# Investigating Categories in a Syntactically-Annotated Corpus of Second Language Learners of English

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Workshop on Categories & Categorization
in First & Second Language Acquisition
7 March, 2014





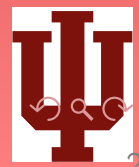
# Starting point

Learner corpora contain the output of second language learners at a certain point in their development

- Regardless of the state of the categories in their interlanguage, we only have the output to annotate







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- Provide linguistic representations of what learners do
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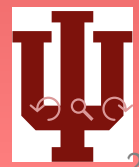

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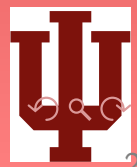

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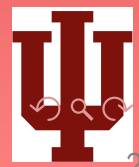
**Today:** Describe our attempts to define categories in a way that leaves full interpretation to a researcher





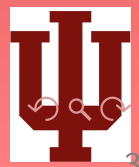


# How to linguistically annotate?

Approaches to annotating linguistic properties:

- In tandem with error annotation, i.e., annotating the category of the *correction*
  - Map to target hypotheses before annotating POS (e.g., Granger 2003) or syntax (e.g., Hirschmann et al. 2010)





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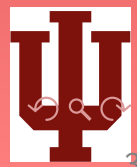

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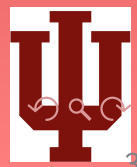
This latter approach allows for a thorough investigation of what learner categories are composed of & is useful for:

- Error detection (Tetreault et al. 2010)
- Learner profiling (Hawkins and Buttery 2010)
- Acquisition research (Ragheb and Dickinson 2011)





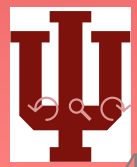
# Our goal

We discuss how our corpus annotation effort defines categories, surveying three aspects:

1. Ill-fitting categories: how do we precisely define types of categories?
2. Broadly-applicable annotation: how can the annotation be applied across various meta-variables?
3. Annotation utilization: how can the resulting annotation be used for research?







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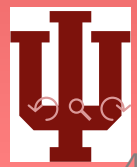
We are working to make these points practical, transparent, & able to be debated by annotating c. 10,000 tokens

- The SALLE (Syntactically Annotating Learner Language of English) Project at Indiana University (IU)
- Placement essays from IU, scored on a 1–7 scale





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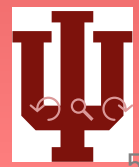

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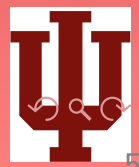

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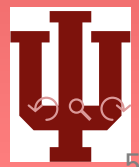

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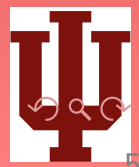
(1) I have **see** a movie

We annotate two POS tags for *see*:

- morphological properties of a baseform verb (VV0)
- distributional slot of a past participle (VVN)





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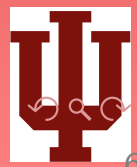
This splitting of layers gets us quite far

- But we discovered that this clean split into multiple layers is not really clean at all







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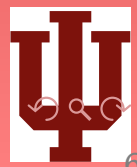

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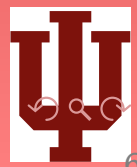

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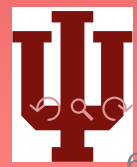

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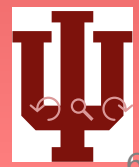

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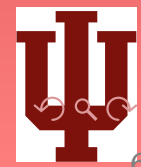
- We will just sketch the issue: see Ragheb and Dickinson (2012) for more details





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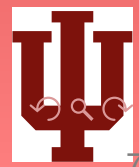
Morphosyntax based on the visible forms of words





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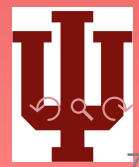

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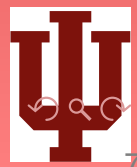

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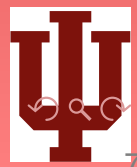

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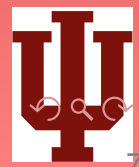

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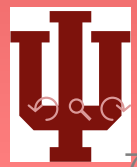

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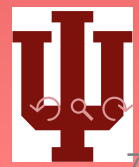
- We do not annotate distributional dependencies: mostly covered by other layers



