Supersense and Sensibility

Proxy Tasks for Semantic Annotation of Prepositions

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LAW XIV at COLING'2020

Prepositional Supersense

A **coarse-grained label** describing a preposition's **meaning**

(1) I rented an apartment **in**$_{\textbf{Locus}}$ Boston

(2) I hope to see you **in**$_{\textbf{Time}}$ the future

(3) It's gone downhill since a change **in**$_{\textbf{Characteristic}}$ ownership

Annotating prepositional supersenses

- ...is currently **hard** and **expensive**

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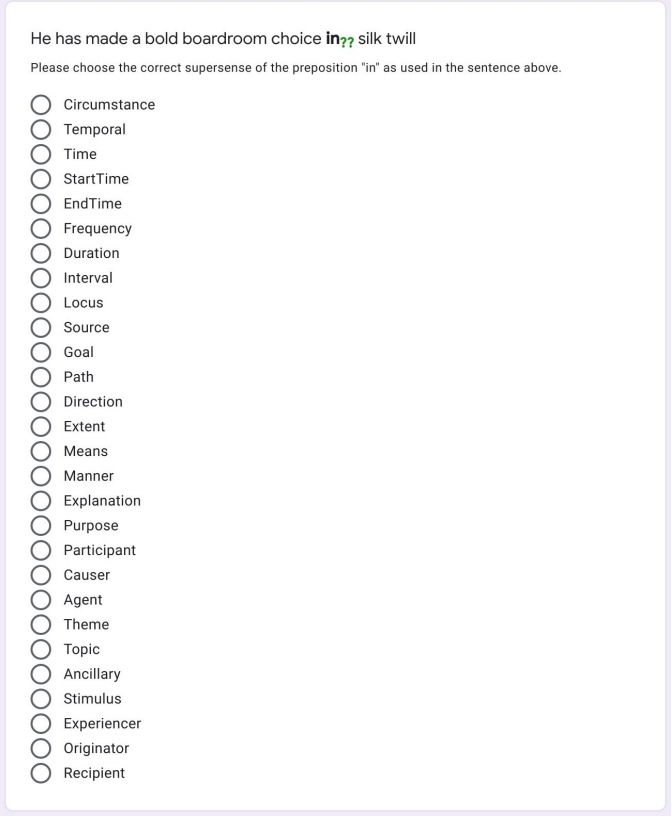
- SNACS v2.5:
  - 50 supersenses
  - 100-page manual

Crowdsourcing prepositional supersenses

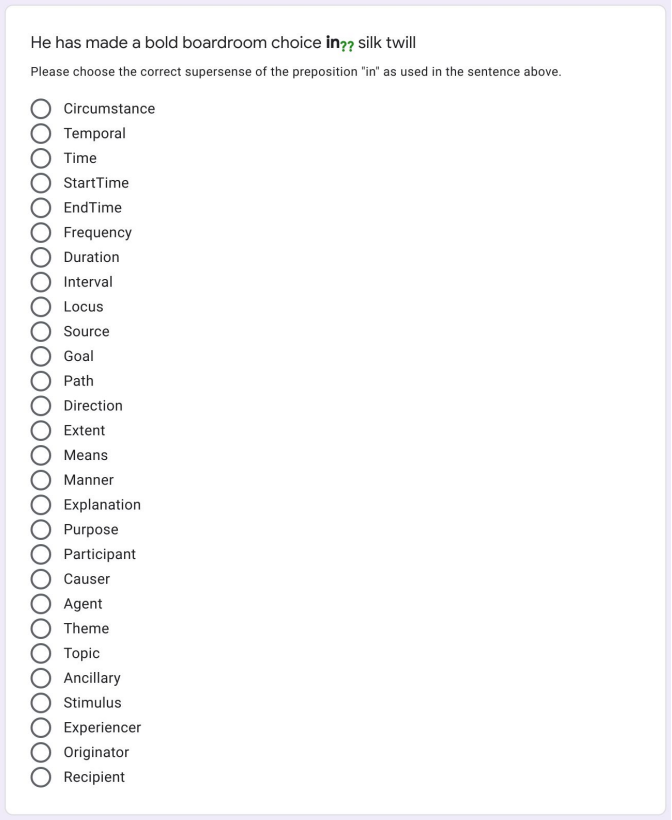
- Direct supersense annotation is **too hard** for crowdworkers



Crowdsourcing prepositional supersenses

- Direct supersense annotation is **too hard** for crowdworkers

- But: could we have crowdworkers solve a **simpler task**, and **infer** a full supersense label?



