



Towards the Automatic Retrieval of Cited Parallel Passages from Secondary Literature

Matteo Romanello (@mr56k)

Deutsches Archäologisches Institut, Berlin



Outline

1. Extraction of canonical references
2. Applications:
 - 2.1 Study of scholarly reception
 - 2.2 Search through secondary literature
3. Future Work



Extraction of canonical references



References in Classics

- **canonical texts** (e.g. Vergil, *Aen.* 12, 101-109, *Hom.* Il. 7.180)
- **inscriptions** (e.g. CIL 3, 6174; AE 1991, 1405)
- **papyri** (e.g. PCair. inv. 10750)
- **manuscripts** (e.g. Vendôme, Bibl. mun. 31)
- **fragmentary texts, coins, etc.**



Parallel passages?

687–98 The *locus amoenus* is a standard setting for violence and rape; cf. e.g. *Hymn. Dem.* 6ff. (Persephone), Callim. *Lau. Pall.* 71ff. (Teiresias), Moschus *Eur.* 63ff. (Europa), Prop. 1.20.33ff. (Hylas). In the *Metamorphoses* a pool, set in wooded and shady surroundings, is used recurrently as a scene for violence, death, and rape; cf. e.g. *Met.* 2.417ff. (Callisto and Jupiter), 2.454ff. (Diana and Callisto), 3.155ff. (Actaeon), 3.407ff. (Narcissus), 4.296ff. (Hermaphrodite), 5.385ff. (Persephone), 5.585ff. (Arethusa), 10.126ff. (Cyparissus); also *Fast.* 3.13ff. (Silvia and Mars), Parry *TAPA* 95 (1964) 275–80, Segal, *Landscape in Ovid's Metamorphoses* 4–19.

Gibson, *Ars Amatoria* III (2003)

cf. e.g. the “infamous opening” (Fowler 1999:434)



Consecutive references

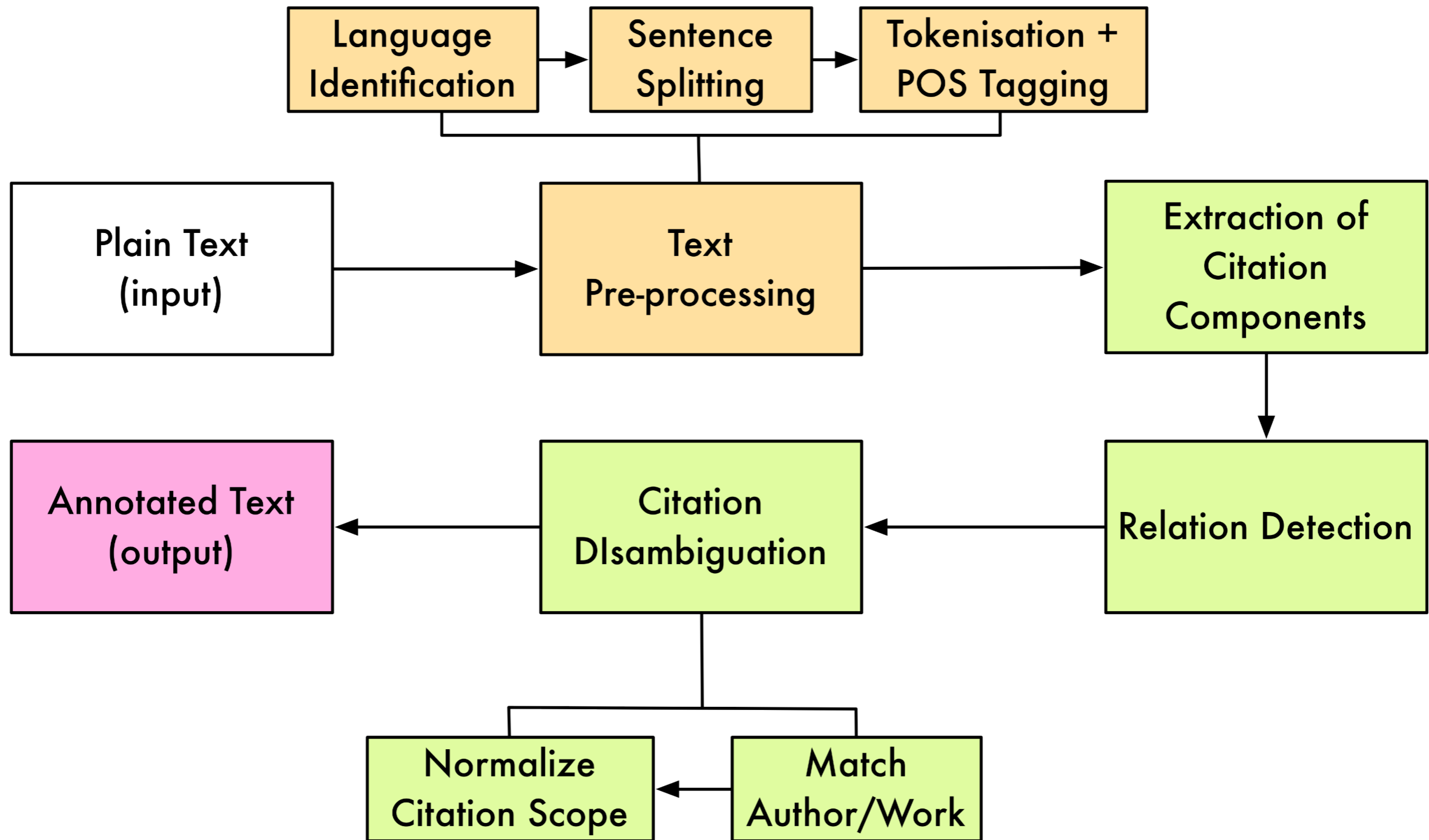
(vgl. Hdt. 2, 170 f. u. 6. Apul. met. 11,23,9. Auson. Mos. 186 f. Ov. fast. 3, 325 f. 4,552. Verg. Aen. 6, 264ff. (E. Norden z. St.). Stat. Theb. 4, 516. Apoll. Rhod. 4, 249).

Discursive references

“The picture of Achilles and of the **Iliad** that emerges from the twenty explicit references in the first half of the **Aeneid** is almost totally negative. Achilles is the unyielding (inmitis, 1.30, 3.87), ferocious (saevus, 1.458, 2.29) warrior of **Iliad 20 and 21** ; he is the preeminent killer of Trojans (1.30, 458, 468, 475, 484 ; 1.458-493, 2.196-198, 3.87, 5.803-811) and of Hector in particular (1.99, 483-484 ; 2.270-279 ; 6.168).”

