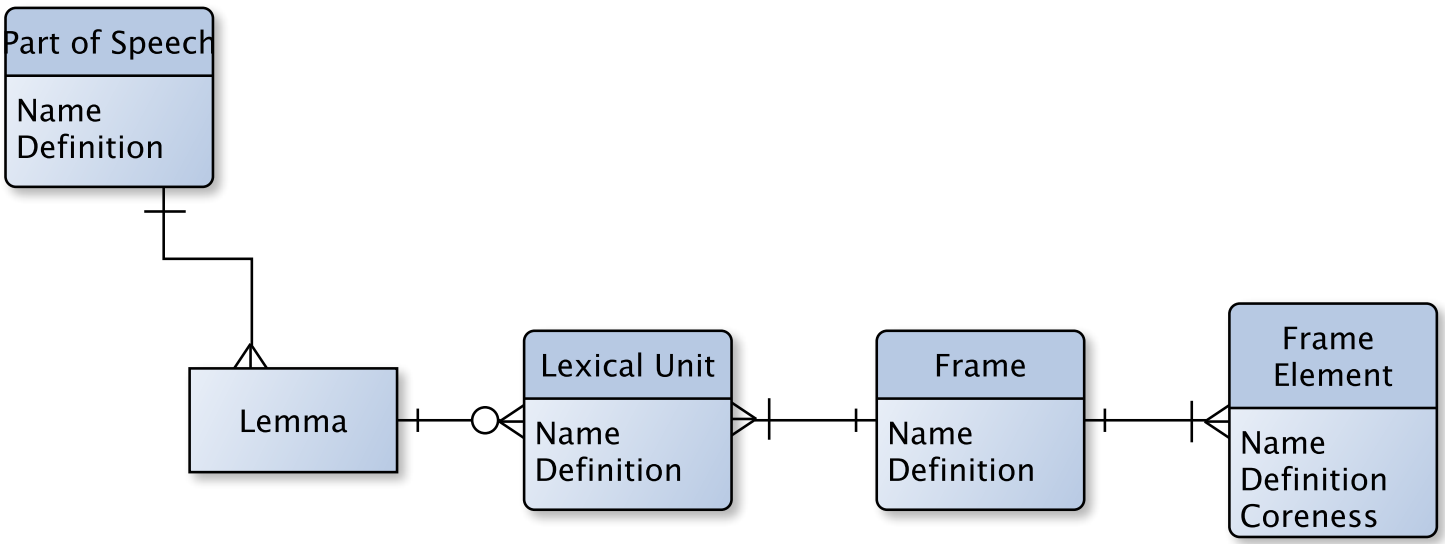
Frames, Frame elements, Lemmas and Lexical units as a graph



Frames, Frame elements, Lemmas and Lexical units as a graph



Frames, Frame elements, Lemmas and Lexical units as a graph

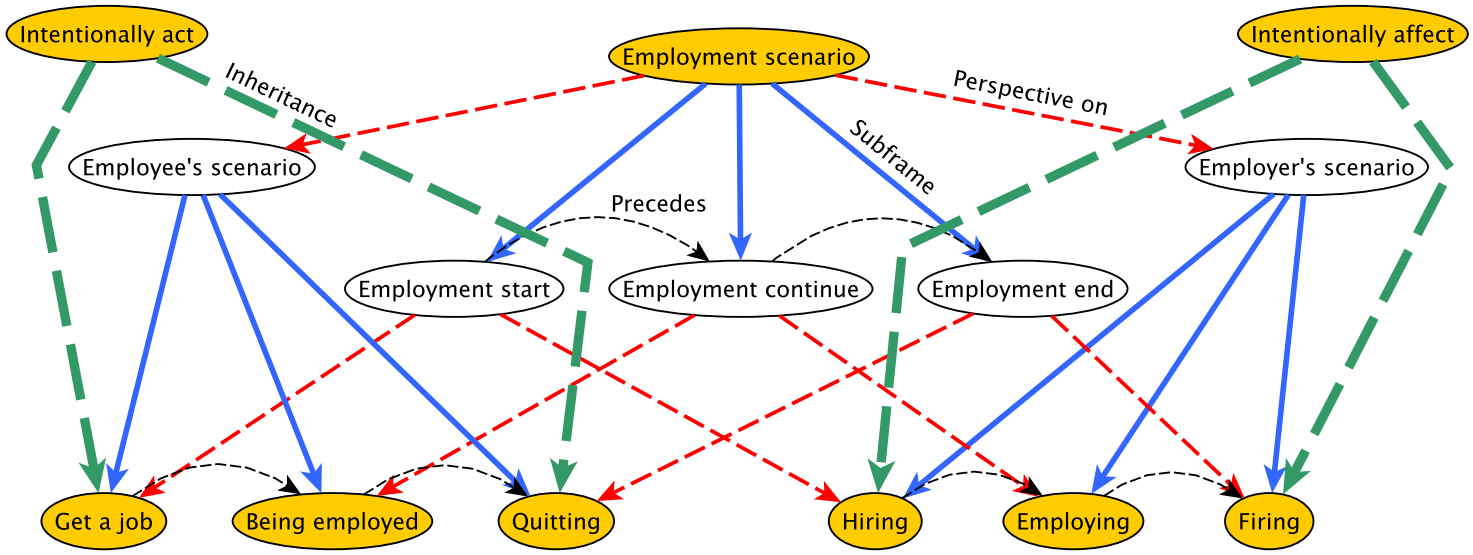


Frame relations

- Inheritance
- Perspective on (full example)
- Subframe and Precedes
- Others
  - Using
  - Causative of, Inchoative of
  - Metaphor
  - "See also"

