

# Measuring the compositionality of N-N compounds over time

## Overview

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- Compositionality in compounds: How **transparent** is the overall meaning of the compound given the **constituents**?
- *speed limit* vs. *ivory tower*
- Question: Is there a temporal element in the compositionality of compounds?
- Findings: **Diachronic** information helps with prediction on the **synchronic** level and **trends** in compositionality are observable for a **time span of 200 years**

## Methods

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- Based on Dhar and van der Plas [1]
- Cosine similarity between:
  - Compound constituents (**sim-bw-constituents**)
  - Compound and head (**sim-with-head**)
  - Compound and modifier (**sim-with-mod**)
- Information theory-based:
  - Log likelihood-ratio (**LLR**)
  - Positive Pointwise Mutual Information (**PPMI**)
  - Local Mutual Information (**LMI**)

## Setup

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- Google Books Ngram corpus, **5-grams**, time span: **1800-2000**
- 90 compounds with compositionality **ratings** of Reddy et al. [2]
  - High: *application form* – Mid: *silver screen* – Low: *ivory tower*
- Hyper-parameters: 1. **time span** 2. **frequency cutoff**

## Experiments

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1. **Synchronic**
  - Do our compositionality scores correlate with the scores in [2]?
2. **Diachronic**
  - Does temporal information help with predicting the scores in [2] better?
  - Can we see a trend in compositionality scores over time?

## Results

5.1

	modifier-mean	head-mean	compound-mean
sim-bw-constituents	0.35	0.41	0.48
sim-with-head	0.26	0.43	0.43
sim-with-mod	0.1	0.18	0.2
LLR	0.36	0.44	0.52
PPMI	-0.12	-0.1	-0.14
LMI	<b>0.38</b>	<b>0.45</b>	<b>0.54</b>

Table 1: Spearman's  $\rho$  between our measures and the compositionality ratings of [2].

Time span	Cutoff	$R^2 \pm sd$
20 (score)	100	<b>0.370 <math>\pm</math> 0.012</b>
Non-temporal	100	0.337 $\pm$ 0.035

