

Subjectivity and English Adjective Ordering (AO)

I. The Problem

Some orderings sound clearly wrong

- (1) *Cambridge is a beautiful academic city*
- (2) ? *Oxford is an academic beautiful city*

Modifier order affects meaning

- (3) *dirty French book* → covered in dirt
- (4) *French dirty book* → adults only
- (5) *wild office party* → wild
- (6) *wild bird enthusiast* → almost certainly not wild

This poses multiple NLP challenges

SPANISH: *Un verano ingles lluvioso*
 ENGLISH: **An English summer rain*
 Google Translate Jan 2013: *Un verano lluvioso ingles* → **A rainy summer English*

- Room for improvement in AO systems for English language generation - 82% best reported accuracy (Mitchell et al. 2011)
- No cross-linguistic systems
- Extracting semantic representations of complex NPs is hard

IV. Features of Adjective Subjectivity

Features potentially indicative of subjectivity – derived from:

- linguistic analysis
- automatic subjectivity quantification e.g. (Wiebe 2000)

MODIFIABILITY: Likelihood that adjective takes a 'degree modifier' (*very hot, really tired*)

COMPARABILITY: Likelihood that adjective takes (morphological or composite) comparative or superlative form (Wiebe 2000) (*colder, the most expensive*)

PREDICATIVITY: Occurrence in predicative (*I am confused*) vs. attributive (*a confusing poster*) constructions

POLARITY: Positive/negative sentiment (*wonderful, terrible*) vs. neutral (*quiet, yellow*) (Wiebe 2000)

ADVERBIABILITY: Prevalence of derived adverbial forms (*slow* → *slowly, yellow* † **yellowly*)

NOMINALITY: Prevalence of nominal senses (expected to indicate objectivity) (*the British are intolerable*)

V. Outcomes

- Features combined are highly significant predictors of AO $\chi^2 = 2257$ $p < 0.001^*$
- Ordering accuracy of unseen combinations 73.0%
- Accuracy rises to 86.3% if testing on the 3000 pairs with highest ordering preference in N-gram Corpus (70.1% lowest 3000)

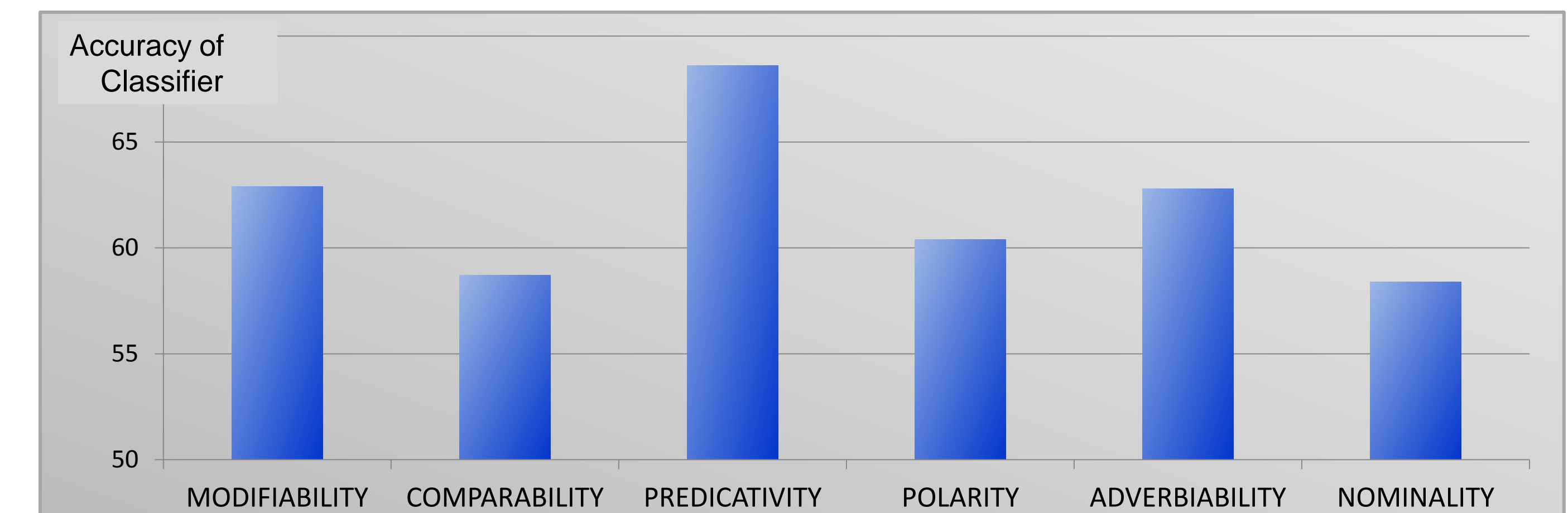


Figure 3: Performance of each feature in isolation

- All features apart from COMPARABILITY are statistically significant in combined model $p < 0.001^*$
- NOMINALITY correlates inversely with distance from head noun as predicted
- All features statistically significant predictors in isolation $p < 0.001^*$
- Introduction of 'direct' feature LEFTTENDENCY increases accuracy to 76.3%

II. The Subjectivity Hypothesis

- *Subjectivity*: the degree to which an utterance can or cannot be interpreted independently of speaker perspective (Langacker 1991)
- *Hypothesis*: More subjective adjectives appear further from the noun

beautiful English rose ✓ (250,000 hits on Google)
English beautiful rose ✗ (2,000 hits on Google)
 beauty is in the eye of the beholder; nationality isn't



Figure 1: Subjectivity Hypothesis was tested with diachronic analyses using Google n-Gram Viewer. In its original meaning, *gay* was more subjective than *young*. The new meaning is less subjective.

