

# FRED as an Event Extraction Tool

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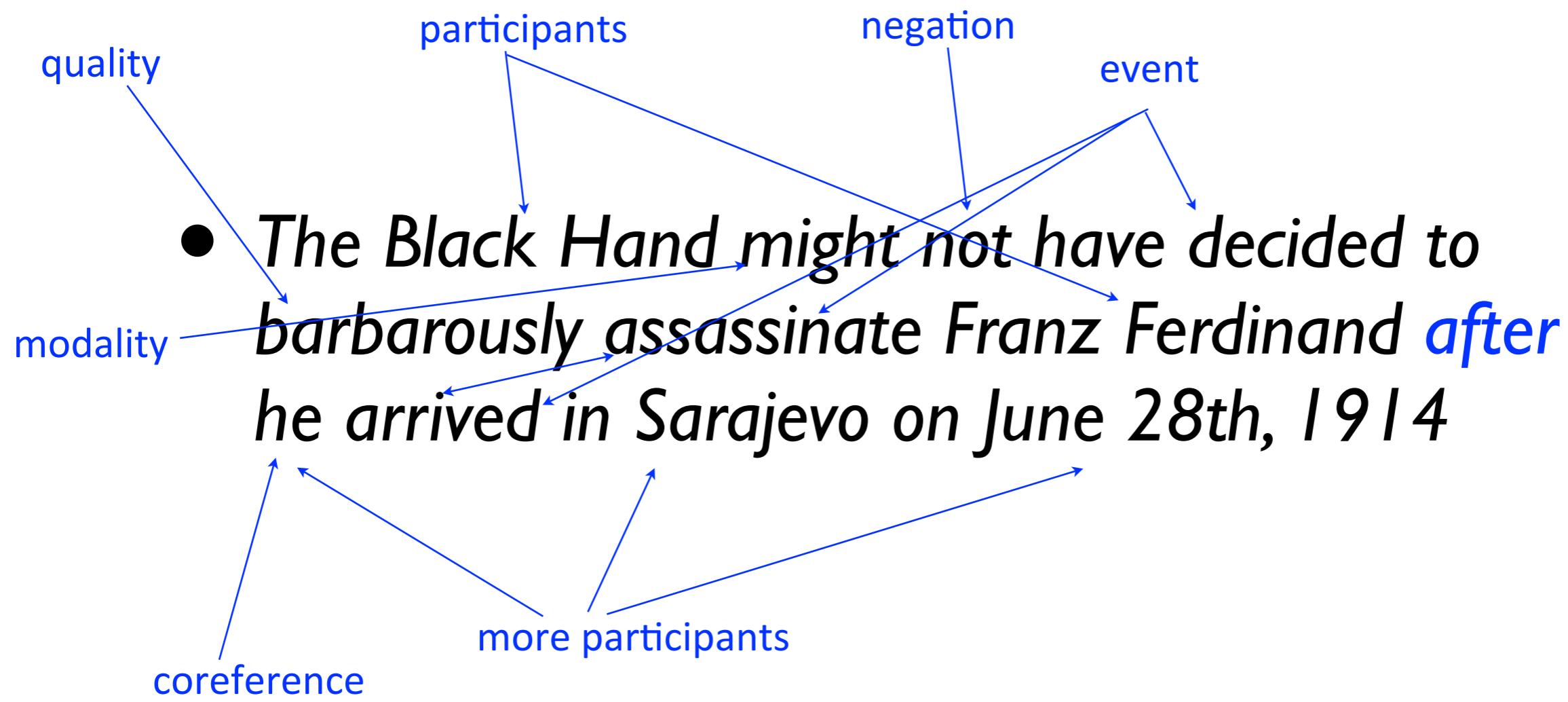
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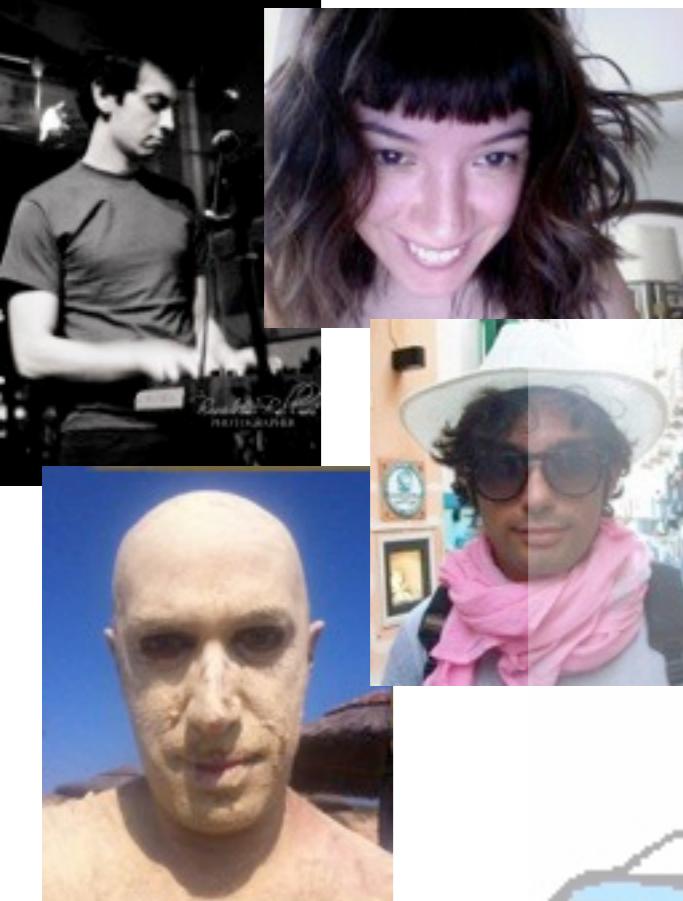
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# Events are elusive