Reference + quotation

The most impressive of these openings within the line accompany the arrival of the chthonic powers: **aduentante dea**. "procul, o procul este, profani! (6. 258) and the miraculous appearance of Aeneas from the cloud: **cum sic reginam adloquitur cunctisque repente improuisus ait**: "coram, quem quaeritis, adsum." (I. 594-595)





Named Entity Recognition & Classification

monks to bees occurs in Aldhelm of Malmesbury 's « De uirginitate ».
 s in their voluntary solidarity and obedience to leadership.
 vn from other Christian and pagan literature.

y influenced by REFAUWORK REFSCOPE Pliny, nat. 11, 4, 11 and REFSCOPE 11, 16, 46 and REFAUWORK REFSCOPE Vergil, georg. 4, 149-218.

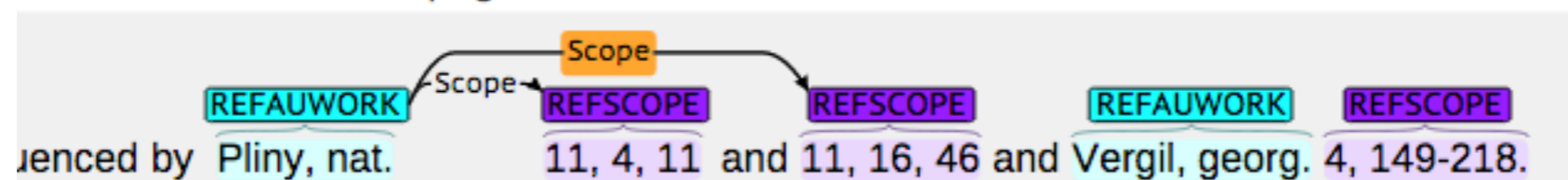
Entities:

- **aauthor** => Omero
- **awork** => Georgics
- **refauwork** => Pliny Nat., Thuc.
- **scope** => 11,4,11 ; IX 49 ;



Relation Detection

to bees occurs in Aldhelm of Malmesbury 's « De uirginitate ».
 their voluntary solidarity and obedience to leadership.
 from other Christian and pagan literature.

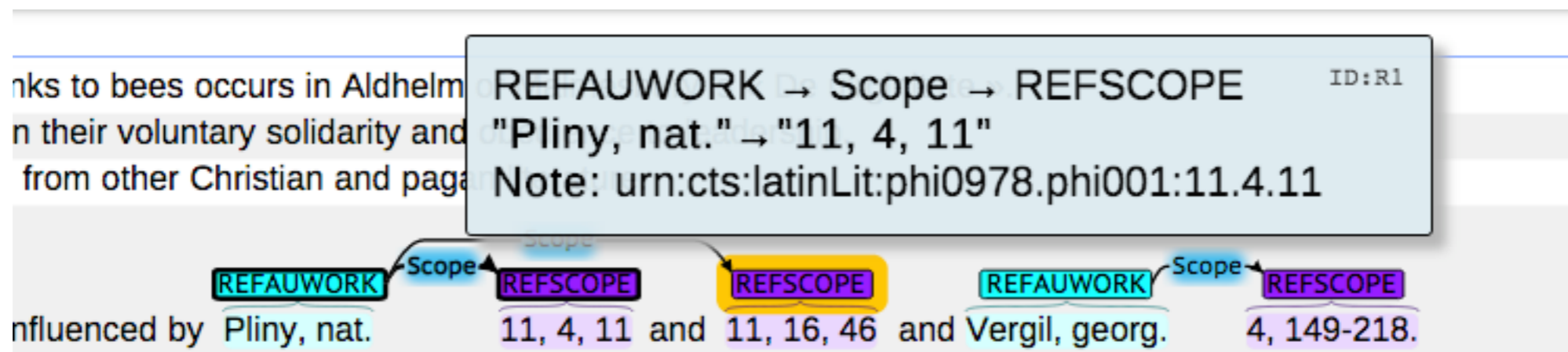


Combinations:

- **refauwork + scope** => Pliny, nat. 11, 4, 11
- **aauthor + scope** => Ammianus (15, 8, 7)
- **awork + scope** => Trabajos 159–173



Entity/Relation Disambiguation



Pliny, nat. 11, 4, 11

=> urn:cts:latinLit:phi0978.phi001:11.4.1

Vergil, Georg, 4,149-218

=> urn:cts:latinLit:phi0690.phi002:4.149-4.218



1 Citation Extractor

Lorem ipsum Verg. Aen. 12.10 f. sit amet, consectetur adipiscing elit. Duis facilisis lacinia ipsum id pharetra.

Verg. Aen. 12.10 f.

Verg. Aen

+

12.10 f.

2 Citation Matcher

Verg. Aen.

lookup against KB

urn:cts:latinLit:latinLit:phi0690.phi003

12.10 f.

through CitationParser

12.10-12.11

urn:cts:latinLit:latinLit:phi0690.phi003:12.10-12.11

3 Knowledge Base

Authors

Name variants

Text Passages

Unique identifiers

Works

Title variants

(1,500 authors; 5,500 works)

4 Citation Parser

12.10 f.

12,10 s.

