Quantifying Early Modern English spelling variation: Change over time and genre

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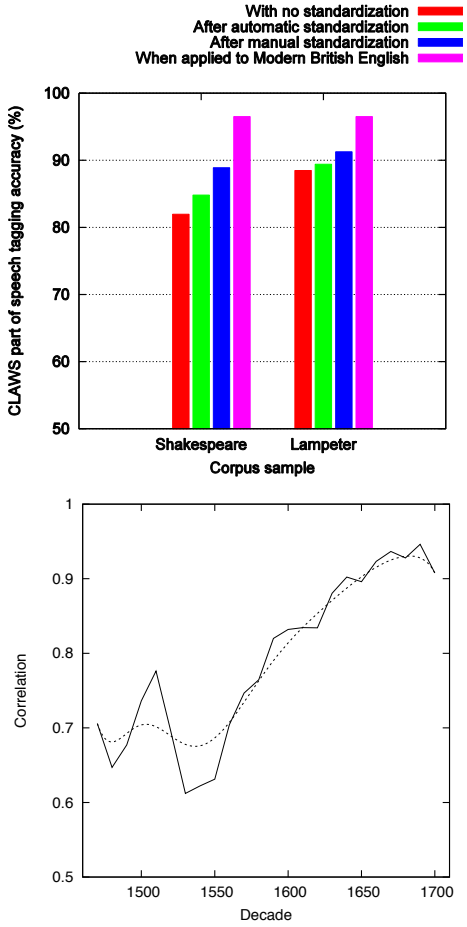
EModE spelling variation

- Marked degree of spelling variation in Early Modern English texts despite the gradual standardisation between 1500-1700 (Vallins & Scragg, 1965; Görlach, 1991; Nevalainen, 2006).
- Spelling variation has a negative effect on the accuracy of automatic corpus linguistic methods. This has been shown to be the case for:
  - Semantic analysis (Archer *et al.*, 2003)
  - POS tagging (Rayson *et al.*, 2007)
  - Key word analysis (Baron *et al.*, 2009)

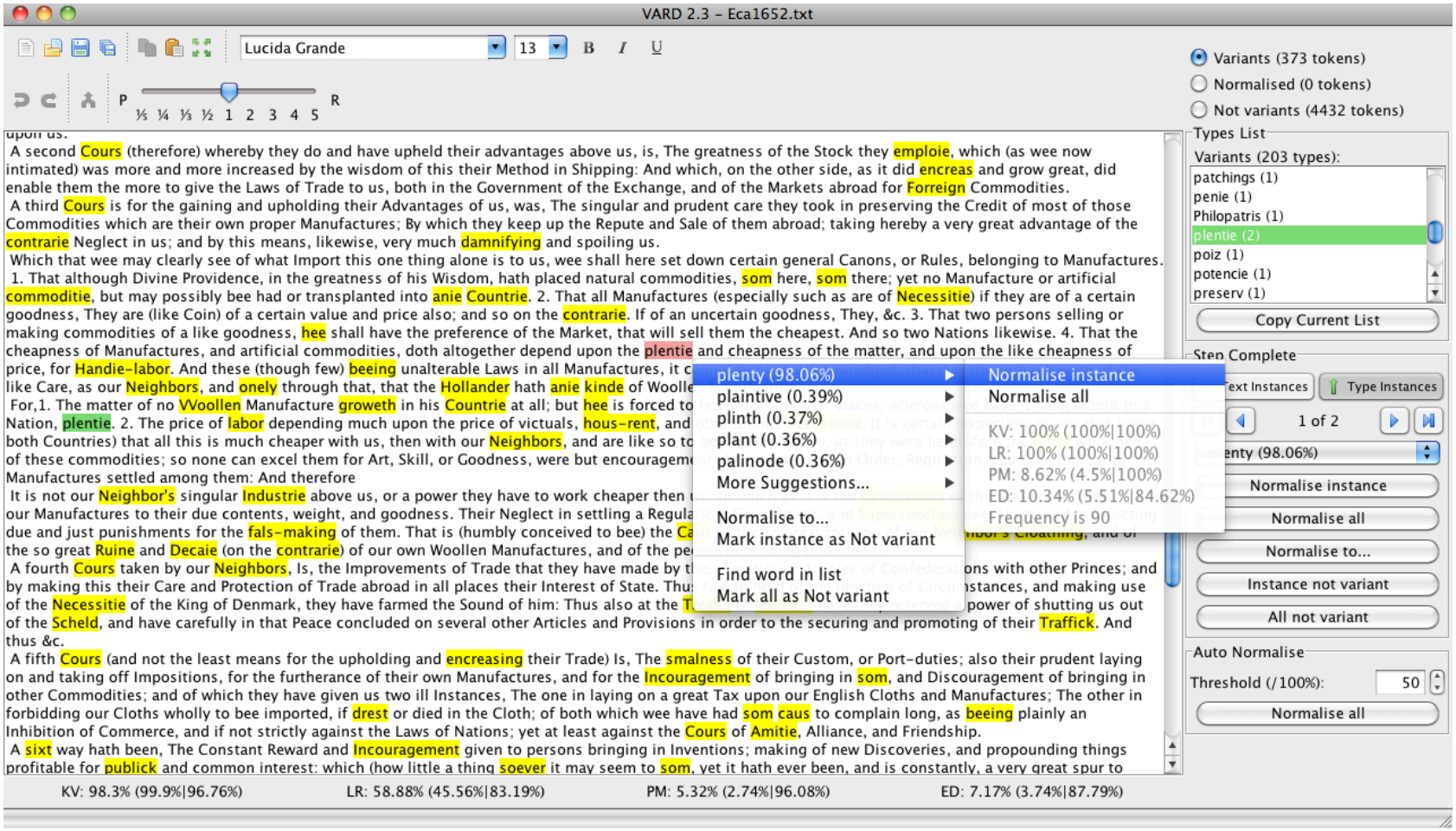


VARD 2

- A tool for normalising spelling variation in historical corpora both manually and automatically.
- Variants are detected by finding those that do not occur in a modern word list.
- A ranked list of normalisation candidates for each variant is produced using four main methods:
  - A manually created list of variant/normalisation pairs.
  - Phonetic matching using a modified Soundex algorithm.
  - A set of letter replacement rules.
  - The Levenshtein Edit Distance algorithm.
- Normalisations are chosen by the user or automatically by the system and replaced in the text with the original spelling retained in an xml tag.

