

Text2Story workshop, April 10th 2025

Revisiting Frames for Event Extraction in the Digital Humanities

Sara Tonelli, Fondazione Bruno Kessler, Trento (Italy)

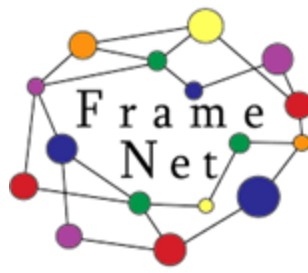
Frame Semantics

A **cognitively grounded** linguistic theory of meaning developed by Charles J. Fillmore

“I mean by **framing** the appeal, in perceiving, thinking and communicating, to structured ways of interpreting experiences”
(Frame Semantics and the Nature of Language, 1976)

“[...] people understand the meaning of words largely by virtue of the **frames** which they evoke” [1]

[1] Ruppenhofer, J.; Ellsworth, M.; Petruck, M. R. L.; Johnson, C. R.; Baker, C. F.; and Scheffczyk, J. (2016) *Framenet II: extended theory and practice*. Technical report.



In FrameNet [2], **events** and **situations** are defined by frames.

Frame: scenario that represents the knowledge base necessary to understand the meaning of words (e.g., `COMMERCE_PAY`)

“The man pays the rent regularly”

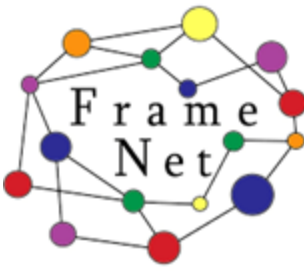
Lexical units:

Words/expressions that evoke a specific frame
e.g., `pay`, `payment`,
`disburse`, `disbursement`

Frame elements:

Frame-specific semantic roles
e.g., `Buyer`, `Goods`, `Seller`,
`Money`, `Time`, `Purpose...`

[2] Baker, C. F., Fillmore, C. J., & Lowe, J. B. (1998). The Berkeley FrameNet project. In *COLING 1998 Volume 1: The 17th International Conference on Computational Linguistics*.



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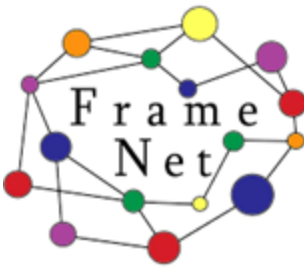
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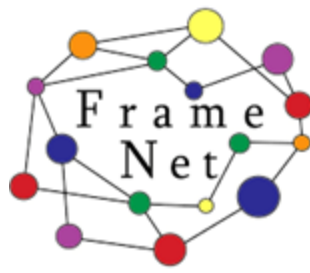
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“^{*Buyer*} [The man] pays ^{*Goods*} [the rent] ^{*Frequency*} [regularly]”

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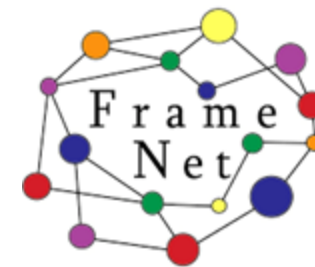
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FrameNet as a Semantic Role labelling task



The **FrameNet** resource was mainly used for **semantic role labelling** tasks [3], supervised machine learning approaches trained on FrameNet or **PropBank** [4].

Frame Element	Core Type
Agent	Core
Characteristic	Core
Containing_event	Extra-Thematic
Degree	Peripheral
Depictive	Extra-Thematic
Duration	Extra-Thematic
Explanation	Extra-Thematic
Manner	Peripheral
Means	Peripheral
Place	Peripheral
Purpose	Peripheral
Standard	Core
Time	Peripheral

IMITATING frame: An Agent displays a Characteristic of a Standard in his or her own way of behaving.

“[The child] imitates [the model] provided by the adult”

“[Kashi] mimicked [his voice] [carefully] [in order to stir my recognition]”

“[Kurt Cobain] aped [him] [in many different ways]”

[3] D. Gildea and D. Jurafsky. 2002. *Automatic Labeling of Semantic Roles*. Computational Linguistics, 28(3):245–288.