XII 10 s.

```
{
  scope:
  {
    start: [12, 10]
    , end: [12, 11]
  }
}
```

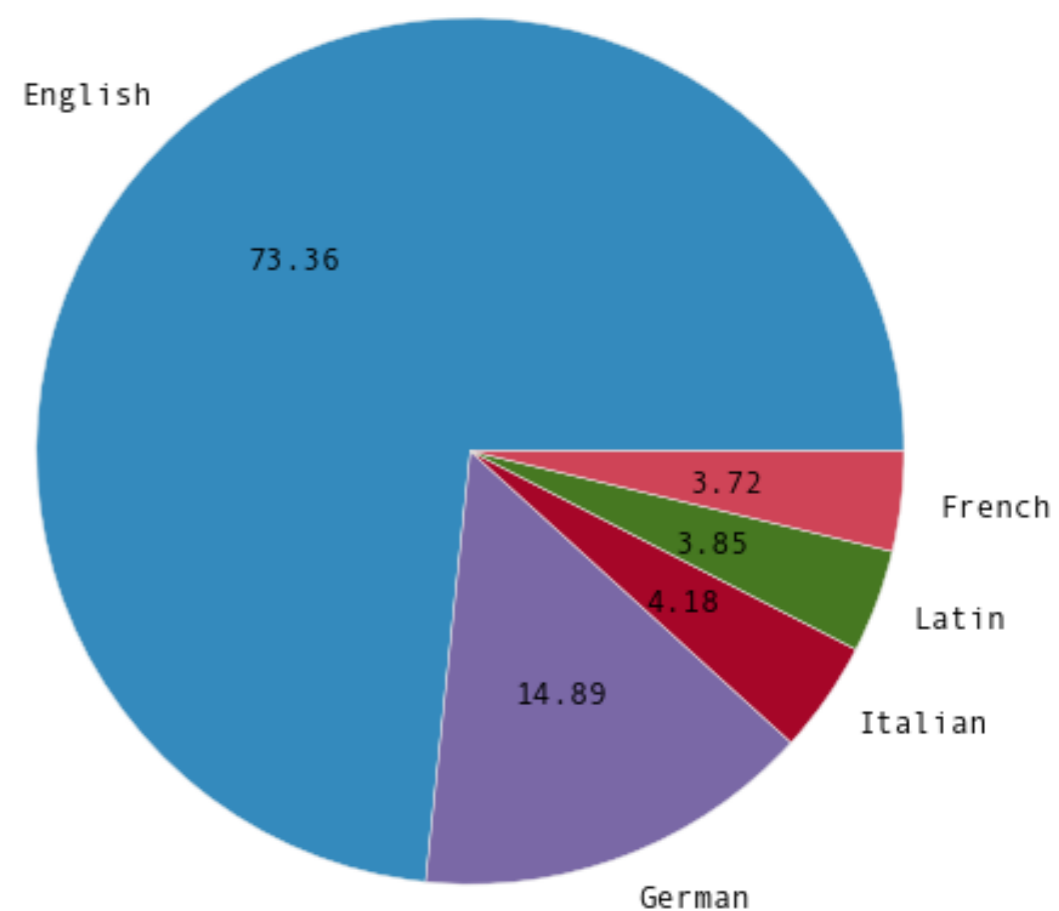
(Context-Free Grammar)



Classics articles in JSTOR

	Number
Total articles	138,821
Successfully processed articles	119,723
Sentences	34,853,399
Tokens	865,075,857
Extracted canonical references	1,649,868
Extracted author mentions	1,448,163
Extracted work mentions	4,665

Table 2: Basic statistics about the JSTOR data.

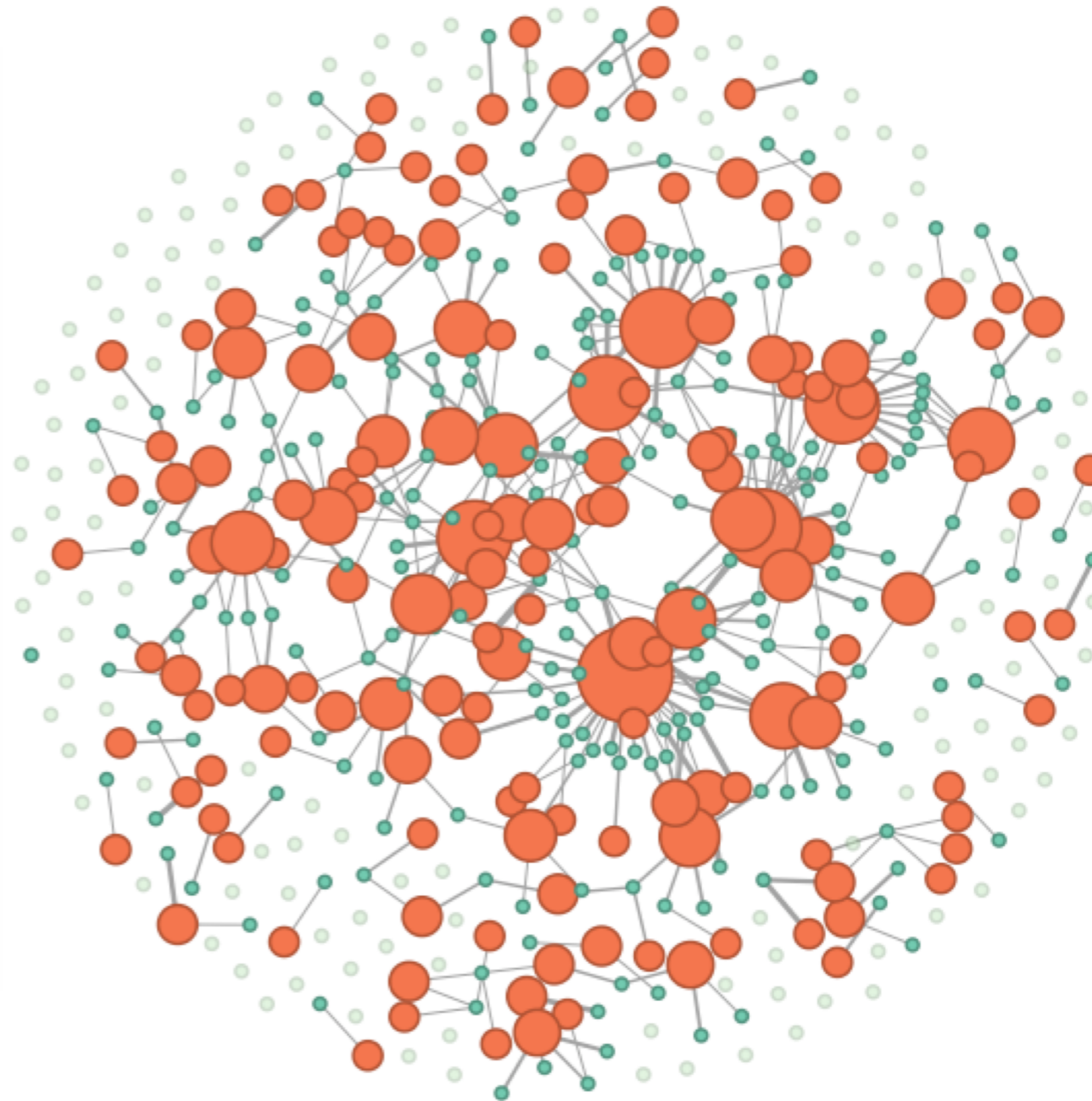




From Index to Network

Index locorum.

