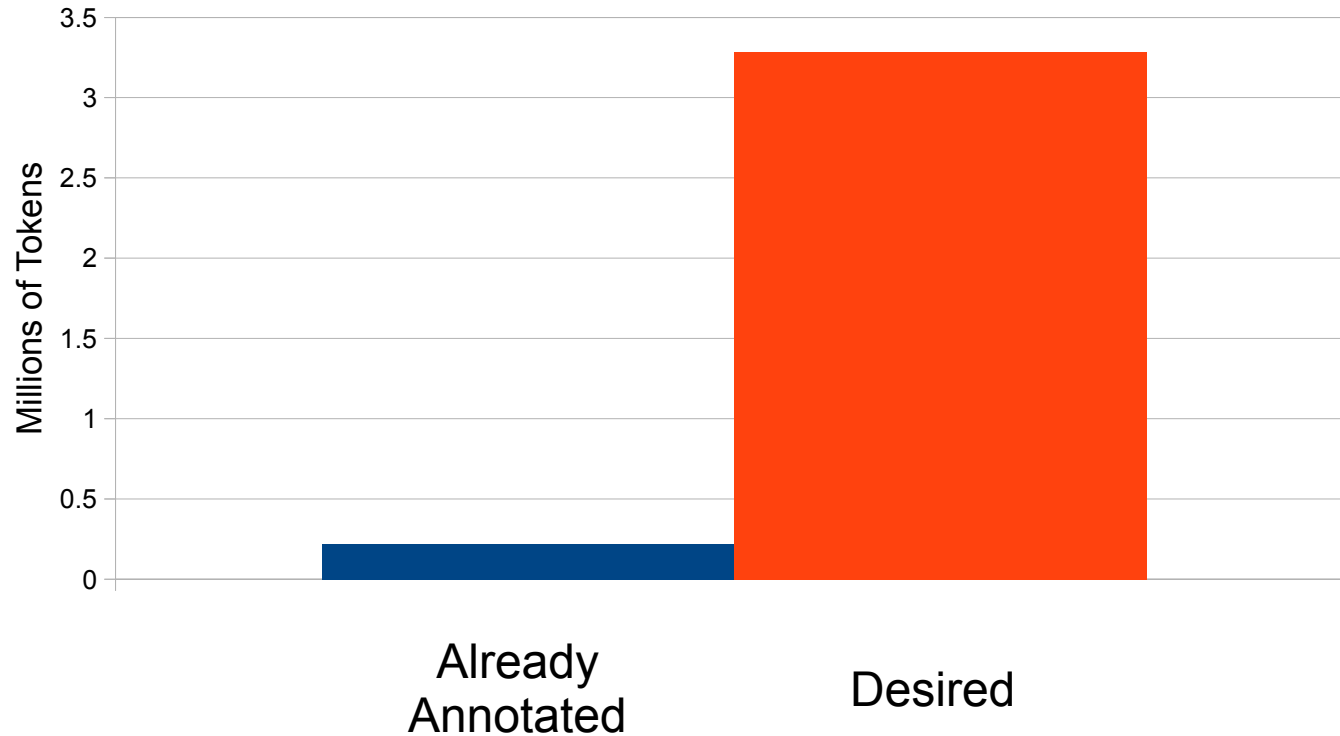


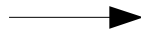
# Semantic Parsing into AMR

Speaker: Jeffrey Flanigan (CMU)

# Motivation



Want MT systems  
that use AMR



Need AMR  
parses



Need AMR  
**parser** for English

# Parsing into AMR

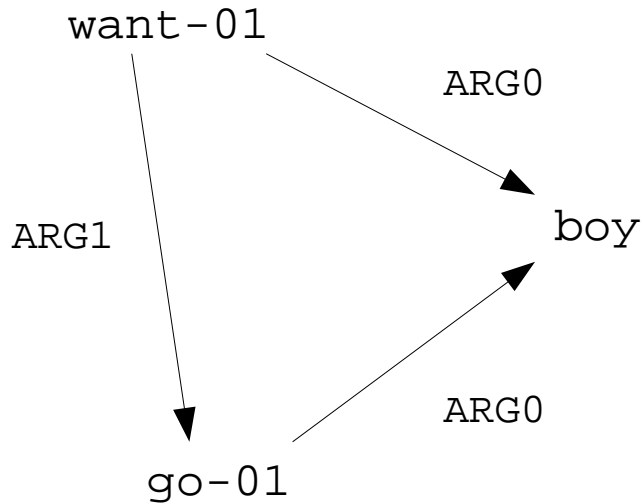
Approximately 11000 guards patrol the 1200 - kilometre border between Russia and Afghanistan.

```
(p / patrol-01
  :ARG0 (g / guard
    :quant (a2 / approximately
      :op1 11000))
  :ARG1 (b / border
    :quant (d4 / distance-quantity
      :unit (k2 / kilometer)
      :quant 1200)
    :location (b2 / between
      :op1 (c / country
        :name (n / name
          :op1 "Russia"))
      :op2 (c2 / country
        :name (n2 / name
          :op1 "Afghanistan")))))
```

# AMRs as Graphs

The boy wants to go.

```
(w / want-01
  :ARG0 (b / boy)
  :ARG1 (g / go-01
        :ARG0 b)
```



```
(w / want-01, ARG0, b / boy)
(w / want-01, ARG1, g / go-01)
(g / go-01, ARG0, b / boy)
```

# Technical Heritage

- Multiple stages: concept identification, relation identification
  - Common technique in semantic parsers
- Edge factored: cost for each relation in isolation
  - Computationally attractive
  - Most (all?) semantic parsers assume this
- Assume rich input:
  - Output of syntactic parsers, POS taggers, **semantic features** (next talk) as input

# New Challenges

- Single, connected graph
- Many tasks in one:
  - Word sense disambiguation
  - Named entity recognition
  - Semantic role labeling

# Parsing into AMR

Approximately 11000 guards patrol the 1200 - kilometre border between Russia and Afghanistan.