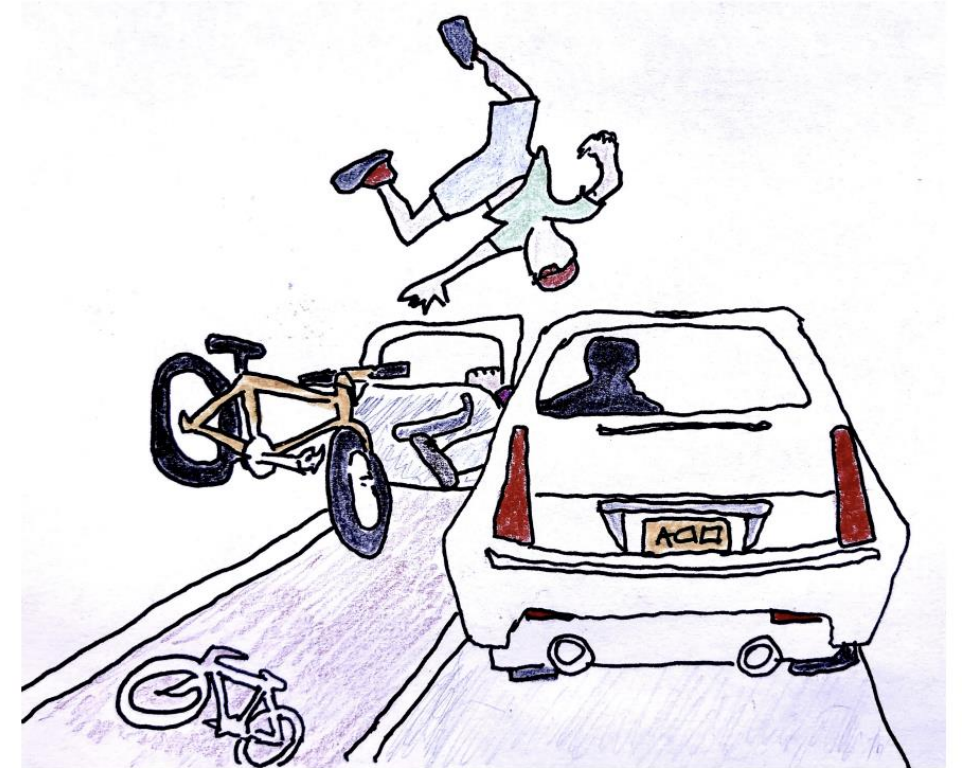
[4] M. Palmer, D. Gildea, and P. Kingsbury. 2005. *The Proposition Bank: An Annotated Corpus of Semantic Roles*. Computational Linguistics, 31(1):71–106.

Frames to Capture Perspectives for Specific Domains

Frames used to conceptualize the same event from different viewpoints by emphasizing certain participants over others [5]

Analysis of human perceptions of **responsibility** in Italian news on gender-based violence

Focus on typical frames that encode possible ways of expressing the **murder event** with different emphasis of participants: KILLING, DEATH, DEAD_OR_ALIVE, EVENT, CATASTROPHE



From Minnema et al. 2022

Cyclist slams into car door
Car driver opens door and hits cyclist
Cyclist injured in road accident on 5th street
Collision between bike and car

[5] Gosse Minnema, Sara Gemelli, Chiara Zanchi, Tommaso Caselli, and Malvina Nissim. (2022) "Dead or Murdered? Predicting Responsibility Perception in Femicide News Reports". In Proceedings of the 2nd AACL and 12th IJCNLP.

Frames to Analyse Events over Time

Analyse full **1948** edition of **Corriere della Sera** (OCR)

10,418 newspaper articles

5M+ tokens

Process corpus with **EventNet-ITA tool** [6], a frame parser for Italian able to recognise and classify around 200 different frames



146,000 frame mentions (events)

198,000 frame elements



[6] Marco Rovera (2024) "EventNet-ITA: Italian Frame Parsing for Events". In Proceedings of the 8th Joint SIGHUM Workshop on Computational Linguistics for Cultural Heritage, Social Sciences, Humanities and Literature (LaTeCH-CLfL 2024), pages 77–90.

Frames to Analyse Events

Exploring 1948, one event at a time

TimeFrame allows to explore the whole textual 1948 edition of Corriere della Sera (10,418 newspaper articles) and to visualize on a timeline over 146,000 event mentions and their participants. TimeFrame makes it possible to build event-based queries at different granularity levels.

TimeFrame [7]: Create an interface to navigate the archive and perform different types of queries.

Available at <https://eventnetdemo.islab.di.unimi.it/>

The screenshot shows the TimeFrame search interface. At the top right, there is a toggle switch for 'Easy' (selected) and 'Advanced'. Below this, the interface prompts the user to 'Select a domain' with a dropdown menu currently showing 'Life and Bio'. It then says 'or select one or more event types' with another dropdown menu showing 'Select event type(s)'. Next, it says 'and select a date range' with a calendar for 'May 1948'. The calendar shows dates from 1 to 31, with the 10th highlighted. Below the calendar is a checkbox labeled 'Extend the search to the article body' which is currently unchecked. At the bottom, there is a blue button labeled 'EXPLORE'.

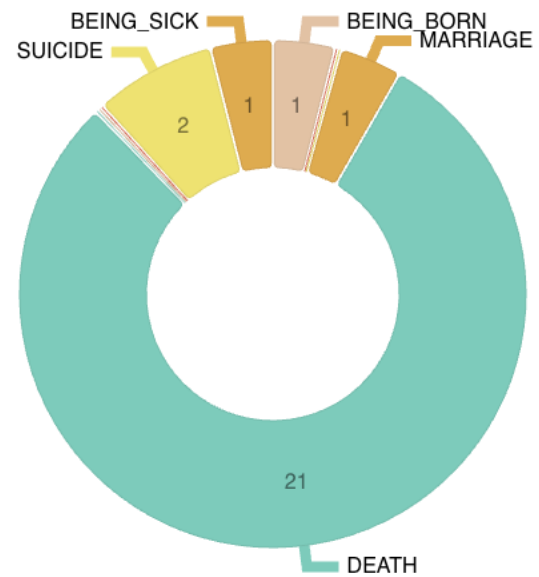
[7] Davide Lamorte, Marco Rovera, Alfio Ferrara, and Sara Tonelli (2024) *TimeFrame: Querying and Visualizing Event Semantic Frames in Time*. Proceedings of the First Workshop on Reference, Framing, and Perspective @ LREC-COLING 2024.

