Antonio De Prisco - Stefano Minozzi
(Università degli Studi di Verona)

Metodi computazionali per l'indagine lessicale su testi latini medievali

Un'applicazione al Codex Diplomaticus Cavensis

II^e Atelier Informatique et Histoire
L'historien, le texte et l'ordinateur
27-28 novembre 2006 – École Normale LSH de Lyon

http://www.cyllenius.net/labium/

Archivio della latinità italiana del Medioevo - Windows Internet Explorer

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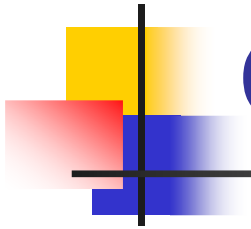
FRANCISCUS ARNALDI PASCHALIS SMIRAGLIA

LATINITATIS ITALICAE MEDII AEVI LEXICON

(saec. V ex. - saec. XI in.)

Editio altera

SISMEL
EDIZIONI DEL GALLUZZO



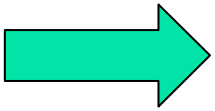
Computational analysis. Benefits:

- Quantitative support to research hypothesis
- Collection of evindences for hypothesis formulation

- Diagnostic function
- Prognostic function

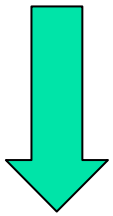
Use in lexicography

- Text retrieval
- Text mining



Dictionary building

- Analysis of word usage



"Snapshot"

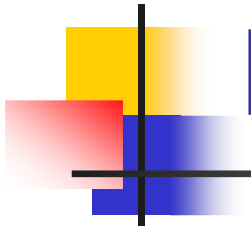
of lexical level of a text

Can be unveiled:

- Permanences in linguistic habits
- Geographical localization
- Chronological localization

Codex diplomaticus Cavensis

- Model of Middle Latin in Campania (Salerno)
- Model of Middle Latin between the VIII and the XI Century



Building of lexical sample

- Dimension of the sample (20MB txt)
- Structure (430 documents of similar lenght)
- Balancing of parts (building of regular partitions)

Two “lexical worlds”

- City of Salerno: 214 documents;
- Countryside of Salerno: 216 documents;

Text pre-processing

TAGGING OF ESSENTIAL METADATA:

