

# Who evoked that frame? Some thoughts on context effects and event types

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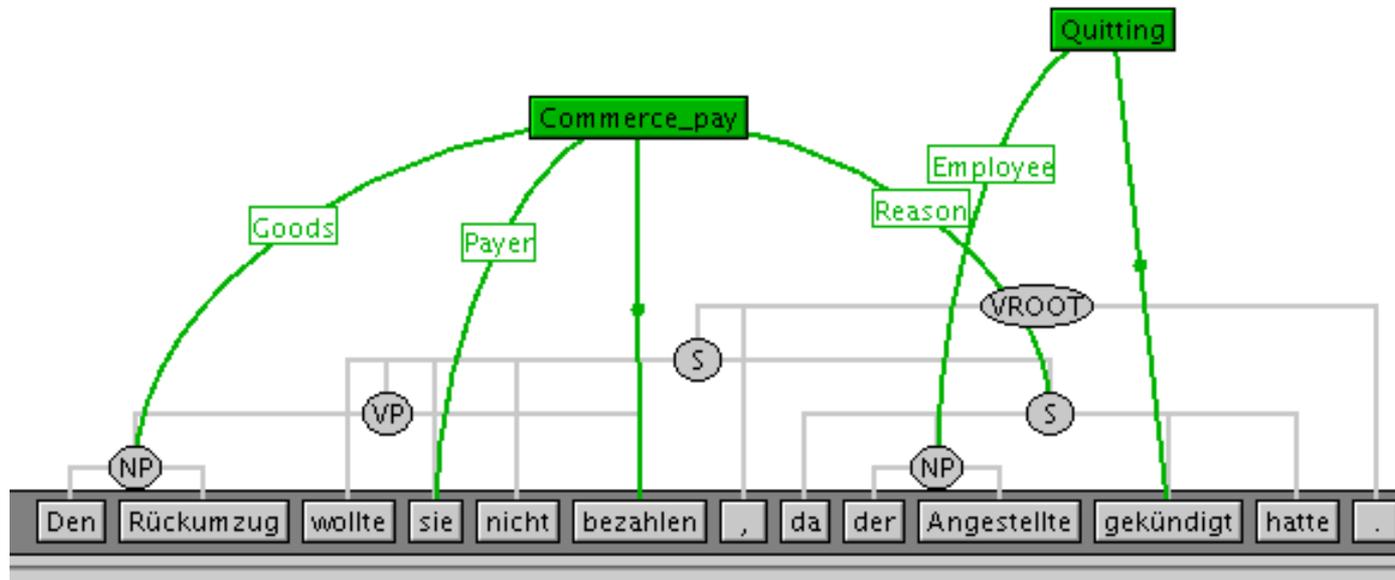
Joint work with Gerhard Kremer, Sebastian Padó, Stefan Thater

**Frame Semantics  
in Natural Language Processing  
A Workshop in Honor of  
Chuck Fillmore (1929–2014)**

# How I first met FrameNet

- SALSA project: The **S**aarbrücken **L**exical **S**emantics **A**nnotation and Analysis Project (Erk et al., ACL 2003, Burchardt et al., 2009)
- Manual annotation of a German corpus with Frame-semantic information (Fillmore et al, 2003)
  - 1.5 million words of syntactically annotated German newspaper text (**TIGER Corpus**)
  - Focus on verb annotation
- People: Manfred Pinkal, Anette Frank, Aljoscha Burchardt, Katrin Erk, Andrea Kowalski, Sebastian Padó
- Funded by Leibniz Program of DFG (German Science Foundation)

# A SALSA annotation example



(They didn't want to pay the move back because the employee had quit.)

- Annotating all verbs in the corpus
- Annotation on top of existing syntactic trees
- Using FrameNet as-is, as far as possible (almost always possible)

# Inter-annotator agreement

	Agreement (Frames)	Agreement (FEs)
Inter-Annotator	84.9%	85.7%
Inter-Adjudicator	97.0%	96.2%

- Reasonable inter-annotator agreement
- Frames somewhat more coarse-grained than WordNet synsets
- Still, interesting issues with frame assignment
  - Some instances with continuing disagreement
  - Some instances where two frames seem to fit at the same time

# Word meaning in context: It's complicated

- Ambiguity – polysemy – contextual modulation may be a gradient, not clearly distinct categories (Tuggy 1993, Cruse 1995)
- Sense boundaries to some extent arbitrary (Kilgarriff 1997: “I don’t believe in word senses”)
- Manual word sense annotation remains a difficult task. Factors that influence difficulty (Passonneau et al., 2010):
  - Sense concreteness
  - Specificity of the sentence context
  - Similarity between senses