Frames to Analyse Events over Time

- By macro-domain: 13 domains based on event classes such as ECONOMICS, ARTS, GEOPOLITICS, etc.
- By single or multiple events (frames), such as STATEMENT, ELECTION, ELECTORAL_CAMPAIGN, etc.
- By single or multiple events with constraints on Frame Elements

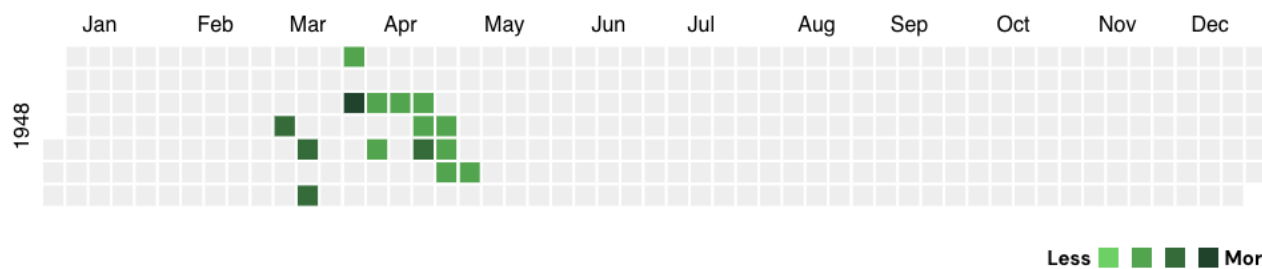
Frames to Analyse Events over Time

Here's a **chart** for you



and a **timeline**,
please select an event

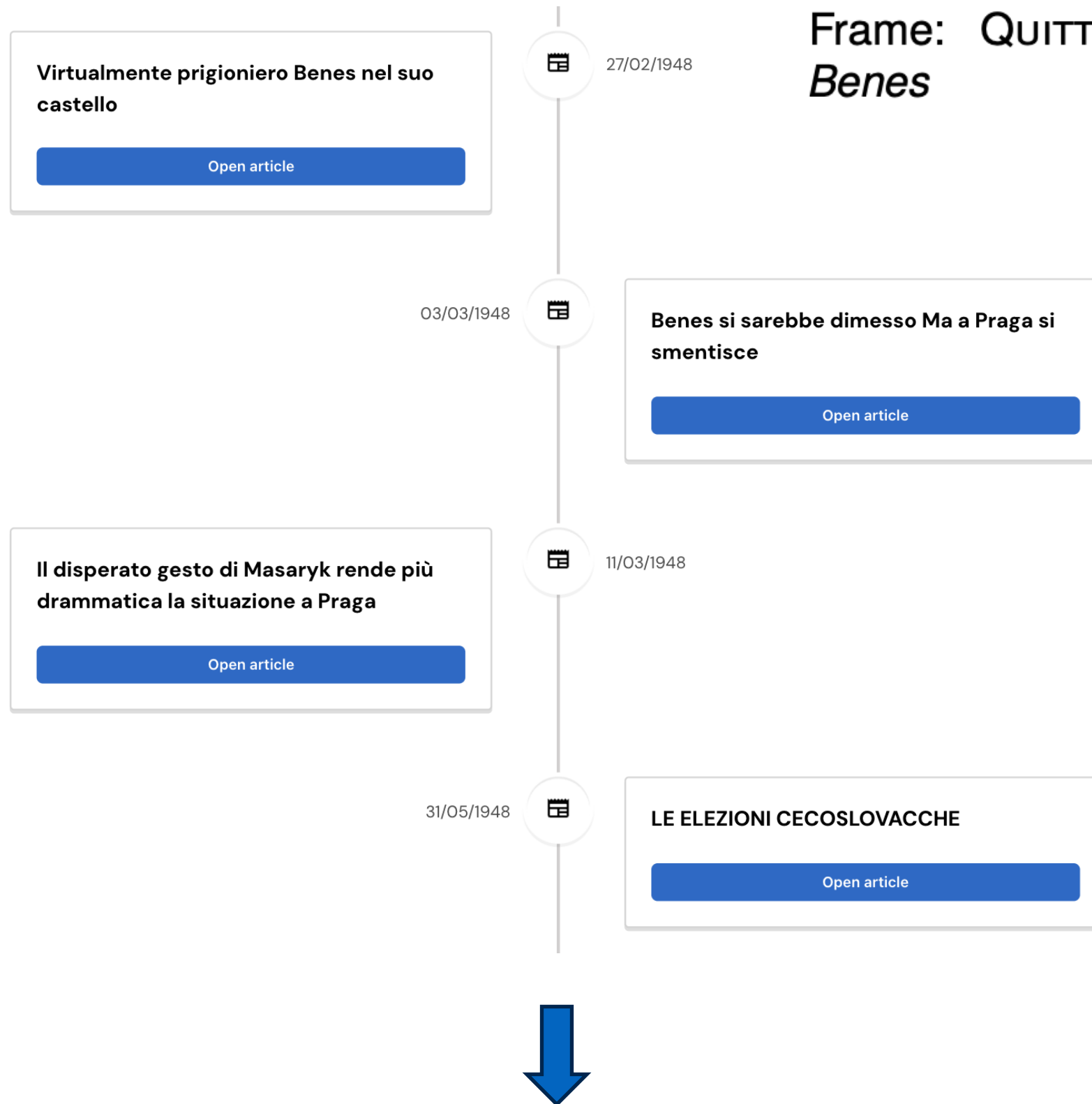
- BEING_BORN
- BEING_MARRIED
- GIVING_BIRTH
- MARRIAGE
- DEATH
- RESIDENCE
- RESIDENCE_CHANGE
- GETTING_SICK
- SUICIDE
- BEING_SICK
- ALL