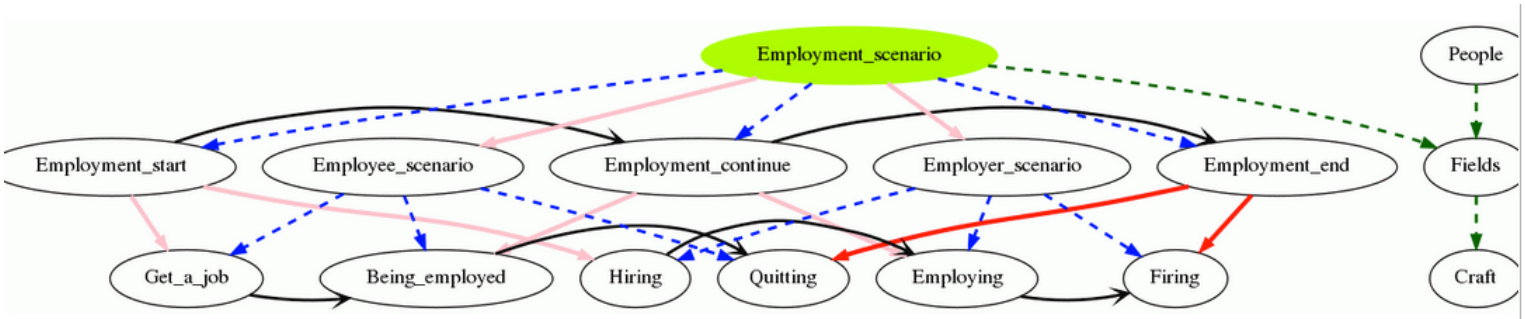
All frame relations are accompanied by relations between corresponding frame element across the frames.

“Perspective on” frame relations

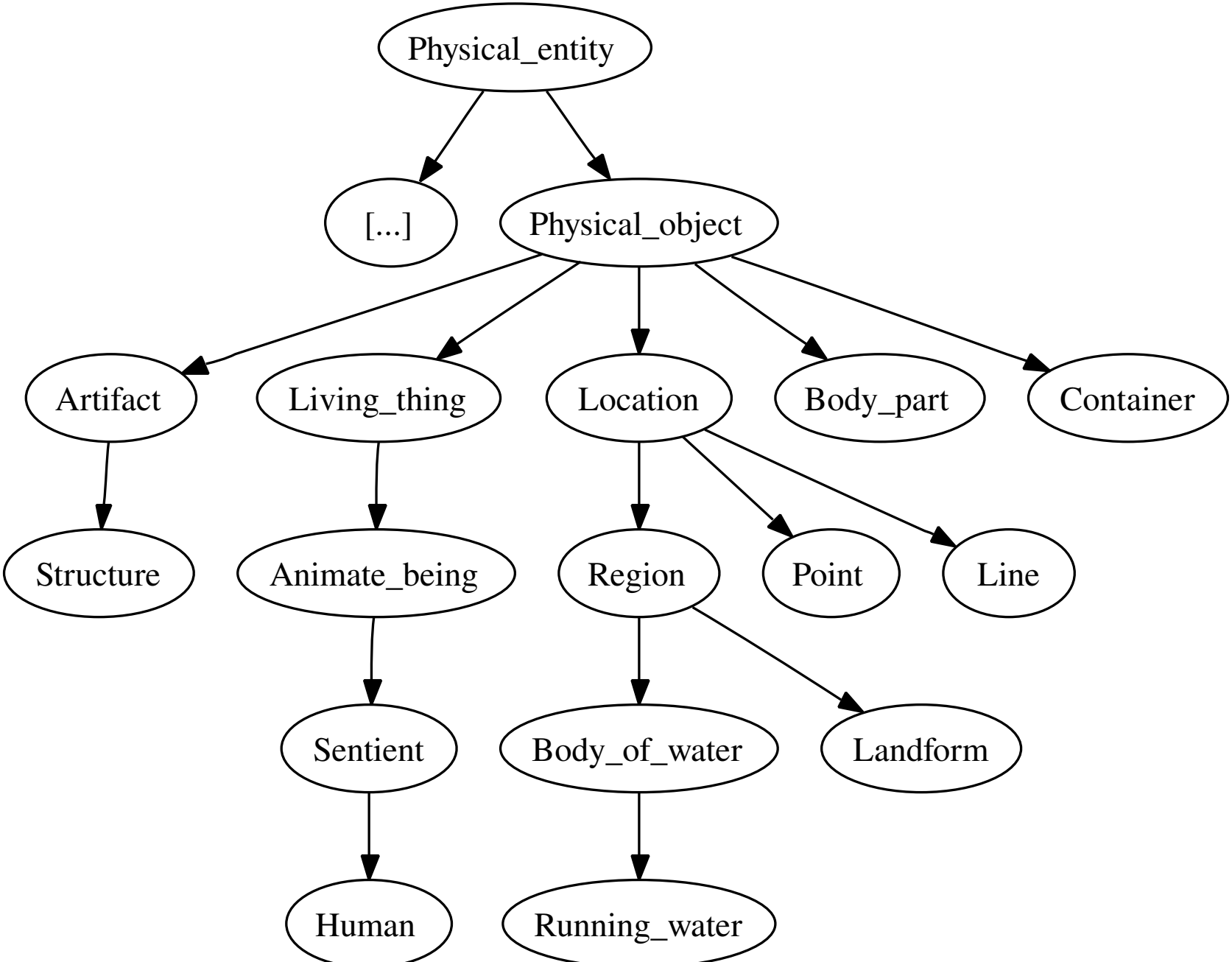


Note that reality is more complex; Quitting and Firing are not the same kind of event, there are many ways employment can end: resigning under pressure, retirement, etc.