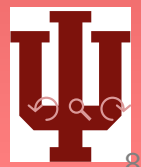


# Broadly-applicable annotation

The annotation is based on linguistic evidence from the L2 grammatical system, making it applicable:

- to learners with different L1s
- to learners at different stages of interlanguage development
- across contexts (e.g., text type)
- regardless of one's (SLA) theory





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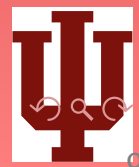

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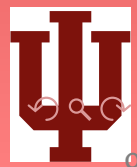

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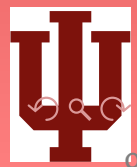

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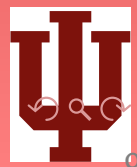
- **After:** Comparable occurrences of usage, found across different learner variables





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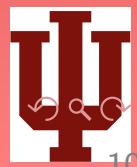
**Primary focus:** use surface evidence always at hand

- Make categories systematic & broadly applicable







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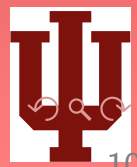

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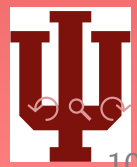

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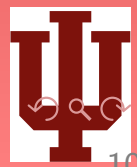
1. We give the learner the benefit of the doubt (if there is no way to disambiguate based on context).
2. We try not to assume too much about the intended meaning of the learner, focusing on morpho-syntax.





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**Primary focus:** use surface evidence always at hand

- Make categories systematic & broadly applicable

(4) Although it not big and famous , but **it still has something own itself** .

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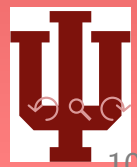

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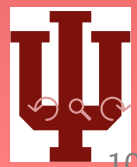

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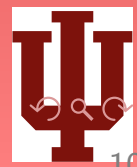

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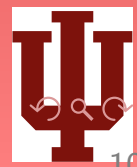
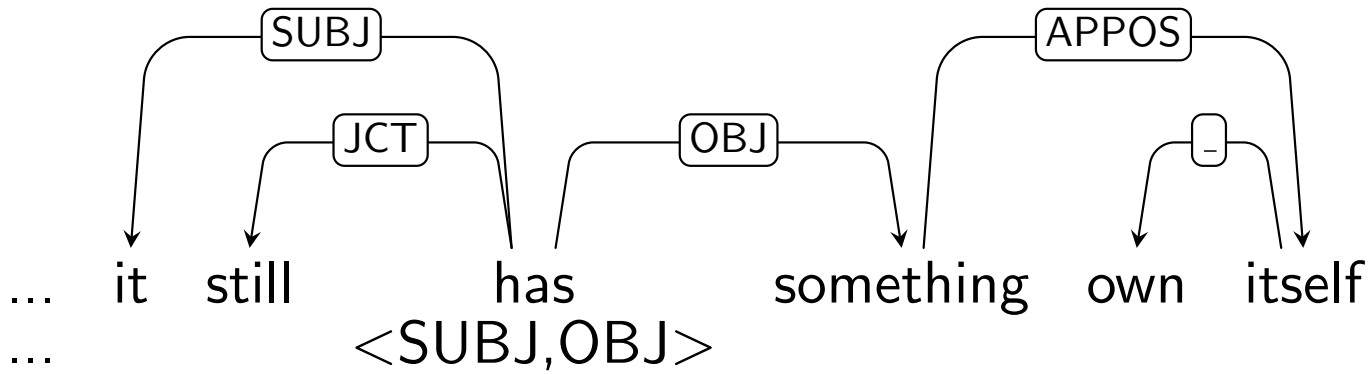
$\Rightarrow$ Principles ensure researchers can interpret categories



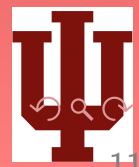


# Example annotation







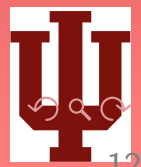
# Broadly-applicable annotation

## Applying the annotation

One of the most challenging aspects for annotators is our strict focus on syntax







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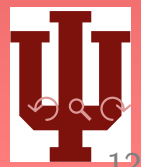
(5) All these me felt better .