Crowdsourcing prepositional supersenses

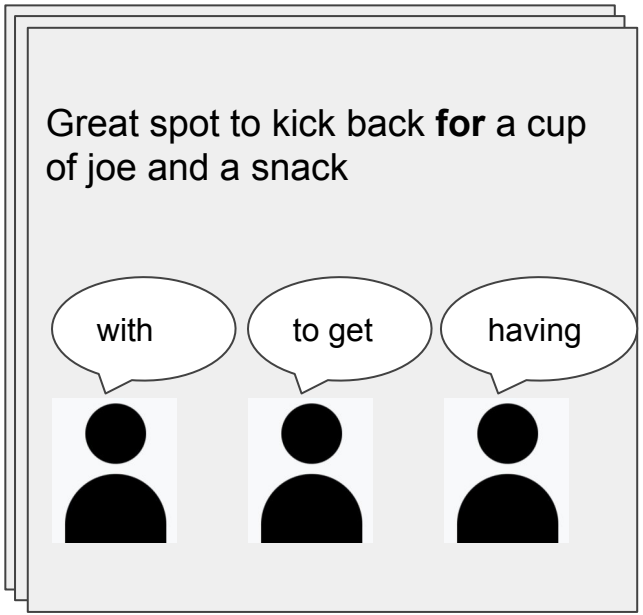
- 2 **proxy task** designs
  - Intended for implementation on Amazon Mechanical Turk
  - Amazon MT already explored for crowdsourcing senses for content-words

- 4 pilot studies with a handful (5-7) of graduate student crowdworkers

- Goal: assess whether designs can work under ideal conditions

Design 1: Preposition Substitution

Step 1: crowdworkers **generate** substitute phrases



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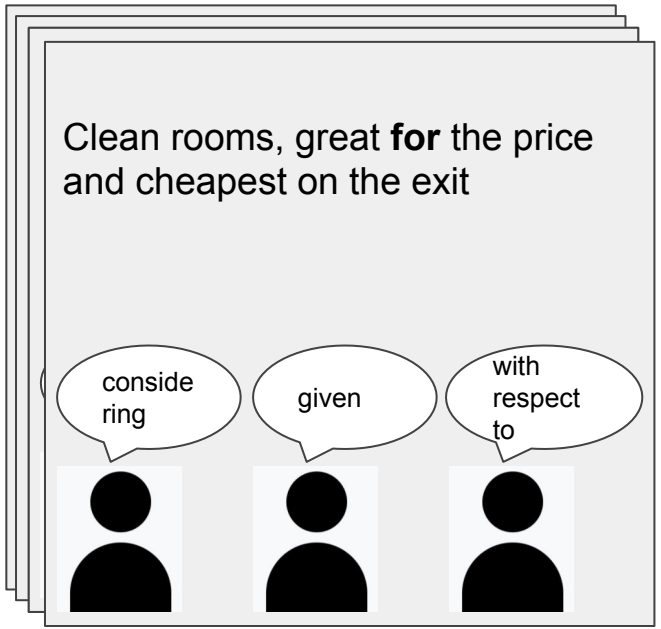