Aemilius Asper p. 113 K.	Pag. 353	Aristot. Eth. ad. Nicom. 1, 3	p. 740
— — p. 120	356	— Polit. II, c. 11, 1272 b 30B.	164
— — p. 127 a. 127 b. 128 a.	355	— III, c. 13, 1234 b 30	162
— — p. 128 b.	354	— — c. 15, 16	386
Aesch. Agam. 861. 1237. 1497.	382	— — c. 17, 1287 b, 37 sqq. B.	392
— Sept. 705	42	— — — 1288 a, 15 sqq.	395
Ampel. c. 2, p. 3, 9 Wölfl. f	663	— — — — 36	397
— c. 6, p. 5, 10		— — — — 41	398
Anacr. fr. 60 Bergk.	700	— IV, c. 1, 1288 b 33	163
Anth. Pal. V, 106	535	— — c. 6, 1327 b 16. c. 8, 1328	
— — 170	533	a 25. c. 9, 1328 b, 29. 1329 a	
— VI, 122	534	25	398
— — 264	160	— — c. 10, 1329 b 33	399
— — 267	536	— — c. 11, 1330 a 36. 41	400
— — 268	160	— — — 1330 b, 2	401
— — 279	691	— — c. 12, 1331 a 28. 1331 b.	
— — 385	536	4	402
— VII 20	534	— — c. 13, 1331 b 1. 1332 b 1	403
— — 375	537	— — c. 14, 1333 a 2	403
— — 414	533	— — — 1333 a 24	405
— — 420	535	— — — 1333 b 23. c. 15, 1334	
— — 488	533	a 18. 1335 b 3. 21	407
— — 491	161	— VII, c. 17, p. 1336 a 3 34 sqq.	408
— — 576	341	— — — 1336 b 3. 9	409
— — 576	691	— Polit. VIII, c. 1, p. 1337 a	
— — 651	691	11. c. 2, 1337 b 5	410
— — 733	536	— — c. 2, p. 1337 b 11. c. 3,	
— IX, 57	692	1337 b 34. c. 4, 1338 b 36 c.	
— — 315	534	5, 1340 a 12	411
— — 324	161	— — — c. 7, 1341 b 19. 38	414
— XII, 138	159	Athen. XIII, p. 588 A	567
— XIII, 22	692	Caes. B. G. III, 35	567
— — Append. Planud. 160, 6. 296	341	Cic. pro Cael, 5, 11	91
Aristoph. Pac. 630	560	— — 12, 29. 19, 47	66
— Plut. 137 v. Tzetzes.		— de Divin. I, c. 11. 12. 13	544