- In context, this probably means that *all these [things]* were things that made the writer feel better
  - But there is no *made* here!







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- *felt* is ROOT, with *better* as its predicate (PRED)
- *All* is QUANT dependent, of *these* or *me*



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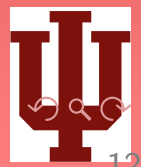
Our (morphologically-based) solution rests on:

- *All these* making for a proper subject
- An allowance for underspecification







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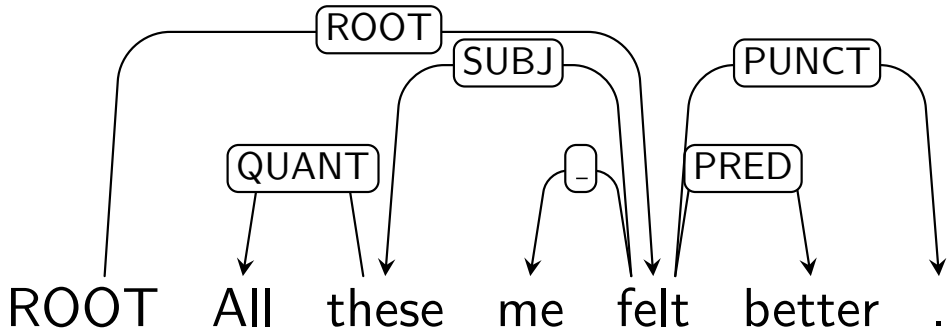


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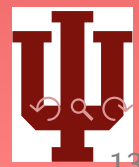

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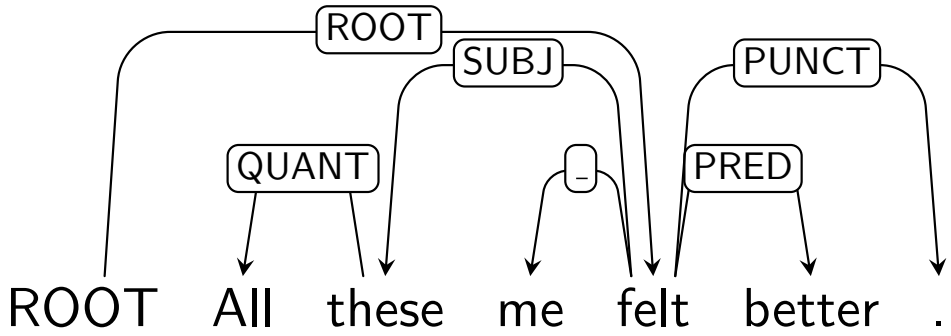


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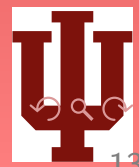

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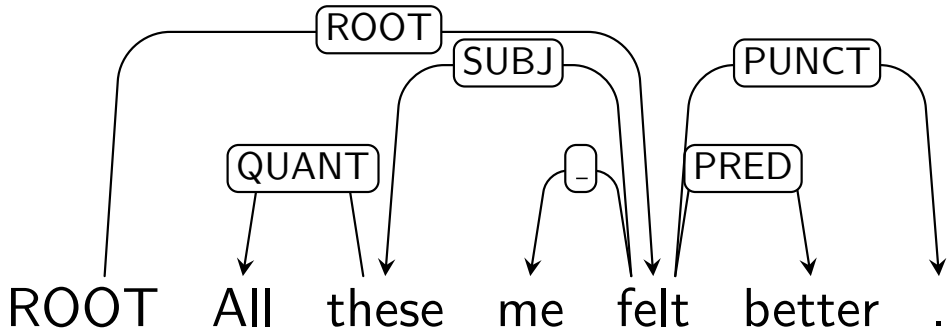


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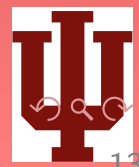

