# Forms of Anaphoric Reference to Organisational Named Entities: Hoping to widen appeal, they diversified

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# Organisational Named Entities

- Names of organisations: Companies, political bodies, sport teams, music bands, etc.
- Often made-up words (*Intel*, *Novartis*) or acronyms (*EU*, *Unesco*)
- Little information about number or gender
- Different conceptualisation
  - Singular: collective as a unit
  - Plural: individuals within organisation

# Names of Organisations as Collective Nouns

- Special case of *collective nouns* such as *team*, *family*, etc.
- Studied in English linguistics, especially for verb agreement
- Can be used with singulars (*syntactic agreement*) or plurals (*notional concord*) in English
- American English: often singular verbs but plural pronouns
- Singular and plural agreement can co-occur (*mixed concord*)

# Our Study

**Research question:** What forms are possible and preferred when re-mentioning named entities?

- Current study on English – multilingual extension planned
- Two types of experiments:
  - Corpus study on OntoNotes
  - Story continuation experiments on Mechanical Turk

# Four Types of References

We consider four types of references to organisations:

name noun it they

**Name: Repetition of the proper name**

> Since the introduction of the first MacBook,
> Apple grew bigger and bigger.

> Last year, Apple sold the most MacBooks in its history.

# Four Types of References

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name noun it they

**Noun: Paraphrastic noun phrases**

AC/DC achieved international success in 1976.

In the next forty years, the band continued to attract more loyal fans.

# Four Types of References

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name noun it they

**It: Pronoun with singular conceptualisation**

> Since the introduction of the first MacBook,
> Apple grew bigger and bigger.

> Last year, it had record sales.

# Four Types of References

We consider four types of references to organisations:

name noun it they

**They: Pronoun with plural conceptualisation**

Google entered the search machine business in 1998.

Ten years later, they were still in business.