Timeline of events in 1948:

- 18/03/1948: **DEATH EXPLOSION**
Centinaia di morti nell' Arsia per uno scoppio in una miniera ?
PLACE: nell' Arsia PLACE: in una miniera
- 20/03/1948: **DEATH**
Morte improvvisa dell' on . Nicolai durante un comizio a Velletri
MANNER: improvvisa
PROTAGONIST: dell ' on . Nicolai
CONTAINING_EVENT: durante un comizio
PLACE: a Velletri
- 20/03/1948: **DEATH**
La morte di Pio De Flavis
PROTAGONIST: di Pio De Flavis
- 28/03/1948: **DEATH**
Venti morti per la caduta di un aereo indiano in Corsica
- 30/03/1948: **CAUSE_HARM DEATH**
Vuol difendere la madre ed è ferito a morte dal papà
RESULT: a AGENT: dal papà
- 30/03/1948: **DEATH CAUSE_HARM**
Tre morti e venti feriti per un camion in una scarpata
PROTAGONIST: Tre VICTIM: venti

Example: Czechoslovakian Coup d'état



Frame: QUITTING | FE: EMPLOYEE, term: *Benes*



Example: Czechoslovakian Coup d'état



Example: Czechoslovakian Coup d'état

LE ELEZIONI CECOSLOVACCHE

Events:

ANNOUNCEMENT EVENT ELECTION POSITIVE_JUDGEMENT STATEMENT WIN_ELECTION ATTEMPT_SUASION BECOMING_AWARE QUITTING DISCUSSION ADVISE
TAKE_PLACE_OF PURPOSE LEADERSHIP QUITTING_A_PLACE

Berws si dimenerebbe fra giorni Praga 31 maggio Il Ministero degli Interni cecoslovacco ha annunciato questa sera che il Governo ha avuto l' 89,3 per cento dei voti validi durante le elezioni svoltasi ieri in tutto il Paese . Le cifre non ancora definitive danno un totale di 6.431.693 voti al Governo e 772.293 La stampa cecoslovacca esalta la gloriosa vittoria e afferma che le elezioni col loro risultato rappresentano un monito all' Occidente . Nel dare annuncio del risultato delle elezioni la radio di Praga aggiungeva a titolo di commento Non è stata fatta nessuna pressione sugli elettori come invece fu il caso nelle elezioni italiane durante le quali aeroplani stranieri facevano evoluzioni sopra i seggi elettorali minacciando gli elettori con la bomba Da fonte bene informata VVnited Press apprende oggi che il Presidente cecoslovacco Eduard Benes , si dimetterebbe entro la settimana in segno di disapprovazione della nuova Costituzione cecoslovacca e dello svolgimento delle elezioni Il Presidente addurrebbe quale motivo delle dimissioni la propria salute ormai ragionevole Tuttavia secondo la stessa fonte — esiste ancora una convenienza che egli rimanga al suo posto Inoltre comunisti sarebbero lieti di averlo ancora a capo dello Stato , a causa della grande considerazione di cui egli gode In tutti gli ambienti politici del Secondo la stessa fonte Benes avrebbe discusso al principio del mese le dimissioni con alcuni esponenti del Governo , ed avrebbe espresso il desiderio di dimettersi fin consultato Tuttavia gli sarebbe stato suggerito di attendere almeno il periodo Un componente della famiglia di Benes ha dichiarato intanto una settimana fa alla United Press che vi sarebbero state delle Da fonte ufficiale si apprende oggi che Benes non ha ancora firmato la Costituzione approvata il 9 maggio e si ha ragione di ritenere che egli non lo farebbe prima abbruttata giugno . Non è precisato quale sia il parere di Benes per quanto contrario nei riguardi della Costituzione e delle elezioni I Si ritiene peraltro che molta parte sia costituita dalla mancanza di una lista di opposizione e dalla mancanza del segreto nelle votazioni In particolare si sostiene che dimettendosi durante la settimana Benes sarebbe in condizioni di non accettare i risultati delle elezioni di Fonti bene informate prevedono che a Benes possa succedere Gottwald , Primo ministro comunista qualora egli voglia accettare intendesse Si esprimono peraltro dubbi in merito ad un suo eventuale desiderio in Secondo altri successore probabile di Benes sarebbe Zdenek Fierlinger , capo dei socialisti fusionisti visto anche che questi sarebbe « poco utilizzato » dai comunisti dopo la imminente fusione dei due partiti Non sono noti i propositi di Benes dopo le dimissioni non si ritiene peraltro che egli abbandoni il Paese , almeno in un primo



FrameNet is **general-purpose** → Smell and Taste are part of more generic frames, such as PERCEPTION_ACTIVE, PERCEPTION_EXPERIENCE, or SENSATION

OLFACTORY EVENT [8] and GUSTATORY EVENT [9] as single frames, including all relevant roles from other frames, such as *Location* or *Quality*

Additional **domain-specific semantic roles**: *Smell_Source*, *Taste_Source*, *Evoked_Odorant*, *Taste_Modifier*...