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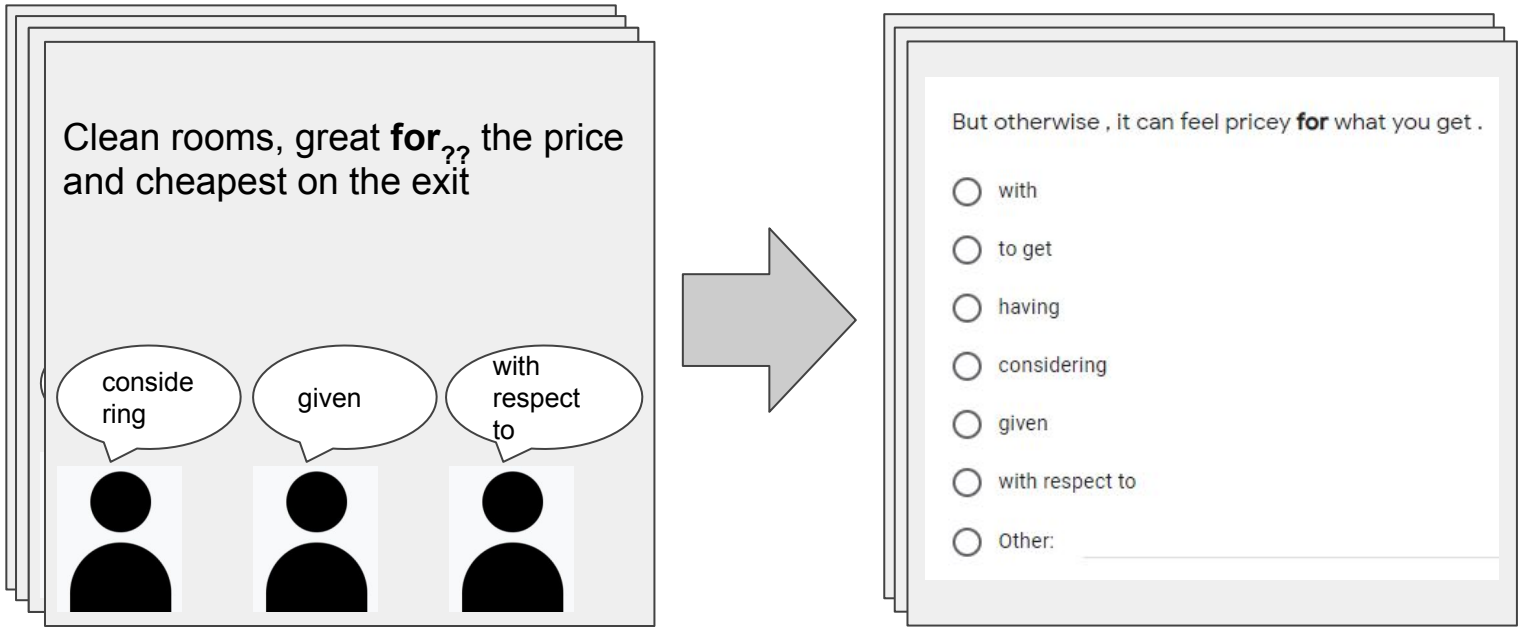
Step 2: crowdworkers **select** substitute phrases



