A connective differentiation of textual production in interaction networks

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This paper exposes textual production in interaction networks, with special emphasis on its relation to topological measures. Four email lists were selected, in which simple measures were taken from the texts participants wrote. Periphery, intermediary and hub sectors of these networks were observed to have very different verbal ellaborations. For completeness of exposition, correlation of textual and topological measures were observed for the entire network and for each connective section. The formation of principal components gives us further insight of how measures are related with respect to dispertion.

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I. INTRODUCTION

Textual production has received considerable attention from social network analysis community. Sentiment analysis and vocabularies related to different parties are among a number of examples. The relation of topological and textual measures is the subject of this article, for the following reasons:

- This relation has been set aside in literature, with scattered and vage suggestions of mutual implications of the text produced and topological characteristics of the agents in the network.
- This results eases undestanding of human interaction, which is useful for both psichological and anthropological typologies (personality and cultural "types".
- There are some interesting hypothesis about verbal differentiation of network sections and groups, some of which were herein confirmed.

Next section exposes the email lists used for this research, its textual and network facets. Section III explains the analysis roadmap, with the measures chosen and methods for understanding data. Section IV is dedicated to detailing results and discussion. Section V has concluding remarks and further works envisioned.

II. MATERIALS

Eighty thousand messages were analysed, twenty thousand from each email list. This data was accessed online through the GMANE database[?] . Each message has an ID, the ID of the message it is a response to (if any), an author, a "date and time" field for the moment the message was sent and the textual content of the message. Other fields are also available, but plays no central role in the work here presented. This basic information of messages and authors are summarized in Table A.

A. Network formation

Message-response pairs yield interaction networks, such as shown in Figure 1. Each participant is represented as a vertex, and each response is considered evidence that information emited by the first message was received by the responder (that had to read, process its contents and render a relevant textual response). This is the "information network" of the system. Edges can be considered in the reverse order, from the responder to the original sender, as a signal of status attribution, as the responder considered what the sender said worthy of responding. This is the "status network". As these networks are virtually equivalent, one considers but one of them, usually the information network.

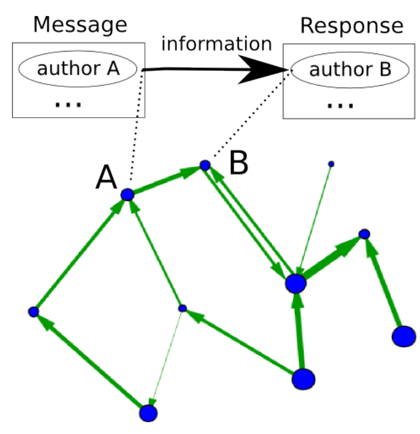

FIG. 1. Formation of interaction network. The edges are directed as information flows, from an original message's author to the observed responder. Further information is given in Section II A

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B. Verbal observations

Each message has a textual content. Analysis this content can be observed regarding author, network section or community, or messages independently. As these are informal communities, there are typos, leet and invented words. This diversity and informality poses some challanges, by which the methodology was shaped. Simply put, tokens (words, numbers, punctuations, etc) were considered. The words identified were related to gramatical classes. For the histograms, message by message were considered. For sections (hubs, intermediary and peripheral), all messages written by authors in each section considered together.

Tables II to V are dedicated to these measures. No further considerations were needed for the hypothesis in hand.

III. METHODOLOGY

A dedicated article was written for characterizing such network from the topological viewpoint[?] . This article is dedicated to primary textual observances, both as overall incidences and correlated to topological aspects.

It is coherent to have participants as vertexes and as references for the messages sent, for the text produced and for activity related to sent time and date. This way, to observe the text produced in certain section, one might gather all text produced by all participants on that section. To observe correlation of textual and topological characteristics, one can take measures on each vertex.

[Figura com uma rede pequena. Um dos vrtices escolhido para dar as caractersticas dele]

A. Network measurements and partitioning

Basic network measures of connectivity, in the same networks, were oberved in a dedicated article[?] . This article uses the same topological measures to observe correlations and PCA formation. This article also uses the same network sectioning in peripheral, intermediary and hub sectors, through strengh measure. "Exclusivist criteria" for such partitionin is closest to literature predictions (5% of hubs, 15% of intermediary and 80% of peripheral vertex). Even so, strengh-based criteria can be considered simpler and yields reasonable results (5-10%, 5-25%, 65-90%). In any case, authors do not believe that changing the sectioning to a degree or a compound criteria would significantly change the presented results. Besides preliminary tests done whle mining the data, these are boudaries should probably be considered a transition, not a sharp distinction.