[8] Sara Tonelli and Stefano Menini. (2021) “FrameNet-like Annotation of Olfactory Information in Texts”. In Proceedings of the 5th Joint SIGHUM Workshop on Computational Linguistics for Cultural Heritage, Social Sciences, Humanities and Literature, pages 11–20.

[9] Teresa Paccosi and Sara Tonelli (2024) “A New Annotation Scheme for the Semantics of Taste”. In Proceedings of the 20th Joint ACL - ISO Workshop on Interoperable Semantic Annotation @ LREC-COLING 2024, pages 39–46, Torino, Italia.

FrameNet for Olfactory Analysis

Lexical units: stink, scent, scents, smell, smells, odour, odor, odours, odors, stench, reek, aroma, aromas, aromatic, whiff, foetor, fetor, fragrance, musk, rankness, redolence, pungency, deodorant, olfaction, smelling, smell.v, reek.v, sniff, sniff.v, sniff.v, deodorize.v, deodorizing ...

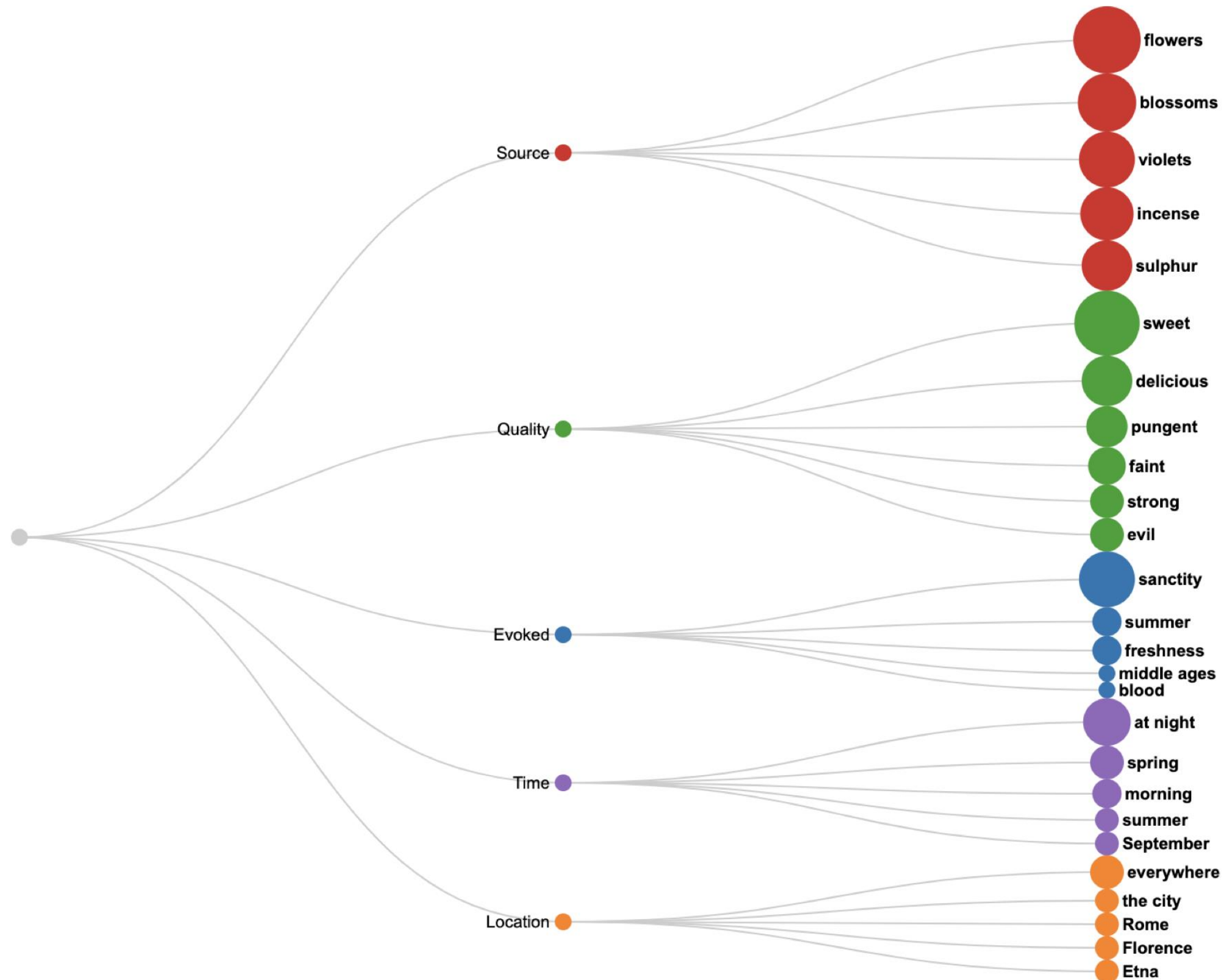
Frame Element
Smell source
Quality
Location
Odor Carrier
Perceiver
Evoked Odorant
Time
Effect
Circumstances

“[The coffee] had a [pungent] smell”

“[I] have no desire to reek [like the floor of a florist’s stall].”