- even human annotators do not agree on what is an event and its aspects (space, time, participants) [Aroyo and Welty, Derive 2012]
- more issues when extracting events from text: *entailment*, *causal* and *temporal relations*, *modality*, *negation*, *polarity*, etc.
- we extract event-like entities from text
  - given an explicit semantics of putative events in natural language and linked data
  - for tasks like summarization, sentiment analysis, text similarity, KB bootstrapping, etc.

- *The Black Hand might not have decided to barbarously assassinate Franz Ferdinand after he arrived in Sarajevo on June 28th, 1914*





<http://wit.istc.cnr.it/stlab-tools/fred>

**FRED** integrates  
NER, SenseTagging, WSD, Tax. Ind.,  
Relation/Event/Role Extraction

Apache Stanbol  
RDF, OWL

Aligned to WordNet,  
VerbNet, FrameNet,  
DOLCE+DnS,  
DBpedia, schema.org

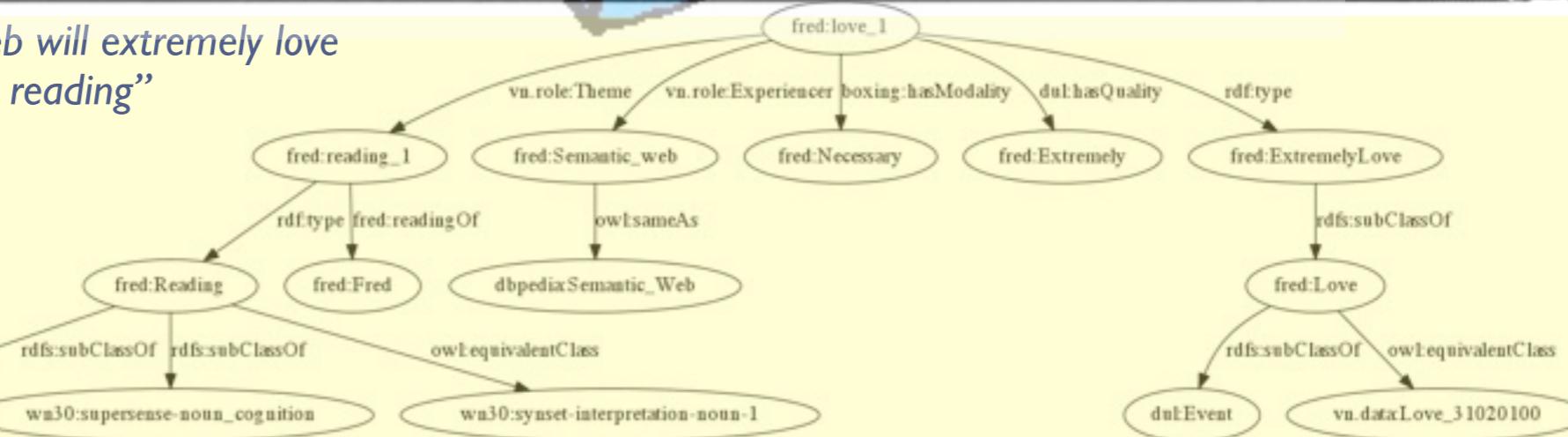
**High EE accuracy**

Earmark

REST

**LOD and ODP design**  
**Frame-based**

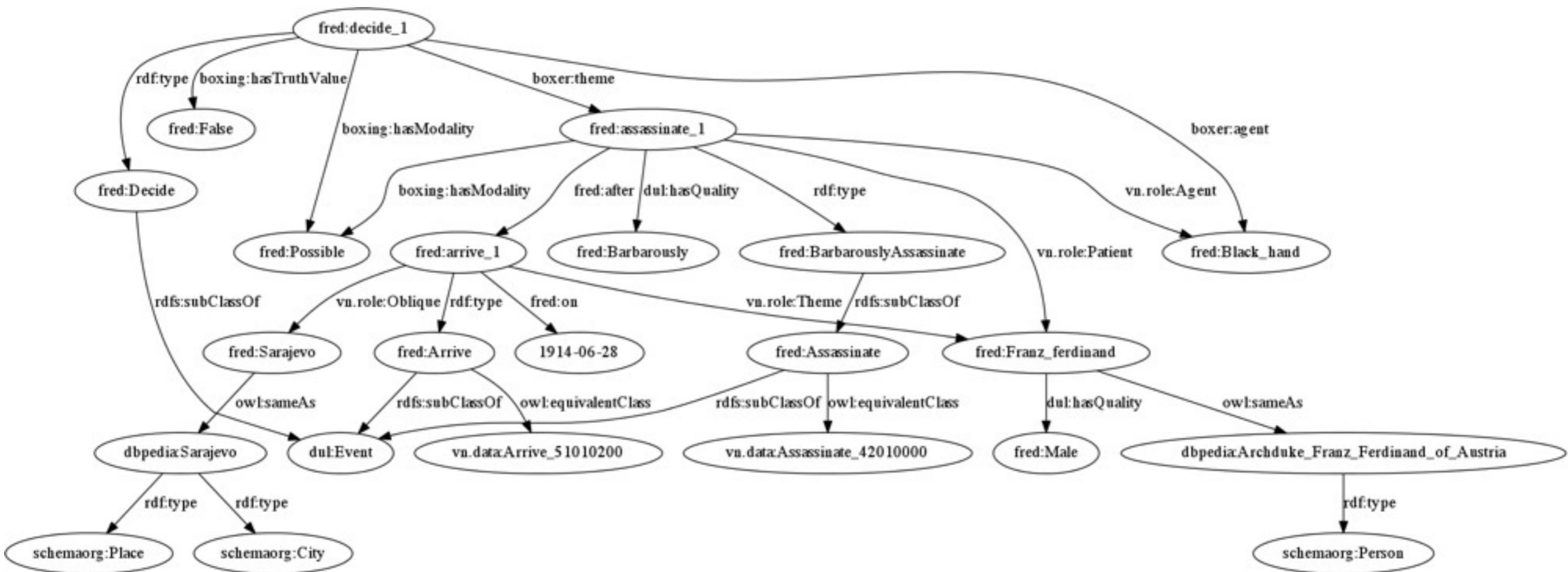
"The Semantic Web will extremely love  
FRED's reading"