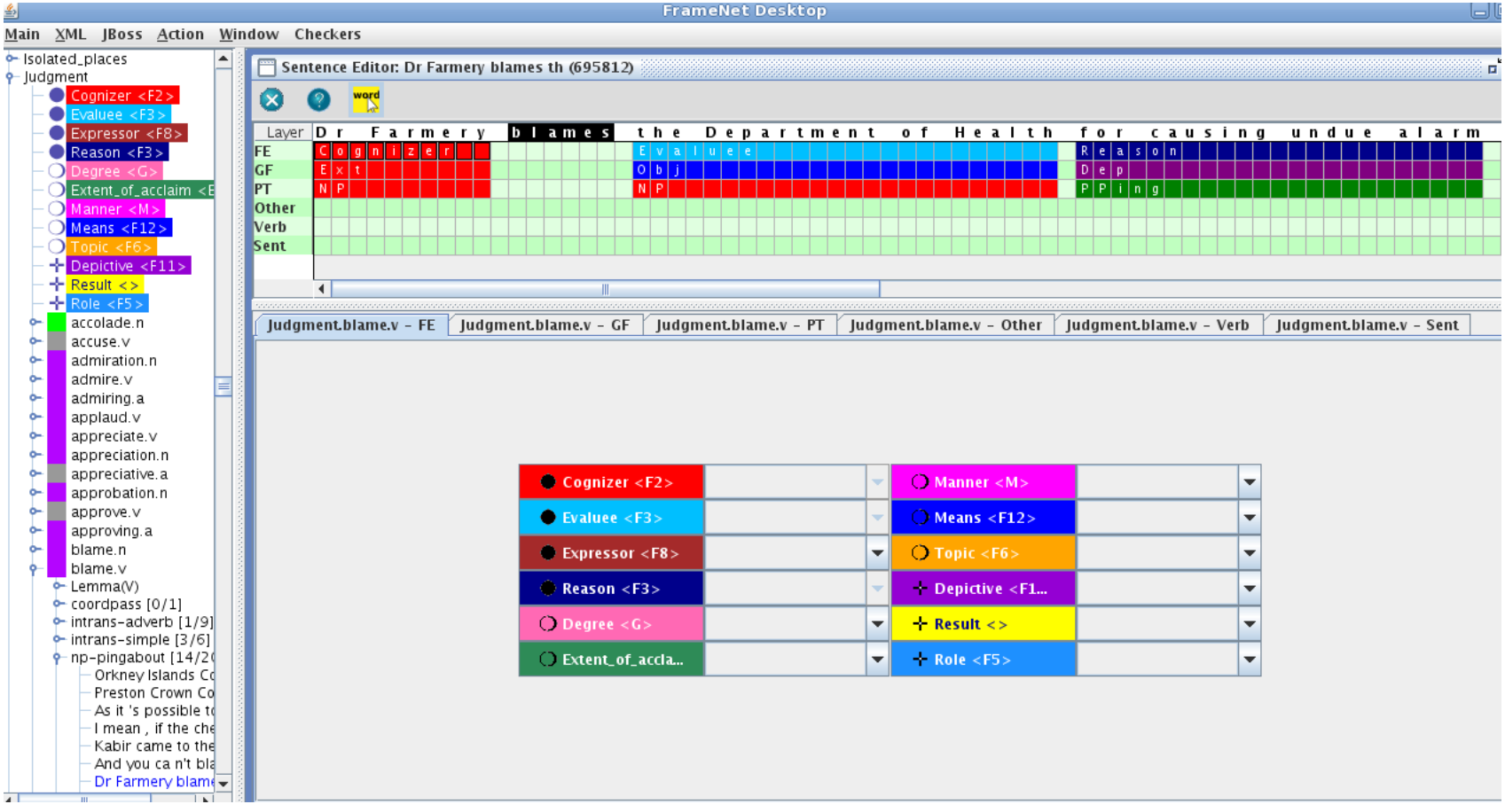
Frame Grapher



Graph of FrameNet semantic types (partial)



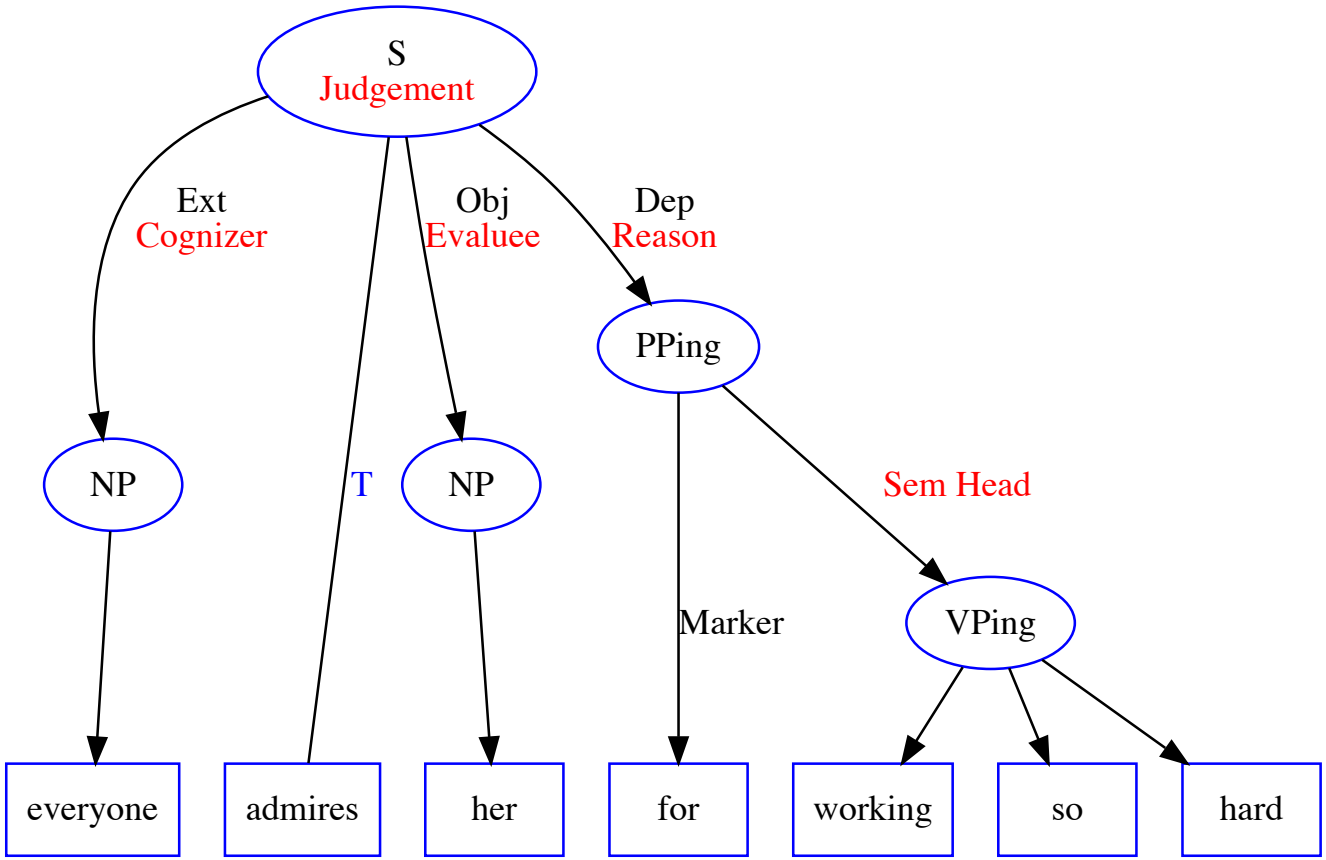
FN Annotation (Annotator's view)