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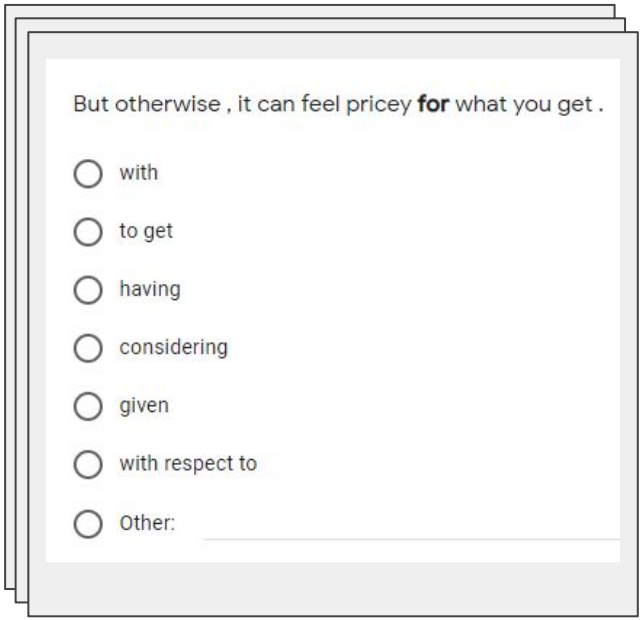
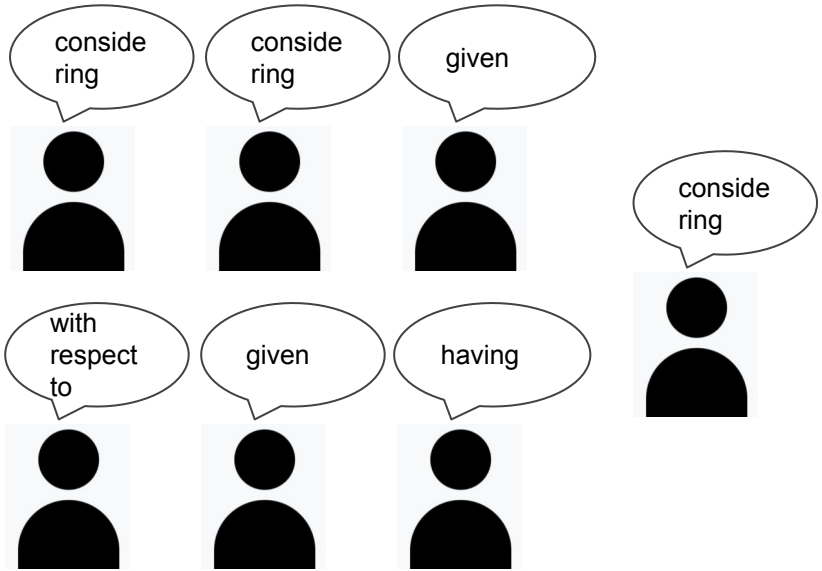
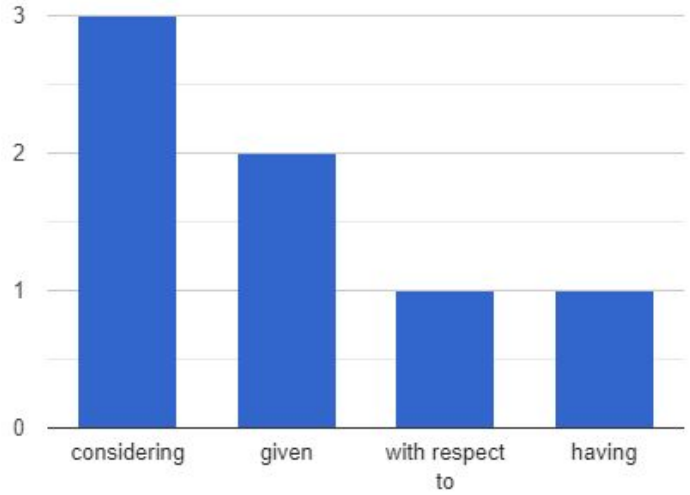




Design 1: Preposition Substitution

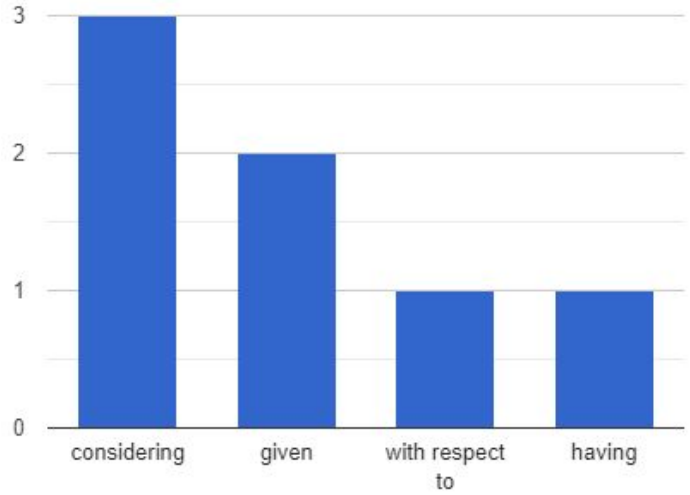
Result: a **distribution across substitutes**, given a **preposition** as used in a **sentence**



