Do phrases with same head nouns refer to the same thing?

**Coreferent**

*Alice sat on the bank...*  
*Her sister was reading a *book**

Same person

**Not coreferent**

*Alice thought, "What good is a *book* without pictures?"

Not the same!

Most unsupervised work assumes they always do... True only about half the time!

Results depend on experimental design

- Most unsupervised work:
  - Gold mentions boundaries: $b^3$
  - Scoring: punish errors in large clusters
  - Maximum loss caused by same-head assumption: 3.3%

- More sensitive to small errors:
  - Parser mention boundaries: CEAF
  - Scoring: all errors equal
  - Loss caused by same-head assumption is greater: 11.2%

Standard experiments are insensitive to same-head NPs

Modeling improves precision

- IBM model 2:
  - For coreferent phrases: choose antecedent based on syntax
    - Source (possible antecedents): *Alice sat on the bank by her sister.*
    - Hidden alignment: $p(ante=sister) \propto \exp(w-f)$
    - Target (context of next NP): *TARGET* was reading a *book*...
  - Distribution over antecedents: log-linear model based on syntactic features, Tree distance, syntactic role, modifiers, etc.

- For non-coreferent phrases: choose antecedent at random
  - Generative mixture model
  - Unsupervised learning via EM: M-step estimates log-linear model

Model trades recall for precision (marks fewer NPs coreferent)

- Standard unsupervised: $b^3$ prec +13%, $b^3$ rec -10%; $b^3$ F -13%

- More sensitive to small errors: CEAF +5% (reduces loss by half)

Syntactic model for same-head NPs can improve over heuristic