Table 2: Best hyper-parameter setup (diachronic) compared to synchronic setup

## Results

5.2

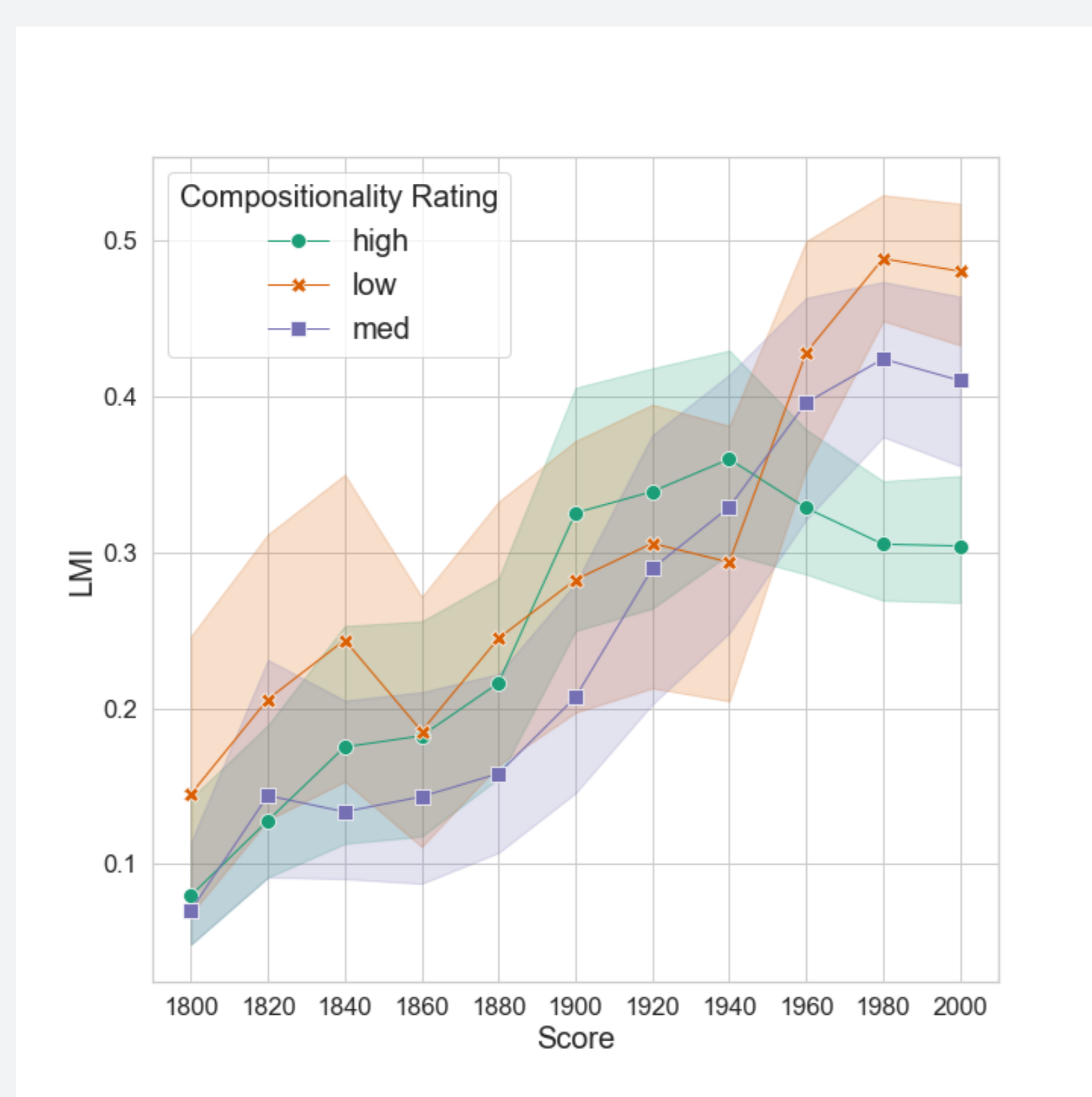


Figure 1: Average LMI of a compound over time, with a time span of 20 years and a frequency cut-off of 100. Compounds are grouped according to their rating in [2].

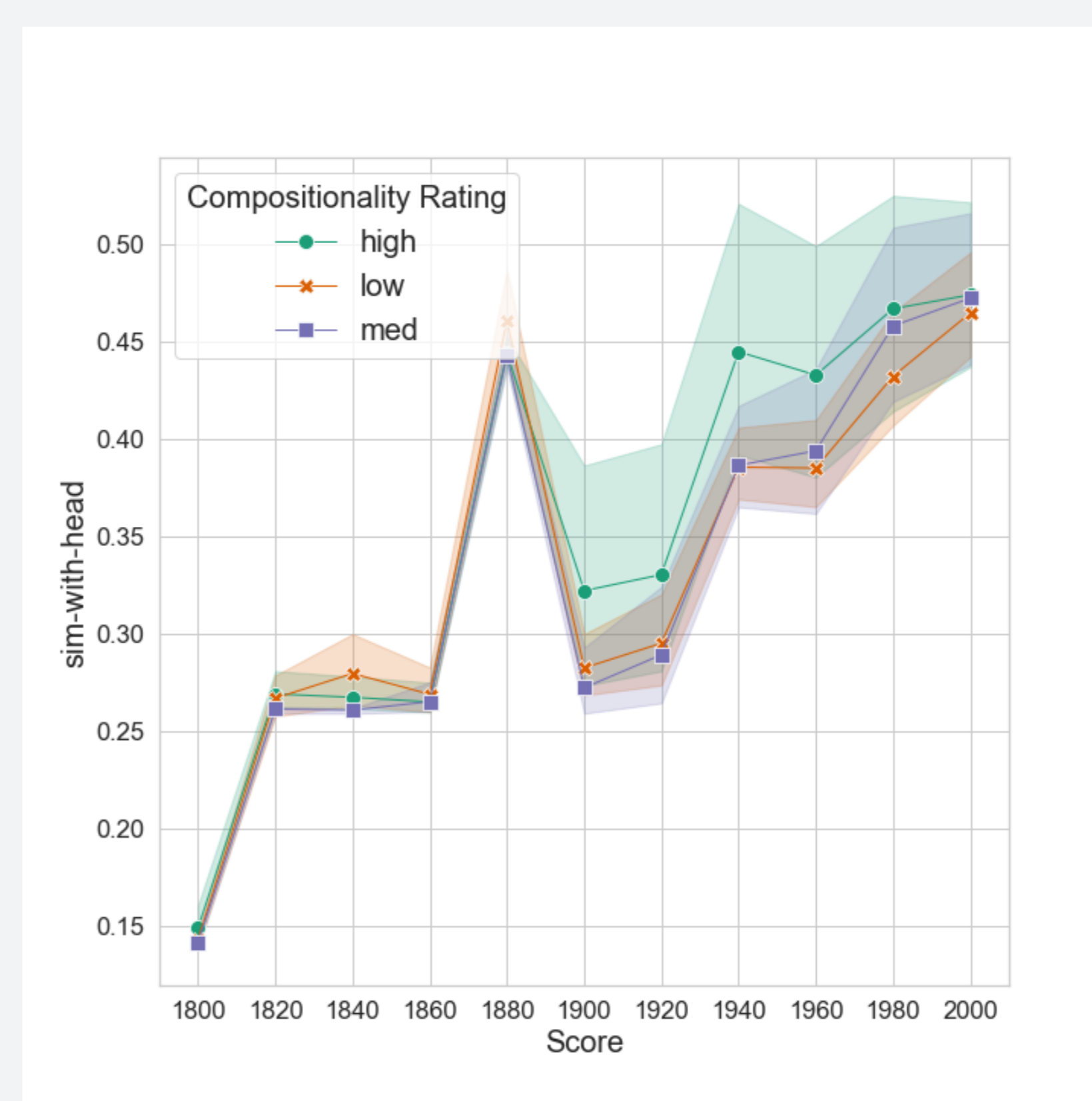


Figure 2: Average *sim-with-head* of a compound over time, with a time span of 20 years and a frequency cut-off of 100. Compounds are grouped according to their rating in [2].

[1] Prajit Dhar and Lonneke van der Plas. Learning to predict novel noun-noun compounds. In *Joint Workshop on Multiword Expressions and WordNet (MWE-WN 2019)*, 2019.

[2] Siva Reddy, Diana McCarthy, and Suresh Manandhar. An empirical study on compositionality in compound nouns. In *Proceedings of the 5th International Joint Conference on Natural Language Processing*, 2011.