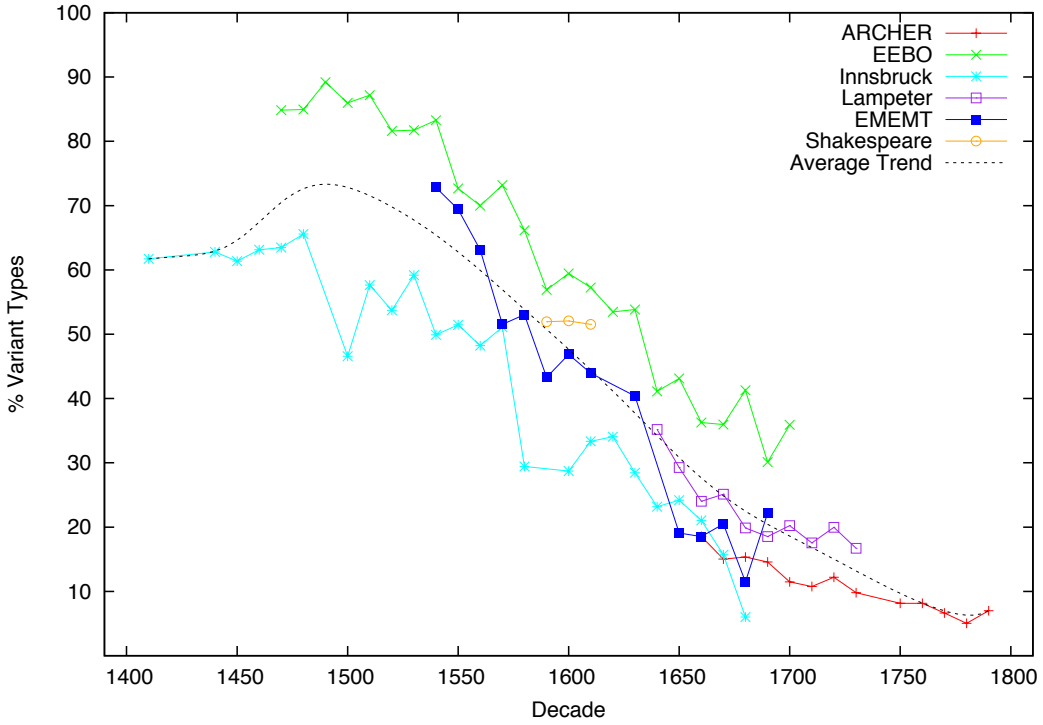
(Baron & Rayson, 2009)

VARD 2.3


VARD 2.3 - Eca1652.txt
Lucida Grande
13
Variants (373 tokens)
Normalised (0 tokens)
Not variants (4432 tokens)
Types List
Variants (203 types):
patchings (1)
penie (1)
Philopatris (1)
plentie (2)
poiz (1)
potencie (1)
preserv (1)
Copy Current List
Step Complete
Text Instances
Type Instances
1 of 2
plenty (98.06%)
Normalise instance
Normalise all
Normalise to...
Instance not variant
All not variant
Auto Normalise
Threshold (/100%):
50
Normalise all
plenty (98.06%)
plaintive (0.39%)
plinth (0.37%)
plant (0.36%)
palinode (0.36%)
More Suggestions...
Normalise to...
Mark instance as Not variant
Find word in list
Mark all as Not variant
Normalise instance
Normalise all
KV: 100% (100%|100%)
LR: 100% (100%|100%)
PM: 8.62% (4.5%|100%)
ED: 10.34% (5.51%|84.62%)
Frequency is 90
KV: 98.3% (99.9%|96.76%)
LR: 58.88% (45.56%|83.19%)
PM: 5.32% (2.74%|96.08%)
ED: 7.17% (3.74%|87.79%)

Quantifying spelling variation

- VARD allows for the study of spelling variation in EModE texts, and its effects.
- A large-scale study of the spelling variation in different EModE corpora quantified the steady decline in the ratio of spelling variants to modern spellings. (Baron *et al.*, 2009)



DICER

- Discovery and Investigation of Character Edit Rules
- Examines variant / normalisation pairs found in the XML output from VARD.
- Determines what letter replacement rules are required to convert the variant form into the normalised form. For example:

Variant	Normalisation	Rules
anie	any	ie → y
publick	public	remove k
ioynte	joint	i → j y → i remove e

- Frequencies are calculated for each rule indicating how often each rule occurs, which position of the variant it should be applied and with which surrounding letters.
- Meta-data is also stored to allow for the analysis of spelling rule trends over time, genre or any other meta-data present.

DICER

DICER: Discovery and Investigation of Character Edit Rules

Innsbruck Letters

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User

Logged in as *a.baron@comp.lancs.ac.uk.*

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Summary | Rules | Search | Profile

Display: Tokens | **Types**

Link to this page

Edit Distance:

Edits	Frequency
1	5988 (44.35%)
2	4490 (33.25%)
3	2034 (15.06%)
4	676 (5.01%)
5	224 (1.66%)
6	64 (0.47%)
7	19 (0.14%)
8	6 (0.04%)
9	1 (0.01%)
14	1 (0.01%)
Total	**13503**

Positions:

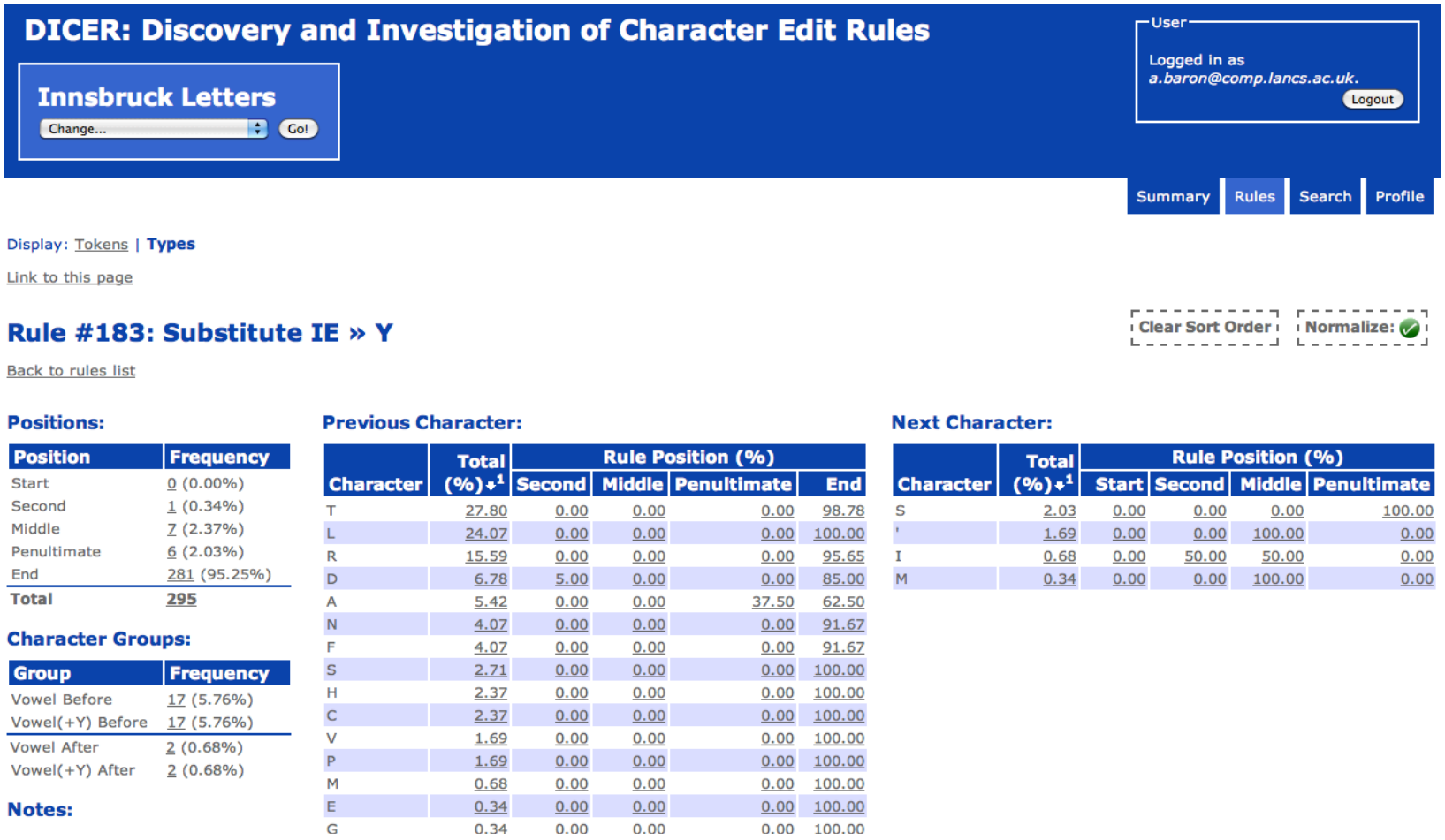
Position	Frequency
Start	1043 (5.10%)
Second	2238 (10.94%)
Middle	8088 (39.54%)
Penultimate	3046 (14.89%)
End	6042 (29.54%)
Total	**20457**

Rules:

Clear Sort Order | Normalize

#	ID	Rule	Variant	Standard	Total (/1000)[1]	Position (%)				
						Start	Second	Middle	Penultimate	End
1	2	Deletion	E		144.40	0.10	0.34	11.78	13.47	74.31
2	3	Substitution	Y	I	89.90	1.36	23.22	69.98	5.44	0.00
3	7	Insertion		E	43.46	1.01	5.06	28.57	15.52	49.83
4	4	Substitution	LL	L	27.33	0.18	7.16	19.14	7.51	66.01
5	130	Substitution	Y	E	22.93	1.28	8.10	22.60	66.31	1.71
6	33	Insertion		A	19.11	6.39	6.14	78.01	8.70	0.77
7	45	Substitution	E	I	17.99	11.68	24.46	57.34	6.52	0.00
8	43	Substitution	U	V	15.54	0.63	7.55	78.62	13.21	0.00
9	183	Substitution	IE	Y	14.42	0.00	0.34	2.37	2.03	95.25
10	32	Deletion	U		14.37	0.00	6.46	84.69	8.50	0.34
11	16	Substitution	I	E	13.59	29.86	13.67	21.94	33.45	1.08
12	207	Substitution	TT	T	12.95	0.00	0.38	30.57	16.60	52.45
13	14	Deletion	Y		11.78	2.90	0.41	36.93	58.09	1.66
14	53	Insertion		U	10.31	0.00	4.74	81.52	13.27	0.47
15	66	Substitution	E	A	10.22	6.70	32.06	45.45	14.35	1.44
16	19	Substitution	E	EE	10.17	0.00	27.88	45.67	20.19	6.25
17	55	Insertion		I	10.12	1.93	8.21	84.54	4.35	0.97
18	229	Substitution	S	SS	9.87	3.96	3.96	18.32	8.42	65.35
19	105	Deletion	_		8.95	0.00	8.20	91.80	0.00	0.00

DICER



DICER: Discovery and Investigation of Character Edit Rules

Innsbruck Letters

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Summary | Rules | Search | Profile

Display: Tokens | **Types**

Link to this page

Rule #183: Substitute IE » Y

Clear Sort Order | Normalize:

Back to rules list

Positions:

Position	Frequency
Start	0 (0.00%)
Second	1 (0.34%)
Middle	7 (2.37%)
Penultimate	6 (2.03%)
End	281 (95.25%)
Total	**295**

Character Groups:

Group	Frequency
Vowel Before	17 (5.76%)
Vowel(+Y) Before	17 (5.76%)
Vowel After	2 (0.68%)
Vowel(+Y) After	2 (0.68%)

Notes:

Previous Character:

Character	Total (%)[1]	Rule Position (%)			
		Second	Middle	Penultimate	End
T	27.80	0.00	0.00	0.00	98.78
L	24.07	0.00	0.00	0.00	100.00
R	15.59	0.00	0.00	0.00	95.65
D	6.78	5.00	0.00	0.00	85.00
A	5.42	0.00	0.00	37.50	62.50
N	4.07	0.00	0.00	0.00	91.67
F	4.07	0.00	0.00	0.00	91.67
S	2.71	0.00	0.00	0.00	100.00
H	2.37	0.00	0.00	0.00	100.00
C	2.37	0.00	0.00	0.00	100.00
V	1.69	0.00	0.00	0.00	100.00
P	1.69	0.00	0.00	0.00	100.00
M	0.68	0.00	0.00	0.00	100.00
E	0.34	0.00	0.00	0.00	100.00
G	0.34	0.00	0.00	0.00	100.00