“[The pomander] emitted a fragrance [of musk]”

FrameNet for Olfactory Analysis: Corpus exploration



[10] Stefano Menini, Teresa Paccosi, Sara Tonelli, Marieke Van Erp, et al. (2022). "A Multilingual Benchmark to Capture Olfactory Situations over Time". In Proceedings of the 3rd Workshop on Computational Approaches to Historical Language Change, pages 1–10,



From **Semantic Shift** Detection to **Perception Shift** Detection

How the meaning
of a word changes

How the perception
of an odour changes

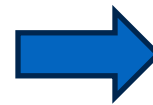
Combining large-scale, automatically extracted olfactory data with proven methods for tracking semantic change offers a powerful framework to explore the interaction between **linguistics** and **cultural changes** in the olfactory domain.

Perception Shift for characterization



- Provide a fine-grained methodology to understand how and why the perception shift took place [13]
- Focus on five **Smell sources** that were characterised by a perception shift: **Candles, Gloves, Incense, Ozone, Tobacco.**

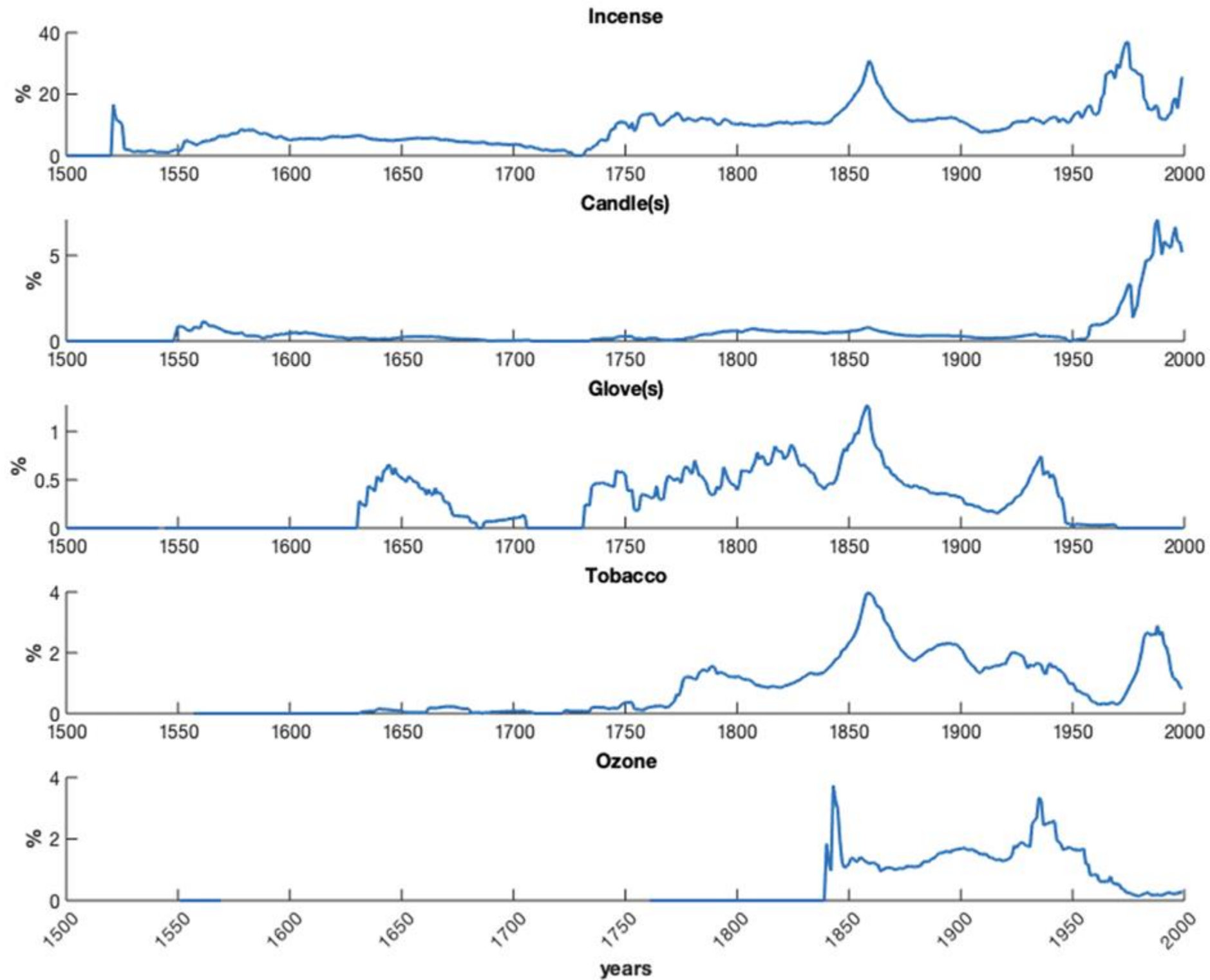
- Project Gutenberg
- The Royal Society Corpus
- The Early English Books Online (EEBO)
- British Library
- London Pulse Medical Reports
- Wikisource
- Eighteenth Century Collections Online (ECCO)
- UK Medical Heritage Library



40,191 Smell sources
39,521 Qualities

[13] Paccosi, T., Menini, S., Leonardelli, E., Barzon, I., & Tonelli, S. (2023). Scent and sensibility: Perception shifts in the olfactory domain. In *Proceedings of the 4th Workshop on Computational Approaches to Historical Language Change*.