Study of scholarly reception



Citations as Traces of Scholarship



<https://www.flickr.com/photos/napafloma-pictures/27317099101/>



Quantitative Approaches to Scholarly Reception

W. Scheidel (1997). “Continuity and Change in Classical Scholarship”, *Ancient Society* 28.

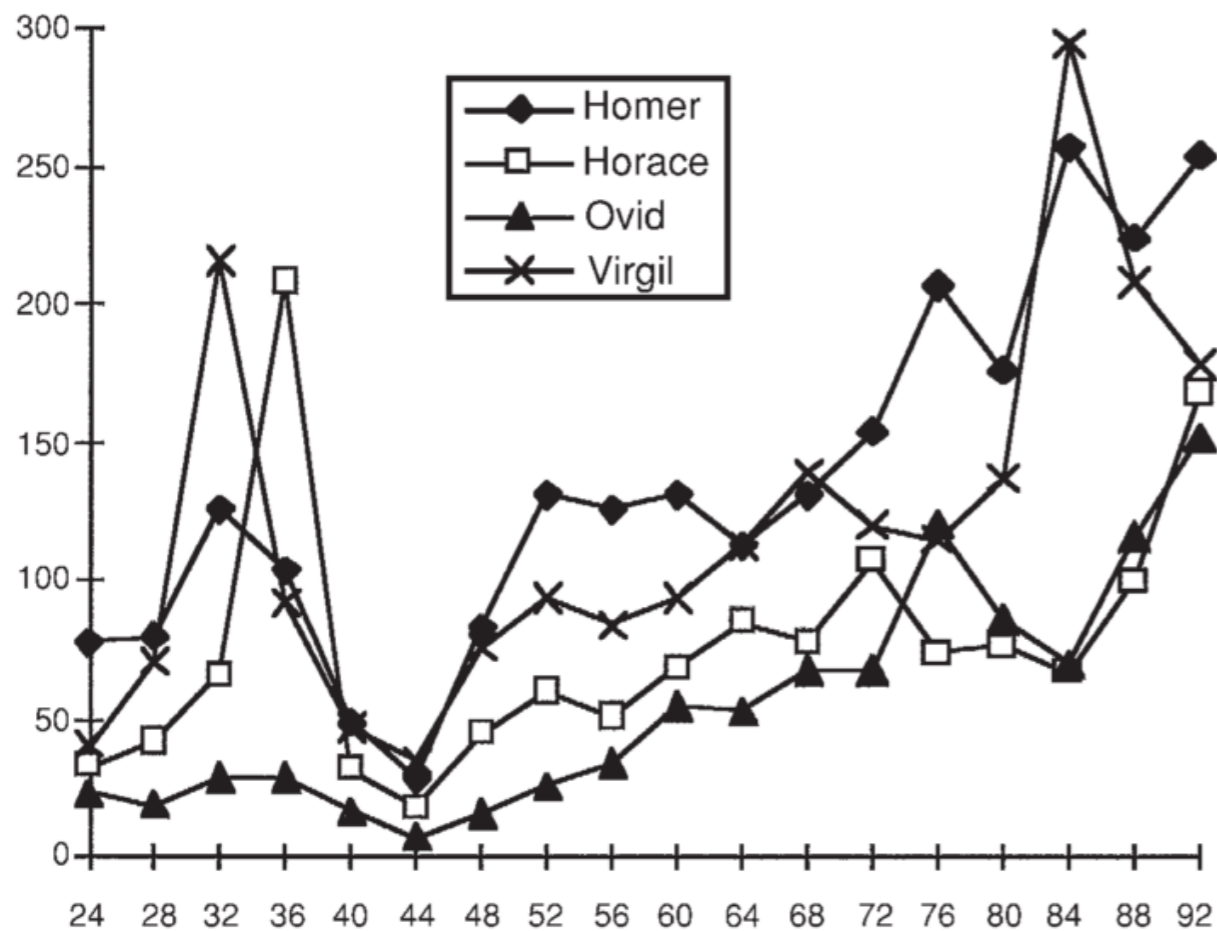


Fig. 7 Number of entries: poets

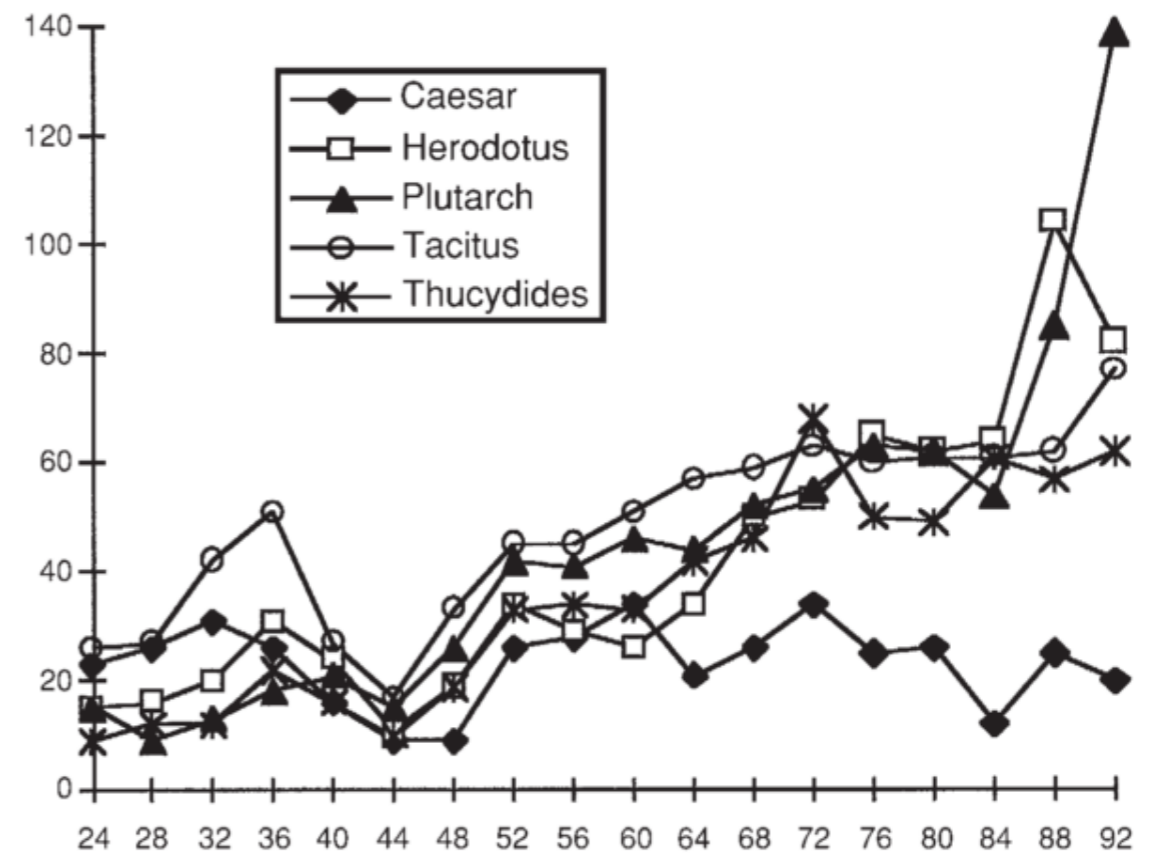
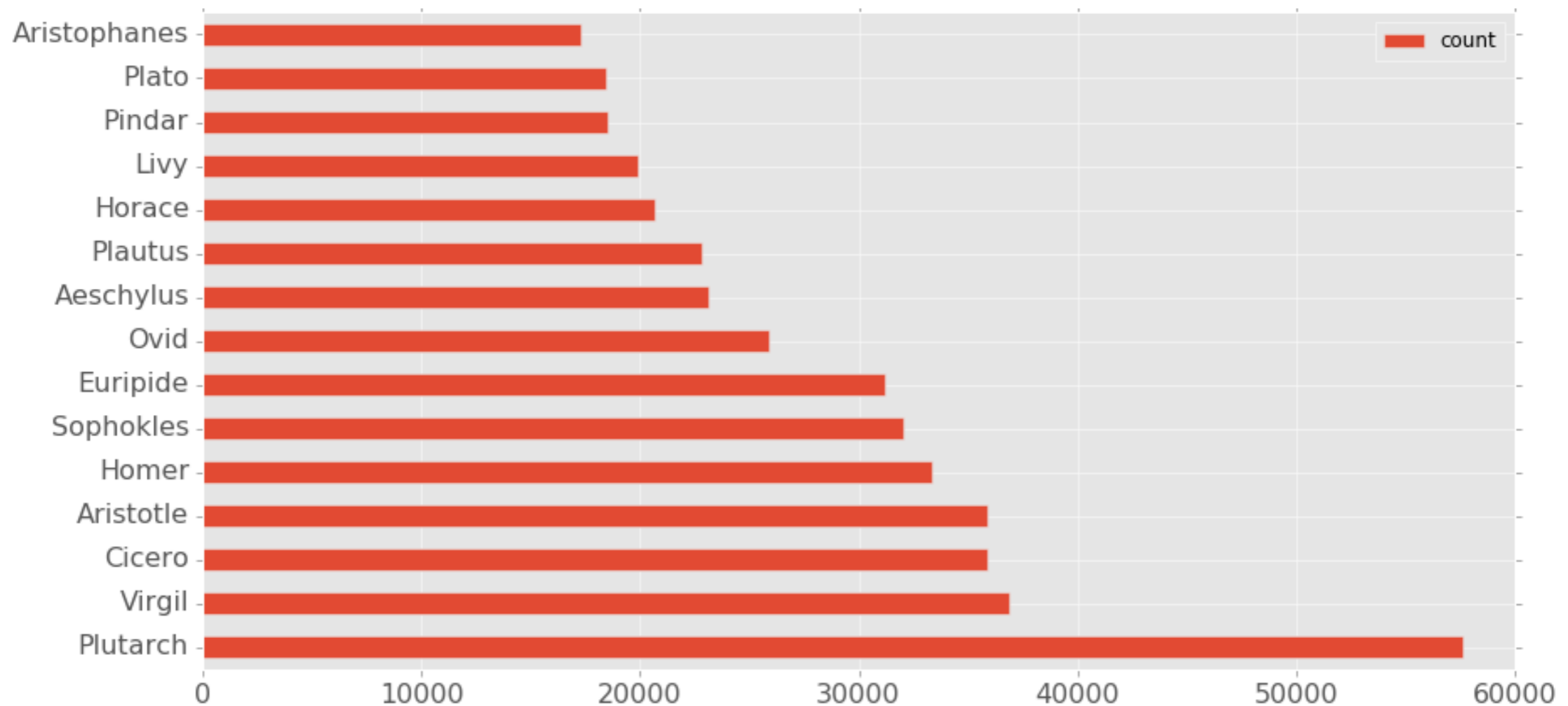