Next Character:

Character	Total (%)[1]	Rule Position (%)			
		Start	Second	Middle	Penultimate
S	2.03	0.00	0.00	0.00	100.00
'	1.69	0.00	0.00	100.00	0.00
I	0.68	0.00	50.00	50.00	0.00
M	0.34	0.00	0.00	100.00	0.00

DICER

	Variant	Standard	ED	Position	Index	Other Rules	Category	Tokens[1]
☐	verie	very	2	End	3			51
☐	Majestie	Majesty	2	End	6			28
☐	Secretarie	Secretary	2	End	8			28
☐	maiestie	majesty	3	End	6	120(2 - Middle)		16
☐	hartie	hearty	3	End	4	7(1 - Second)		14
☐	companie	company	2	End	6			14
☐	anie	any	2	End	2			12
☐	sorie	sorry	2	End	3	59(2 - Penultimate)		11
☐	daylie	daily	3	End	4	3(2 - Middle)		10
☐	trustie	trusty	2	End	5			10
☐	happie	happy	2	End	4			8
☐	mercie	mercy	2	End	4			8
☐	humblie	humbly	2	End	5			7
☐	copie	copy	2	End	3			6
☐	contrarie	contrary	2	End	7			6
☐	almightie	almighty	2	End	7			6
☐	treatie	treaty	2	End	5			6
☐	glorie	glory	2	End	4			6
☐	shortlie	shortly	2	End	6			6
☐	libertie	liberty	2	End	6			6
☐	dutie	duty	2	End	3			5
☐	manie	many	2	End	3			5
☐	Nobilitie	nobility	2	End	7			5
☐	Ladie	Lady	2	End	3			5
☐	certaintie	certainty	2	End	8			4
☐	holie	holy	2	End	3			4
☐	honestie	honesty	2	End	6			4
☐	partie	party	2	End	4			4
☐	satisfie	satisfy	2	End	6			4
☐	adversarie	adversary	2	End	8			4
☐	pittie	pity	3	End	4	207(2 - Middle)		4
☐	armie	army	2	End	3			4

DICER

Search Results | Decade | Year | Century | ½ Century | ¼ Century

¼ Century	Matching types	Total types	%
1375-1399	0	345	0.000
1400-1424	10	776	1.289
1425-1449	10	1999	0.500
1450-1474	3	1693	0.177
1475-1499	0	2368	0.000
1500-1524	33	2047	1.612
1525-1549	64	2687	2.382
1550-1574	62	1354	4.579
1575-1599	51	1263	4.038
1600-1624	65	1790	3.631
1625-1649	64	1676	3.819
1650-1674	54	1208	4.470
1675-1699	8	446	1.794

Corpora – EMEMT

- Contains 2 millions words from texts dated between 1500 and 1700 from the specific domain of science and medicine (Taavitsainen & Pahta, 2010).
- Corpus released with spelling variation automatically normalised using VARD 2 (Lehto *et al.*, 2010).
- VARD 2 was trained by Anu Lehto manually normalising a representative sample of the corpus. This comprised of:
  - 24 text extracts of 1,000 words representing all six categories at each 50-year time period.
  - 24 samples of 500 words generated by randomly selecting small portions of texts from the remaining corpus.
- The manually normalised samples (36,000 words total) contain 5,406 variant tokens and 2,820 variant types for analysis in DICER.

Corpora – Innsbruck Letters

- Part of the Innsbruck Computer-Archive of Machine-Readable English Texts (ICAMET) (Markus, 1999).
- 469 complete letters dated between 1386 and 1688, containing a total of 182,000 words.
- Contains parallel line pairs, one of the original text and one with a normalised version of the first line:

  $I schepyng at thys day, but be the grace of God I am avysyd
  $N shipping at this day, but by the grace of God I am advised

- Converted into XML format so individual spelling variant-normalisation pairs can be analysed:

  <replaced orig="schepyng">shipping</replaced> at <replaced orig="thys">this </replaced> day, but <replaced orig="be">by</replaced> the grace of God I am <replaced orig="avysyd”>advised</replaced>

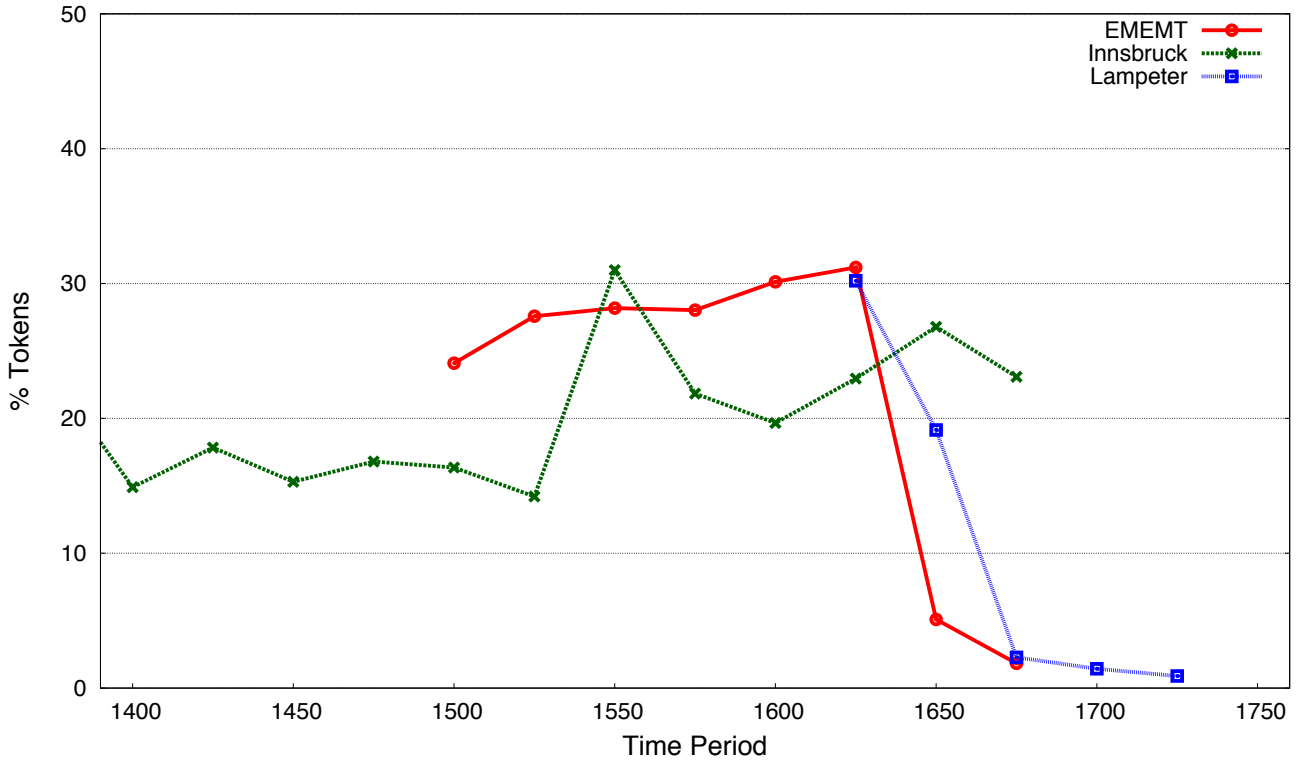
- 43,740 variant tokens and 13,503 variant types to be analysed with DICER.