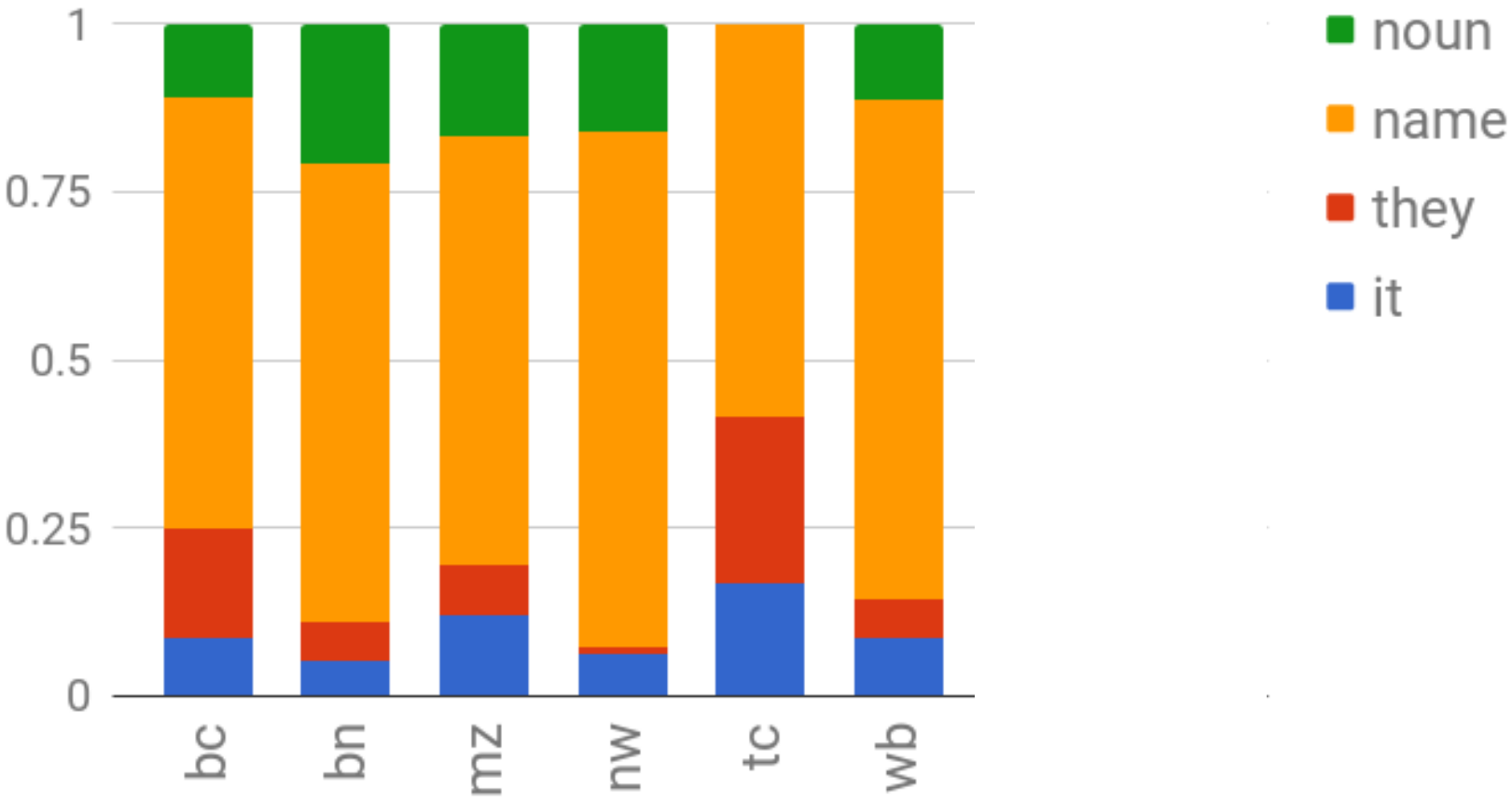
# Example Extraction

- OntoNotes: ~1.7 million words of American English text
- Gold-standard coreference and named entity annotations
- Subcorpora:

| | | | |
|---|---|---|---|
| **bc** | broadcast conversation | **bn** | broadcast news |
| **mz** | magazines | **nw** | newswire |
| **tc** | telephone conversations | **wb** | web data |

- Each example:
  - a pair of mentions belonging to the same coreference chain
  - occurring in adjacent sentences
  - with no intervening mentions from the same chain

# Reference Types per Genre



# Reference types per genre

| | it | they | name | noun | other | total |
|---|---|---|---|---|---|---|
| bc | 8 | 15 | 59 | 10 | 13 | 105 |
| bn | 11 | 12 | 146 | 44 | 12 | 225 |
| mz | 17 | 11 | 91 | 24 | 4 | 147 |
| nw | 76 | 11 | 926 | 193 | 36 | 1242 |
| tc | 2 | 3 | 7 | 0 | 0 | 12 |
| wb | 6 | 4 | 52 | 8 | 4 | 74 |
| | 120 | 56 | 1281 | 279 | 69 | 1805 |

# Formality and Use of *it*

- **Hypothesis:** *Singular conceptualisation is more likely in more formal text genres.*
- Suggested for general collective nouns (Hundt, 2009)
- Measure: proportion of *it* among pronominal references:

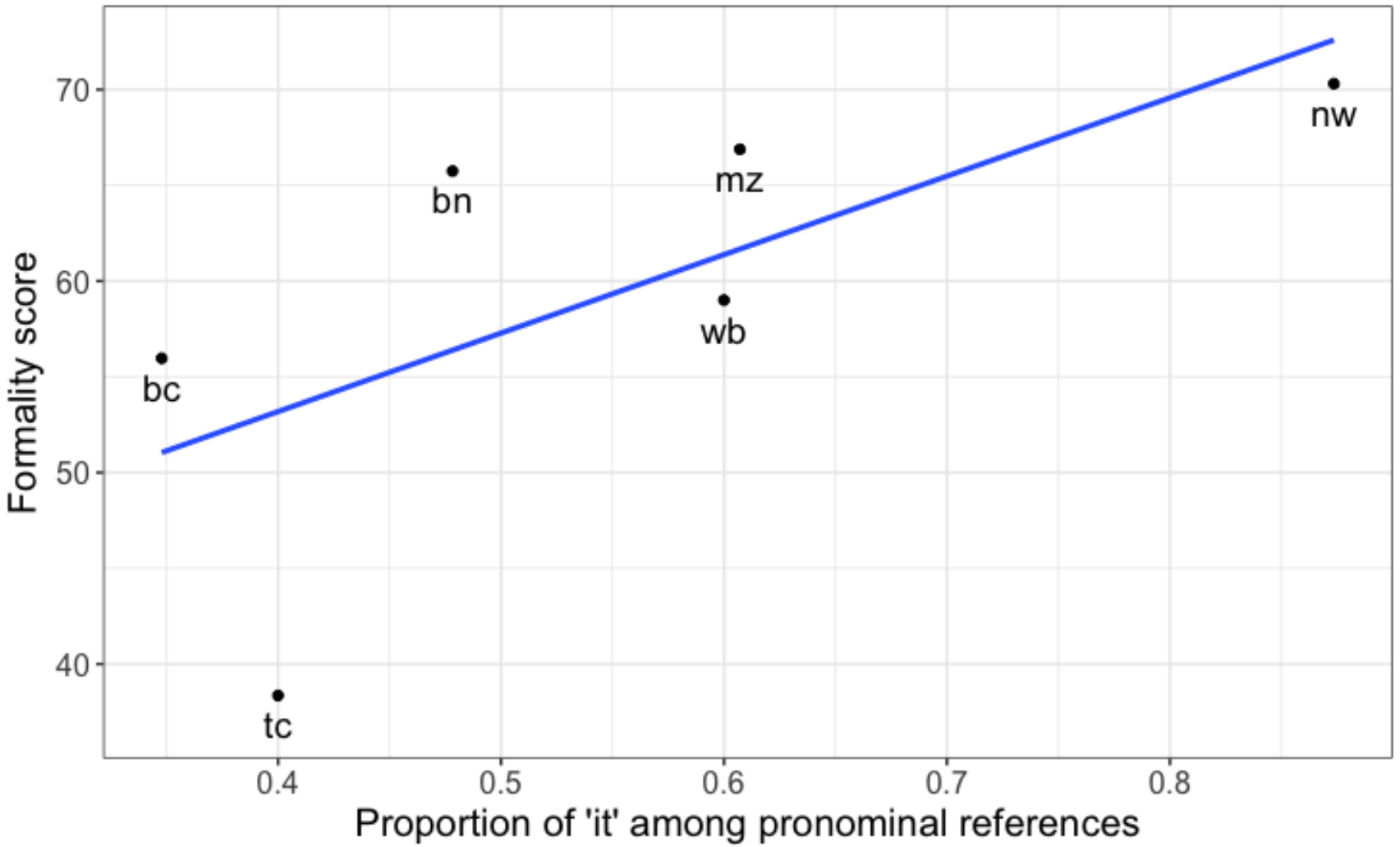
$$\frac{N(\text{it})}{N(\text{it}) + N(\text{they})}$$

# Measuring Formality

- Metric of text formality (Heylighen & Dewaele, 2002)
- Assumption: Formality is reflected in the use of certain parts of speech.
- *Formal* vocabulary: nouns, adjectives, prepositions, articles
- *Deictic* vocabulary: pronouns, verbs, adverbs, interjections
- Score calculation:

$$F = 100 \cdot \frac{N_{\text{formal}} - N_{\text{deictic}}}{2N} + 50$$

# Formality and Use of *it*



# Conclusions

- Correlation between formality and singular conceptualisation confirmed in OntoNotes.
  - Rank correlation is significant ($\rho = 0.886; p < 0.05$).
  - Linear correlation is not ($r = 0.67; p = 0.146$).
- *Modality* also seems to play a role:
  Strongest preference for *they* in the spoken subcorpora.