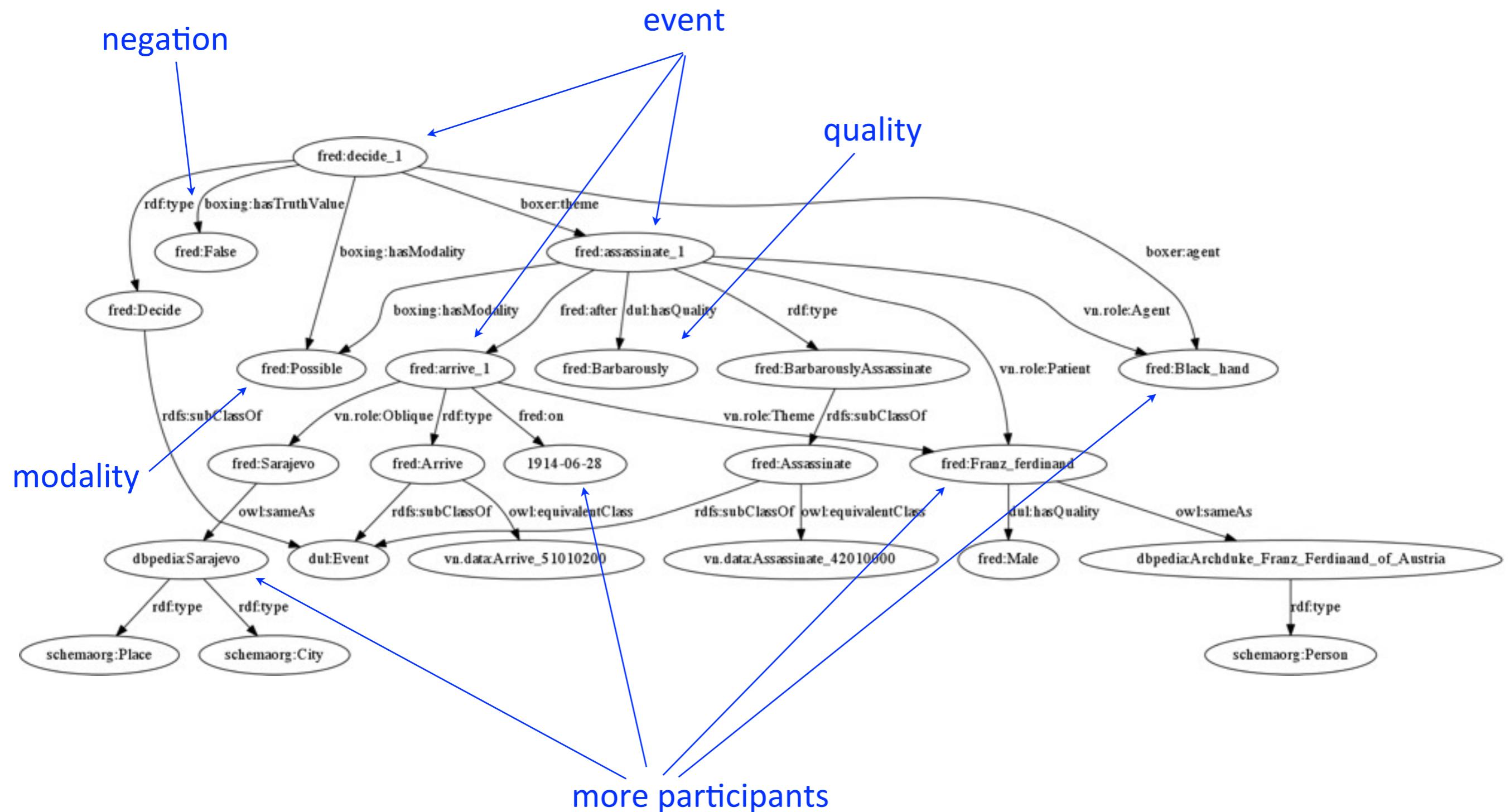
# EE tasks in FRED

- Event *identity*: FRED focuses on events expressed by verbs, propositions, terms, and named entities (possibly resolved), as well as on event *graphs*
- Event *classification*: FRED uses Linked Data-oriented induction of types for identified events, reusing e.g. VerbNet, WordNet, DBpedia, schema.org, and DOLCE+DnS as reference ontologies
- Event *unity*: FRED applies semantic role labeling to verbs and propositions (“situations”) in order to detect event boundaries, and frame detection for resolving roles against a shared event ontology (VerbNet, FrameNet, ...)
- Event *modifiers*: FRED extracts logical *negation*, basic *modalities*, and adverbial *qualities*, applied to verbs and propositions, which can also be used as event judgment indicators
- Event *relations*: FRED relates events via the role structure of verbs and propositions, and extracts *tense* and *entailment* relations between them