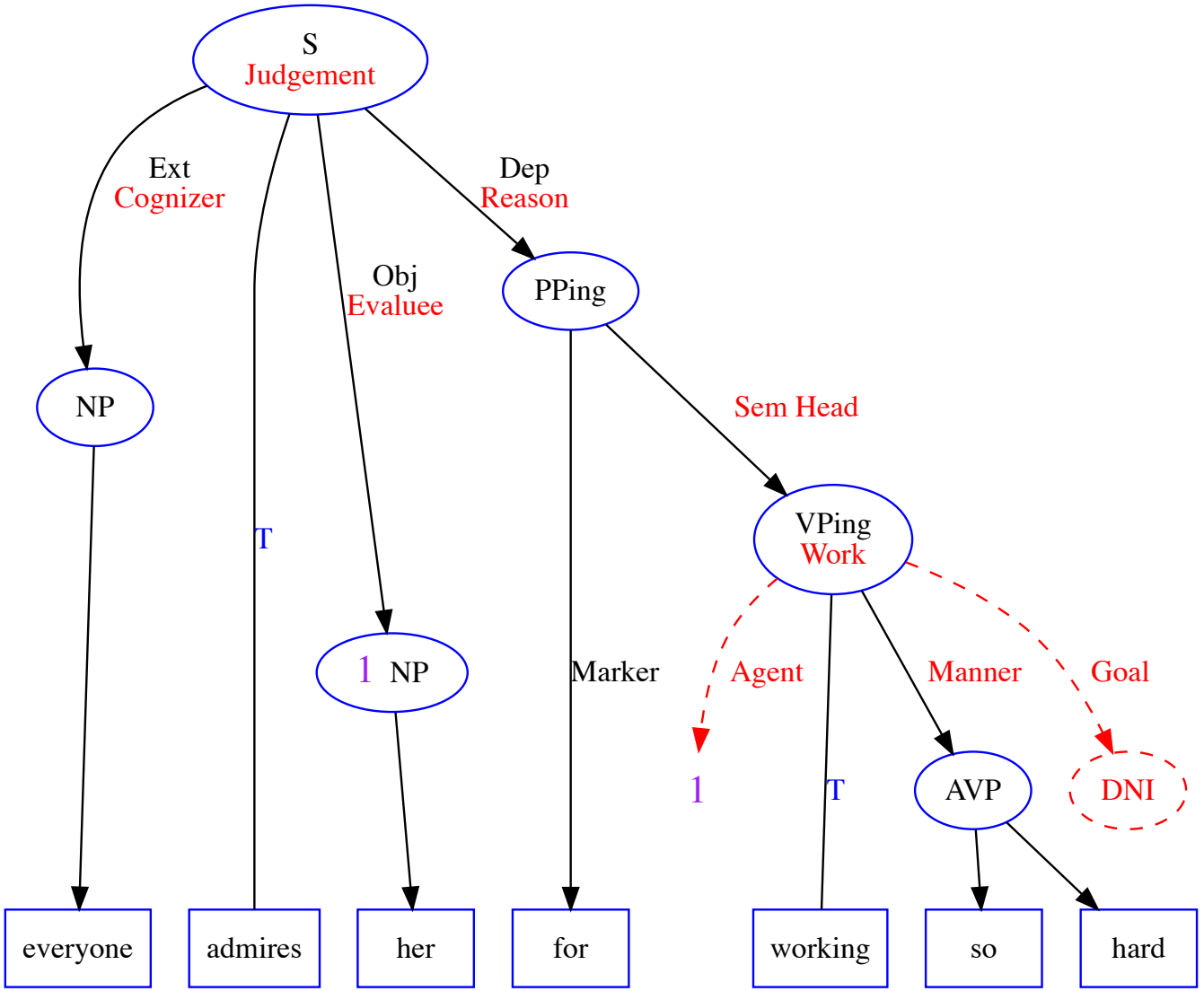
FN Annotation (XML view)

```
<sentence sentNo="0" aPos="102894573" ID="695812">
<text>Dr Farmery blames the Department of Health for causing undue alarm,  but that
claim's rejected by the Helpline set up to address public concern. </text>
        <annotationSet cDate="01/07/2003 11:09:51 PST Tue" status="MANUAL"
        ID="867585">

            <layer rank="1" name="FE">
                <label cBy="BoC" feID="115" end="9" start="0" name="Cognizer"/>
                <label cBy="BoC" feID="116" end="41" start="18" name="Evaluee"/>
                <label cBy="BoC" feID="117" end="65" start="43" name="Reason"/>
            </layer>

            <layer rank="1" name="GF">
                <label end="9" start="0" name="Ext"/>
                <label end="41" start="18" name="Obj"/>
                <label end="65" start="43" name="Dep"/>
            </layer>

            <layer rank="1" name="PT">
                <label end="9" start="0" name="NP"/>
                <label end="41" start="18" name="NP"/>
                <label end="65" start="43" name="PPing"/>
            </layer>

            <layer rank="1" name="Target">
                <label cBy="BoC" end="16" start="11" name="Target"/>
            </layer>
        </annotationSet>
        </sentence>
```