B. Textual measures

An infinitude of textual measures can be drawn from texts. This work focuses on the simplest of them, as they proved sufficient for current intereses. These measures include incidences of word, sentence and message size, of individual words and letters, of plurals, gender, POS (Part-Of-Speech) tags. Simple wordnet related measures were also used.

This choice is based on: 1) the lack of such information in literature, as far as authors know; 2) potential relations of these incidences with topological aspects, such as conectivity; 3) the interdependence of textual artifacts suggests that simple measures should reflect more complex behaviors and verbal resources. A preliminary study, with all the work from Machado de Assis[?] , made clear that these measures vary with respect to style.

Based on characters, letters, tokens and word incidences and sizes, considered measures are:

- Number of characters: letters, numeric types and vogals. Table 3 is dedicated to selected measures of this type.
- Number of tokens, percentage of puntcuations, of known words, of words that returns synsets, of tokens that are stopwords, of words that return synsets and and are stop words. Table III is dedicated to some measures of this kind.
- Distribution of word and token sizes, e.g. distribution of sizes of stopwords. Table IV is dedicated to these measures.
- Sentences size distribution. Number of empty lines (as paragraph/block organization measures). Table V is dedicates to measures of this kind.
- Number of characters and words per messages. Table VI is dedicated to these measures.
- Histogram with respect to most occurent or most basic words and word types in the English language. Figures 2, 3, 4, 5 and 6.

Morpholinguistics and POS tags is also of interest. Table XVI is dedicated to these:

- Fraction of plurals, gender, common prefixes and suffixes, etc.
- Fraction of adverbs, adjectives, verbs, etc.
- Fraction of incidences of POS tags and other sintagma classification.

Wordnet synsets incidences was studied as well, as a potentially useful way to characterize networks and sectors:

- Incidence of hypernyms, hyponyms, holonyms and meronyms.

- Similarity measures of words, phases and messages, by use of semantic criteria (Wordnet) and bag of words.

Emotion classification has not been done and considered out of the scope for this stage of development.

C. Relating text and topology

Key observations for a deeper insight about network structure depend on theoretical background and intentions. For this article, these were considered:

1. Incidences of these linguistic traces in hub, intermediary and peripheral network sectors.
2. Correlation of measures of each vertex, easing pattern detection involving topology of interaction and language used. Date and time incidence measures is also addressed, as potentially linked to participation habits and purposes (e.g. low dispersion of sent time).
3. PCA to gain further insights about how measures combine.

Criteria for these priorization include integration with previous topological results, lack of concise results that could substantiate correlations of topological and textual traces, and common sense as mundane integrant of these networks.

First task, of textual production observance in hubs, intermedary and peripheral sectors, is observed by Tables 3-XVI. An adaptation of the Kolmogorov-Smirnof test was used to observe diferences in textual productions.

Second approach to relate text and topology is addressed by the correlation matrix with both textual and topological measurements of each participant. Third, principal components composition are used to deepen understanding of measurements interelation.

IV. RESULTS AND DISCUSSION

Although the results drawn from experiments and statistics were diverse, some fundamental insights can be given by going through tables anf figures in the appendix. Most importantly: conectivity has strong influence in textual production of participants in the network. Hubs use more contractions, use more common words and less punctuation if compared to the rest of the network, specially the peripheral sector.

A. General characteristics of activity distribution among participants

Hubs and peripheral swap number and participants and activity. While Peripheral sector has $\approx 75\%$ of participants, it produces $\approx 10\%$ of all messages. Conversely, hubs has $\approx 10\%$ of participants and produces $\approx 75\%$ of all messages. Fewer threads are created in proportion to total messages sent by the hubs, while threads created by peripheral are twice as common as messages in general. This suggests a symbiosis of peripheral diversity and hub activity.

Also, for a fixed number of messages, the number of threads created seem to increase as the number of participants decrease. These information is condensed in Table I, with further details.

