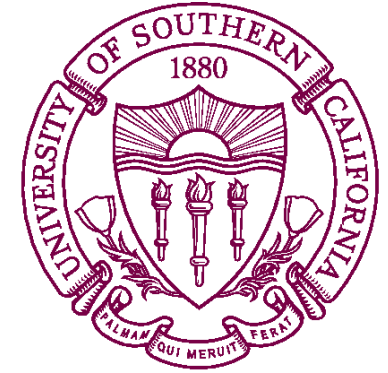








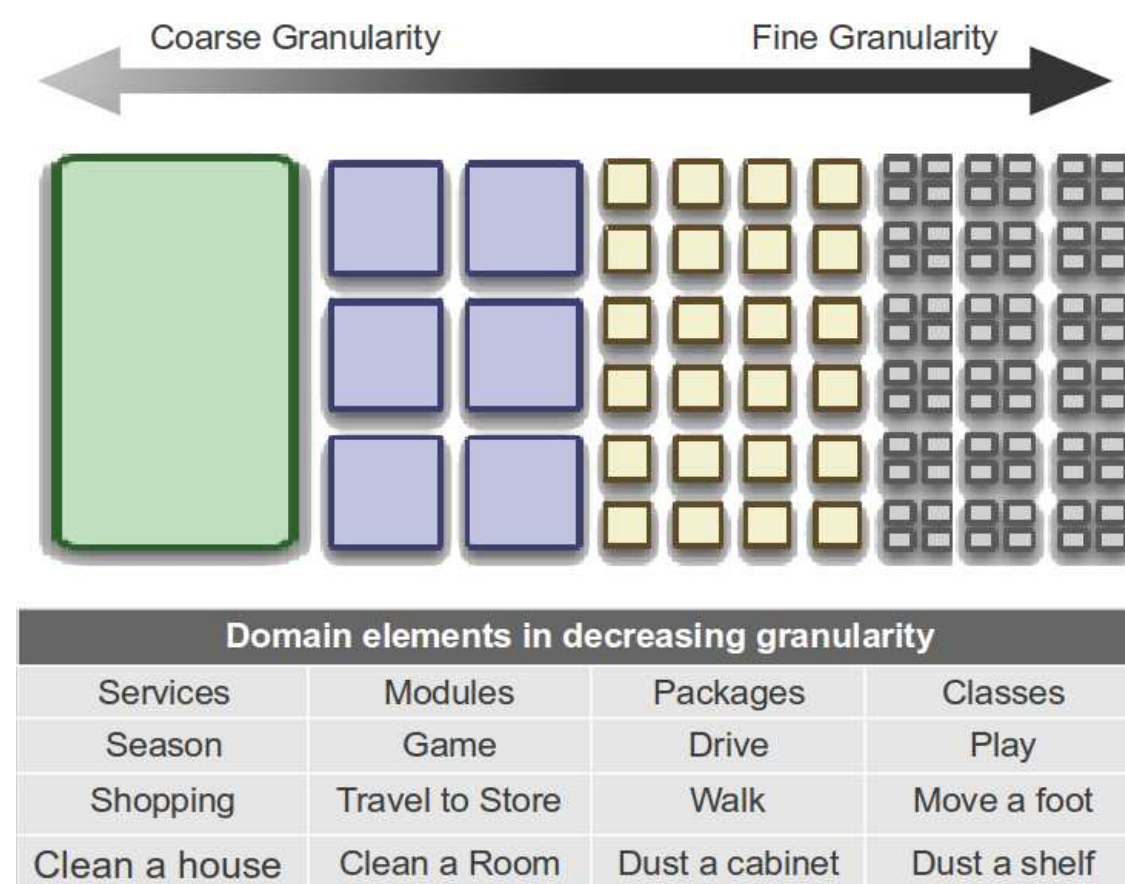
# Applications and Discovery of Granularity Structures in Natural Language Discourse



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## What is Granularity?

Granularity: the level of detail of description of an event or object.