Annotation of a sentence as a graph (1)



Annotation of a sentence as a graph (2)



Grammatical Function, Phrase Type, and Other layers

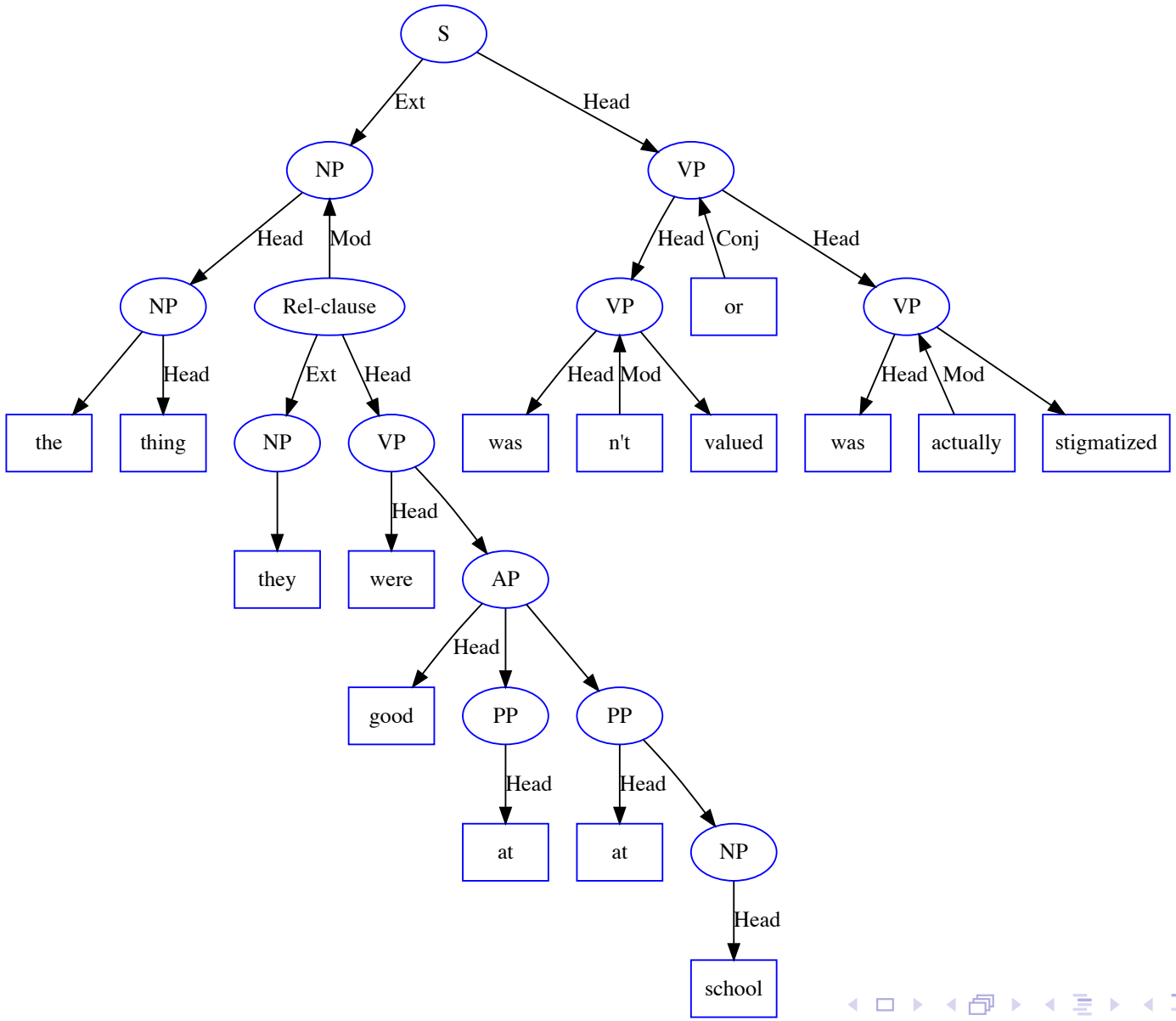
- Construction Grammar is presupposed in FN syntactic analysis, but not fully explicit in the annotation.
- Grammatical functions (GFs)
  - "External"
  - "Obj"
  - "Dep"
  - Modified head
- Phrase types (PTs)
  - NP, VPto, AdjP, etc.
- "Other" layer
  - Relativizer and Antecedent