B. Characters

Peripheral vertex use more punctuation characters, digits and uppercase leters. Hubs use more letters and vogals among letters. The use of space does not seem to have any relation to connectivity, with the exception that the intermediary presented a lower incidence of spaces than both peripheral and hub sectors.

Total number of characters in ELE list, in the 20 thousand messages, is more than three times what other lists exhibited. This suggests peculiarities related to communication conventions and style.

Further information is given in Table 3.

C. Tokens and words

Largest size of tokens is with the most wordy list (ELE). This implies that is has more characters than tokens in comparrison to the other lists. Longer words used by hubs might be related to the used of a specialyzed vocabulary. Although the token diversity ($\frac{|tokens\neq|}{|tokens|}$) found in peripheral sector is far greater, this result has the masking artifact that the peripheral sector copus is smaller, yielding a larger token diversity. This artifact is present and can be noted by the token diversity of the whole network, which is lower than in the sections. This same discussion applies to the lexical diversity ($\frac{|kw\neq|}{kw}$).

Punctuations among tokens are still less abundant in hubs, but discrepancies are larger. Known words are used more frequently by hubs.

MET and CPP both exhibit intermediaries with the more frequent production of punctuation, less frequent producion of known words, the highest incidence of words with wordnet synsets among known words. This suggests some peculiarity in network structure, such as the intermediary be strong authorities in such networks, using smaller sentences and a larger jargon.

Words with synsets, among known english words, are less frequent in hubs further evidencing the jargon hubs develop.

Further information is given in Table III.

1. Sizes of tokens and words

Sizes of known words are smaller for hubs, which suggests its use of more common words, although some of the previous results suggests that hubs have a very differentiated and speciallized vocabulary.

Further information is given in Table IV.

2. POS tags

This exhibited a preference for lower connectivity to deliver more nouns and less adjectives, adverbs and verbs. This suggests that the networks collect issues important to the world by the peripheral sector, which brings nouns. These issues are qualified, ellaborated about, by the more connected participants.

Further information is given in Table XVI.

D. Sentences

Hubs present the lowest average sentence size, both in characters and in tokens. Also, the incidence of usual known words seems to decay with connectivity, as does the number os known words with synsets.

Further information is given in Table V.

E. Messages

Regarding characters and tokens, connectivity was related to smaller messages, except in ELE list, which was considered a peculiarity of the list, to be further verified. Regarding sentences, the size of messages seem to hold steady untill hubs are reached.

Further information is given in Table VI.

V. FINAL REMARKS

A. Further work

Current research, including this article, suggests that less connected participants bring external proposals, while hubs helps the network to process this new information being brought by peripheral and intermediary vertexes.

Similarity of texts in message-response threads has been thought about by authors, and some results are being organized. These are two hypothesis, obtained from recent experiments, which has to do with similarity measures:

- observance of information “ducts” through similarity measures. These might coincide with asymmetries of edges between vertexes pairs, with homophily or with message-response threads.
- autossimilarity of messages by same authors, of messages sent at the same period of the day, etc. This includes incidences of word sizes and outliers, incidences of tags and morphosintactic classes, incidences of particular synset characterisctics. This includes wordnet word distances.

For example, peripheric vertex messages should exhibit greater diversity. Self-similarity of messages might vary with respect to connectivity as well.

VI. ACKNOWLEDGMENTS

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Appendix A: Support information

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
$date_1$	3/13/2	-	-	-	6/30/3	-	-	-	06/29/3	-	-	-	3/18/02	-	-	-
$date_M$	8/25/9	-	-	-	10/07/9	-	-	-	07/23/5	-	-	-	8/31/11	-	-	-
N	1052	834	163	55	1268	936	210	122	1183	904	155	124	302	225	36	41
$N_{\%}$	-	79.28%	15.49%	5.23%	-	73.82%	16.56%	9.62%	-	76.42%	13.10%	10.48%	-	74.50%	11.92%	13.58%
M	19993	1654	2673	15666	19996	2331	3542	14123	19995	3018	2882	14095	19946	1821	2413	15712
$M_{\%}$	-	8.27%	13.37%	**78.33%**	-	11.65%	17.71%	**70.61%**	-	15.09%	14.41%	**70.47%**	-	9.11%	12.06%	**78.56%**
Γ	4506	924	702	2880	3113	812	670	1631	3373	1121	675	1577	6070	782	1072	4216
$\Gamma_{\%}$	-	20.51%	15.58%	**63.91%**	-	26.08%	21.52%	**52.39%**	-	33.23%	20.01%	**46.75%**	-	12.88%	17.66%	**69.46%**
$-M$	7	-	-	-	4	-	-	-	5	-	-	-	54	-	-	-
Δ_Y	7.44	-	-	-	6.25	-	-	-	2.08	-	-	-	9.37	-	-	-