# FRED content graph

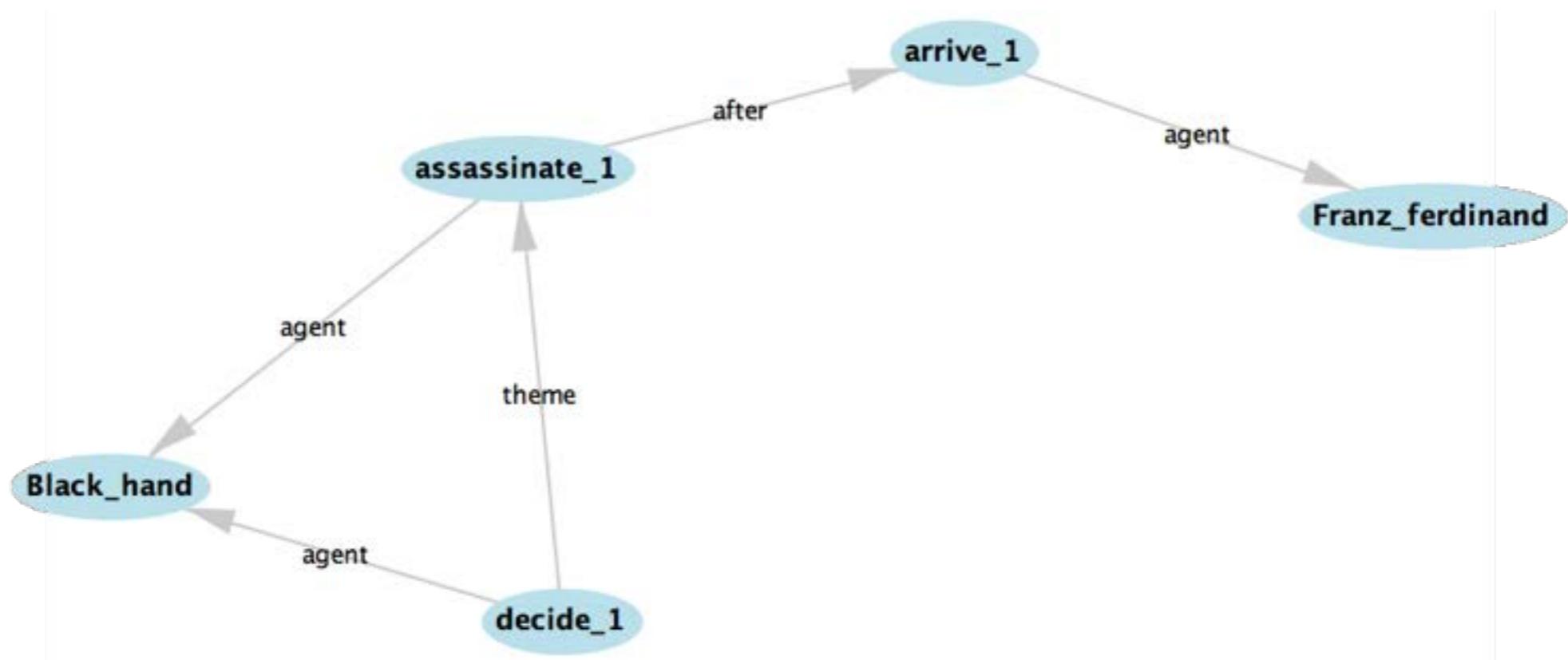


# FRED content graph



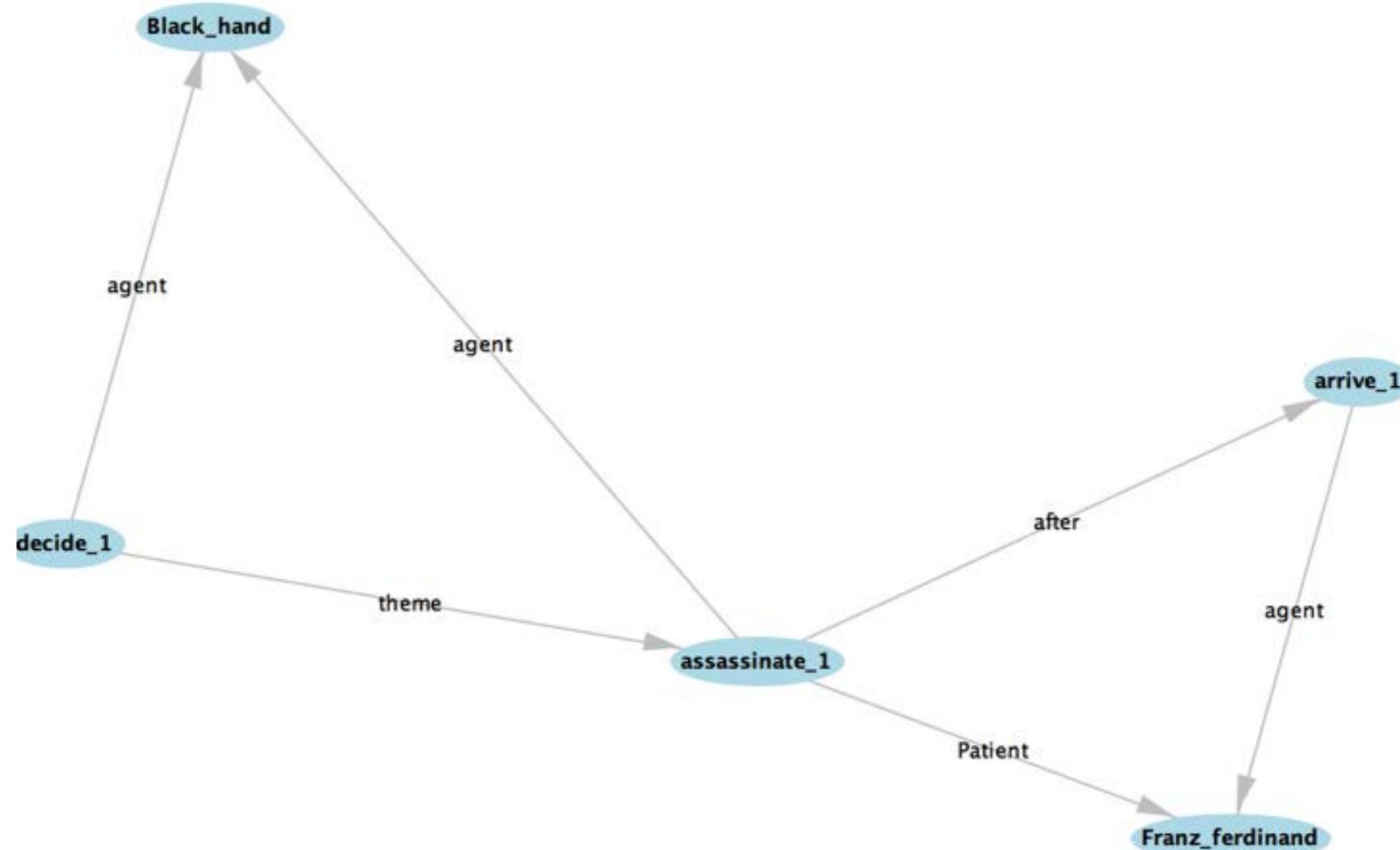
# Event extraction #1

```
PREFIX dul: <http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#>
PREFIX vnrole: <http://www.ontologydesignpatterns.org/ont/vn/abox/role/>
PREFIX boxing: <http://www.ontologydesignpatterns.org/ont/boxer/boxing.owl#>
PREFIX boxer: <http://www.ontologydesignpatterns.org/ont/boxer/boxer.owl#>
PREFIX : <http://www.ontologydesignpatterns.org/ont/boxer/test.owl#>
CONSTRUCT {?e :agent ?x . ?e ?r ?e1 . ?e ?rol ?filler . }
WHERE {
{{?e a boxing:Situation} UNION {?e a ?class . ?class rdfs:subClassOf+ dul:Event}}
?e ?p ?x
FILTER (?p = vnrole:Agent || ?p = boxer:agent || ?p = vnrole:Experiencer ||
?p = vnrole:Actor || ?p = vnrole:Actor1 || ?p = vnrole:Actor2 || ?p =
vnrole:Theme)
FILTER NOT EXISTS {?e vnrole:Theme ?x . ?e vnrole:Agent ?y
FILTER (?x != ?y)}
```