III. System Overview

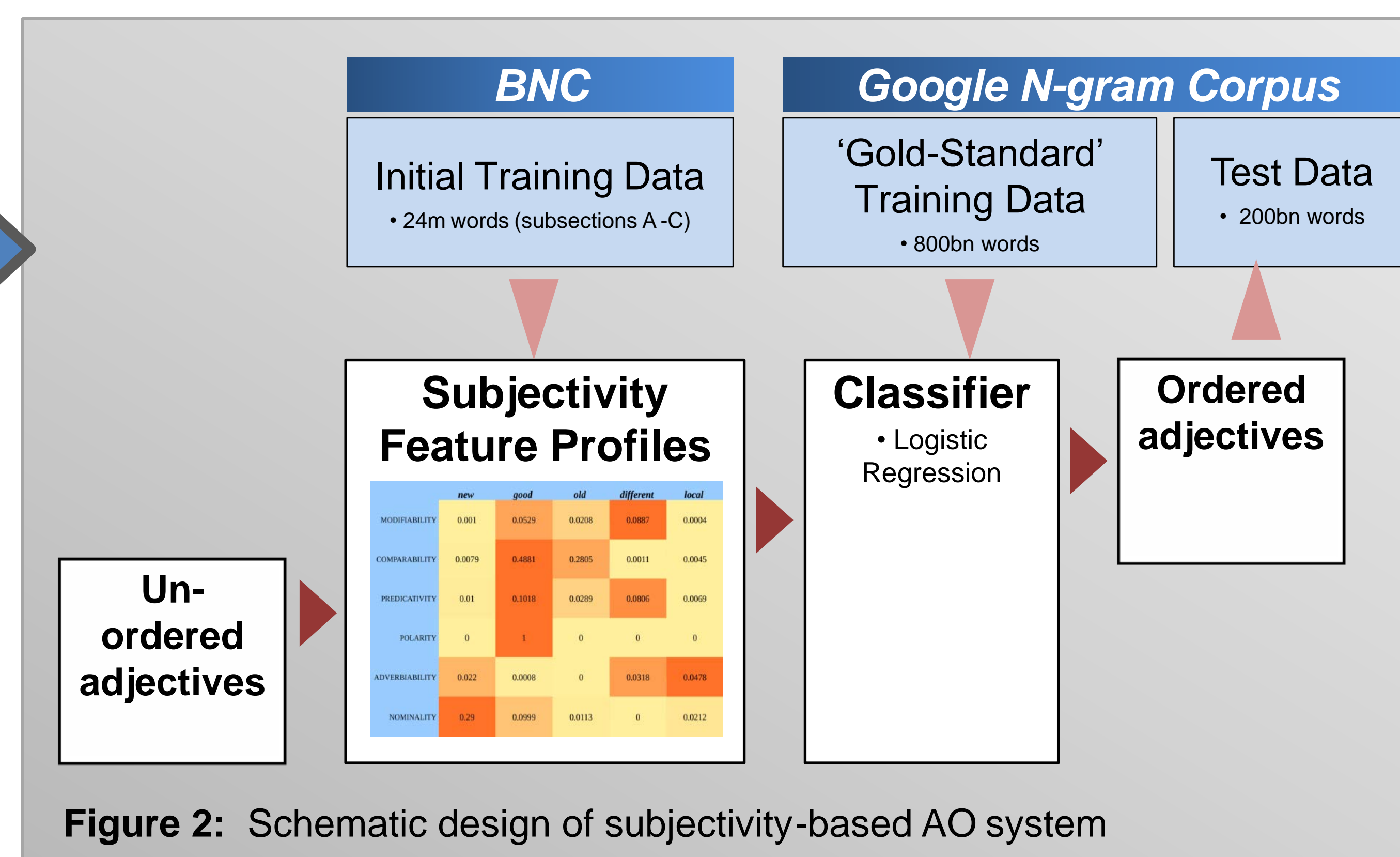


Figure 2: Schematic design of subjectivity-based AO system

- Feature profiles extracted for each from 24m words of BNC data
- Logistic regression classifier trained on 'correct' orderings taken from 1st word Google N-gram Corpus – then tested on unseen pairs

VI. Conclusions

Implications:

- Semantic features can be usefully incorporated into AO systems
- Potential to apply distributional subjectivity features to other tasks e.g. phrase-level semantic interpretation and inference, and cognitive modelling
- Strong empirical evidence for the subjectivity hypothesis for AO previously supported only by discussion and examples

Future work:

- **More Training Data:** Analysis shows rising accuracy when more data used for feature extraction (73.0% for 24m words vs. 71.1% for 7m words)
- Combine semantic (subjectivity) and direct (n-gram) features
- **Direct comparison with existing benchmarks:** Current testing framework does not correspond to other published work

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References

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- Langacker, R. 1991. *Foundations of Cognitive Grammar*. Stanford, CA: Stanford University Press
- Wiebe, J. 2000. Learning Subjective Adjectives from Corpora. *Proc. 17th National Conference on Artificial Intelligence (AAAI-2000)*