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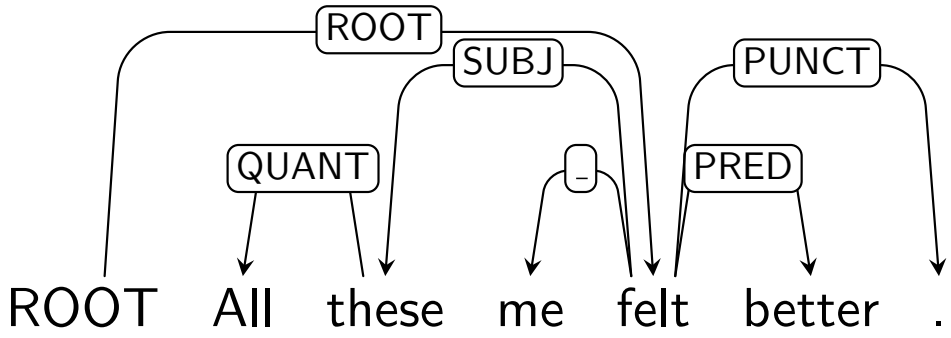


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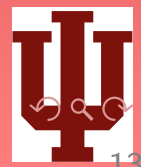
These analyses would be useful, but this analysis:

- Fits the evidence at hand & still provides access to useful categories





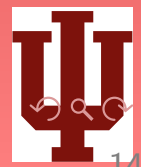
# Broadly-applicable annotation

## Comparable occurrences

e.g., learners using multiple arguments when one is required







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- Some cases are found by a search for TOP (topic)

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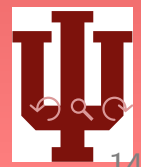

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$\Rightarrow$ What each TOP label means may differ, but we are able to group cases together across L1 & level



# Comparable occurrences (cont.)

- Other example are found by finding multiple dependents of the same type when only one is required

(9) **Korea (3, same as previous):** I 'm not decide yet **which**$_{DET}$ **my**$_{DET}$ job .

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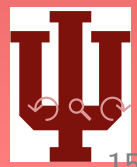

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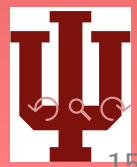
$\Rightarrow$ Whether this corresponds to the same type of thing as with TOP is up to the researcher

- The annotation brings the sentences to light





# Ways to utilize the annotation

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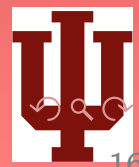

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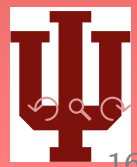
  - 10 uses of the ELL (elliptical) label
  - 24 past tense copulas (VBD) taking a predicate (PRED)





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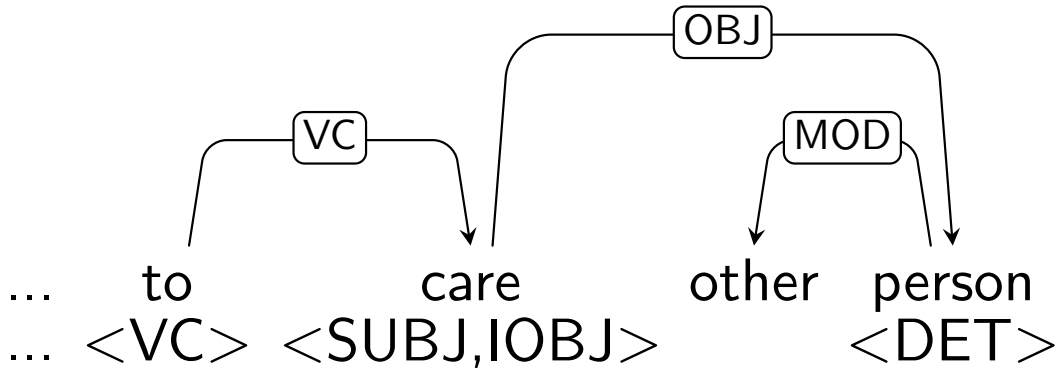




