

The Dostoyevskian Trope
Persistent Processes and State Incongruence in 19th Century Textual Cultural
Heritage

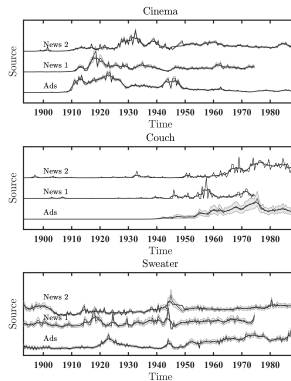
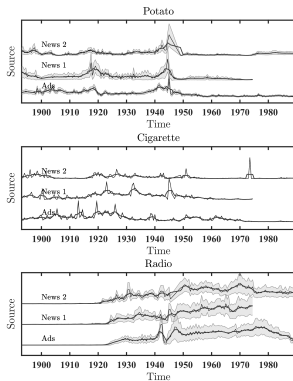
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PROGRAM

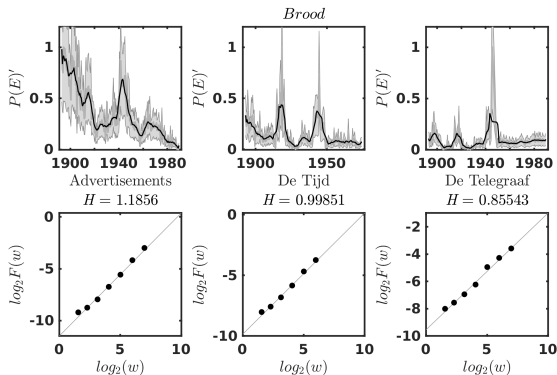
0	Motivation	history and dynamics
1	RQs and Data	Danish textual cultural heritage
2	Design	fractal analysis and causal dependencies
3	Kehre	author-specific cognitive dynamics
4	D-trope	cognitive-affective dependencies
*	Extra	literary optimality

Background



-
- dynamics are fundamental to cultural and historical objects of research
 - in history and antropology “dynamics” almost has a status dogma

Background



-
- structural features can often be “read off” the historical process, but are not captured by simple statistics
 - risk of ignoring core features of the process (e.g. periodicity, fractal properties, long-range correlations).

Overview of Research Problems

Die Kehre

- “authors of fiction (and non-fiction) undergo personal paradigm shifts”

Dostoyevskian Trope

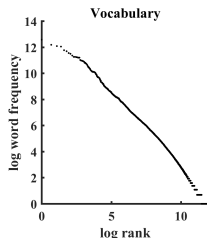
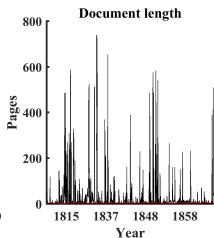
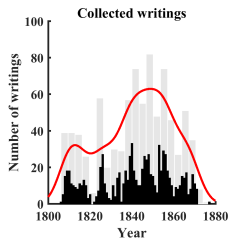
- “authors’ creative states are inversely related to their emotional states”
- “authors’ creative states *depend* on their emotional states” (state incongruent writers)

Geertzian v-function

- particular case where the *kehre* is reflected in a topicality shift for state congruent writers, which might characterize successful innovators

Sources of Danish Textual Cultural Heritage

- N.F.S. Grundtvig, active years 1804-1871 (born: 1783, dead: 1872)
- H.C. Andersen, active years 1829-1874 (born: 1805, dead: 1875)
- S.A. Kierkegaard, active years 1830-1855 (born: 1813, dead: 1855)



DATA|Danish Textual Cultural Heritage

- $N = 1329$ documents ($n_{NSFG} = 921$, $n_{HCA} = 194^*$, $n_{SAK} = 214$)
- language normalization (orthographic variation and casefolding)
- length normalization ($slice\ len = 10^2 - 10^3$ words)