TABLE I. Columns $date_1$ and $date_M$ have dates (month/day/year) of first and last messages from the 20,000 messages considered. N is the number of participants (number of different email addresses). M is number of messages. Γ is the number of threads (count of messages without antecedent). $-M$ is messages missing in the 20,000 collection, $100\frac{54}{20000} = 0.27/100$ in the worst case. ELE notably has the fewer participants and the larger number of threads. This relation holds for pairs of lists considered: as the number of participants increase, the number of threads decrease. A similar role is observed in MET list described in[?] , suggesting that 1) Non-technical topics gathers fewer participants and yields shorter threds; 2) MET techno-political characteristic is confirmed by having intermediary $\frac{N}{\Gamma}$ relation, between ELE (politics) and LAD (highly technical - GNU/Linux and music). These results should be further investigated in future research (see section **??**). The number of threads started by hubs is significantly lower than activity for all list, this suggests creative exploitation is done by hubs. Δ_Y is number of years involved in the first 20,000 messages of each list. Dates of first and last message is: Mar/13/2002 and Aug/25/2009 for CPP; Jun/30/2003 and Oct/07/2009 for LAD; Jun/29/2003 and Jul/23/2005 for LAU; finally, Abr/18/2002 and Aug/31/2011 for ELE.

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
$n\,chars$	12708286	11.65	17.65	70.69	12632264	14.21	18.21	67.58	11893325	17.37	15.60	67.04	38719505	7.74	11.17	81.09
$\left(\frac{n\,spaces}{n\,chars}\right) \times 100$	17.03	17.66	15.68	17.26	18.35	18.50	18.16	18.38	19.17	20.14	19.18	18.91	18.19	17.86	17.82	18.28
$\left(\frac{n\,punct}{n\,chars - n\,spaces}\right) \times 100$	10.10	10.88	12.11	9.45	5.67	6.27	5.81	5.50	5.88	6.66	5.86	5.69	4.68	4.97	5.06	4.60
$\left(\frac{n\,digits}{n\,chars - n\,spaces}\right) \times 100$	2.44	3.18	3.07	2.15	1.63	2.79	1.57	1.40	2.25	3.26	2.54	1.92	0.99	1.21	1.66	0.88
$\left(\frac{n\,letters}{n\,chars - n\,spaces}\right) \times 100$	87.28	85.77	84.47	88.24	92.65	90.86	92.55	93.05	91.82	90.02	91.52	92.35	94.28	93.79	93.18	94.48
$\left(\frac{n\,vogals}{n\,letters}\right) \times 100$	35.36	36.42	36.08	37.51	34.20	35.93	35.56	37.55	34.65	36.29	35.94	37.34	35.71	36.56	36.24	37.52
$\left(\frac{n\,Uppercase}{n\,letters}\right) \times 100$	4.60	4.96	5.38	3.55	6.06	6.05	6.19	3.77	5.31	4.88	5.78	4.15	4.20	4.75	5.09	3.44

TABLE II. Measures based on characters, of the text produced by network participants. These are fairly stable. Suggested relations are: 1) punctuations of CPP, that can be expected by its programming language focus and dots and semicolon abundance in such parlance; 2) greater number of letters on ELE is expected by its political disposition; 3) not statistically clear, but higher percentage of vogals might be a sign of erudition. Most of all, number of characters incident in ELE 20,000 messages are more then the other three lists added. MET has an intermediary value of 13,137,042 characters, above CPP, LAD, LAU and below ELE. This builds up to a dicothomic typology of networks: technical (more participants, fewer and longer threads, e.g. CPP) – political (less participants, more and shorter threads, e.g. ELE). Higher incidence of digits and lower incidence of letters seem to be associated to technical subjects.