Corpora – Lampeter

- Tracts and pamphlets published between 1640 and 1740 (Schmied, 1994).
- Six domains represented (Religion, Politics, Economy & Trade, Science, Law and Miscellaneous) with two texts for each domain per decade.
- Total of 120 complete texts by 120 different authors. 1.1 million words.
- Spelling variants automatically normalised with VARD 2.3 at a 50% threshold after being trained by manually normalising a 3,000 word sample (as used in Rayson *et al.*, 2007).
- 34,304 variant tokens and 7,339 variant types to analyse in DICER.

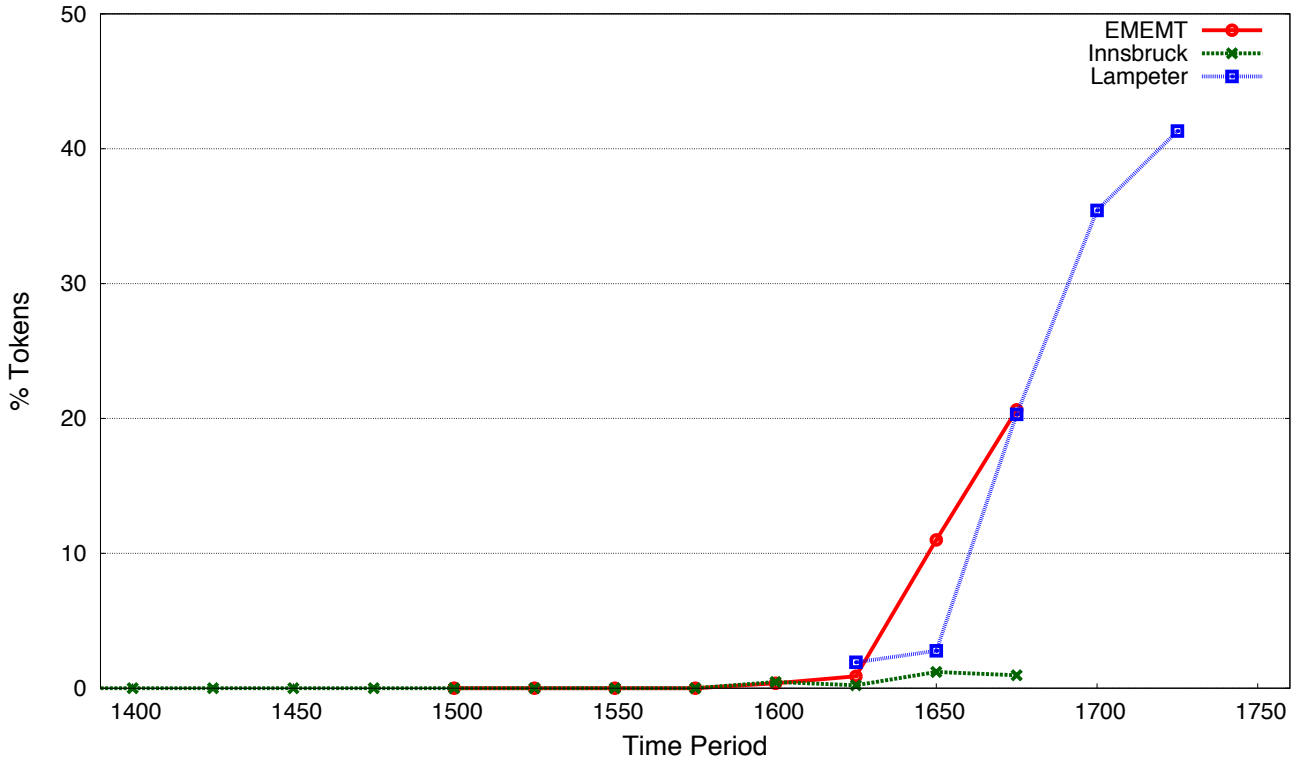
Extra final e removed

- Examples:
  - doe (do)
  - thinke (think)
  - owne (own)
- Most common rule in all three datasets.