Normalization of Historical Texts

Orthographic Variation

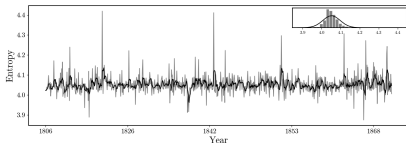
- automated analysis depends critically on existing tools and data (ex. sentiment dictionaries)
- NLP, IR and TM resources “suffer from presentism”
- projects often try to adapt the tool (ex. modify dictionary to historical data set)
- this solution scales badly due to lack of standardization

Solution

- statistical spelling corrector that treats historical variants as errors of contemporary Danish
- rule-based improvement

the dostoyevskian trope

- authors' creative states are **inversely** related to their affective states (*state incongruence*)
- authors' creative states **depend** on their affective states
- use average dictionary-based **sentiment** scores as a proxy for author's affective states
- use Shannon's (source) **entropy** h as a proxy for author's cognitive complexity



$$h = - \sum_{i=1}^K p_i \times \log_2(p_i)$$

$$p_i = Fr(w_i) / \sum_{i=1}^K Fr(w_i)$$

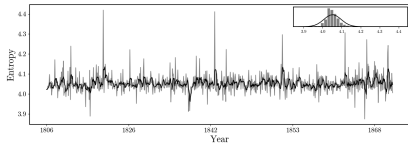
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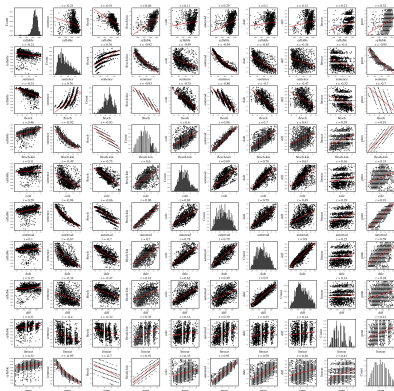


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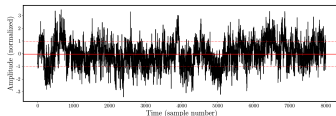
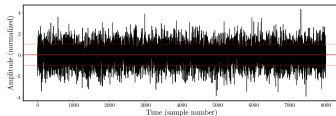
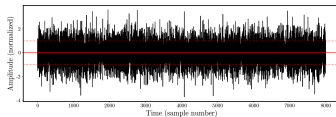
A comment on Shannon Entropy

- axiomatic approach to information
- correlates with perceived complexity across modalities
- for natural language it is a direct measure of lexical variability
- associated with a wide range of readability* measures
- lost popularity due to semiotics and chaos theory

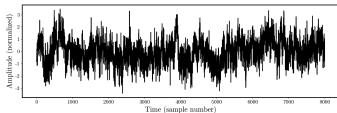


Fractal properties of entropy

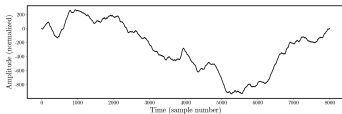
- not interested in an average state of complexity *per se*
- capture long-range correlations in h as a model of how complexity states persist
- *Detrended Fluctuation Analysis* or *Adaptive Fluctuation Analysis*
- estimate the power law relation between the overall variation for multiple time-windows (scales) as the Hurst exponent H



$$X = x_1, x_2, \dots, x_n$$

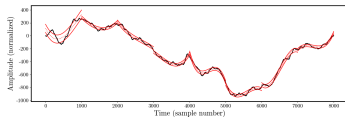
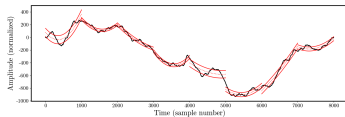
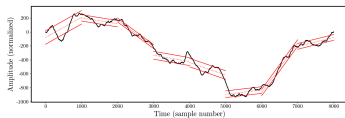


$$\sum_{i=1}^n (x_i - \bar{x})$$



construct random walk process:

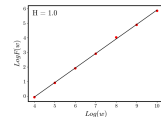
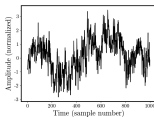
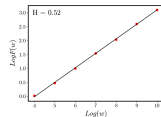
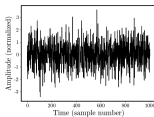
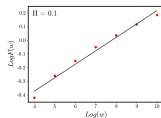
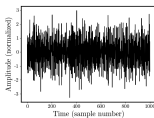
$$u(n) = \sum_{i=1}^n (x_i - \bar{x}), \quad n = 1, 2, \dots, N,$$