But otherwise, it can feel pricey **for** what you get

Design 1: Preposition Substitution

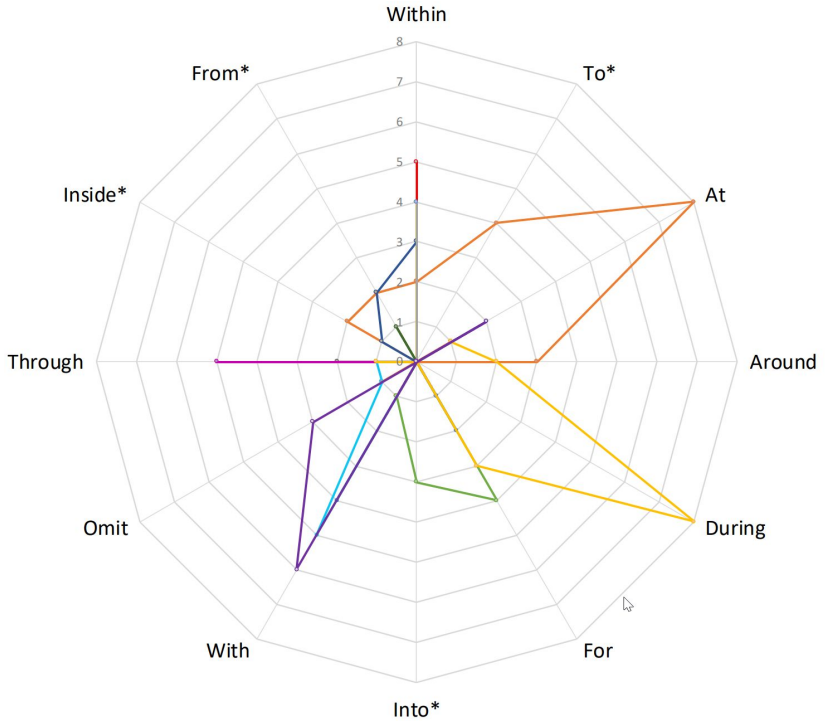
Result: a **distribution across substitutes**, given a **preposition** as used in a **sentence** which we can use for **supersense inference**



But otherwise, it can feel pricey **for** what you get

Design 1: Preposition Substitution

Distributions for **in** aggregated by gold supersenses



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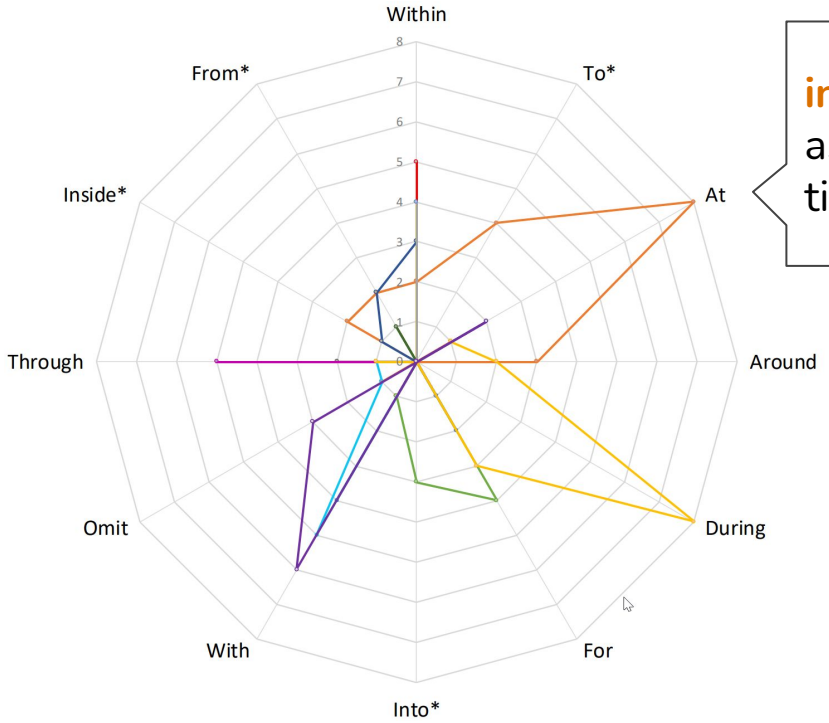
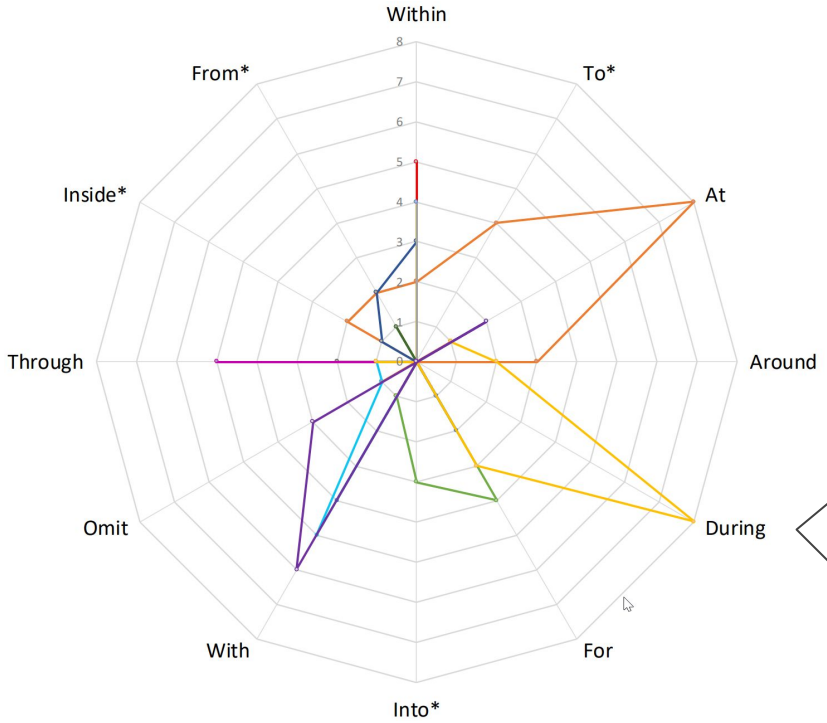