# A U-semantic exercise

- Fillmore 1985: U-semantics, semantics of understanding:
  - “uncover the nature of the relationship between linguistic texts and the interpreter’s full understanding of the texts in their contexts”
  - Contrast: T-semantics, semantics of truth
- Finding the interpretive frames necessary for understanding a sentence
  - Corpus-based, bottom-up approach
- Today:
  - Corpus-based, bottom-up analysis of word meaning in context
  - Using one-word paraphrases (substitutes) given by human readers: a probe into perceived frames?

# Lexical substitution

- Annotation framework for describing word meaning in context
  - Alternative to using dictionary senses
- McCarthy and Navigli 2007, 2009
- Describe instance by collection of contextually appropriate lexical substitutes (one-word paraphrases)

# Lexical substitution: an example

sentence with target	substitutes
If science finds a <u>way</u> to safely free the subjects of Emil's art, perhaps the I who reads this file will know that my decision is wise.	means, process, practice, technique, solution, plan, avenue, method, procedure

- Annotators see a target word in context
- They provide one or more one-word substitutes
- Multiple annotators per instance:  
yields paraset (paraphrase set) for the instance

# Properties of lexical substitution annotation

- Annotators can be non-experts
- No sense inventory required
- Provides more graded meaning description through the collection of substitutes in the paraset
- Substitutes can be viewed as weighted:  
How many annotators proposed this substitute?

# CoInCo: A recent all-words lexical substitution corpus

- CoInCo (Kremer et al., EACL 2014)
  - Large, all-words lexical substitution corpus
  - Constructed using Amazon Mechanical Turk
- All content words annotated
  - Target sentence, plus one sentence context either side
  - 6 annotators per target
- Part of MASC (Ide et al. 2008, 2010): selected news and fiction documents
  - 30k words of running text, 15.4k annotated words
- <http://www.ims.uni-stuttgart.de/forschung/ressourcen/korpora/coinco.html>

# Analyzing the lexical substitution data

- What relations do we find between targets and substitutes? Synonymy? Hypernymy?
- Are parasetts similar to word senses?
- How fine-grained are they?
- Basis: WordNet

# Analyzing the lexical substitution data

- What relations hold between targets and substitutes?
  - Lookup in WordNet

Relation	Syn	Hyper	Hypo	Other	Not in WN
% substitutes	9.4	9.8	10.5	68.9	2.1

- Virtually all substitutes are in WordNet
- But majority does not instantiate a classical relation to the target

# Analyzing the lexical substitution data

- What relations hold between targets and substitutes?
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Relation	Syn	Hyper	Hypo	Other	Not in WN
% substitutes	9.4	9.8	10.5	68.9	2.1

- Manual analysis of “Other” cases:
  - Some errors (not that many)
  - Some cases of missing WordNet links
  - Many cases of contextual modulation

# Context-specific substitutes

sentence with target	substitutes
When I think of Julia Child I think of the television episode where she's <u>showing</u> you how to make a turkey dinner and the turkey fell on the floor.	exhibit, demonstrate, present, display, tell, <i>explain, instruct, teach</i>

“Other” substitutes (italics):

give very specific description of the situation

Neither WordNet nor FrameNet has any connections between “show” and “teach”

# Context-specific substitutes

sentence with target	substitutes
Mama <u>kept</u> her mink jacket, a family hand-me-down, safe from time in a stopbox, and lent the capturador to my uncle for his stamp collection.	preserve, protect, save, store, <i>guard, secure, stow</i>

Also no FrameNet connection between “keep” and “guard/secure/stow”

# Comparing three instances of “move”

sentence with target	substitutes
Reuters Holdings PLC said Michael Reupke resigned as general manager to pursue unspecified interests, a <u>move</u> the news organization termed an "amicable separation."	decision, change, maneuver, action, act, step, measure, <i>development, transfer, departure, switch</i>
Ochoa's new teammates were generally pleased with the <u>move</u> , even if it wasn't a blockbuster.	decision, change, shift, <i>deal, trade, swap, situation</i>
Also spurring the <u>move</u> to cloth: diaper covers with Velcro fasteners that eliminate the need for safety pins.	change, shift, drive, <i>switch, transfer, transition</i>