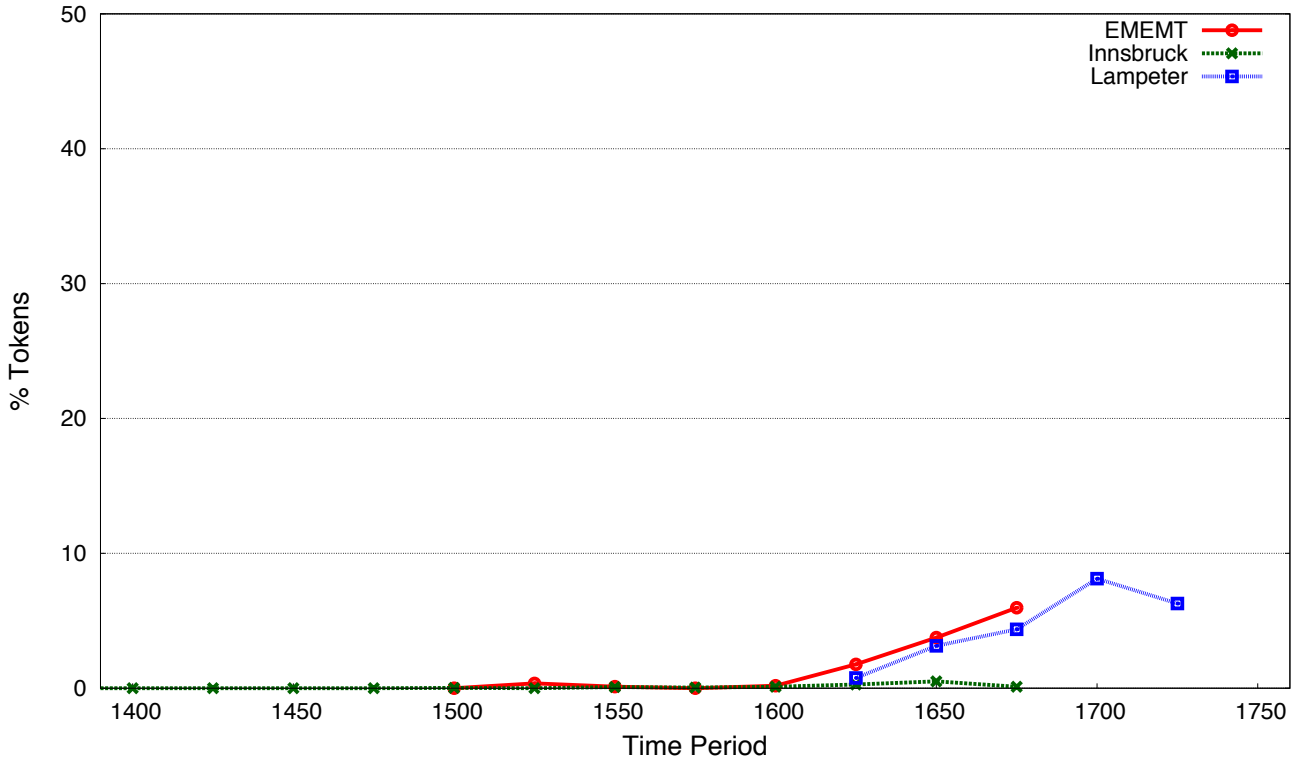
-'d → -ed

- Examples:
  - call'd (called)
  - pleas'd (pleased)
  - prov'd (proved)
- Difference between corpora:
  - 10th in EMEMT.
  - 91st in Innsbruck.
  - 2nd in Lampeter.



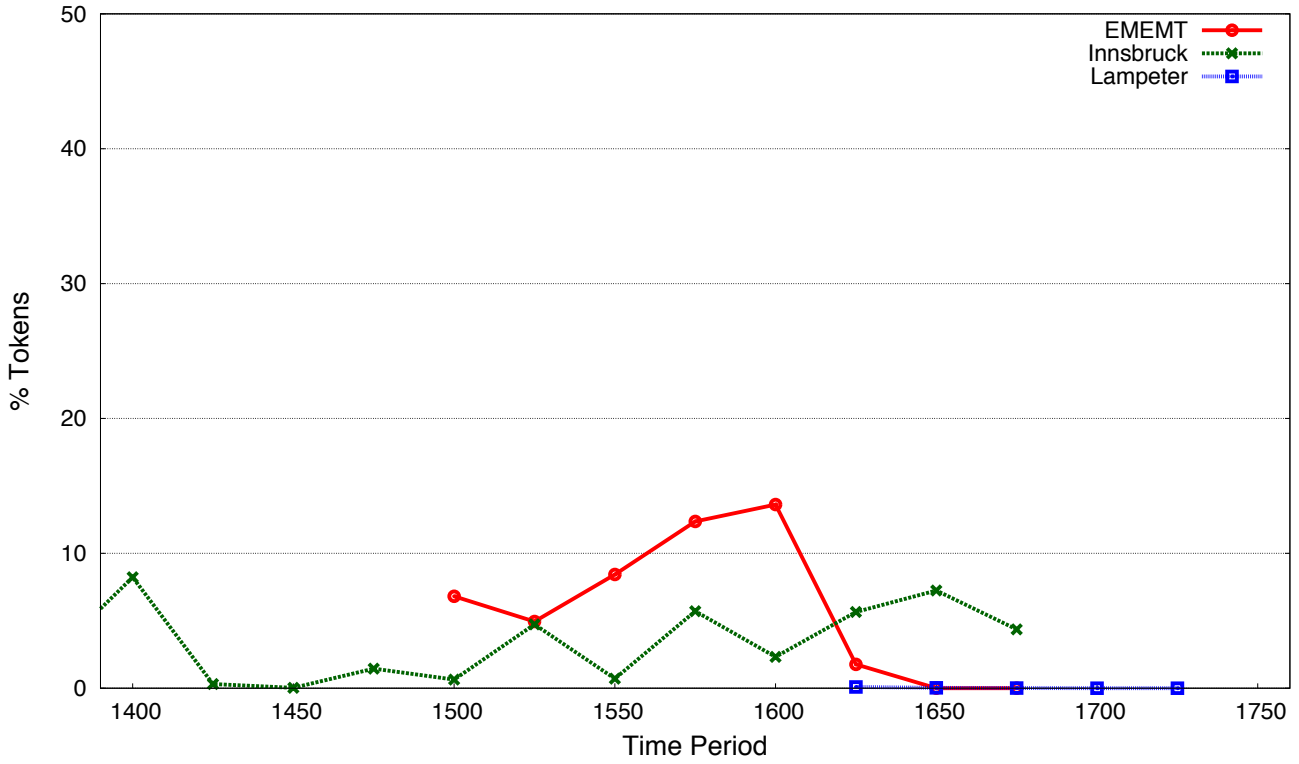
ck → c

- Examples:
  - Physick (Physic)
  - publick (publick)
  - Zodiack (Zodiac)
- Vast majority –ick endings.
- Lower frequency:
  - 21st in EMEMT.
  - 138th in Innsbruck.
  - 5th in Lampeter.