# Continuation Experiments

- Two crowdsourcing experiments on Amazon Mechanical Turk
- Participants saw 16 target items + 48 fillers
- Each item was a pair of sentences:
  - Sentence #1: introduced a named entity in subject position
  - Sentence #2: adverbial prompt to elicit a reference to the named entity
- Instructions: complete sentence #2

# Two Studies

**Study 1: Constructed stimuli**

- 27 mturk participants (restricted to US IP addresses)
- Prompt sentences constructed by the authors
- Four types of named entities: Companies, publishers, sport teams and music bands

Last week, Intel announced the shutdown of the factory. In the press release, _____

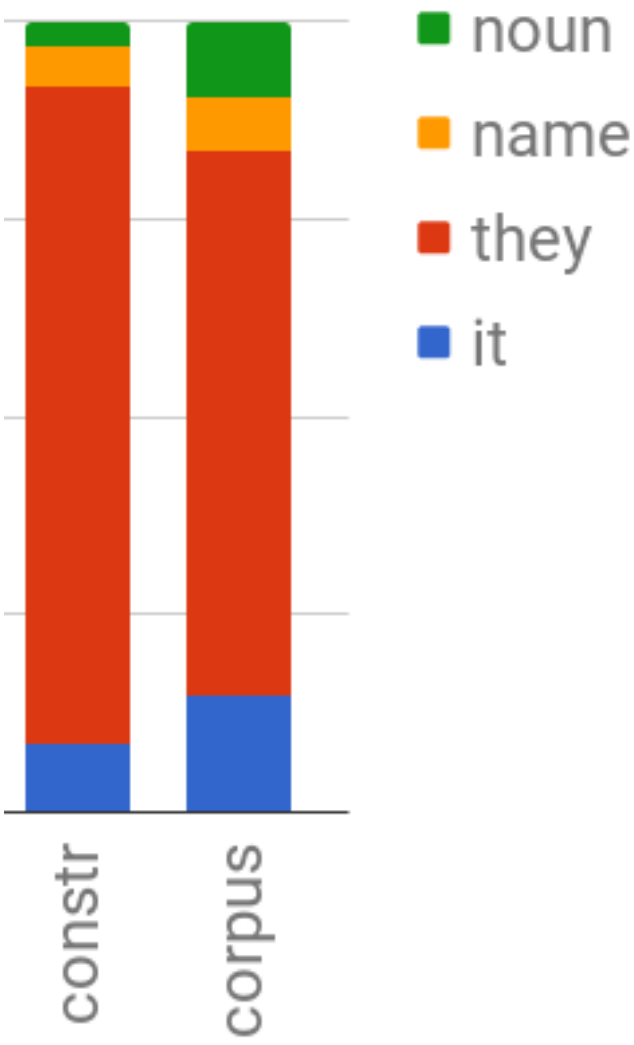
# Two Studies

**Study 2: Corpus stimuli**

- 19 mturk participants (same US IP address restriction)
- Prompt sentences extracted from OntoNotes and simplified
- Continuations constructed to increase chances of eliciting a reference to the named entity
- Generally longer and more complex than Study 1 stimuli
- Unrelated filler items likewise from corpus data