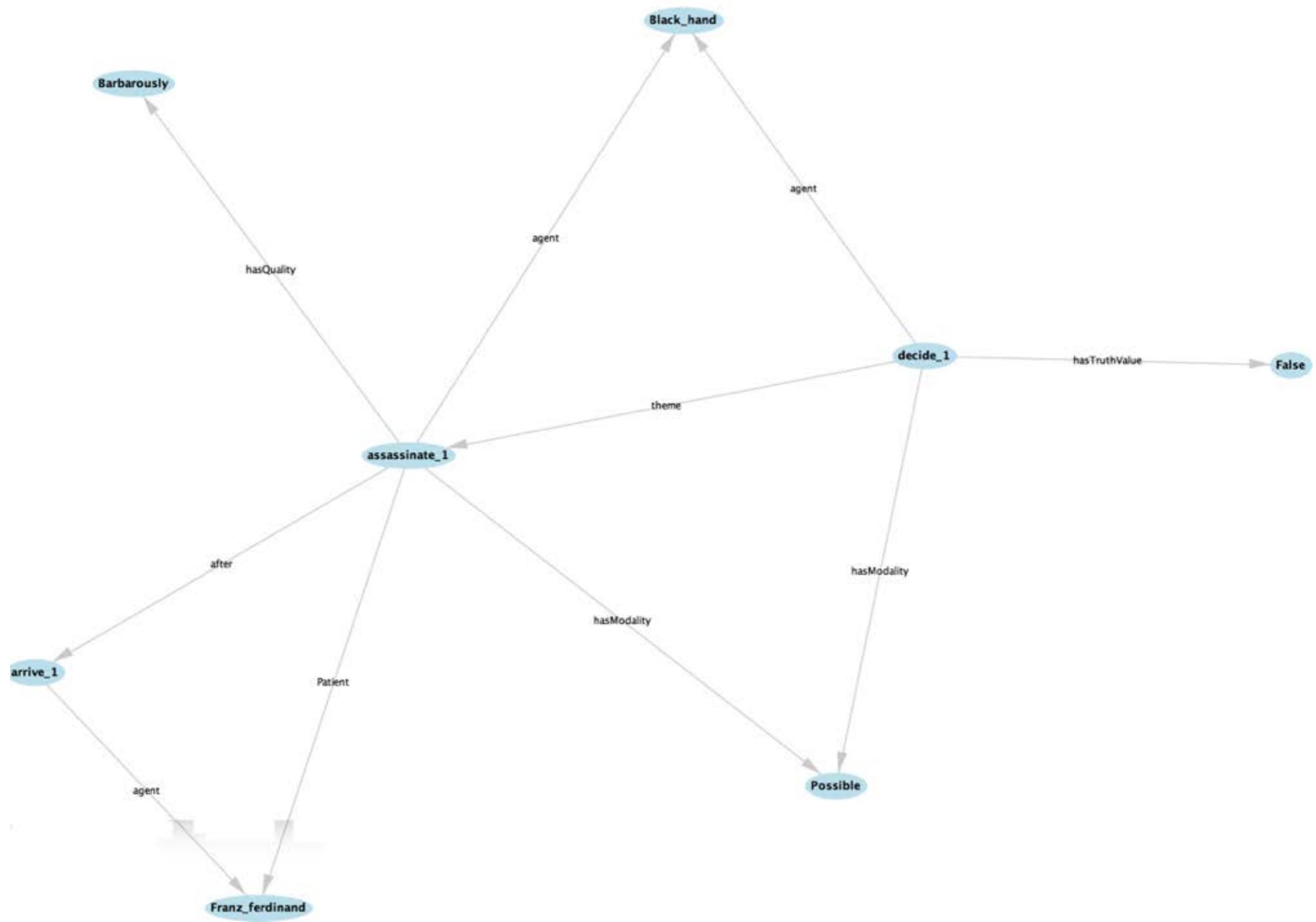
# Event extraction #2

```
PREFIX dul: <http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#>
PREFIX vnrole: <http://www.ontologydesignpatterns.org/ont/vn/abox/role/>
PREFIX boxing: <http://www.ontologydesignpatterns.org/ont/boxer/boxing.owl#>
PREFIX boxer: <http://www.ontologydesignpatterns.org/ont/boxer/boxer.owl#>
PREFIX : <http://www.ontologydesignpatterns.org/ont/boxer/test.owl#>
CONSTRUCT {?e :agent ?x . ?e ?r ?el . ?e ?rol ?filler . }
WHERE {
{{?e a boxing:Situation} UNION {?e a ?class . ?class rdfs:subClassOf+ dul:Event}}
?e ?p ?x
FILTER (?p = vnrole:Agent || ?p = boxer:agent || ?p = vnrole:Experiencer || ?p = vnrole:Actor
|| ?p = vnrole:Actor1 || ?p = vnrole:Actor2 || ?p = vnrole:Theme)
FILTER NOT EXISTS {?e vnrole:Theme ?x . ?e vnrole:Agent ?y
FILTER (?x != ?y)}
OPTIONAL {{?e ?r ?el} UNION {?e ?s ?z . ?z ?t ?el}} {{?el a boxing:Situation} UNION
?el a ?class1 . ?class1 rdfs:subClassOf+ dul:Event}
FILTER (?e != ?el)
OPTIONAL {?e ?rol ?filler
FILTER (?rol = vnrole:Topic || ?rol = vnrole:Beneficiary || ?rol = vnrole:Patient ||
?rol = vnrole:Patient1 || ?rol = vnrole:Patient2)}
OPTIONAL {?e vnrole:Theme ?theme . ?e vnrole:Agent ?y
FILTER (?x != ?y)}}
```