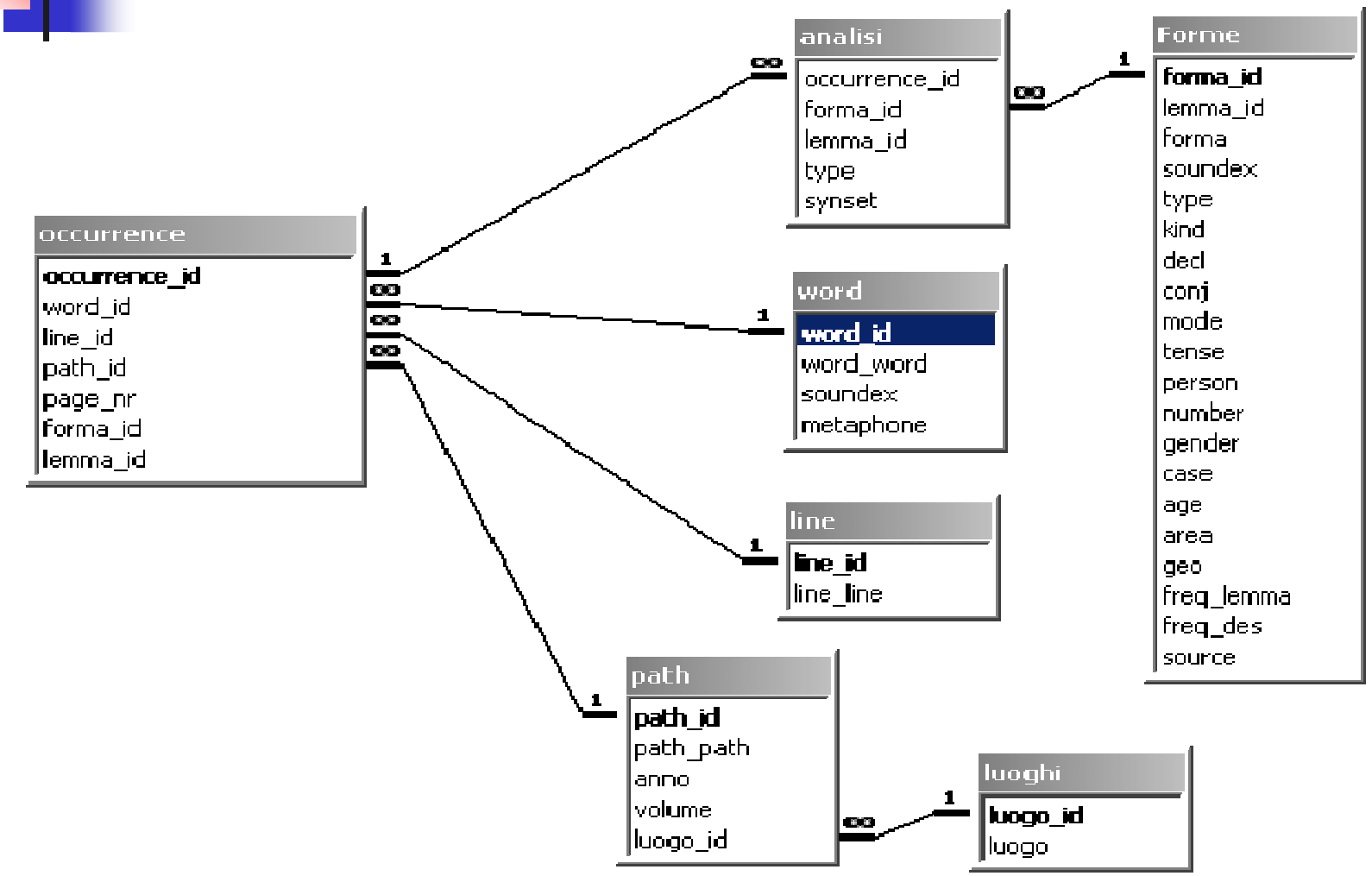
- **COLLOCATION**
- **DATE**
- **PLACE**

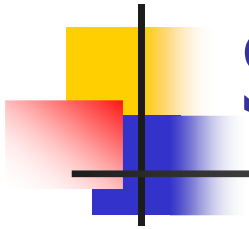
```
<meta vol="1">
<meta anno="792">
<meta luogo="Forini">

1
+ In nomine domini quinto anno principatum domni nostri
dux gentis langubardorum mense octobri per indictione p
consilio et bolumtates aldefusi genitori meo havitatori
quondam roderisi de nuceria in meo sociavit coniugio, t
et amicus nostros trado adqe tradedit tive suprascripte
portionem substantie mee quod me iuxto hordine a germar
case quam et intrinsicus case, curte, territuriis, vine
planus et in monte, homnia et de omnibus de quitquit vi
meam una tivi tradedit ad possidendum. et per hunc hell
rovoratum ostendere previdimus sicundum ritum genti nos

2
foturo pro hanc causa periurio non percurrat et secundu
quartam rationem una tive que supra uxori mee tradedit
in tua sit potestate, quam hanc chartulam morgincaput i
scribendum rogavimus. Actum forinese mensi et indictior
signum + manus alderisi viro eius et aldefusi genitore
morgincaput conmuniter fierit rogavimus.
+ MELONIANUS ME TESTE subscripsi.
+ ego maio filio meloniani sculdais me teste subscribis
+ ego aceprandu filiu meloniani me teste subscripsi.
+ ego ermoald notarius rogatus a suprascripti me teste
```