An English sentence for analysis

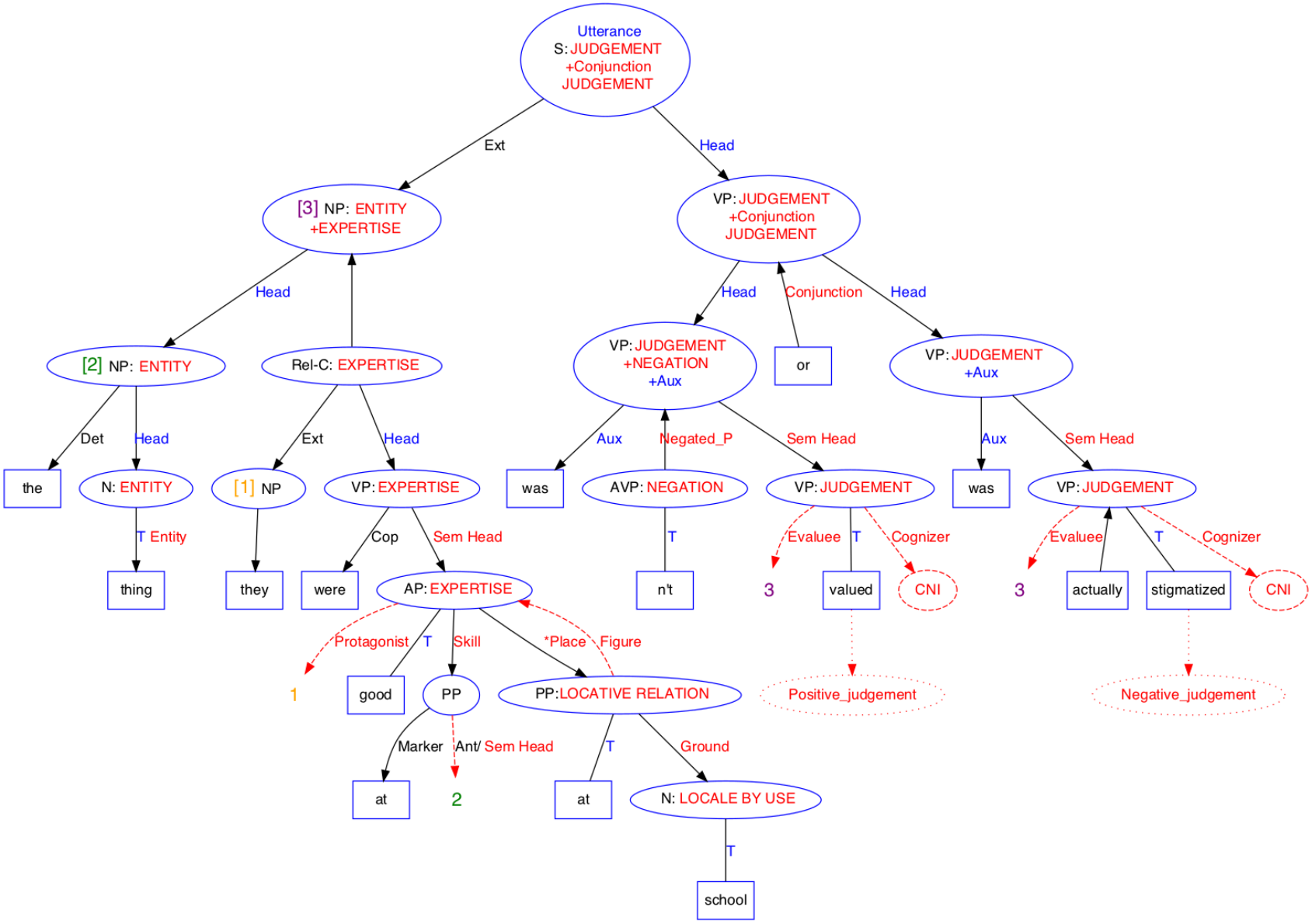
We will be looking at (a clause from) a sentence from a TED talk by Ken Robinson: “Do Schools Kill Creativity?”:

> *The thing they were good at at school was not valued or was actually stigmatized.*

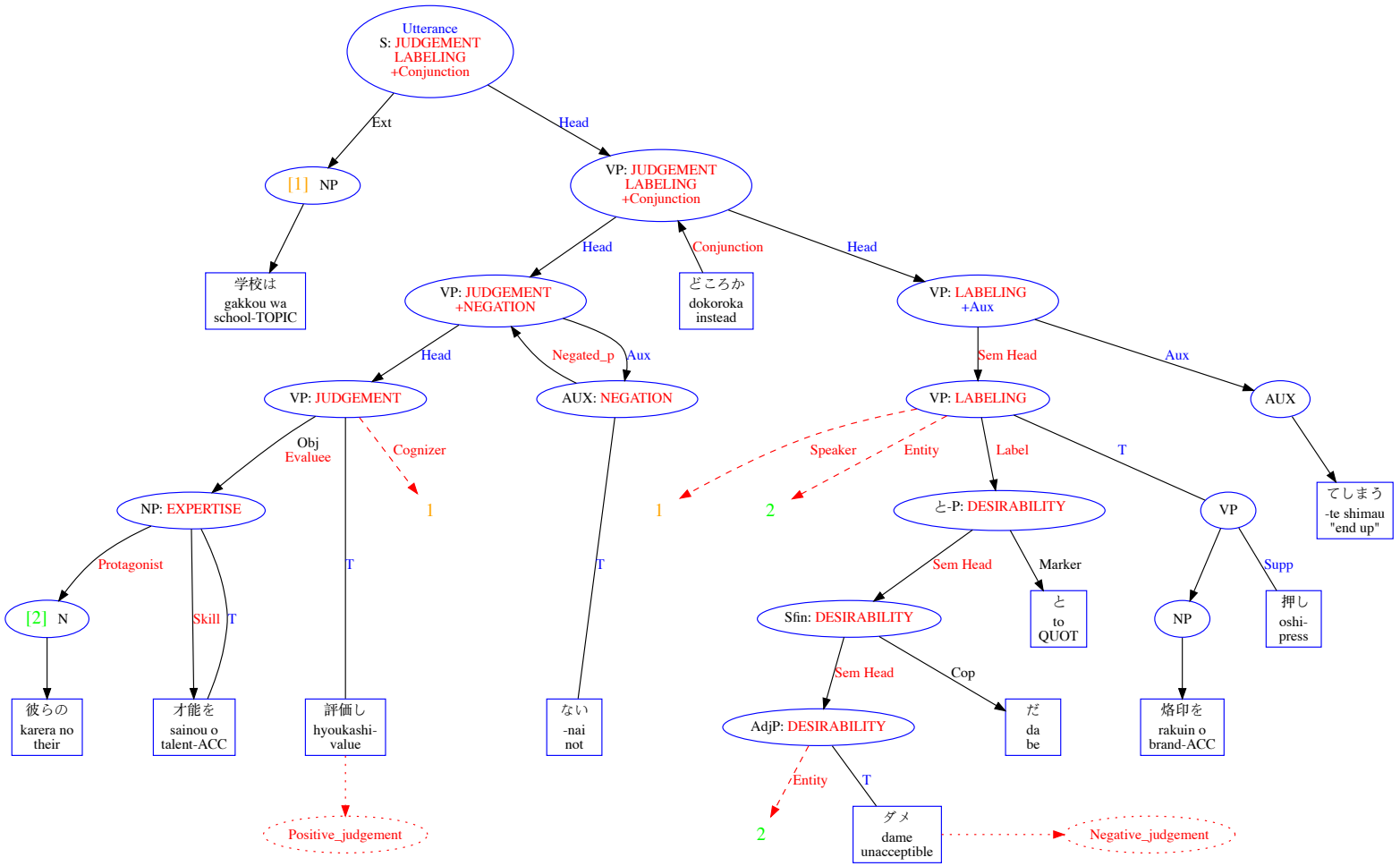
Syntactic (constituency) tree of sentence