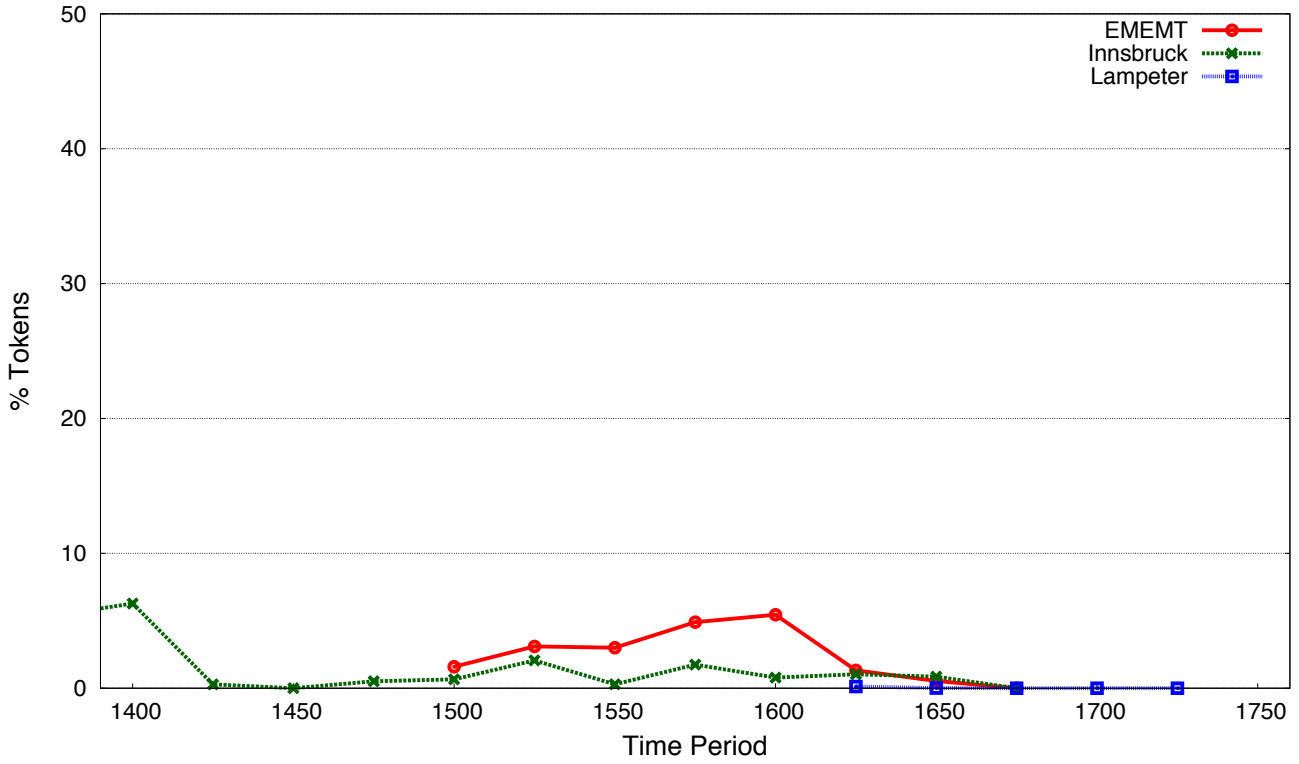
U → V

- Examples:
  - neuer (never)
  - haue (have)
  - Uote (Vote)
- Mainly middle of variant.
- (Mostly) high frequency:
  - 3rd in EMEMT.
  - 4th in Innsbruck.
  - 91st in Lampeter.



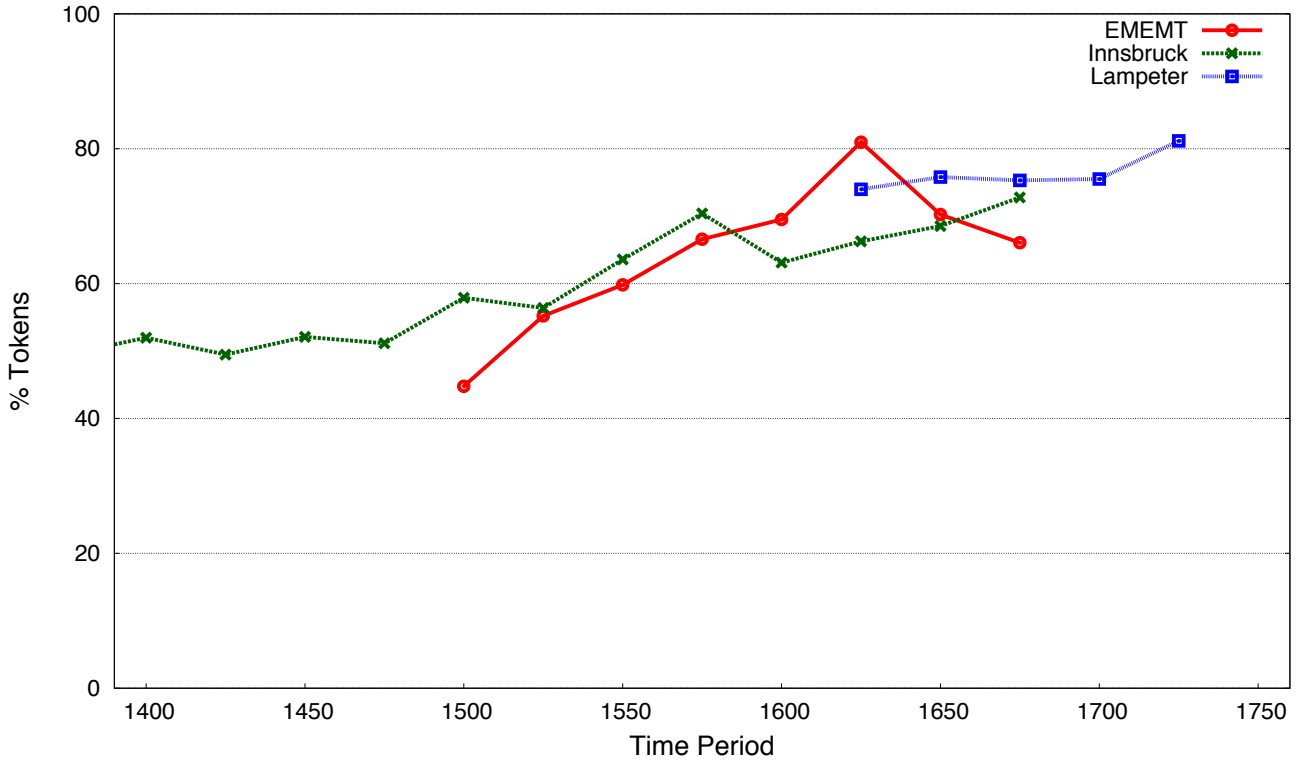
V → U

- Examples:
  - vpon (upon)
  - vs (us)
  - Vnicorn (Unicorn)
- Nearly always first letter.
- Less frequent:
  - 8th in EMEMT.
  - 22nd in Innsbruck.
  - 135th in Lampeter.

