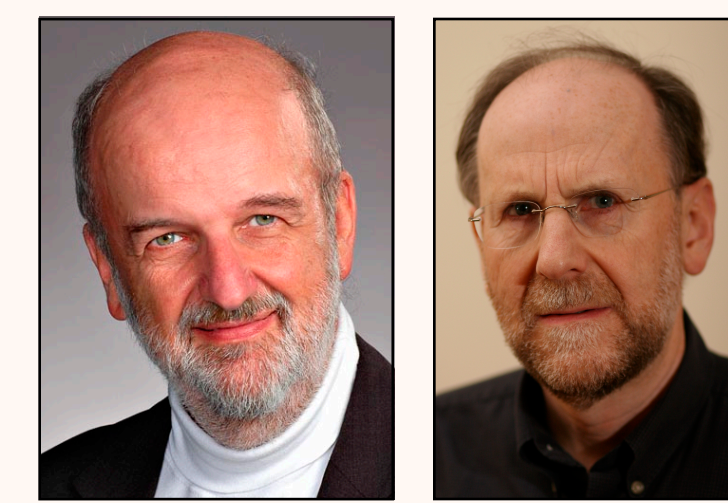


Vocabulary Changes in Agatha Christie's Mysteries as an Indication of Dementia: A Case Study

Ian Lancashire* and Graeme Hirst†

University of Toronto, *Department of English and †Department of Computer Science

ian.lancashire, graeme.hirst@utoronto.ca



Agatha Christie

Abstract

Although the novelist Agatha Christie was never diagnosed with dementia, it is believed to have been the cause of her decline in her later years. We analyzed the vocabulary size, the repeated use of fixed phrases, and the indefinite noun usage in 16 Agatha Christie novels written between ages 28 and 82. We found statistically significant drops in vocabulary, and increases in re-

peated phrases and indefinite nouns in 15 detective novels from *The Mysterious Affair at Styles* to *Postern of Fate*. These language effects are recognized as symptoms of memory difficulties associated with Alzheimer's disease. Our study supports the conclusion that Agatha Christie's last few novels show early signs of encroaching dementia.

1. Language in normal aging and in Alzheimer's disease

Language in normal aging and in Alzheimer's disease (AD)

- Vocabulary richness (Maxim & Bryan 1994):
 - ▶ *Normal aging*: Mental lexicon expands indefinitely but retrieval is slower;
 - ▶ *AD*: Mental lexicon becomes inaccessible.
- Use of indefinite words (*thing, anything, something*):
 - ▶ *Normal aging*: Modest increase (Maxim & Bryan 1994: 46);
 - ▶ *AD*: Dramatic rise (Nicholas et al. 1985).
- Repetition, including fixed phrases (Nicholas et al. 1985):
 - ▶ *Normal aging*: Some increase;
 - ▶ *AD*: Greater increase.
- Syntax (Bates et al. 1995):
 - ▶ *Normal aging*: No effect in range of structures;
 - ▶ *AD*: Decline in passives and embedded clauses; increase in conjunctions (Ellis 1996).
- Discourse
 - ▶ *Normal aging*: Focus on essentials, the so-called "late style";
 - ▶ *AD*: Incoherence, shortening, perseverations (Harnish and Neils-Strunjas 2008).

2. Agatha Christie (1890–1976)

Background

- Wrote about 85 novels and plays in 53-year career.
 - ▶ 2 billion copies sold by 1990.
 - ▶ Mostly detective novels following strict rules of genre.
- Crafted each plot meticulously before commencing writing.
 - ▶ Little or no editing by publisher.

Aging and decline

- Physical and mental decline from her late 70s.
- Last few novels are meandering, confused.
- Never diagnosed for dementia.

3. Experiment

Goal: Analyze Christie's writing for changes that indicate possible dementia.

- Follow general idea of Garrard et al.'s (2005) study of Iris Murdoch, but cover material much more comprehensively.

Materials

- 16 Christie novels from age 28 to 82 — first 50,000 words of each.

Analysis

- Count number of different words (*word-types*) used in each.
- Count number of fixed phrases repeated in each.
- Count number of indefinite words (*thing, anything, something*) in each.

4. Results

Decrease in vocabulary size

- Decreases by 15–30% from ages 28–32 to 81–82.
- Approaches significance [$F(1,14) = 3.95, p = .066$] even with outlier (*see box 5 below*); highly significant without it [$F(1,13) = 9.80, p < .01$].

Increase in use of repeated phrases

- Increases by 14% between ages 28–32 and 81–82.
- Approaches significance [$F(1,14) = 4.06, p = .064$] even with outlier; highly significant without it