in$_{\textbf{Locus}}$ paraphrased as ***at*** 8 times, ***to*** 4 times, …

Design 1: Preposition Substitution

Distributions for **in** aggregated by gold supersenses



in_{Time} paraphrased as ***during*** 8 times, ***around*** 2 times, ...

Design 2: Neighbor Selection

Step 1: given a **target instance**

I am **in**$_{??}$ love with a giant plate of nachos!

Design 2: Neighbor Selection

Step 1: given a **target instance**, retrieve **similar instances** from a **gold corpus**

I am **in**$_{??}$ love with the giant plate of nachos!

- I am now more **at**$_{\text{Characteristic|Locus}}$ peace and my food craving is about 99% gone
- They are very rude over the phone and **in**$_{\text{Circumstance|Locus}}$ person
- They worked **around**$_{\text{Time}}$ the clock to ensure that my puppy life was saved.

Design 2: Neighbor Selection

Step 1: given a **target instance**, retrieve **similar instances** from a **gold corpus** (by taking **supersense tag probability vectors** for the target instance and gold-tagged instances and ranking them)

I am **in**$_{??}$ love with the giant plate of nachos!

- I am now more **at**$_{\text{Characteristic|Locus}}$ peace and my food craving is about 99% gone
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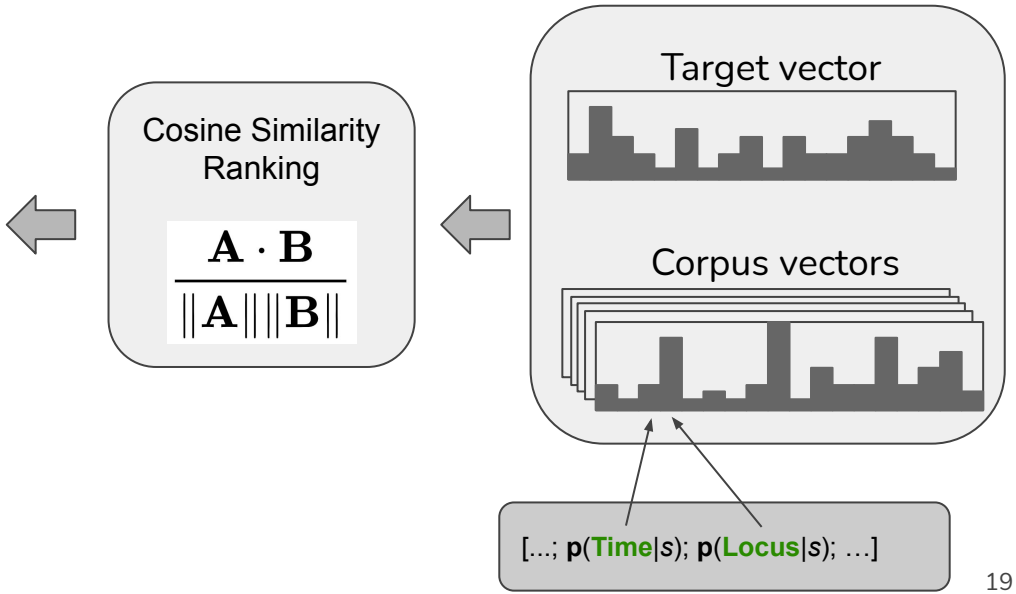
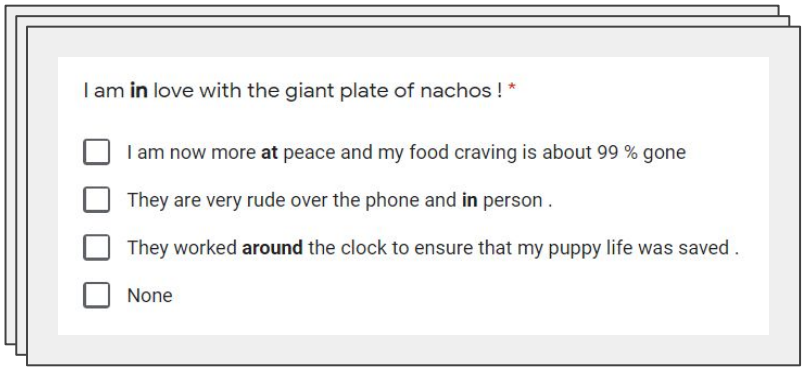