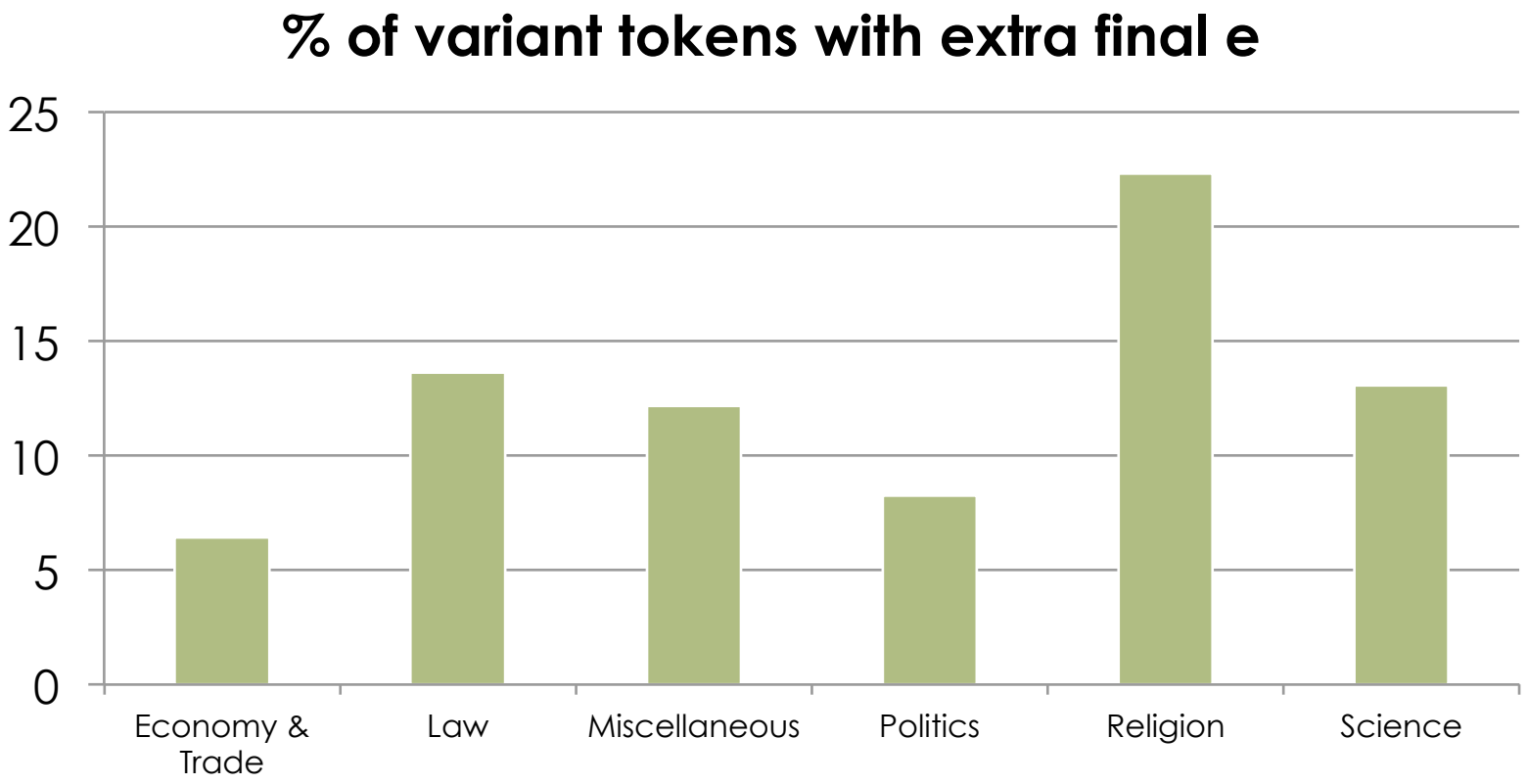


Single edits

- Single edit variants, e.g. one insertion, deletion or substitution from the standard form.
- Generally easier to normalise automatically.
- More variants requiring more than one edit in later texts makes spelling normalisation harder further back in time.

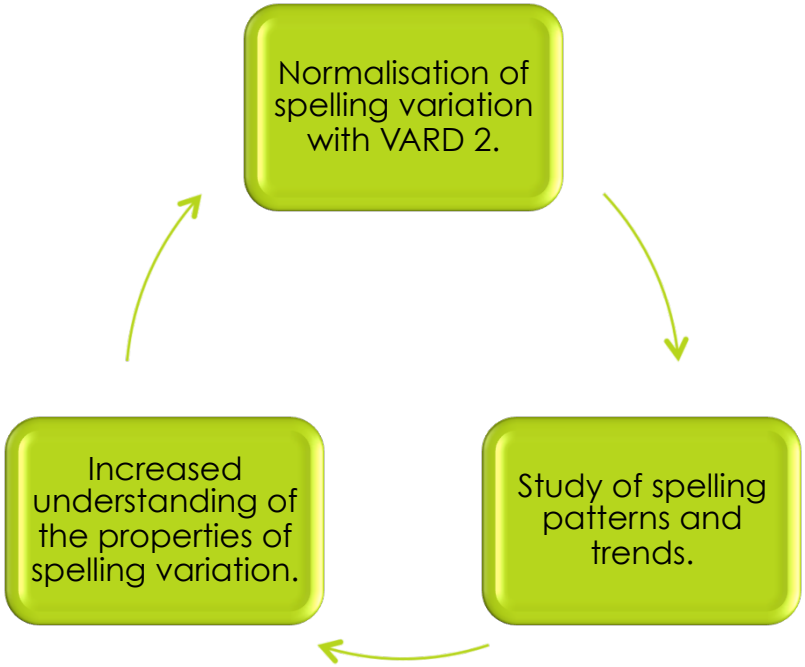


Lampeter Domain



Future work

- Further analyse DICER results to search for (new) trends over time, genre and text types.
- Look at other (larger) datasets, such as Early English Books Online.
- Incorporate DICER into VARD 2 to allow for learning normalisation rules "on the fly".



Thanks for listening

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  - Thanks to Irma Taavitsainen and the Helsinki team for providing the EMEMT corpus, particularly Anu Lehto for the manual normalised samples.
  - Thanks to Manfred Markus for providing the Innsbruck Letters corpus with manually checked normalised text.
  - Research funded by EPSRC PhD Plus at Lancaster University.

- **More information:**
  - VARD: http://www.comp.lancs.ac.uk/~barona/vard
  - DICER: http://corpora.lancs.ac.uk/dicer

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