Fig. 8 Number of entries: historians and biographers



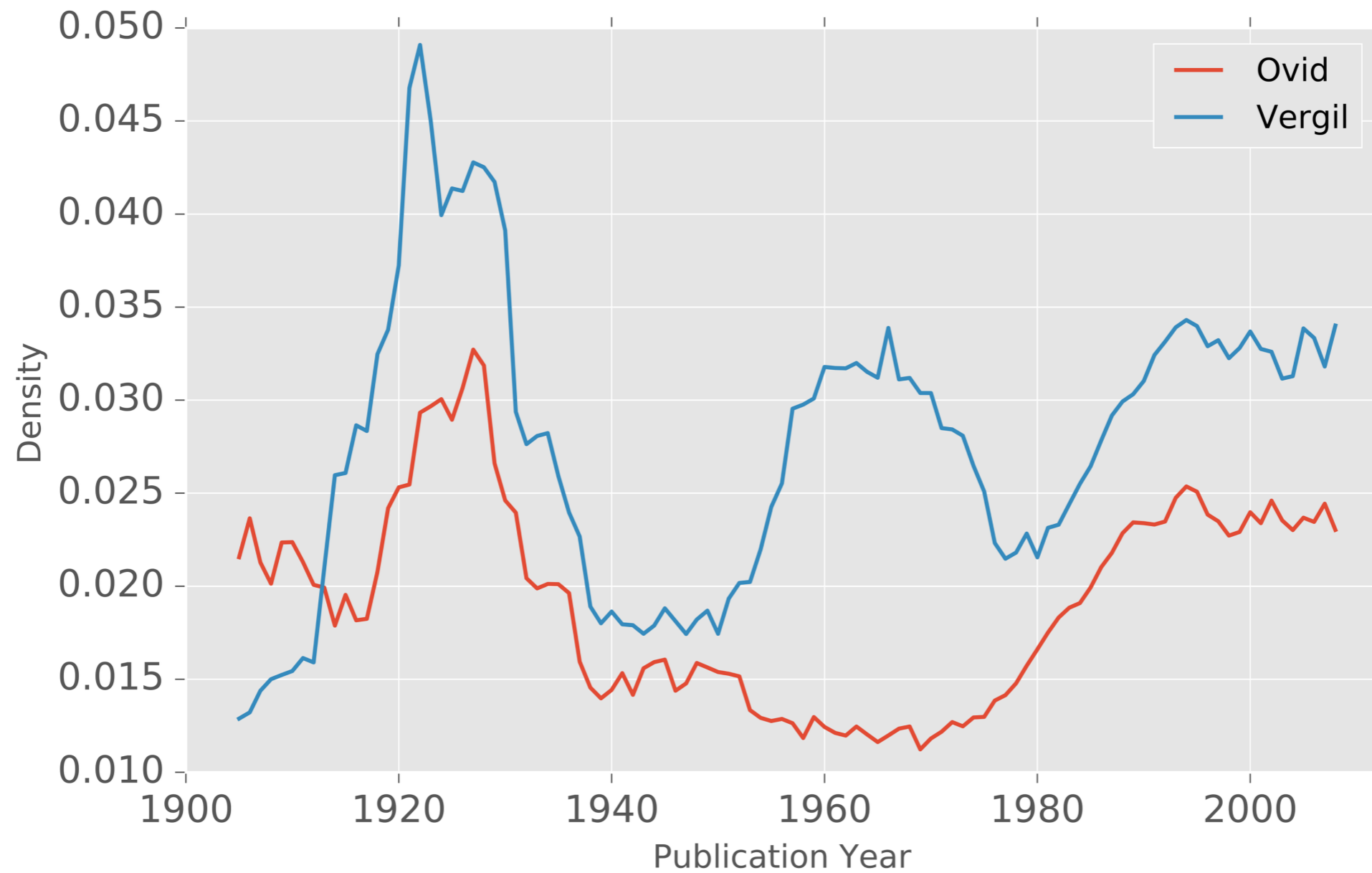
Towards to a Quantified Canon



1% of Greek/Latin authors accounts for 30% of references in JSTOR



Waves of Reception

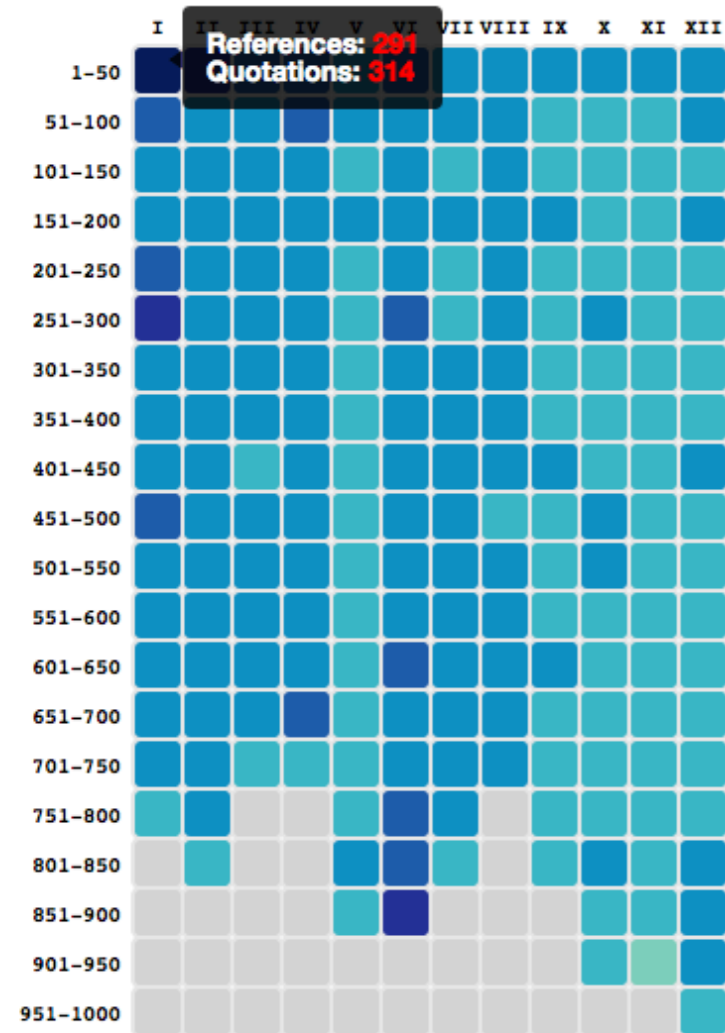




Search through secondary literature



Display: all



In Focus: Book 1, lines 1-50

Arma virumque cano, Troiae qui primus ab oris
 Italiam, fato profugus, Laviniaque venit
 litora, multum ille et terris iactatus et alto
 vi superum saevae memorem Iunonis ob iram;
 5 multa quoque et bello passus, dum conderet urbem,
 inferretque deos Latio, genus unde Latinum,
 Albanique patres, atque altae moenia Romae.
 Musa, mihi causas memora, quo numine laeso,
 quidve dolens, regina deum tot volvere casus
 10 insignem pietate virum, tot adire labores
 impulerit. Tantaene animis caelestibus irae?
 Urbs antiqua fuit, Tyrii tenuere coloni,
 Karthago, Italiam contra Tiberinaque longe
 ostia, dives opum studiisque asperrima belli;
 15 quam Iuno fertur terris magis omnibus unam
 posthabita coluisse Samo; hic illius arma,
 hic currus fuit; hoc regnum dea gentibus esse,
 si qua fata sinant, iam tum tenditque fovetque.

Results: quotations references

Aen. 1.1

112 52 3

Menin Virumque: Translating Homer with Virgil in "Epigrammata Bobiensia" 46_47 and 64

SCOTT MCGILL
 The Classical Journal 2006
 DOI: 10.2307/30038019

By rendering Iliad 1.1 with Aeneid 1.1 rather than translating Homer with an eye to word-for-word correspondence, the EB poets offer a striking perspective on that aspect of ancient education.

— (reference: 571a5798b634c1c68fef6343)

Silius Punica 6. 1-53

EDWARD L. BASSETT
 Classical Philology 1959
 DOI: 10.2307/266203



Searching for Secondary Literature about Similes

1) Verg. *Aen.* 1.430-436

430 qualis apes aestate noua per florea rura
 exercet sub sole labor, cum gentis adultos
 educunt fetus, aut cum liquentia mella
 stipant et dulci distendunt nectare cellas,
 aut onera accipiunt uenientum, aut agmine facto
 ignauum fucos pecus

2) Verg. *Aen.* 4.143-145

 qualis ubi hibernam Lyciam Xanthique fluenta
 deserit ac Delum maternam inuisit Apollo
145 instauratque choros,



Searching via the API

1. articles with 1+ references to Verg. Aen. 1.430

GET

```
http://nlp.dainst.org/citedloci/api/references?  
urn=urn:cts:latinLit:phi0690.phi003:1.430
```

2. articles with any reference to the Aeneid

GET

```
http://nlp.dainst.org/citedloci/api?  
references?  
urn=urn:cts:latinLit:phi0690.phi003&type=scope
```

3. articles mentioning the Aeneid

GET

```
http://nlp.dainst.org/citedloci/api/references?  
urn=urn:cts:latinLit:phi0690.phi003&type=awork
```



Search for parallels in secondary literature?

- **Parallel**

- co-occurrence of two (or more) references within a given context (e.g. sentence)

- **Query example**

- Which articles discuss parallels between Vergilian and Homeric poems?

- **Use cases**

- was a given parallel already known in the literature?
- preparation of a commentary
- ...