Pre-processing builds a multidimensional index





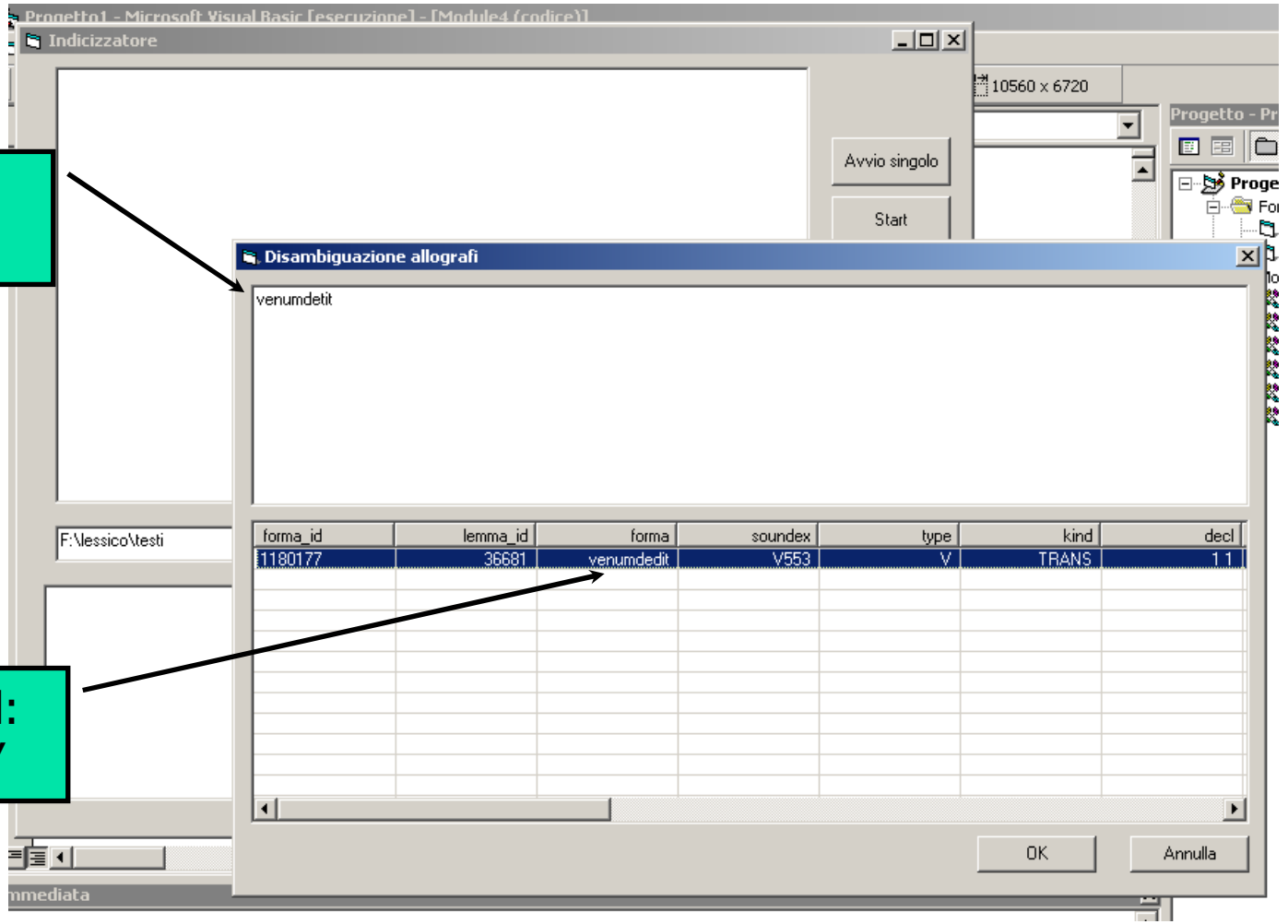
Segmentation of text

- Documents
- Phrases
- Lexical units

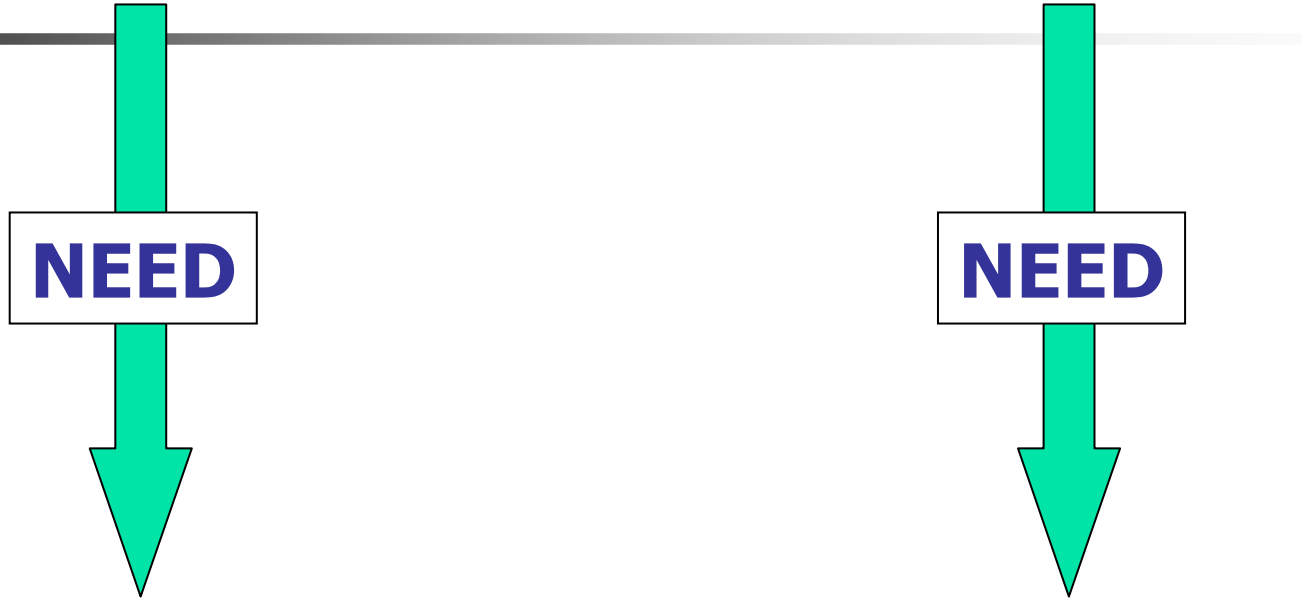
Custom interactive software provides support for identification of heterographs

Unknown word:
"**venumdetit**"

Suggested word:
"**venumdedit**"



Problems in identification:
homographs and ***heterographs***

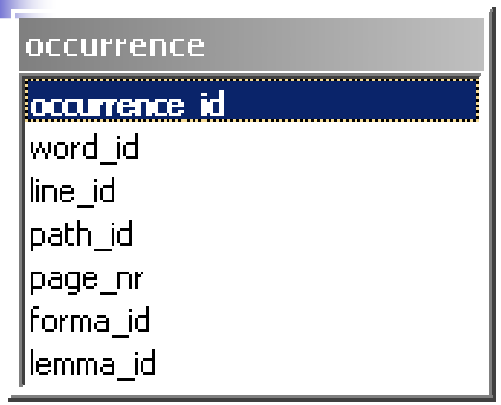


disambiguation ***assimilation***

Kinds of heterographs:

- Paradigmatic heterographs
- Orthographic heterographs
- Dialectal and stylistic heterographs
- Syntagmatic heterographs

Morphological lemmatization



Each word occurrence is tagged by the pre-processing engine, making assumption to which lemma each form belongs

occurrence_id	word_id	line_id	path_id	forma_id	lemma_id
149880	3483	4506	357	PREP1086692|	36359|36358|
149881	2680	4506	357	PREP1086645|	706|705|
149882	2794	4506	357	PREP1086713|	19647|19652|19
149883	2729	4506	357	PRON1087401|	21429|
149884	2732	4506	357	V1851785|PRO	30951|30733|30
149885	4408	4506	357	V1174562|	37369|
149886	6873	4506	357	?	?
149887	5899	4506	357	N979637|N9665	16844|16844|16
149888	2647	4506	357	PRON1087333|	30747|30746|30
149889	3559	4506	357	PRON1087505|	21535|
149890	2651	4506	357	PREP1086697|	3|4|2|1|5|
149891	5673	4506	357	N818498|N8116	27478|27478|

forma_id	lemma_id	type
700419	36358	ADV
1086692	36359	PREP

Orthographic heterographs

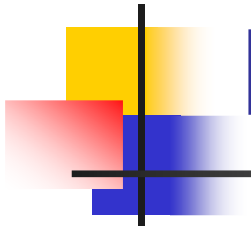
- Affect only the graphic form
- Are consequence of editorial choice (distinction U/V; jam/iam etc.)