Estimation and interpretation

for $1/f^{2H+1}$ processes:

- anti-persistent process: $0 < H < 0.5$
- short-range correlations only $H = 0.5$
- $0.5 < H < 1$ **persistent process**



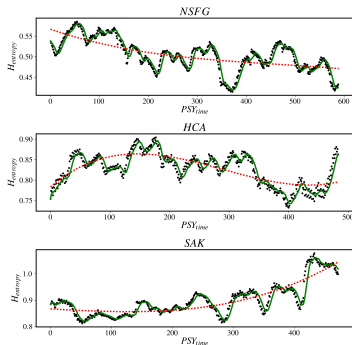
Finally, we estimate time-varying H for the data in order to build “creativity” processes resulting in an:

Author Typology

Kehre prototype (persistence → anti-persistence): **NSFG**

eternal child (persistence): **HCA**

extended 27 Club (persistence → intermittency): **SKS**



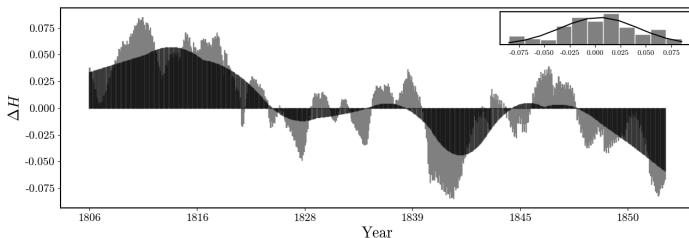


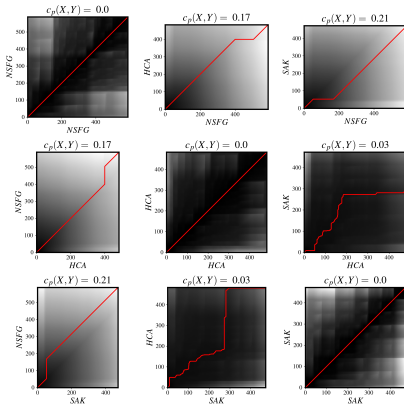
Table: Dominant Dynamic in the Phases of N.F.S. Grundtvig's Writings

Time period	Age of onset	Coarse	Fine	Behavior	Profile
1806-1826	23	$H > 0.5$	$H > 0.5$	<i>persistent</i>	theoretician
1826-1839	43	$H \leq 0.5$	$H \approx 0.5$	<i>short memory</i>	pragmatic
1839-1845	56	$H \leq 0.5$	$H < 0.5$	<i>anti-persistent</i>	breakthrough
1845-1848	62	$H \leq 0.5$	$H \approx 0.5$	<i>short memory</i>	disease
1849-1872	65	$H \leq 0.5$	$H < 0.5$	<i>anti-persistent</i>	politician

Author comparison

– with sequence alignment techniques (*DTW*), it becomes possible to compare dynamics between authors

– **SKS** is similar to **HCA** and dissimilar to **NFSG**, but that might have changed had **SKS** developed a late style



Affective state

- Lexical matching based on a contemporary Danish sentiment dictionary
- Technique is popular for author profiling (among other things)

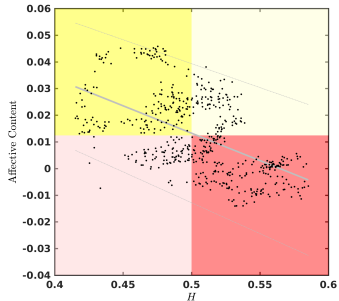
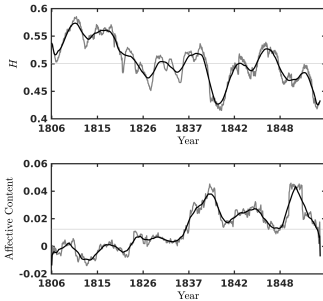
Example