Design 2: Neighbor Selection

Step 2: Crowdworkers select an appropriate neighbor, the **majority winner**'s **gold tag** is used for the target instance



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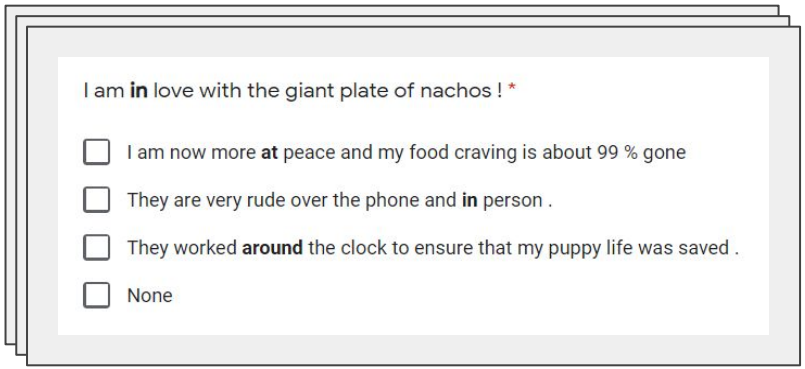

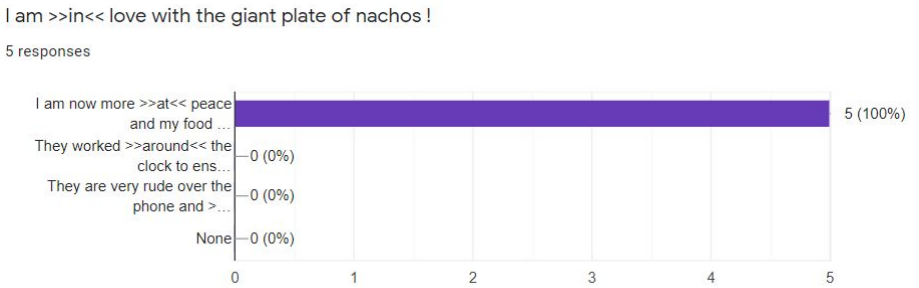

- I am **in**$_{??}$ love with the giant plate of nachos!

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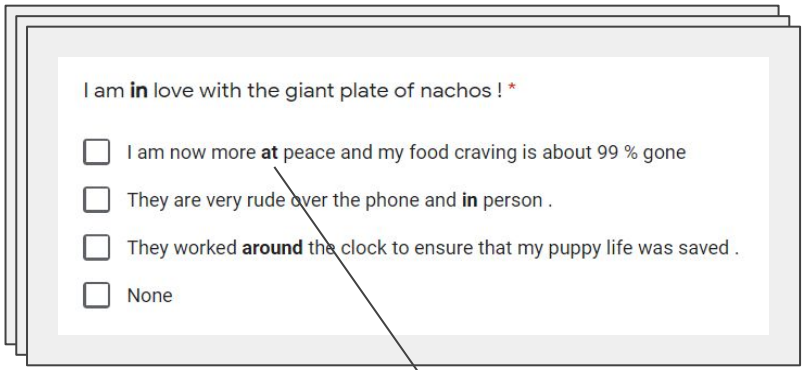