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
$\|tokens\|$	2839679	0.12	0.18	0.70	2686539	0.14	0.18	0.68	2588673	0.17	0.16	0.67	8019188	0.08	0.11	0.8
$\frac{\|chars\|-\|spaces\|}{\|tokens\|}$	3.71	3.63	3.69	3.73	3.84	3.83	3.84	3.84	3.71	3.68	3.70	3.72	3.95	3.93	3.89	3.9
$100\frac{\|tokens\neq\|}{\|tokens\|}$	1.84	5.60	4.08	1.89	2.43	6.55	5.10	2.67	2.42	5.64	5.40	2.73	0.85	3.45	2.83	0.8
$100\frac{\|punct\|}{\|tokens\|}$	26.48	27.59	29.96	25.39	17.96	19.89	18.37	17.45	18.29	20.57	18.58	17.63	16.35	17.07	17.32	16.
$100\frac{\|known\ words=kw\|}{\|tokens\|-\|punct\|}$	76.52	71.24	70.27	78.89	84.42	80.43	83.47	85.49	81.92	76.30	80.69	83.60	90.01	88.58	86.72	90.
$100\frac{\|kw\neq\|}{kw}$	0.83	3.83	2.81	1.00	1.06	3.96	3.16	1.36	1.11	3.36	3.50	1.44	0.43	2.55	1.97	0.4
$100\frac{\|kw\ with\ wordnet\ synset=kwss\|}{\|kw\|}$	74.21	74.75	75.74	73.80	74.84	75.26	74.80	74.76	74.80	75.54	75.02	74.59	73.49	73.77	74.16	73.
$100\frac{\|kw\ that\ are\ stopwords=kwsw\|}{\|kw\|}$	47.14	46.02	44.32	47.91	49.16	46.62	48.64	49.78	49.26	46.86	48.44	49.98	49.25	48.43	48.16	49.
$100\frac{\|unknown\ words\ that\ are\ sw=ukwsw\|}{\|kw\|}$	2.86	3.39	2.73	2.81	2.56	2.82	2.74	2.46	3.67	4.04	3.68	3.58	1.73	1.90	2.04	1.6
$100\frac{\|kw\ that\ are\ stopwords\ and\ have\ synsets\|}{\|kw\|}$	24.29	23.84	23.31	24.57	26.39	24.38	25.83	26.93	26.60	25.20	26.05	27.04	25.22	24.78	24.69	25.
$100\frac{\|stopwords\ without\ synsets\|}{\|kw\|}$	22.85	22.18	21.01	23.34	22.76	22.24	22.81	22.85	22.66	21.67	22.39	22.94	24.03	23.65	23.47	24.
$100\frac{\|contractions\|}{\|kw\|}$	1.65	1.24	1.59	1.72	1.76	1.34	1.59	1.89	2.19	1.73	1.74	2.40	1.43	1.26	1.33	1.4
$100\frac{\|kw\ not\ stopwords\ no\ synset\|}{\|kw\|}$	2.94	3.07	3.26	2.86	2.40	2.50	2.39	2.39	2.54	2.79	2.59	2.47	2.48	2.58	2.37	2.4
$100\frac{\|kw\ not\ stopword\ has\ synset\|}{\|kw\|}$	49.92	50.92	52.42	49.23	48.44	50.88	48.97	47.84	48.20	50.35	48.97	47.55	48.27	48.99	49.47	48.

TABLE III. Basic measures on tokens, known English words, stopwords, words with and without synset. Lexical diversity is higher in LAU and LAD, probably linked to these lists hybrid technical interests (music and GNU/Linux). Larger known words nd tokens are incident in ELE and LAD. ELE also exhibits larger incidence of stopwords without synsets (prolixity?). Stronger use words with synsets that are not stopwords is held by CPP. Stopwords that have synset account for $\approx 25\%$ of all known words, which might be an indicative of language complexity (not same as good writing though).