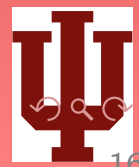

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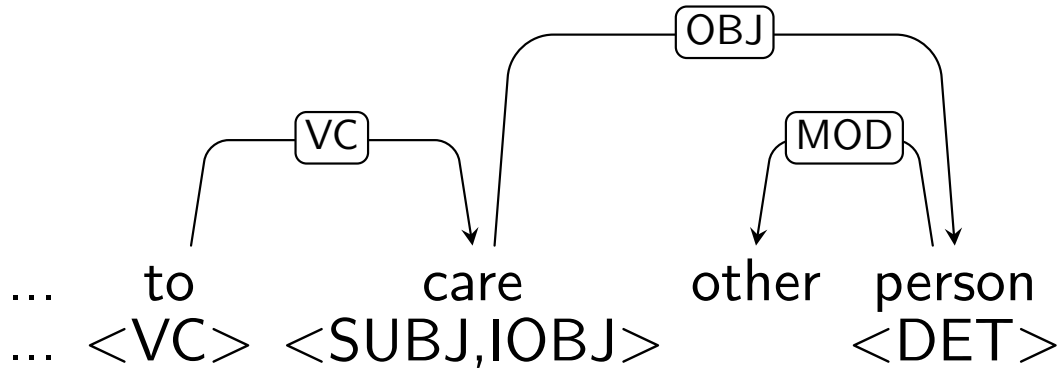
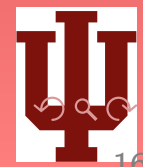



- Examining underspecified labels (_)

(13) ... I can n't **losing**_ these all things .



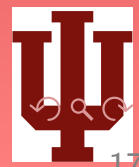


# Ways to utilize the annotation (2)

- Investigating rare/interesting labels: ELL, APPOS, ...

(14) I think if I was in my hometown , or **in**$_{ELL}$ better word , in my home country , I would n't be as hard working person , as now I am .





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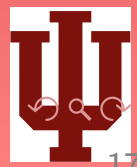
- Quantitatively & qualitatively investigating correct and innovative uses of specific labels/constructions
  - e.g., We are currently investigating all the instances of determiner (non)use in the annotated part of the corpus

  (15) a. **Correct:** In addition, **the government** provides for **students food** and facilitative **dormitories**

  b. **Mismatch:** So the person who has gotten education by **the government money** and help ..





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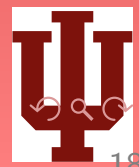
- Examining words with more than one syntactic head
  - e.g., right node raising:

(16) All countries in the world , especially United States of America helped and are helping our **coutry**$_{OBJ}$ to be in a better situation .





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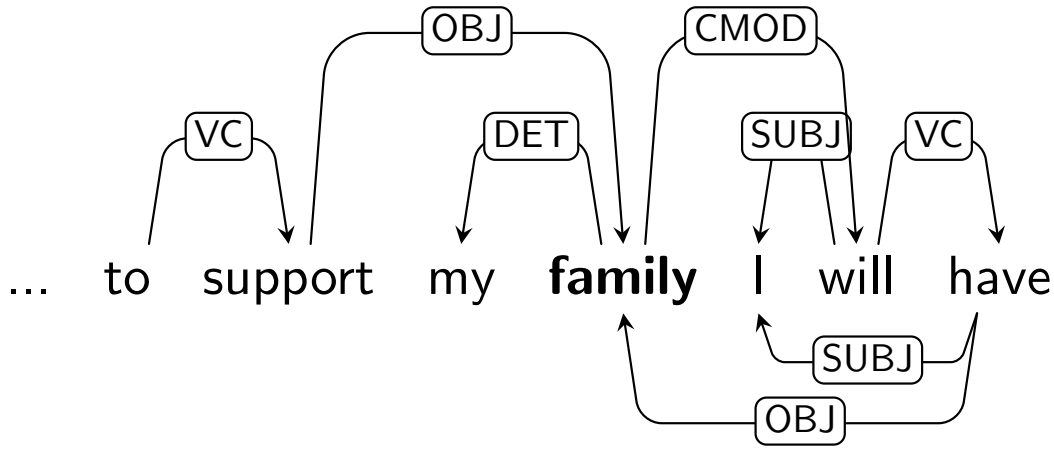
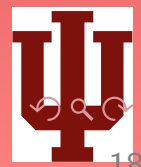
  - e.g., relative clauses





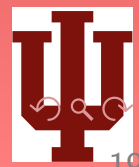



# Summary and Outlook

**Take-home point:** Corpus categories as well-documented indices provide data for researchers to interpret







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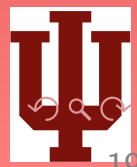
- Notes on how the annotation applies in different settings
- Opportunities in utilizing the annotation for research