When items became smell-related

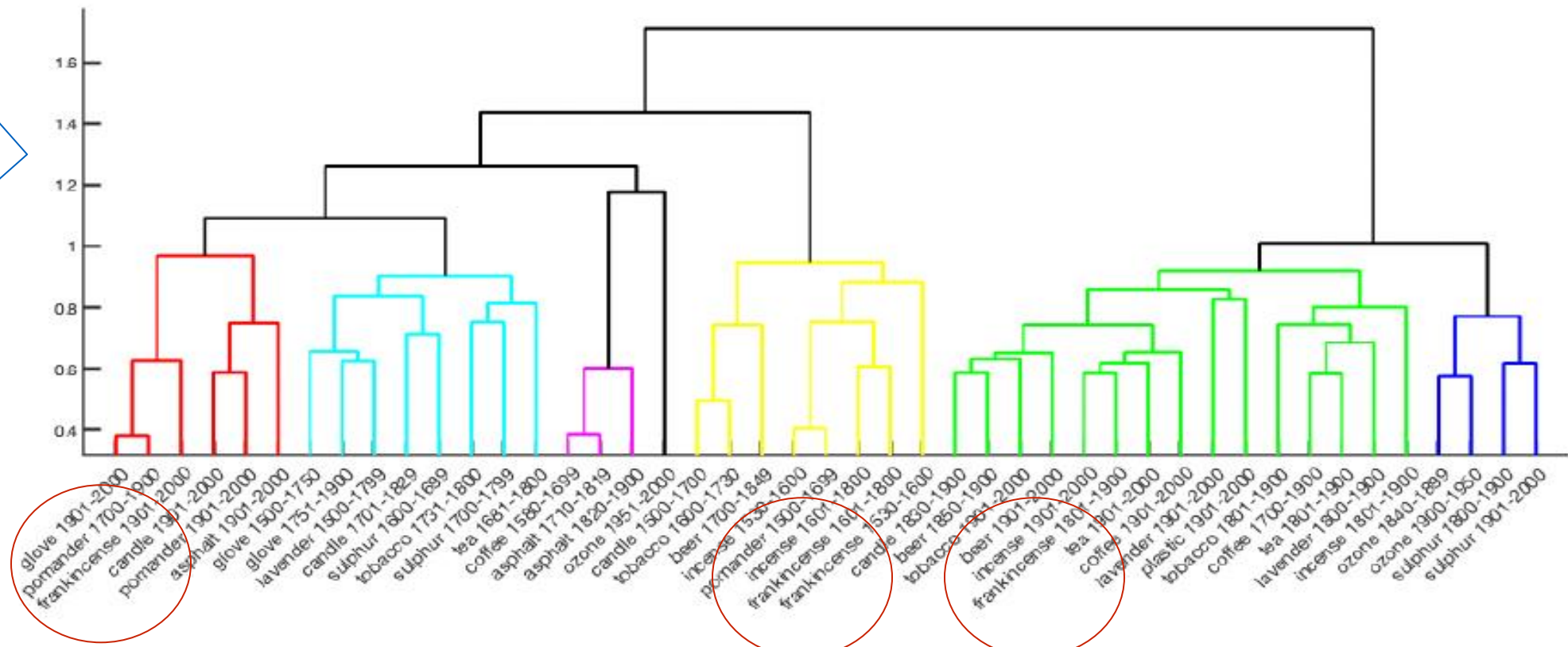


How smells were described in time

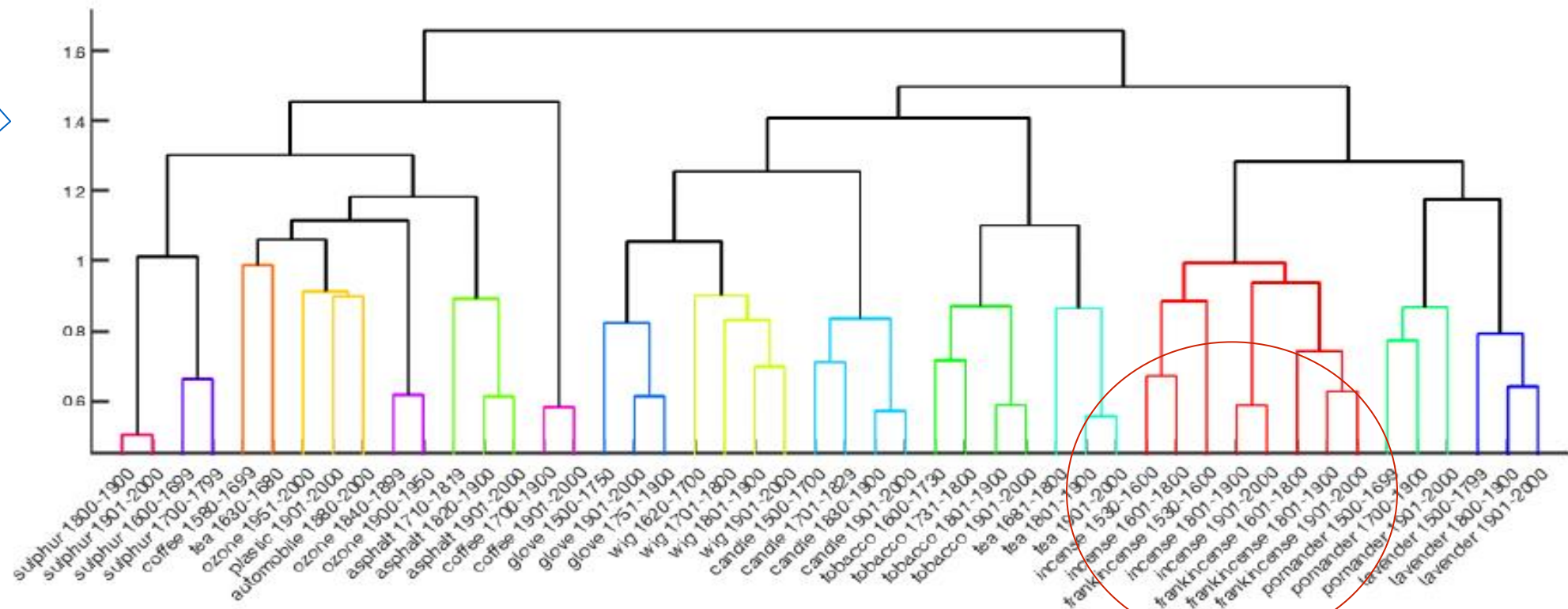
Smell Source	Time period			
	1530 – 1600	1601 – 1800	1801 – 1900	1901 – 2000
incense	aromatical <i>perfume</i>	vernal <i>dragge</i>	noisomely <i>nidorous</i>	somnolent <i>donative</i>
	perfume <i>odours</i>	breathe <i>breezy</i>	frank <i>sepulchred</i>	sacerdotal <i>exasperate</i>
	sweet <i>perfumed</i>	acceptable <i>perfumed</i>	sanguinary <i>perfuming</i>	frank <i>wafing</i>
	fragrant <i>fuming</i>	strange <i>odours</i>	raptourous <i>sweet-smelling</i>	sacred <i>perfuming</i>
	odoriferous <i>burnt</i>	holy <i>perfume</i>	murky <i>lawny</i>	heavenly <i>enrage</i>
candle	1500 – 1700	1701 – 1829	1830 – 1900	1901 – 2000
	abominable <i>lighted</i>	ferous <i>snuffing</i>	salutary <i>guttering</i>	fragrance <i>fumigating</i>
	ill <i>lighting</i>	offensive <i>lighted</i>	corrupt <i>arsenicated</i>	scented <i>re-lighted</i>
	fetid <i>blinking</i>	ill <i>cerifera</i>	filthy <i>re-lighted</i>	naseous <i>lighting</i>
	stink <i>tallow</i>	odoriferous <i>stationery</i>	snuff <i>fumigating</i>	scent <i>lighted</i>
odoriferous <i>cereus</i>	olfactory <i>suppurating</i>	unsavoury <i>sputtering</i>	perfume <i>flickering</i>	
gloves	1500 – 1750	1751 – 1900		1901 – 2000
	excellent <i>perfumed</i>	perfume <i>perfuming</i>	perfume <i>gauntlet</i>	
	venomous <i>fringed</i>	spanish <i>pictured</i>	scented <i>buttoning</i>	
	fine <i>imbroidered</i>	remarkable <i>cuticular</i>	scent <i>boxing</i>	
	rich <i>ichy</i>	costly <i>worded</i>	odoriferous <i>unbuttoning</i>	