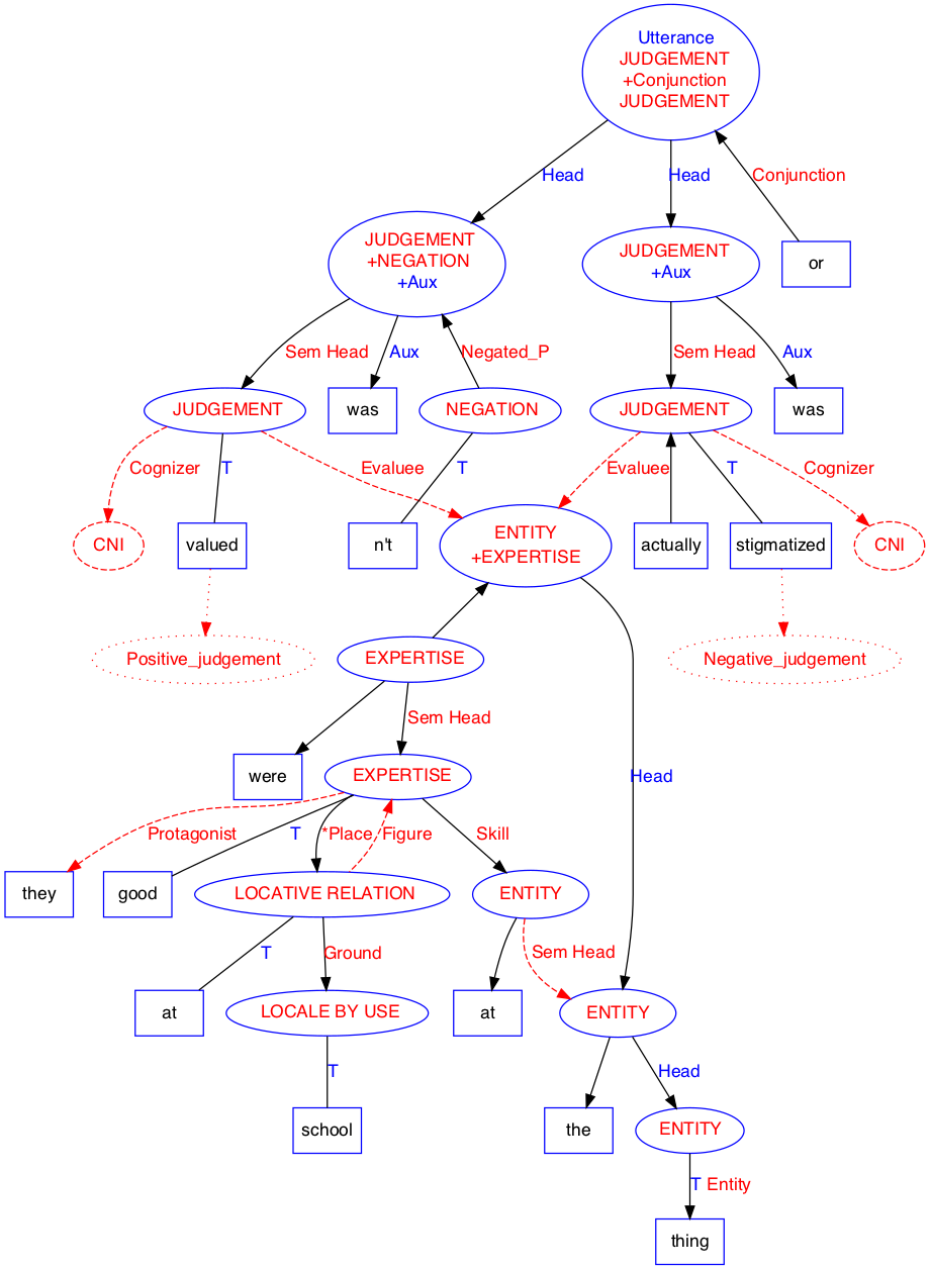
Syntactico-semantic graph of English sentence



Syntactico-semantic graph of parallel Japanese sentence



Semantics-only graph of English sentence



Frame shifts in translation

We examined frames in two different semantic domains, in two documents with different styles of translation:

- Sherlock Holmes, *The Hound of the Baskervilles* (professional, "literary" translation)– Motion events
- TED, "Do Schools Kill Creativity?" (volunteer, "literal" translation)– Motion and Communication events

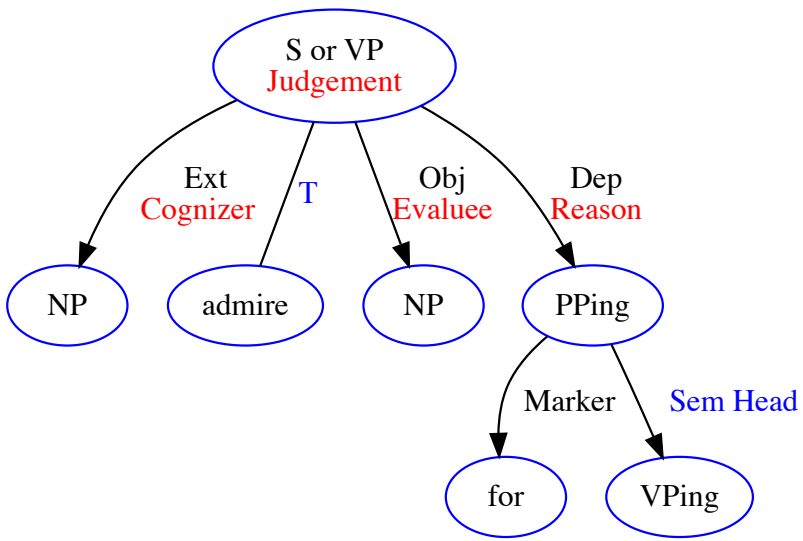
Source	**Langs**	**Domain**	**Same**	**Partial**	**Diff.**	**Total**
Hound	EN–ES	Motion	33	3	23	59
TED	EN–BrPT	Motion	38	4	22	64
TED	EN–BrPT	Commun.	47	11	7	65