-	CPP				LAD				LAU				ELE		
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.
$\mu(size\,of\,known\,word = skw)$	4.51	4.53	4.56	4.50	4.44	4.52	4.45	4.42	4.35	4.42	4.36	4.34	4.64	4.65	4.66
$\sigma(skw)$	2.39	2.38	2.42	2.39	2.35	2.40	2.36	2.34	2.25	2.27	2.25	2.25	2.52	2.54	2.53
$\mu(\neq skw)$	7.52	7.15	7.29	7.50	7.54	7.24	7.22	7.51	7.43	7.02	7.09	7.41	7.92	7.62	7.69
$\sigma(\neq skw)$	2.57	2.51	2.56	2.57	2.53	2.54	2.53	2.53	2.51	2.49	2.48	2.51	2.62	2.62	2.63
$\mu(skwss)$	4.92	4.94	4.95	4.95	4.82	4.94	4.84	4.84	4.70	4.77	4.71	4.71	5.11	5.14	5.14
$\sigma(skwss)$	2.54	2.52	2.56	2.56	2.50	2.54	2.50	2.50	2.40	2.40	2.38	2.38	2.69	2.70	2.68
$\mu(\neq skwss)$	7.56	7.20	7.34	7.34	7.57	7.29	7.27	7.27	7.47	7.09	7.14	7.14	7.94	7.66	7.73
$\sigma(\neq skwss)$	2.54	2.48	2.52	2.52	2.49	2.51	2.50	2.50	2.48	2.46	2.45	2.45	2.58	2.59	2.60
$\mu(ssw)$	2.89	2.87	2.87	2.89	2.85	2.83	2.85	2.86	2.86	2.86	2.85	2.87	2.88	2.86	2.87
$\sigma(ssw)$	1.06	1.06	1.07	1.06	1.06	1.05	1.05	1.06	1.05	1.05	1.04	1.05	1.09	1.09	1.09
$\mu(\neq ssw)$	3.92	3.88	3.90	3.89	3.97	3.92	3.90	3.97	3.97	3.92	3.92	3.97	3.97	3.97	3.97
$\sigma(\neq ssw)$	1.60	1.58	1.60	1.58	1.68	1.65	1.60	1.69	1.68	1.61	1.60	1.69	1.68	1.69	1.68
$\mu(snsssw)$	3.01	2.98	2.99	3.02	2.97	2.96	2.96	2.98	2.99	2.99	2.97	2.99	2.99	2.97	2.97
$\sigma(snsssw)$	1.25	1.23	1.25	1.26	1.25	1.24	1.23	1.25	1.25	1.27	1.24	1.24	1.23	1.22	1.22
$\mu(\neq snsssw)$	6.32	5.44	5.65	6.14	6.65	5.77	5.81	6.50	6.48	5.31	5.53	6.43	7.37	5.83	6.14
$\sigma(\neq snsssw)$	3.07	2.83	2.97	3.04	3.07	2.90	2.92	3.08	2.93	2.60	2.70	2.98	3.37	3.02	3.26

TABLE IV. Sizes of tokens and words. Practically all sizes are greater for ELE. Results here are not as strong as other measures.

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
$\|sents\|$	106086	10154	17618	78309	113033	15581	15838	81608	111703	15822	19968	75926	325399	23835	36775	264794
$\mu\left(\frac{chars}{sent}\right)$	118.31	148.63	125.02	112.87	110.52	125.69	116.16	106.54	105.15	120.64	107.55	101.27	117.67	126.06	128.01	115.48
$\sigma\left(\frac{chars}{sent}\right)$	250.34	312.02	259.34	239.11	148.98	243.78	148.28	122.42	208.63	386.51	259.32	120.50	127.57	120.89	122.34	128.79
$\mu\left(\frac{tokens}{sent}\right)$	26.80	34.06	28.91	25.38	23.79	27.04	25.03	22.93	23.20	26.40	23.98	22.33	24.68	26.78	27.29	24.13
$\sigma\left(\frac{tokens}{sent}\right)$	64.74	81.47	64.30	62.36	33.44	51.90	29.21	29.40	38.11	51.39	54.91	27.88	34.48	27.38	29.18	35.69
$\mu\left(\frac{kw}{sent}\right)$	13.88	16.09	12.99	13.80	15.15	15.76	15.67	14.94	14.11	14.39	13.98	14.08	17.03	17.76	17.88	16.84
$\sigma\left(\frac{kw}{sent}\right)$	17.22	22.67	18.33	16.09	13.81	17.71	14.63	12.76	13.48	15.03	15.38	12.58	13.23	13.91	14.14	13.03
$\mu\left(\frac{kwssnsw}{sent}\right)$	6.90	8.13	6.73	6.78	7.26	7.79	7.57	7.09	6.67	7.06	6.69	6.58	8.19	8.60	8.74	8.07
$\sigma\left(\frac{kwssnsw}{sent}\right)$	10.72	14.17	11.76	9.92	7.79	11.11	7.84	6.95	7.54	8.92	9.71	6.49	6.59	7.05	7.13	6.46

TABLE V. Sizes of sentences in characters and in tokens. Hubs produce the smallest sentences and, at the same time, present the lowest incidence of known words and of known words with synsets.