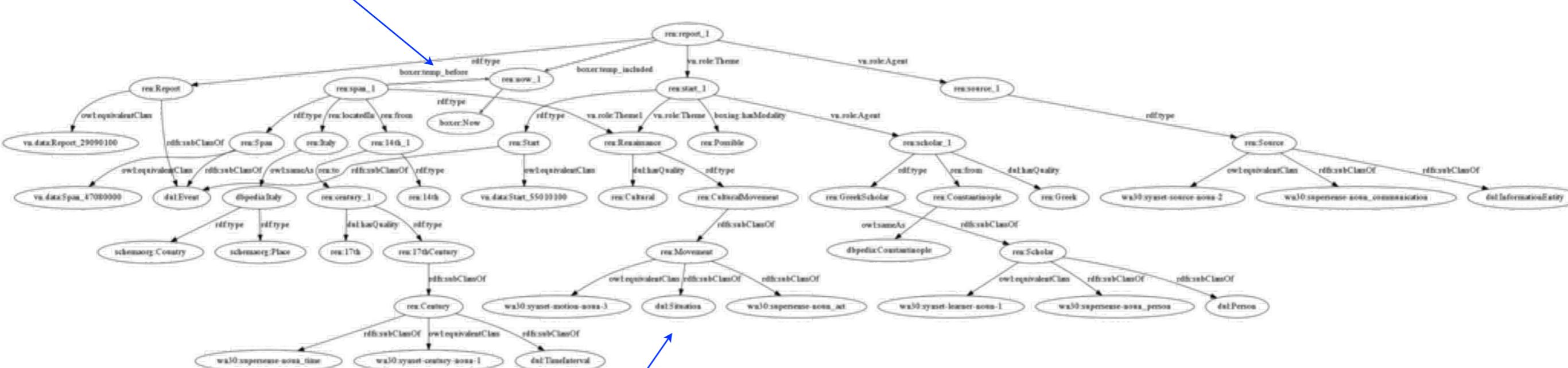
# Event extraction #3

```
PREFIX dul: <http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#>
PREFIX vnrole: <http://www.ontologydesignpatterns.org/ont/vn/abox/role/>
PREFIX boxing: <http://www.ontologydesignpatterns.org/ont/boxer/boxing.owl#>
PREFIX boxer: <http://www.ontologydesignpatterns.org/ont/boxer/boxer.owl#>
PREFIX : <http://www.ontologydesignpatterns.org/ont/boxer/test.owl#>
CONSTRUCT {?e :agent ?x . ?e ?r ?e1 . ?e ?rol ?filler . ?e ?aspect ?mod}
WHERE {
{{?e a boxing:Situation} UNION {?e a ?class . ?class rdfs:subClassOf+ dul:Event}}
?e ?p ?x
FILTER (?p = vnrole:Agent || ?p = boxer:agent || ?p = vnrole:Experiencer || ?p = vnrole:Actor
|| ?p = vnrole:Actor1 || ?p = vnrole:Actor2 || ?p = vnrole:Theme)
FILTER NOT EXISTS {?e vnrole:Theme ?x . ?e vnrole:Agent ?y
FILTER (?x != ?y)}
OPTIONAL {{?e ?r ?e1} UNION {?e ?s ?z . ?z ?t ?e1}} {{?e1 a boxing:Situation} UNION
?e1 a ?class1 . ?class1 rdfs:subClassOf+ dul:Event}}
FILTER (?e != ?e1)
OPTIONAL {?e ?rol ?filler
FILTER (?rol = vnrole:Topic || ?rol = vnrole:Beneficiary || ?rol = vnrole:Patient ||
?rol = vnrole:Patient1 || ?rol = vnrole:Patient2)}
OPTIONAL {?e vnrole:Theme ?theme . ?e vnrole:Agent ?y
FILTER (?x != ?y)}
OPTIONAL {?e ?aspect ?mod
FILTER (?aspect = owl:sameAs || ?aspect = owl:sameAs || ?aspect = dul:hasQuality ||
?aspect = boxing:hasModality || ?aspect = boxing:hasTruthValue)}}
```



- *The Renaissance was a cultural movement that spanned in Italy from the 14th to the 17th century. Some sources report that the Renaissance might have been started by Greek scholars from Constantinople.*

# Allen's tense relations



## disambiguated types