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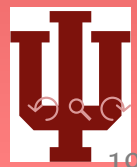
Some immediate next steps:

- Annotate more data, including parsing as a first step
- More thoroughly utilize the annotation
  - e.g., ongoing determiner study (Ragheb forthcoming)
- More deeply explore the connection between this annotation & error annotation
  - More thoroughly investigate how the annotation connects to semantic forms





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The annotation:

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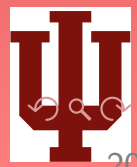
- Has extensive guidelines already available online (Dickinson and Ragheb 2013)
  - These guidelines let you know what the categories mean





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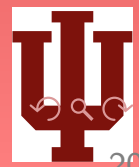
Target corpus release: within the next year (fingers crossed)

- Currently: 24 essays, 474 sentences, 7208 words ... with 5 main layers of annotation for each sentence
- This still needs more hand-checking

See: http://cl.indiana.edu/~salle/





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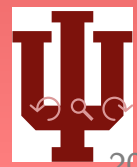

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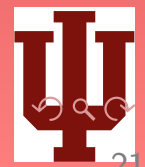


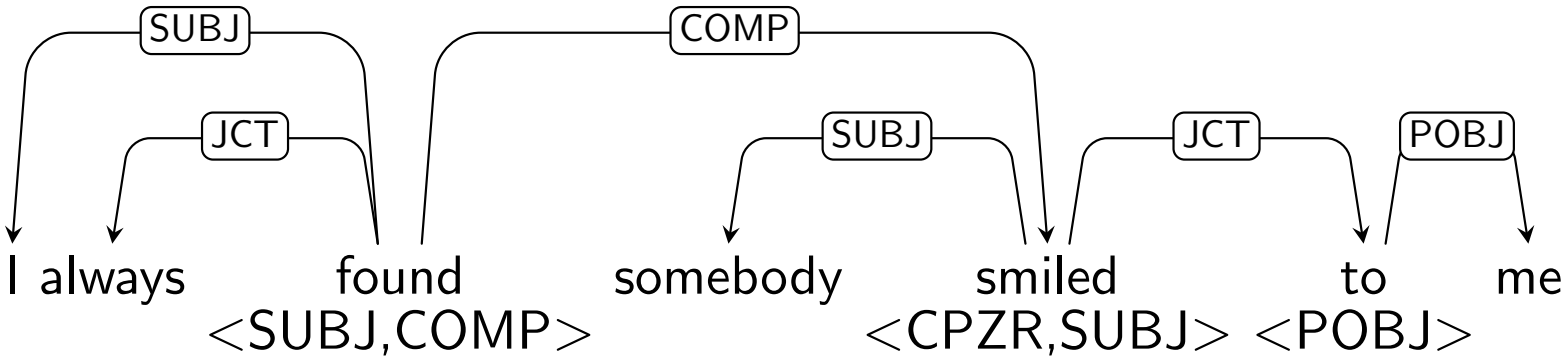
# Broadly-applicable annotation

## Applying the annotation

Consider this complement clause:

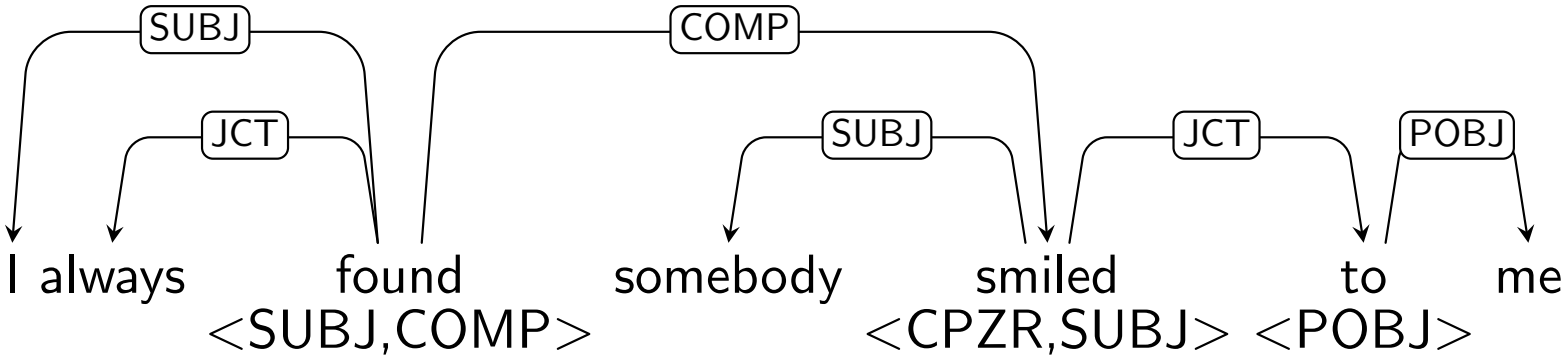
(17) When I walked on the road , **I always found somebody smiled to me** .