Heterographs for “convenientia”:

- comvenientia
- combenientia
- conbenientia
- comvenihentia
- convenihentia
- cumvenihentia

Syntagmatic heterographs

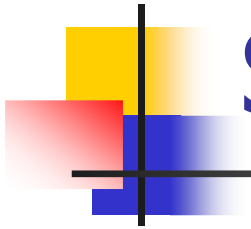
- Are effect of *sandhi* (“chaining of words”):
  - *Ecceos, viden, bonast ecc.*



Homographs

- Intralemmatic homographs → same word, same spelling, different function *(not a problem if our interest is only in quantitative analysis of lemma's usage)*

- Esalemmatic homographs → same spelling, different word *(can be a problem in quantitative analysis)*



Statistic analysis

- Two parameters:
  - Frequency of words in the “lexical universe”
  - Dispersion of words in the partitions of the “lexical universe”

Dispersion as standard deviation from the mean

$$D = 1 - \frac{\sigma}{2\overline{x}}$$

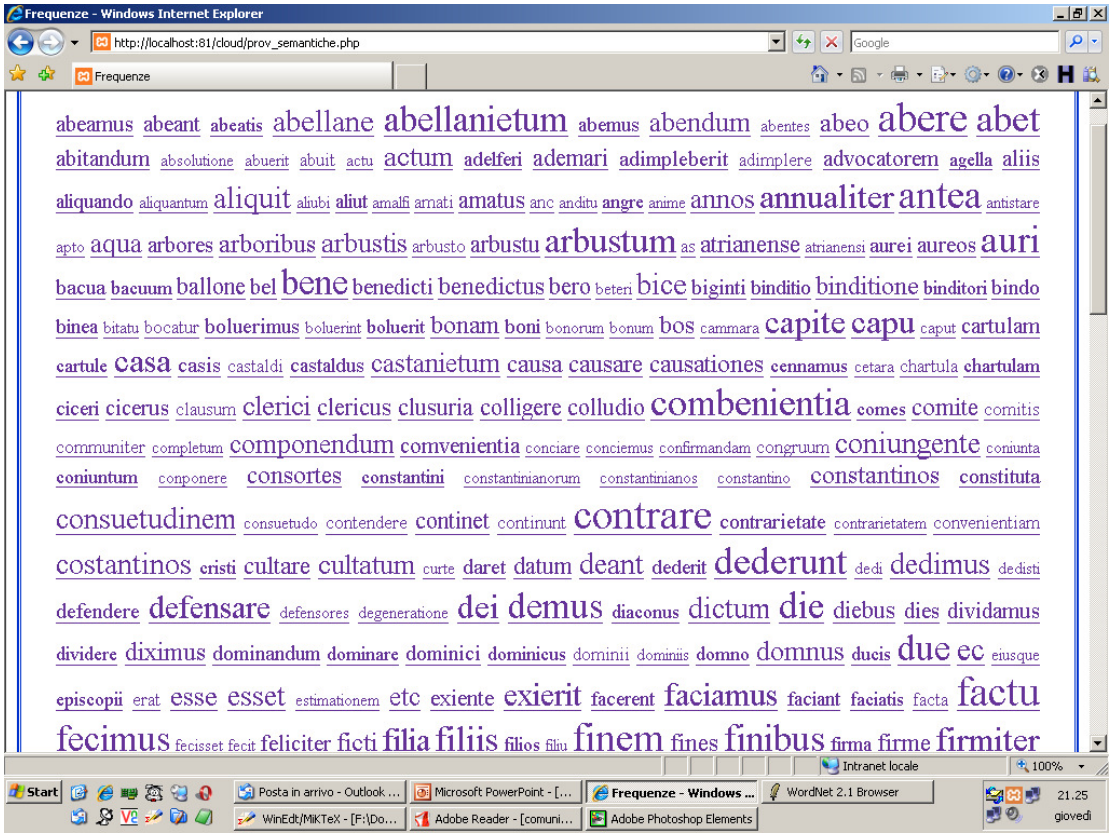
Standard deviation of occurrences of a word in partitions of the "lexical universe"

Mean value of occurrences in partitions of the "lexical universe"

D = 0 → dispersion *pessima*

D = 1 → dispersion *optima*

A *sort of game*… a "tag cloud" based on frequency and dispersion:



Usage of word can be seen as a combination of both parameters:

$$\mathrm{U} = \frac{FD}{100}$$

Analysis of co-occurrences

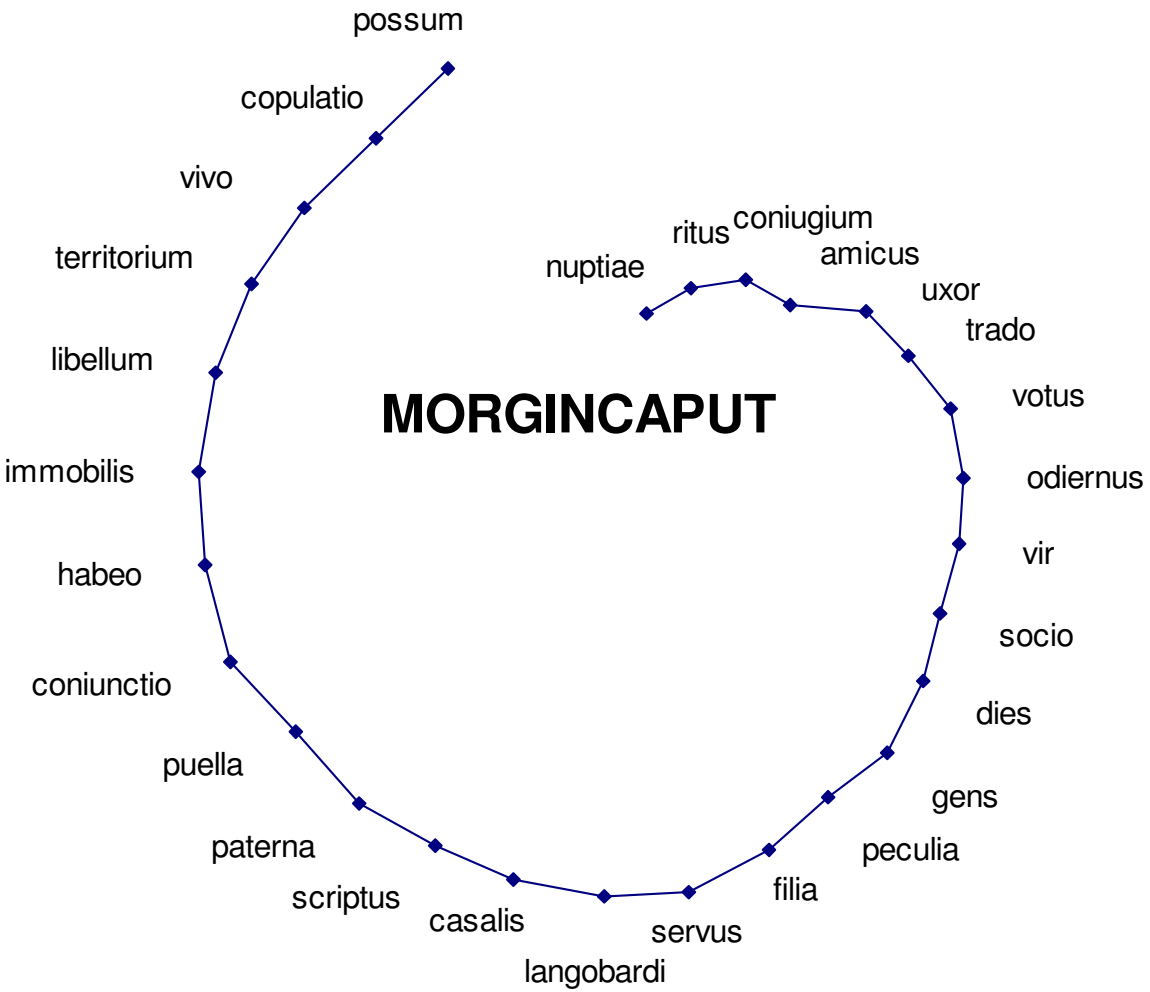
- Interest for lexycographers:
  - Better understanding of contexts of use
- Interest for historians:
  - Reconstruction of material culture