# Parsing into AMR

Approximately 11000 guards patrol the 1200 -  
kilometre border between Russia and Afghanistan.

## Invoked concepts:

```
a2 / approximately  
11000  
p / patrol-01  
g / guard  
(d4 / distance-quantity :unit (k2 / kilometer)  
1200  
b / border  
b2 / between  
(c / country :name (n / name :op1 "Russia"))  
(c2 / country :name (n2 / name :op1 "Afghanistan"))
```



# Parsing into AMR

Approximately 11000 guards patrol the 1200 -  
kilometre border between Russia and Afghanistan.

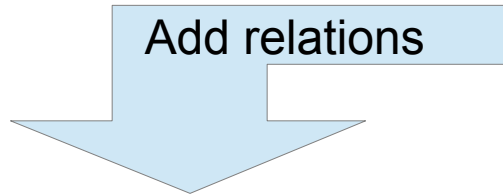
## Invoked concepts:

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a2 / approximately  
11000  
p / patrol-01  
g / guard  
(d4 / distance-quantity :unit (k2 / kilometer)  
1200  
b / border  
b2 / between  
(c / country :name (n / name :op1 "Russia"))  
(c2 / country :name (n2 / name :op1 "Afghanistan"))
```

**Sequence labeling task**  
well-studied algorithms exist

# Parsing into AMR

Approximately 11000 guards patrol the 1200 - kilometre border between Russia and Afghanistan.

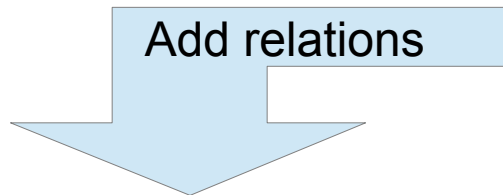


```
a2 / approximately
11000
p / patrol-01
g / guard
(d4 / distance-quantity :unit (k2 / kilometer)
1200
b / border
b2 / between
(c / country :name (n / name :op1 "Russia"))
(c2 / country :name (n2 / name :op1 "Afghanistan"))
```

```
(p / patrol-01
:ARG0 (g / guard
:quant (a2 / approximately
:op1 11000))
:ARG1 (b / border
:quant (d4 / distance-quantity
:unit (k2 / kilometer)
:quant 1200)
:location (b2 / between
:op1 (c / country
:name (n / name
:op1 "Russia"))
:op2 (c2 / country
:name (n2 / name
:op1 "Afghanistan"))))))
```

# Parsing into AMR

Approximately 11000 guards patrol the 1200 - kilometre border between Russia and Afghanistan.



```
a2 / approximately
11000
p / patrol-01
g / guard
(d4 / distance-quantity :unit (k2 / kilometer)
1200
b / border
b2 / between
(c / country :name (n / name :op1 "Russia"))
(c2 / country :name (n2 / name :op1 "Afghanistan"))
```

```
(p / patrol-01
:ARG0 (g / guard
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:quant (d4 / distance-quantity
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:quant 1200)
:location (b2 / between
:op1 (c / country
:name (n / name
:op1 "Russia"))
:op2 (c2 / country
:name (n2 / name
:op1 "Afghanistan"))))))
```

Find the **maximum-weighted, connected, spanning graph** (with additional constraints)

# Performance

- Preliminary system (work in progress!)
- Train on 2.5k annotated sentences
- Test on 2.5k annotated sentences (different from train)
- Gold standard invoked concepts
- Evaluated using Smatch (ISI)

73% F1 score

# Actual Output

The United States urged North Korea to meet obligations under international arms control accords.

<u>Output AMR:</u>	<u>Edge score</u>
(a / accord, mod, i / international)	-3.9
(c / country, name, n / name)	-22.2
(c2 / country, name, n2 / name)	-20.2
(c3 / control-01, ARG0, a / accord)	-0.1
(c3 / control-01, ARG1, a2 / arm)	59.9
(m / meet-01, ARG1, o / obligation)	60.4
(m / meet-01, prep-under, a / accord)	-1.9
(n / name, op, "States")	-26.1
(n / name, op, "United")	-26.1
(n2 / name, op, "Korea")	-24.1
(n2 / name, op, "North")	-24.1
(u / urge-01, ARG0, c / country)	1.5
(u / urge-01, ARG1, c2 / country)	66.9
(u / urge-01, purpose, m / meet-01)	-1.1

## Human annotated AMR:

.  
. (same as above)  
.

(u / urge-01, ARG2, m / meet-01) -2.3

# Thank you!

```
(t / thank-01  
  :ARG1 (y / you))
```