- Even though it is odd, most of the annotation decisions are relatively easy
  - e.g., *to* is treated like a normal preposition



# Applying the annotation

## How is the sentence ungrammatical?

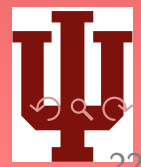



- *smiled* is a finite verb heading a clause, as a complement (COMP) of *found*, cf.

  (18) I found that somebody was smiling at me.

- The only mismatch is the complementizer (CPZR) on the subcategorization list of *smiled*
  - We do not need to know why the absence of *that* makes a difference here, only annotate as such



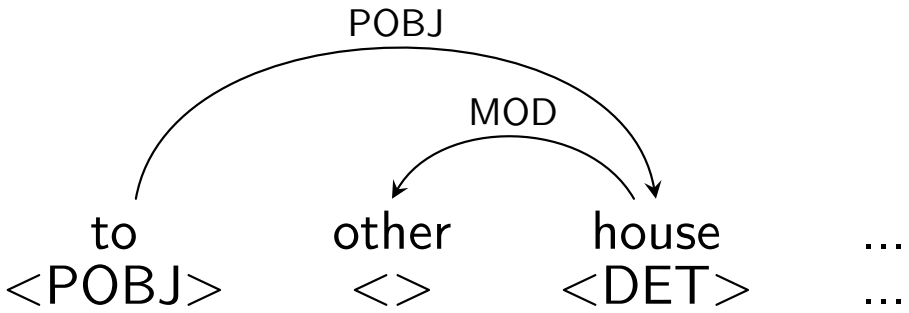


# Defining subcategorization

Subcategorization encodes general constraints

- It can help capture discrepancies in argument structure

(19) . . . we moved again to other **house** . . .

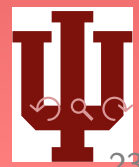



- Annotate every possible subcategorization or only one?
  - One annotation makes it context-specific, overlapping with distributional evidence

  (20) One [goal] is to contribute to both global and local **community** ...

  - <DET> fits discourse; <> is a general possibility





# Defining morphosyntax

Morphosyntax based on the visible forms of words

- e.g., analysis should be appropriate for 3 sg. verb:

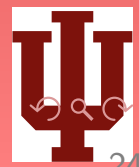
  (21) I had a problem a bout **chooses** my car.

- We use distribution to disambiguate:

  (22) And also I can heart the step of my **walked** .

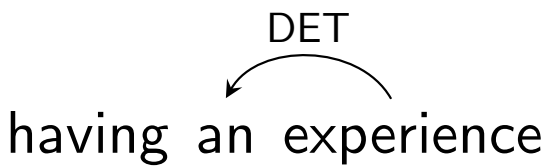
  - 3 POS for *can*, 2 for *step*, 2 for *walked*: 3x2x2=12 trees
  - What would be the tree for past tense of *walked*?
    - Adjectival/past participle fits better to the context





# Defining distribution

- Syntactic distributional slot: position where token with particular properties (e.g., singular noun) predicted to occur, on the (syntactic) basis of surrounding tokens
- Does morphology play a role in disambiguation?