Cosine calculation for co-occurent words

$$C(X,Y) = \frac{X \cap Y}{\sqrt{X}\sqrt{Y}}$$

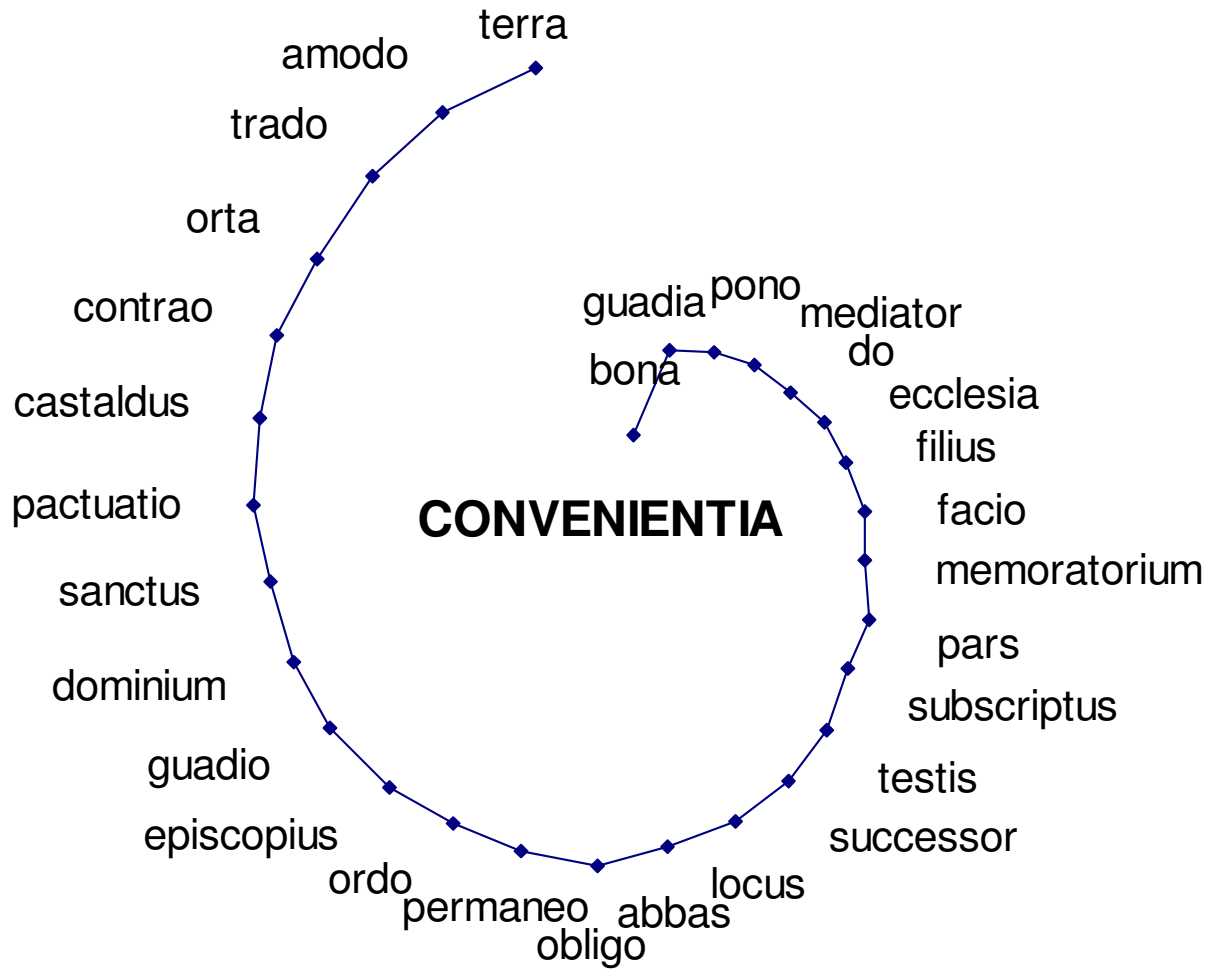
First 30 words co-occurent with “guadia”
(distance is inversely proportional to association)

First 30 words co-occurent with "morgincaput"
(distance is inversely proportional to association)



First 30 words co-occurent with "convenientia"

(distance is inversely proportional to association)



First 30 words co-occurent with “bonus”

(distance is inversely proportional to association)