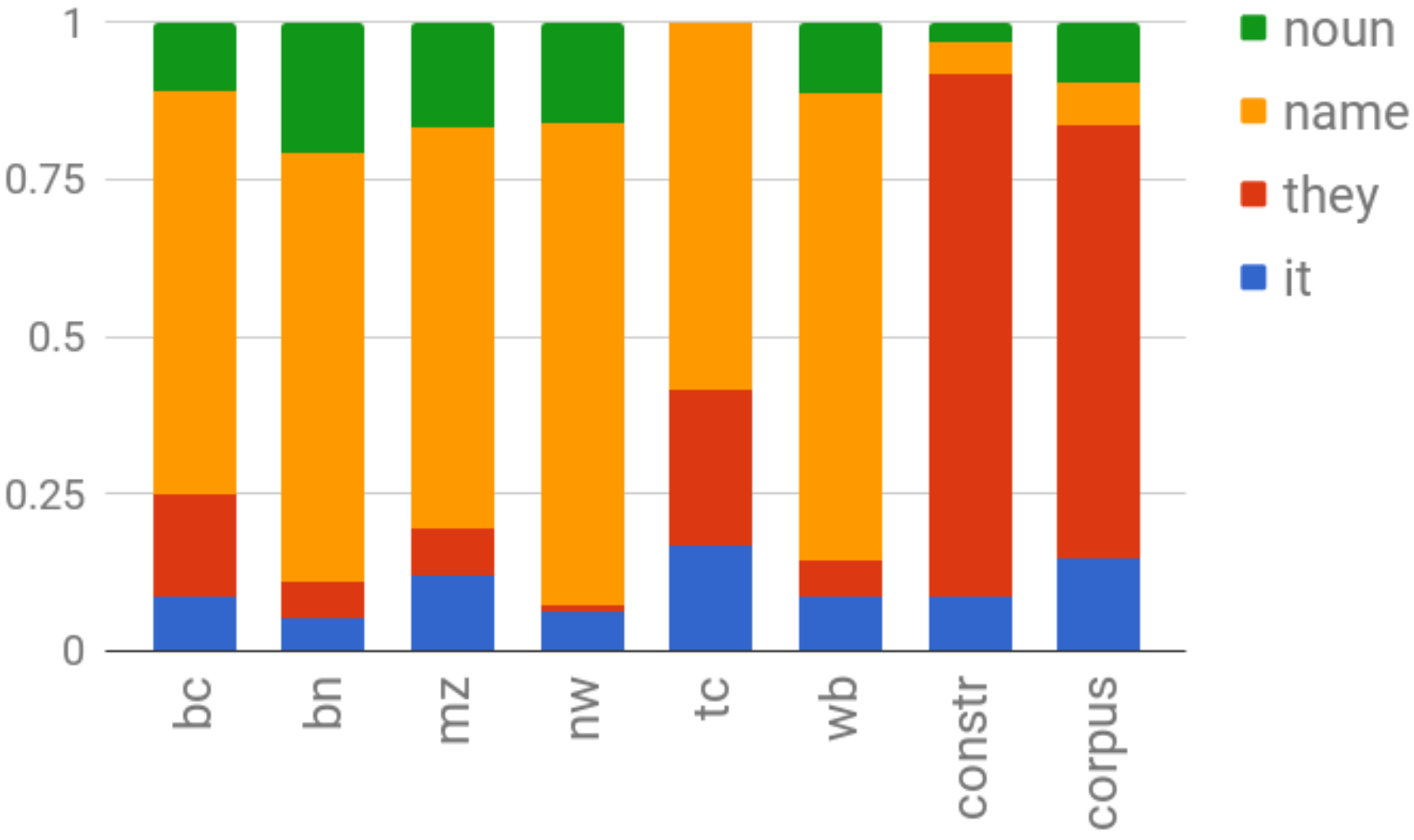
To distinguish itself, CNN is also expanding international coverage and adding a second global-news program. At the annual press conference, _____

# Continuation Studies: Results




| | constructed | corpus |
|---|---|---|
| it | 32 | 24 |
| they | 307 | 113 |
| name | 19 | 11 |
| noun | 12 | 16 |
| total | 370 | 164 |

# All Results



# Conclusions

- Very high proportion of *they* in continuation study.
- More varied responses with corpus stimuli, but *they* is still dominant.
- In OntoNotes, *they* use is negatively correlated with formality.
- Results of continuation study are more representative of informal and spoken language, even though the task was done in writing.
- Results will be used as a baseline in a multilingual experiment on English, German, French, Italian and Spanish.

# Questions

Further questions can be addressed to:

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