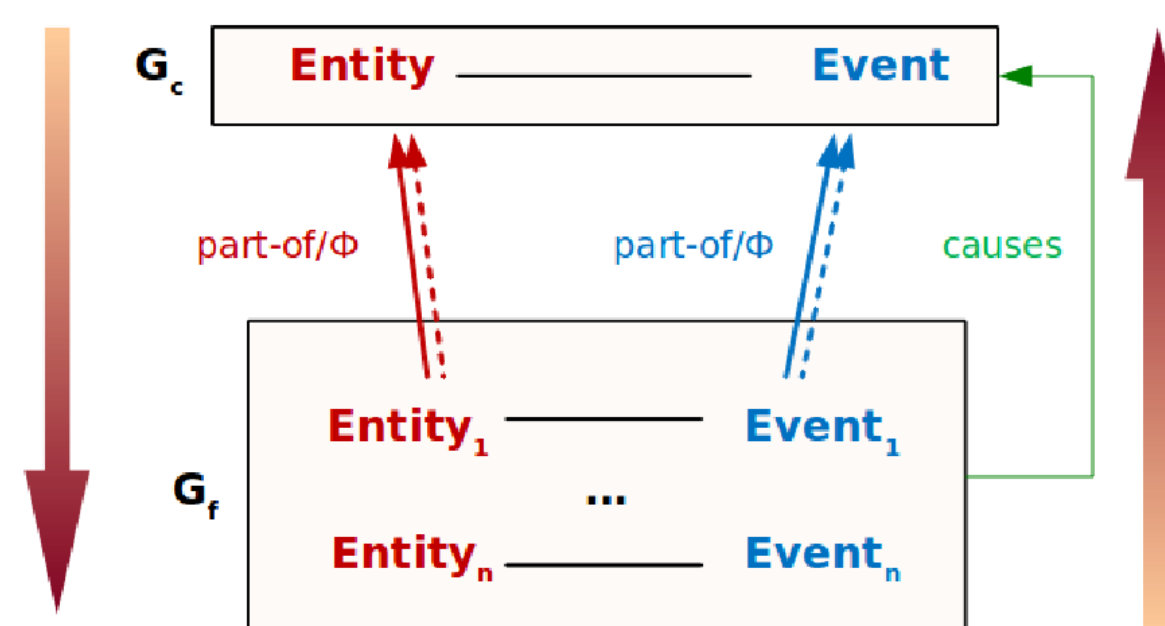


Related Work: (Hobbs 1985), (Mani 1998), (Keet 2008), (Bitner et al. 2001)

There are 2 types of causality:

- Sequential Causality: *The building collapsed because of the earthquake*
- Granular Causality: *The building collapsed because the roof caved in*

## Theory of Causal Granularity



$G_c$ : Coarse granularity information

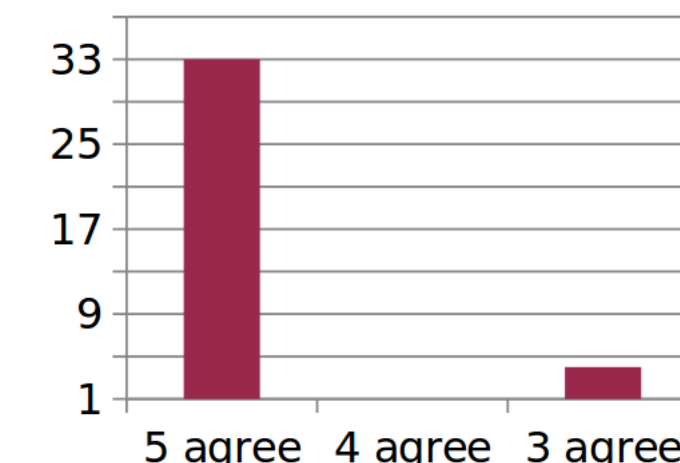
$G_f$ : Fine granularity information

Relevant categories of Part-of Relations (Winston et al. 1987) and Causal Relations (Girju et al. 2002) as they occur in natural language discourse.

Part-of Relations (Winston et al. 1987)		Causal Relations (Girju et al. 2002)		
Category	Example	Category	Type	Example
Component-Integral	pedal - bike	Connectives	Prep.	because of, thanks to, due to
Member-Collection	ship - fleet		Adv.	for this reason, the result that
Portion-Mass	slice - pie		Clause	because, since, for
Stuff-Object	steel - car	Verbs		kill, melt
Feature-Activity	pay - shop			poison, hang
Place-Area	LA - USA	Conditionals		If S1 then S2.