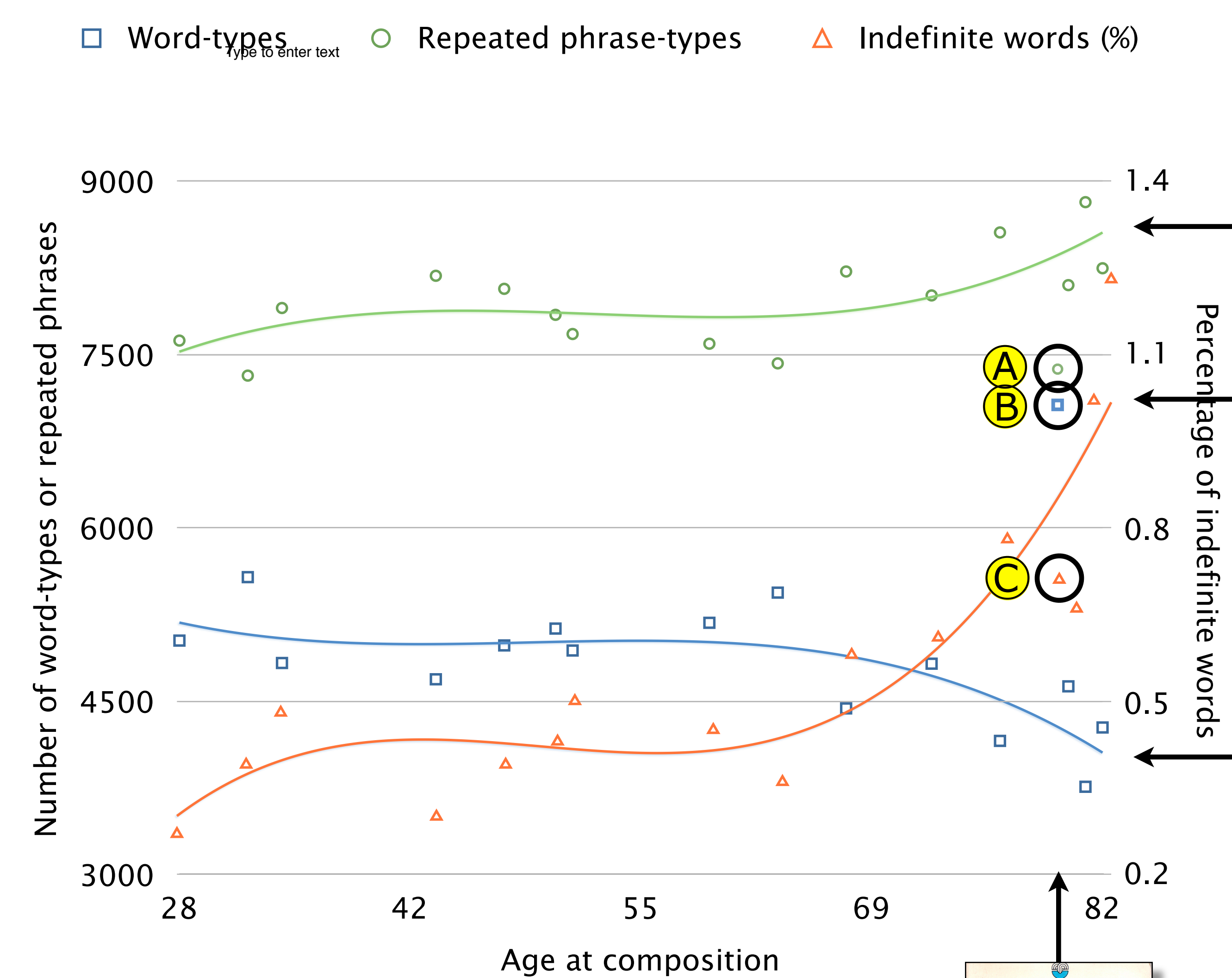
[$F(1,13) = 8.47, p < .015$].

Increase in use of indefinite words

- Increases significantly from 0.27% at age 28 to 1.23% at age 82 [$F(1,14) = 22.6, p < .0005$].
- Outlier makes very little difference to the analysis.

Example: *Elephants Can Remember* (at age 81) has 30% fewer word-types than *Destination Unknown* (at age 63), 18% more repeated phrases, 2.83 times as many indefinite words.

Changes in vocabulary in Agatha Christie's novels from age 28 to 82



Repeated use of phrases increases with age ($p < .015$)

Use of indefinite words increases with age ($p < .0005$)

Vocabulary size decreases with age ($p < .01$)

5. An outlier: Christie's thriller

- *Passenger to Frankfurt* — thriller, not detective novel.
 - ▶ Written in her early to mid-70s, published at age 79.
- **Outlier:**
 - ▶ In phrase repetition; (A)
 - ▶ In vocabulary; (B)
- **Largest** vocabulary of all novels analyzed: Draws on vocabulary of much political commentary read by Christie in research for the novel.
- **Not** an outlier in use of indefinite words. (C)
- Demonstrates limitations of measures dependent on nature or genre of content, advantages of content-independent measures.

6. Discussion

- A sharp vocabulary drop, and a sharp increase in repeating phrases (where tested texts are of the same genre) and a sharp increase in indefinite-word usage suggest that Agatha Christie suffered from Alzheimer's disease.
- These signs, especially indefinite-word usage, are present in her writing from her early 70s.
- Our results support Garrard et al.'s (2005) conclusion, based on their smaller study of three novels by Iris Murdoch (diagnosed with AD), that non-invasive text analysis can detect the onset of dementia "before anyone [has] the remotest suspicion of any untoward intellectual decline".

7. Extending the analysis

Our present work: A more-rigorous analysis*

- Complete syntactic analysis of all 16 novels:
 - ▶ Look for declines in syntactic complexity.
 - ▶ Look for changes in use of passive verbs.
- Lexical-semantic analysis of vocabulary:
 - ▶ Look for declines in specificity.
 - ▶ Look for declines in propositional density.
- Discourse-level analysis:
 - ▶ Look for changes in use of connective words.
 - ▶ Look for changes in coherence and narrative order of temporal sequences.
- Compare with contemporaries for whom dementia is not suspected, e.g., H.G. Wells.

*Work with Xuan Le and Youngchan Kim.

Bottom line

Changes in Agatha Christie's writing are consistent not with normal aging but with Alzheimer's disease.

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