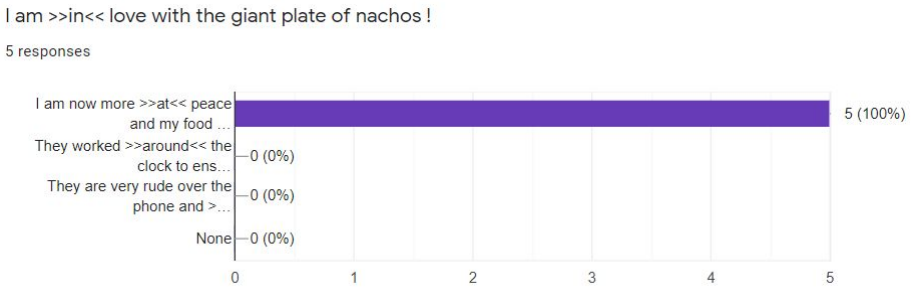

- I am **in** **Characteristic|Locus** love with the giant plate of nachos!

Design 2: Neighbor Selection

Two questions

- What if no neighbor has a supersense that matches the target?

I am **in**$_{\text{??}}$ (Characteristic|Locus) love with the giant plate of nachos!

- Again, a great outing for the kids, a frustration for an **out**$_{\text{Locus}}$ of town climber
- They are very rude over the phone and **in**$_{\text{Circumstance|Locus}}$ person
- They worked **around**$_{\text{Time}}$ the clock to ensure that my puppy life was saved.
- None

Design 2: Neighbor Selection

Two questions

- What if no neighbor has a supersense that matches the target?
  → **crowd should select none**

I am **in**$_{\text{??}}$ (Characteristic|Locus) love with the giant plate of nachos!

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Design 2: Neighbor Selection

Two questions

- What if no neighbor has a supersense that matches the target?
  → **crowd should select none**

- Is the quality of the neighbors seriously affected if the predicted tag for the target is wrong?

I am **in**$_{\text{Circumstance|Locus}}$ love with the giant plate of nachos!

- I am now more **at**$_{\text{Characteristic|Locus}}$ peace and my food craving is about 99% gone
- They are very rude over the phone and **in**$_{\text{Circumstance|Locus}}$ person
- They worked **around**$_{\text{Time}}$ the clock to ensure that my puppy life was saved.
- None

Design 2: Neighbor Selection

Two questions

- What if no neighbor has a supersense that matches the target?
  → **crowd should select none**

- Is the quality of the neighbors seriously affected if the predicted tag for the target is wrong?
  → **hopefully, a neighbor with the appropriate tag will still be retrieved**

I am **in**$_{\text{Circumstance|Locus}}$ love with the giant plate of nachos!

- I am now more **at**$_{\text{Characteristic|Locus}}$ peace and my food craving is about 99% gone
- They are very rude over the phone and **in**$_{\text{Circumstance|Locus}}$ person
- They worked **around**$_{\text{Time}}$ the clock to ensure that my puppy life was saved.
- None

Design 2: Neighbor Selection

Case	Tagger	Crowd	"None"
1 (Tagger correct, gold present)	17/17	17/17	0/17
2 (Tagger incorrect, gold present)	0/12	6/12	5/12
3 (Tagger correct, gold absent)	3/3	0/3	2/3
4 (Tagger incorrect, gold absent)	0/8	0/8	5/8

Pilot study

- 40 instances, 5 workers
- Divide instances for analysis by (1) tag correctness, (2) presence of the target instance's gold tag among neighbors

Design 2: Neighbor Selection

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Pilot study

- What if no neighbor has a supersense that matches the target?
  → **crowd often selects none**

- Is the quality of the neighbors seriously affected if the predicted tag for the target is wrong?
  → **appropriate neighbors are still retrieved sometimes**

Conclusion

- Under **ideal conditions**, can we obtain **labels** from **proxy tasks**, by having crowdworkers solve an easy task, and then inferring the labels from their output?
  - Yes!

- Future work
  - **Implementation** on a platform like Amazon Mechanical Turk
  - Different **ranking strategies** for the neighbor selection design
  - Explore **tradeoffs** between the two designs
  - Application to **different annotation tasks**