"Ingen veed, trods Halfreds Sange, Hvor Kong Olav fandt sin Grav;"

nobody knows, in spite of Halfred's songs, where king Olav found his grave

ingen vide trods Halfred sang hvor kong Olav finde sin grav

$\langle -1, 1, 0, 0, 0, 0, 0, 0, 0, 0, -2 \rangle$



Creativity::affect

– Author's creative states are inversely related to his emotional states – **NSFG** is an example of a state incongruent author

Granger Causality

compare nested model:

$$y_t = \beta_0 + \beta_1 y_{t-1} + \dots + \beta_k y_{t-k} + \epsilon$$

with full model:

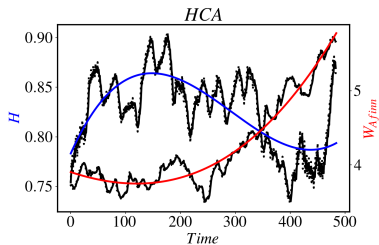
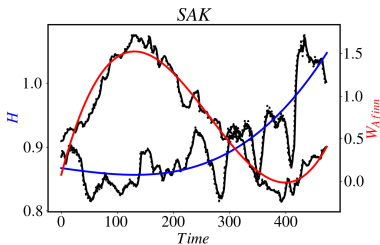
$$y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots + \beta_k y_{t-k} + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \dots + \alpha_m x_{t-m} + \epsilon$$

to see which one does the better job at explaining y by testing:

$$H_0 : \alpha_i = 0 \text{ for each } i \text{ of } [1, m]$$

$$H_1 : \alpha_i \neq 0 \text{ for at least one } i \text{ of } [1, m]$$

– bidirectional test such that **dostoyevskian trope** finds support IF we can confirm that '*Sentiment Granger cause h*' AND reject that '*h Granger cause Sentiment*'



The Dostoyevskian Trope

state incongruent authors (creativity::affect): **NFSG, HCA, SAK**

writes on affective state (affect → creativity): **NFSG, SAK**

Conclusion

Kehre

- "No mathematician should ever allow himself to forget that mathematics, more than any other art or science, is a young man's game." (G.H. Hardy, *A Mathematician's Apology*, 1940)
- 30-40 yrs
- change in scaling dynamics for creativity that separates early and late writer: NFSG, SAK*

Dostoyevskian trope

- support for the state incongruent author among authors from 19th century Denmark
- some authors seem to be driven by their affective state

Literary optimality

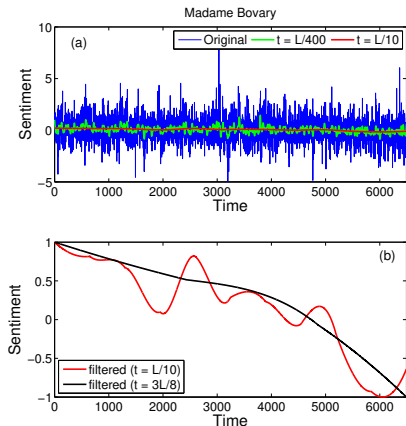
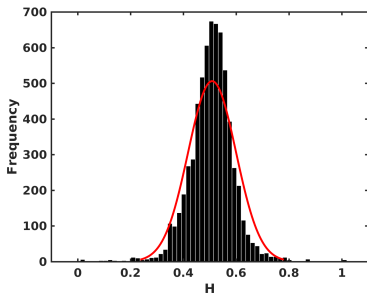
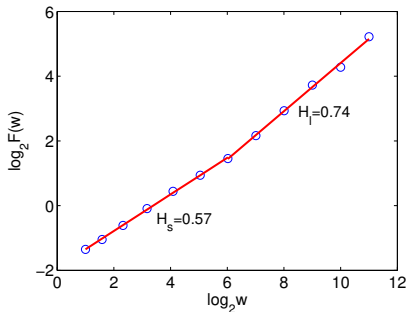


Figure: sentiment analysis and adaptive filtering reconstructs narrative vectors that reflect the reader experience. Particular fractal scaling-range, $0.6 < H \leq 0.8$, indicates literary optimality.



THANK YOU

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& credits to

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