Frame Shifts in the Communication Domain

he turned to her mother and said, 'Mrs.Lynne,. . . ele se virou para a mãe e disse: 'Sra.Lynne,. . .	Statement.say Statement.dizer
I said, 'What happened?' Eu perguntei: 'O que aconteceu?'	Statement.say Questioning.perguntar
She said, "She did." Ela respondeu: Ela levou.	Statement.say Communication_response responder
I mean, he was seven at some point. Quero dizer, ele algum dia teve sete anos.	Linguistic_meaning.mean Statement dizer

Uses of Graph methods with Frame Semantic Annotation and Parsing

- Visualize of complex relations, including cross-lingual relations
- Query with graph expressions (e.g. using Neo4j DB)
- Express constraints as graph unification ($\approx$ Construction grammar)
- Summarize valences (Kernel Dependency Graphs, cf. Fillmore & Sato 2002)



Conclusions

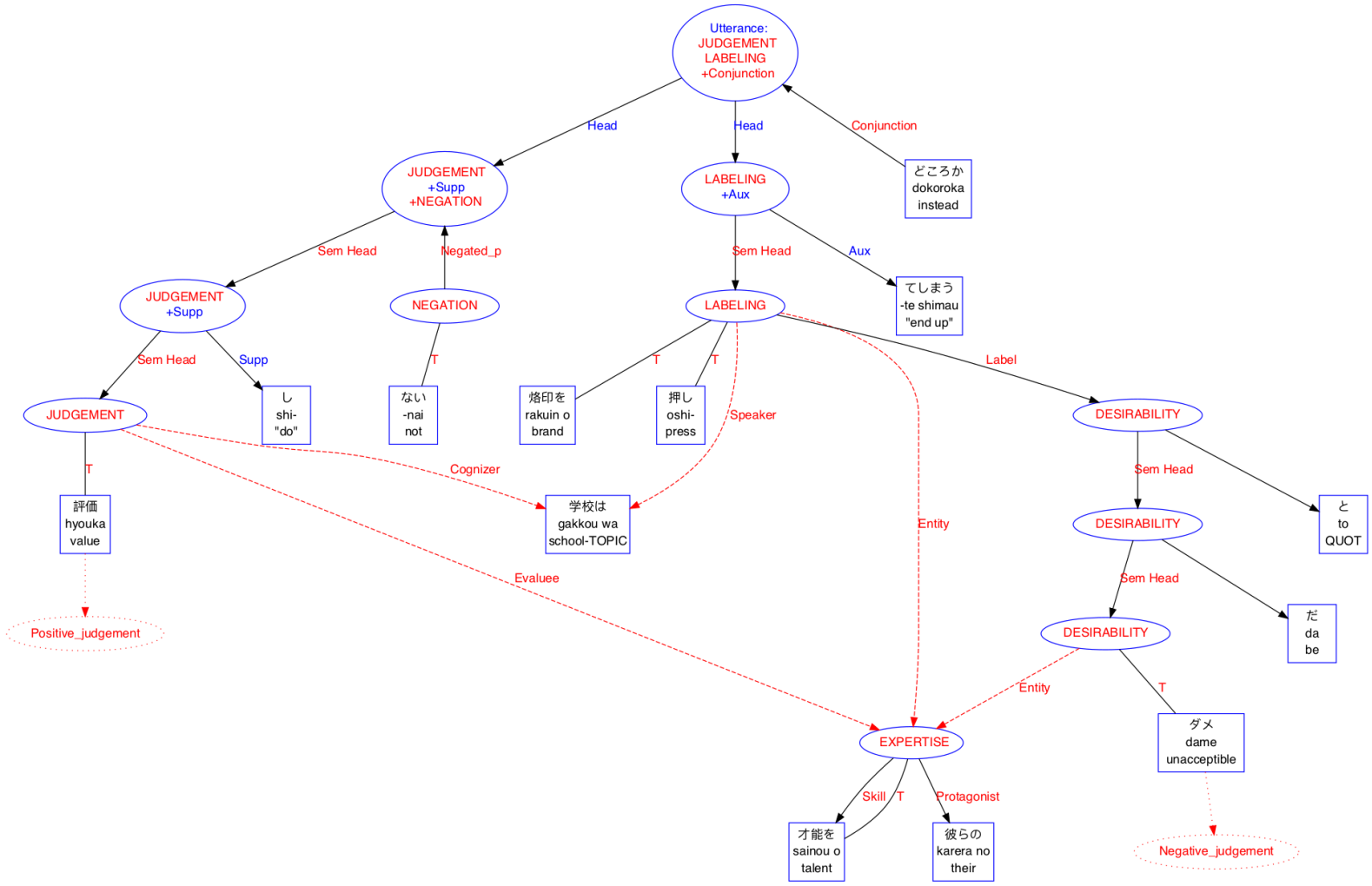
- The current XML format is too close to the DB structure, less than optimal for both humans and machines
- A more perspicuous representation would help collaboration in Multilingual FrameNet and NLP research more generally
- Graphs can serve this purpose
- We welcome your suggestions about how we can make better use of graph representations!

Acknowledgements

This material is based in part upon work supported by the National Science Foundation under grant No. 1629989 ”Multilingual FrameNet: A Resource Enabling Cross-Lingual Research for the Natural Language Processing Community”.

- Thank you!
- Questions?
- `http://framenet.icsi.berkeley.edu`

Semantics-only graph of parallel Japanese sentence



FILLMORE, CHARLES J., & HIROAKI SATO.
2002.
Transparency and building lexical dependency graphs.
In *Proceedings of the 28th Annual Meeting of the Berkeley Linguistics Society*, ed. by J. Larson & M. Paster, 87–99.