# Comparing four instances of “leave”

sentence with target	substitutes
<u>leave</u> for early retirement	depart, exit, go, resign, <i>opt, withdraw, deter</i>
<u>leave</u> the bar	depart, exit, desert
<u>leave</u> the U.S.	depart, exit, <i>disembark, emigrate</i>
<u>leave</u> university training	Depart, abandon, quit, <i>finish, stop, discontinue,</i> <i>flee</i>

# Sometimes substitutes are really not paraphrases

sentence with target	substitutes
Come on, I have something to <u>show</u> you	present, give, <i>bestow, offer, amuse</i>

Substitutes do not even fit the same syntactic structure, but are contextually plausible

# Wide context plays a role

sentence with target	substitutes
I mean, where do the dryads fit in a <u>place</u> like this?	spot, residence, occupation, location, <i>habitat, society, world</i>

“world” is not a synonym of “place”, but if we are speaking of dryads, we are most likely in a Fantasy context.

Error here: “occupation”

# Same sense, different substitutes

sentence with target	substitutes
Now, how can I help the elegantly mannered friend of my Nephthys and his surprising young <u>charge</u> ?	dependent, person, <i>task, lass, protégé, effort, companion</i>
The distinctive whuffle of pleasure rippled through the betas on the bridge, and Rakal let loose a small growl, as if to caution his <u>charges</u> against false hope.	dependent, command, accusation, <i>private, companion, follower, subordinate, prisoner, teammate, ward, junior, underling, enemy, group, crew, squad, troop, team, kid</i>

Note context effect: *protégé* versus *underling*

# A dramatic sentence with dramatic context effects

sentence with target	substitutes
My fear is that she would live, and I would learn that I had lost her long before Emil Malaquez translated her into a thing that can be <u>kept</u> , admired, and loved.	preserve, retain, hold, fix, store, <i>own, possess, enshrine, stage</i>

“Other” substitutes: more fine-grained characterization of the situation than WordNet-related substitutes

In FrameNet, Retaining (with “keep”) does inherit from Possession (with “own”, “possess”).

# More than one word sense activated

sentence with target	substitutes
I clapped her shoulder to <u>show</u> I was not laughing at her.	demonstrate, express, establish, indicate, prove, convey, imply, display, <i>disclose, clarify</i>

- WordNet show.2: prove, demonstrate
  - FrameNet: Evidence, Reasoning
- WordNet show.6: express

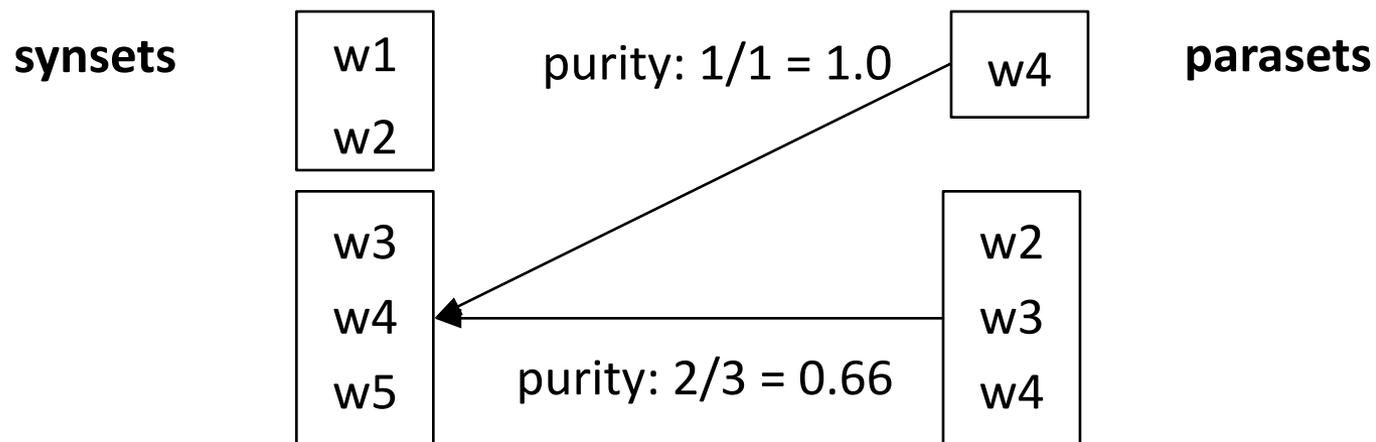
# More than one word sense activated

sentence with target	substitutes
He jumped at my arm while I was still off-balance, and I <u>felt</u> the surge of adrenaline that comes right when your body realizes that it's too late to save itself.	feel, experience, sense, perceive, notice, detect, realize