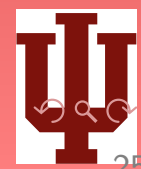



  - MOD & QUANT are possible here, but *an* = DET

**Overall point:** The layers are inter-defined

- Morphosyntax + subcategorization covers nearly all distributional dependency distinctions
- We thus do not to annotate distributional dependencies





# Interannotator agreement

## Initial layers

Overview of agreement rates before & after discussion (phases 2 & 4):

| Annotators | lemma | | $POS_m$ | | $POS_d$ | |
|---|---|---|---|---|---|---|
| | P2 | P4 | P2 | P4 | P2 | P4 |
| A, B | 93.4 | 96.9 | 99.0 | 98.7 | 99.2 | 98.7 |
| B, C | 94.4 | 97.7 | 99.0 | 99.5 | 98.7 | 99.3 |
| C, A | 92.4 | 96.9 | 99.7 | 99.7 | 98.5 | 99.3 |

- $POS_m$ & $POS_d$: High agreement rates reflect annotators making very few changes to automatic pre-annotation
- Lemmas: Improvement in agreement—although it could be higher, given the simplicity of lemma information





# Interannotator agreement

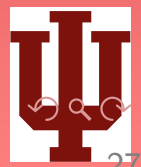
## Dependencies

Overview of agreement rates before & after discussion (phases 2 & 4):

| Annotators | Subcat. | | UAA | | LAA | |
|---|---|---|---|---|---|---|
| | P2 | P4 | P2 | P4 | P2 | P4 |
| A, B | 85.5 | 94.0 | 86.6 | 97.0 | 80.0 | 95.2 |
| B, C | 86.1 | 95.7 | 86.7 | 97.1 | 80.3 | 96.0 |
| C, A | 86.1 | 96.6 | 86.9 | 97.7 | 82.4 | 96.7 |

- Initial agreement rates around 80–85%: moderately high
- Agreement rates improved after discussion, achieving approximately 95% agreement





# Interannotator agreement

## Dependencies (cont.)

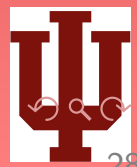
| Ann. | UAA | | LAA | | LOA | |
|---|---|---|---|---|---|---|
| | P2 | P4 | P2 | P4 | P2 | P4 |
| A, B | 81.8 | 96.1 | 73.6 | 93.4 | 80.3 | 95.5 |
| B, C | 80.9 | 96.2 | 73.4 | 94.4 | 79.3 | 97.1 |
| A,C | 83.6 | 97.6 | 79.7 | 96.7 | 81.8 | 97.9 |

Table: MASI percentages for dependencies, Text 1

| Ann. | UAA | | LAA | | LOA | |
|---|---|---|---|---|---|---|
| | P2 | P4 | P2 | P4 | P2 | P4 |
| A, B | 92.6 | 98.1 | 87.8 | 97.4 | 89.3 | 97.8 |
| B, C | 93.8 | 98.3 | 88.7 | 97.9 | 90.2 | 98.6 |
| A, C | 90.9 | 97.9 | 85.7 | 96.8 | 87.6 | 97.9 |

Table: MASI percentages for dependencies, Text 2





# Interannotator agreement

## Subcategorization

| Ann. | MASI | | $GCM_1$ | | $GCM_2$ | |
|---|---|---|---|---|---|---|
| | P2 | P4 | P2 | P4 | P2 | P4 |
| A,B | 84.3 | 92.4 | 81.9 | 90.8 | 72.8 | 88.1 |
| B,C | 83.6 | 93.8 | 74.4 | 91.6 | 73.6 | 90.2 |
| A,C | 84.9 | 96.1 | 83.0 | 96.4 | 73.1 | 92.2 |

Table: Agreement rates for subcategorization, Text 1

| Ann. | MASI | | $GCM_1$ | | $GCM_2$ | |
|---|---|---|---|---|---|---|
| | P2 | P4 | P2 | P4 | P2 | P4 |
| A,B | 87.1 | 95.9 | 88.9 | 96.0 | 77.2 | 94.1 |
| B,C | 89.3 | 98.0 | 88.3 | 98.0 | 82.0 | 96.8 |
| A,C | 87.6 | 97.2 | 91.2 | 97.3 | 73.7 | 94.2 |

Table: Agreement rates for subcategorization, Text 2