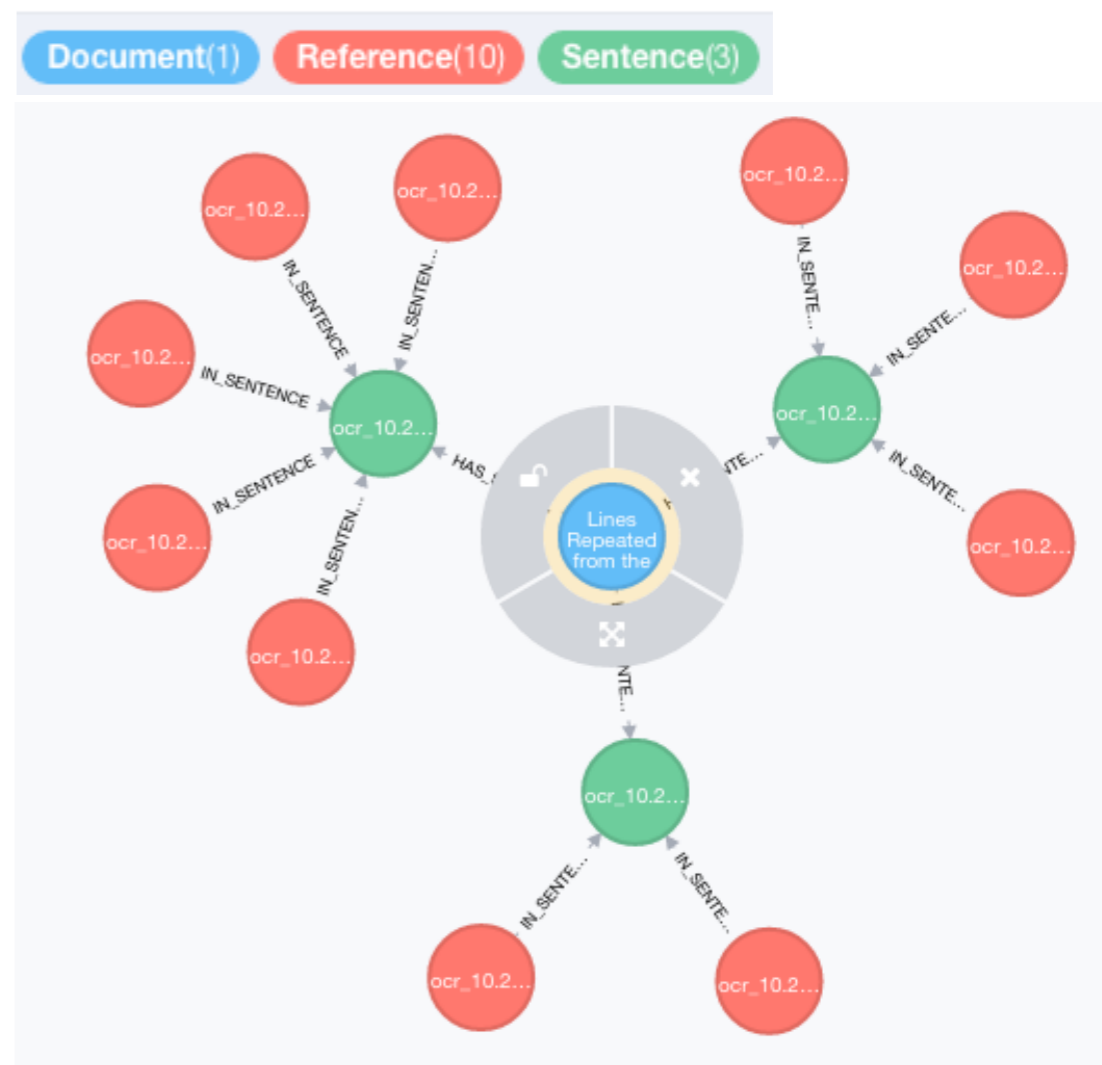


Graph Search for Parallels

GET
<http://nlp.dainst.org/citedloci/api/references?urn=urn:cts:latinLit:phi0690&level=scope&urn=urn:cts:greekLit:tlg0012&level=scope>



- 1 MATCH (d:Document)-[:HAS_SENTENCE]-(s:Sentence)
- 2 MATCH (r1:Reference)-[:IN_SENTENCE]-(s)
- 3 MATCH (r2:Reference)-[:IN_SENTENCE]-(s)
- 4 WHERE r1.author_urn = "urn:cts:greekLit:tlg0012" and r1.annotation_type = "scope" and r2.author_urn = "urn:cts:latinLit:phi0690" and r2.annotation_type = "scope"
- 5 RETURN d.doi as doi, s.sequence as sentence_number, r1 as ref1, r2 as ref2





Result Example 1

It was already apparent to Servius (ad Aen. 6.468) that the encounter of Dido and Aeneas in the underworld (**Verg. Aen. 6.450-76**) is modelled upon Homer's scene of Ajax' shade shunning Odysseus in silence because he had been the provocation for his suicide (**Od. 11.541-64** ; Knauer 108-12).

R. Drew Griffith, "Catullus' Coma Berenices and Aeneas' Farewell to Dido", in *TAPhA* 1995(125), pp. 47-59. DOI: 10.2307/284345



```
{
  "document": {
    "publisher": "American Philological Association",
    "doi": "10.2307/284345",
    "pubdate": 1995,
    "author": "R. Drew Griffith",
    "journaltitle": "Transactions of the American Philological Association (1974-)",
    "reviewed-work": "",
    "title": "Catullus' Coma Berenices and Aeneas' Farewell to Dido",
    "filename": "ocr_10.2307_284345.txt",
    "volume": "125",
    "issue": "",
    "pagerange": "pp. 47-59",
    "type": "fla",
    "id": "10.2307/284345"
  },
  "matching_references": [
    {
      "urn": "urn:cts:greekLit:tlg0012.tlg002:11.541-11.64",
      "_id": "571a40dab634c1c6a2ee9943",
      "type": "scope",
      "surface": "(Od. 11.541-64 ;"
    },
    {
      "urn": "urn:cts:latinLit:phi0690.phi003:6.450-6.76",
      "_id": "571a40dab634c1c6a2ee9942",
      "type": "scope",
      "surface": "(Verg. Aen. 6.450-76)"
    }
  ],
  "sentence": {
    "text": "It was already apparent to Servius (ad Aen. 6.468) that the encounter of Dido and Aeneas in the underworld (Verg. Aen. 6.450-76) is modelled upon Homer 's scene of Ajax ' shade shunning Odysseus in silence because he had been the provocation for his suicide (Od . 11.541-64 ; Knauer 108-12).",
    "sequence": 124
  }
},
```



Result Example 2

“The picture of Achilles and of the **Iliad** that emerges from the twenty explicit references in the first half of the **Aeneid** is almost totally negative.

Achilles is the unyielding (*inmitis*, 1 .30, 3.87), ferocious (*saevus*, 1.458, 2.29) warrior of **Iliad 20 and 21** ; he is the preeminent killer of Trojans (1.30, 458, 468, 475, 484 ; 1.458-493, 2.196-198, 3.87, 5.803-811) and of Hector in particular (1.99, 483-484 ; 2.270-279 ; 6.168).”

Katherine Callen King, "Foil and Fusion: Homer's Achilles in Vergil's Aeneid", in *Materiali e discussioni per l'analisi dei testi classici*, 1982(9), pp. 31-57.

DOI: 10.2307/40235789



Result Example 3

The role of Boreas as the lover of Oreithyia and Pharmakeia is also interesting in view of the horse symbolism involved in the maenad 's rituals : Boreas was thought to be able to fertilize horses (**Hom., Il. 20.221** ; cf. **Verg., Georg. 3.274-5**).

Carl A. P. Ruck, “On the Sacred Names of Iamos and Ion: Ethnobotanical Referents in the Hero's Parentage”, in *CJ* 1976 71(3), pp. 235-252. DOI: 10.2307/3296184



Future work

- **Extraction**
 - improve accuracy
 - more (types of) publications
 - more languages
- **Analysis**
 - quantified scholarly reception
 - citation network analysis
- **Access**
 - more user interfaces
 - release API
- **Search**
 - citation-based recommendation system



Thanks for your attention!

@mr56k

matteo.romanello@dainst.de

www.aeneidinjstor.eu/explore