- FrameNet Perception\_experience: feel, detect, experience, perceive
- FrameNet Becoming\_aware: detect, perceive, notice

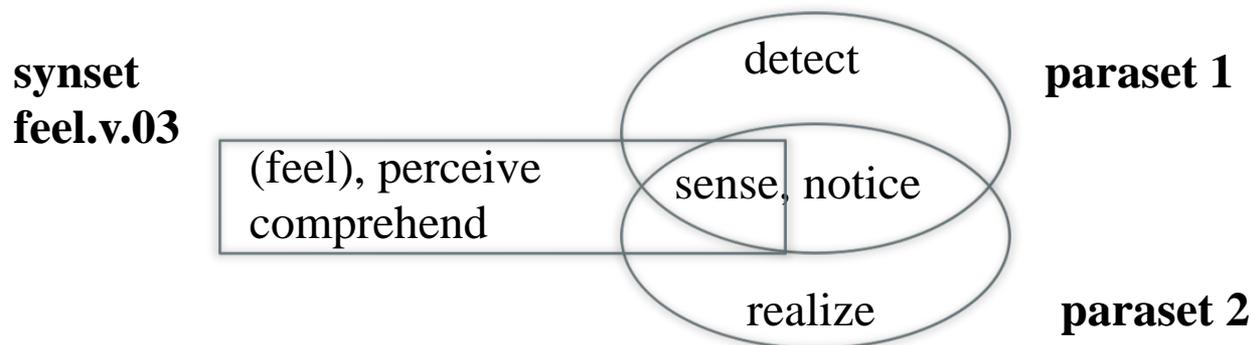
# Further analysis of lexical substitution data

- Are parasetes different, or just more fine-grained?
- Evaluate like a word clustering problem
  - WordNet (extended) synsets: Gold standard clusters
  - Parasetes: “Predicted” clusters
  - Evaluation: Average cluster purity
    - Accuracy of each cluster compared to its best-match gold class



# Paraset purity with respect to WordNet synsets

- Cluster purity is 75.1% for verbs, 81.2% for nouns
  - Surprisingly high
- Parasets make the same “major sense distinctions” as synsets
  - but describe more fine-grained meaning modulation



# How similar are parasetes that map to the same sense?

- Purity analysis maps parasetes to best WordNet sense
- How similar are parasetes that map to the same sense?
- Common core: intersection of parasetes with same sense
  - Mostly non-empty (86% of cases)
  - May go beyond the synset
  - About quarter to third of substitutes shared among same-sense parasetes
- Non-shared substitutes:
  - Contextual modulation
  - Small-sample effects

# Some questions

- **How specific should frames be?**
- ...if we want to find the interpretive frames necessary for understanding a sentence?
- Does “keep” need a “person as precious thing to be owned” frame with “possess” and “enshrine” as other LUs?
- Not possible for FrameNet as a resource
- But what does a listener need to know to understand the sentence?

# Some questions

- **Sense boundary issues**
- All those closely related uses of “leave”
- Instances with more than one sense being prominent

sentence with target	substitutes
I clapped her shoulder to <u>show</u> I was not laughing at her.	prove, express, ...

- Fillmore 1982, “climb”
- Paraset with partial overlap

# Sense boundary issues

- Senses/frames as
  - prototypes with fuzzy boundaries
  - local maxima in a instance landscape (Kawamoto 1988, Murphy 2002)
- Modeling this:  
This is where distributional models come in
- Studying this: Lexical substitutes

# Some questions

- **Who evoked that frame?**

sentence with target	substitutes
...where do the dryads fit in a <u>place</u> like this?	world, ...
...translated her into a thing that can be <u>kept</u> ...	own, possess, enshrine, stage, ...

- How best to describe why a frame is relevant for sentence: Is it just the LU that introduces the frame?
  - Context can effect large change in perceived sense

# Who evoked that frame?

- McRae and Matsuki 2009: “People use their knowledge of common events to understand language, and do so as quickly as possible”
- Effect of general event knowledge on expected words and constructions
- “thing to be kept” example: Integration of frame introduced by situation, and frame introduced by “keep”?

# Some questions

- Lexical substitution is a useful annotation paradigm:
  - Non-expert annotators
  - Fine-grained meaning annotation
  - Parasetes that can be further analyzed automatically
- **Can this be used to aid frame creation?**