sweet <i>scented</i>	excellent <i>worshipful</i>	odorous <i>rubber</i>		
tobacco	1600 – 1730	1731 – 1800	1801 – 1900	1901 – 2000
	hateful <i>smoked</i>	olfactory <i>smoky</i>	undiminished <i>pipeful</i>	homely <i>latakia</i>
	fulsom <i>nicotian</i>	perfume <i>chewing</i>	hateful <i>negrohead</i>	indefinable <i>unmanufactured</i>
	ungrateful <i>fulling</i>	peculiar <i>fulling</i>	superficial <i>unmanufactured</i>	spirituous <i>chewing</i>
	offensive <i>heroically</i>	grateful <i>narcotick</i>	snug <i>superexcellent</i>	stale <i>carcinogenic</i>
bad <i>spicery</i>	pungent <i>chewed</i>	vilest <i>smoaking</i>	medicinal <i>snuffing</i>	
ozone	1840 – 1899	1900 – 1950		1951 – 2000
	restorative <i>allotropique</i>	refresh <i>ozonized</i>		photochemical
	inexhaustible <i>oxidiser</i>	odorless <i>allotropique</i>		diurnal
	denser <i>ozonized</i>	peculiar <i>triasomic</i>		antarctic
	electrical <i>sterilizes</i>	fresh <i>ultraviolet</i>		nickelic
obvious <i>vigorating</i>	pungent <i>transboundary</i>		spheric	

What's the difference with and without Frames?

With Frame Annotation



Without Frame Annotation

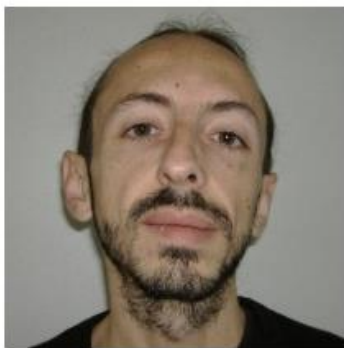


Conclusions

- After 50 years, frame semantics can still contribute to text analysis in different application scenarios
- Frames can be used to compare perspectives, perform diachronic studies, model event chains and much more
- From general-purpose to domain-specific frame semantics
- What's the role of LLMs?

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Marco Rovera



Teresa Paccosi



Stefano Menini



Elisa Leonardelli

Thank you!