## Annotation Experiments

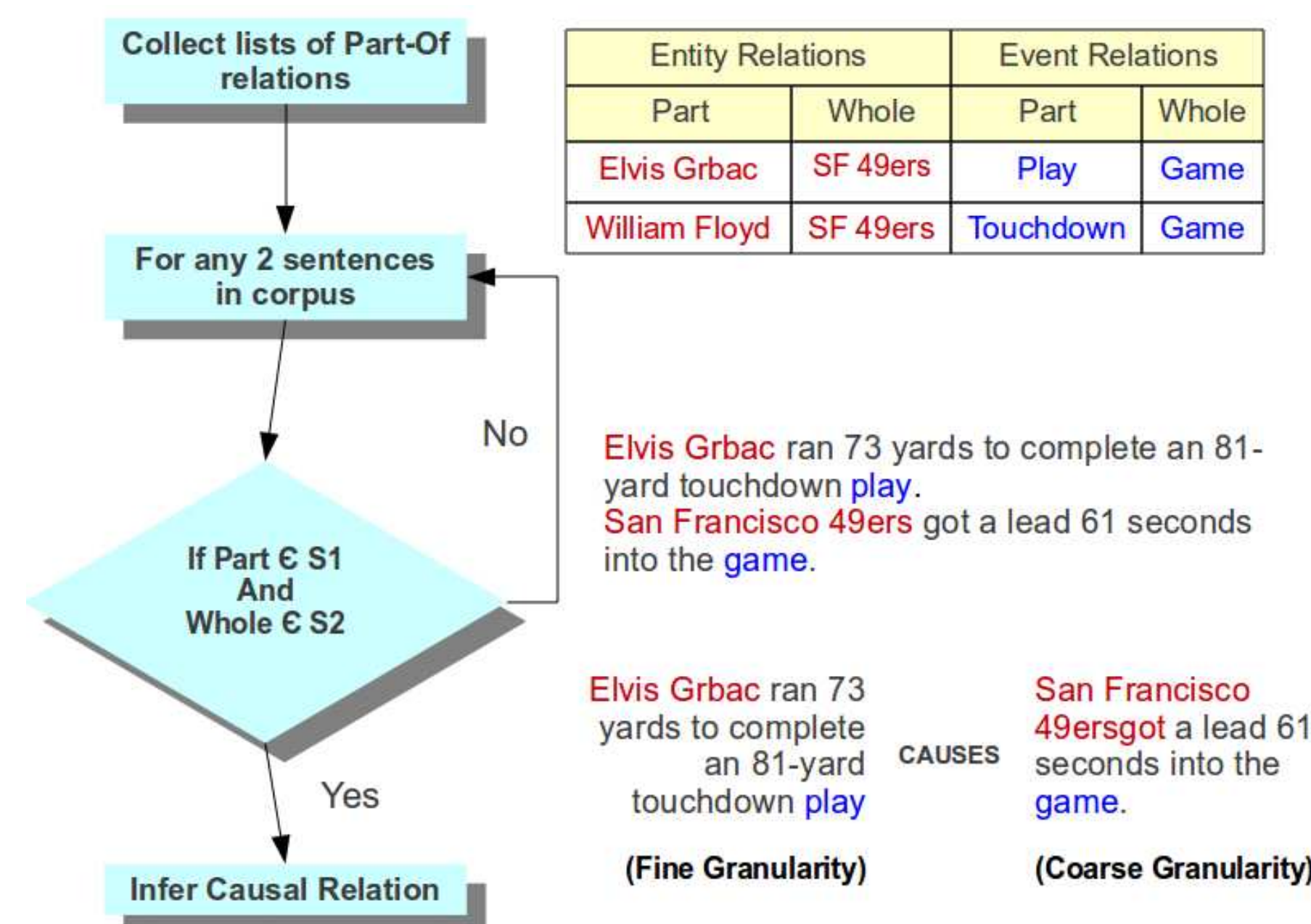
- **Articles:** 37 articles from three domains
  1. Travel
  2. Timebank (Pan et al. 2006)
  3. Football games)
- **Annotators:** 5 People from Mechanical Turk
- **Annotation Guidelines:**
  1. Is one paragraph a subevent of the other paragraph?
  2. Did one paragraph cause the other paragraph?
  3. Is one paragraph less detailed and the other paragraph more detailed?
  4. Did one paragraph happen after the other paragraph?



Annotator ID	A2-K9	A2-CA	A2-GH	A3-CN	A3-FM
A2-K9		0.82	0.76	1	0.76
A2-CA	0.82		0.93	0.82	0.93
A2-GH	0.76	0.93		0.76	1
A3-CN	1	0.82	0.76		0.76
A3-FM	0.76	0.93	1	0.76	

The average pairwise Kappa Agreement (Cohen 1960): 0.85

## Discovery of Granularity Structures



## Applications of Granularity Structures for solving NLP problems

1. San Francisco 49ers won 27-17 to the Green Bay Packers.
2. Brett Favre threw a three-yard touchdown pass to Keith Jackson in the first quarter moving the 49ers ahead 7-0.
3. Brett Favre threw a 13-yard touchdown toss to Mark Chmura in the second quarter moving the 49ers ahead 14-0.



### Application Areas:

1. Extracting Causal Relations (Mulkar-Mehta et al. 2011)
2. Question Answering: Traversing down the granularity structure will answer “how” the event happened
3. Text Summarization: Traversing up the granularity structure will provide an overall summary

## Other Experiments

We have used granularity relations to discover and infer the presence of causal relations in text. We compare this with causal relations identified using just causal markers. We achieve a precision of 0.91 and a recall of 0.79 using granularity for causal relation detection, as compared to a precision of 0.79 and a recall of 0.44 using pure causal markers for causality detection. Additional details can be found in a separate compilation [1].

1. Mulkar-Mehta R, Welty C, Hobbs JR, Hovy E. Using Part-Of Relations for Discovering Causality. FLAIRS. 2011.(to appear)
2. Mulkar-Mehta R, Hobbs JR, Hovy E. Granularity in Natural Language Discourse. International Conference on Computational Semantics, Oxford, UK. 2011:360–364.