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
$\mu\left(\frac{\|chars\|}{msg}\right)$	632.81	883.15	841.05	570.09	628.49	763.32	655.59	599.39	591.12	697.59	623.79	561.61	1934.43	1638.41	1796.38	1993
$\sigma\left(\frac{\|chars\|}{msg}\right)$	1761.57	1247.79	3896.49	1101.55	836.23	1136.90	826.08	770.30	831.47	1194.85	982.59	686.75	2642.25	1737.49	1992.88	2819
$\mu\left(\frac{\|tokens\|}{msg}\right)$	143.35	202.36	194.09	128.28	135.99	164.49	141.88	129.81	131.37	153.18	139.27	125.01	406.39	347.64	383.28	417.
$\sigma\left(\frac{\|tokens\|}{msg}\right)$	444.20	287.17	940.83	304.37	178.11	237.80	172.03	165.98	173.89	213.52	212.91	152.35	557.29	365.05	435.87	593.
$\mu\left(\frac{\|sents\|}{msg}\right)$	5.71	6.39	7.09	5.40	6.12	6.55	6.11	6.04	6.08	6.23	6.23	6.01	17.22	13.74	14.79	18.0
$\sigma\left(\frac{\|sents\|}{msg}\right)$	16.36	6.29	41.76	6.55	6.75	7.51	6.67	6.61	6.58	8.03	6.87	6.18	23.97	14.06	17.01	25.8

TABLE VI. Mean and standard deviation of message sizes. Greater size of messages from ELE list reflects domain of interest, as does its hubsi sector, which produces the largest texts.

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
NN	28.17	30.38	31.13	27.19	26.68	29.29	26.98	26.08	26.64	29.87	28.03	25.58	24.68	25.54	25.35	24.50
NNS	2.51	2.32	2.56	2.53	2.82	2.97	2.92	2.76	2.63	2.63	2.65	2.63	4.41	4.56	4.61	4.36
NNP	0.72	0.75	1.03	0.65	0.70	1.10	0.74	0.61	0.90	0.94	0.94	0.88	0.76	1.13	1.04	0.69
NNPS	0.01	0.01	0.00	0.01	0.01	0.03	0.02	0.01	0.01	0.01	0.02	0.01	0.03	0.05	0.02	0.03
+	31.41	33.46	34.73	30.38	30.21	33.39	30.65	29.47	30.18	33.45	31.63	29.10	29.88	31.29	31.02	29.58
JJ	4.83	4.60	4.72	4.89	5.05	5.03	5.00	5.06	4.65	4.46	4.42	4.75	5.19	5.11	5.24	5.19
JJR	0.45	0.37	0.38	0.48	0.47	0.43	0.48	0.48	0.45	0.36	0.40	0.48	0.66	0.71	0.73	0.65
JJS	0.17	0.15	0.14	0.17	0.25	0.22	0.26	0.26	0.25	0.22	0.22	0.26	0.38	0.41	0.46	0.37
RB	6.43	5.29	5.73	6.76	6.55	5.41	6.30	6.83	6.60	5.74	6.11	6.91	5.78	5.27	5.34	5.89
RBR	0.11	0.08	0.09	0.12	0.12	0.10	0.12	0.12	0.11	0.07	0.09	0.12	0.16	0.14	0.16	0.16
RBS	0.02	0.01	0.01	0.02	0.03	0.02	0.03	0.03	0.02	0.01	0.02	0.02	0.04	0.05	0.04	0.04
RP	0.35	0.30	0.27	0.37	0.39	0.36	0.43	0.39	0.50	0.43	0.50	0.52	0.26	0.30	0.25	0.26
+	12.36	10.79	11.34	12.82	12.86	11.59	12.61	13.17	12.58	11.29	11.76	13.08	12.47	12.00	12.23	12.55
VB	6.25	6.24	6.31	6.25	5.90	5.72	5.91	5.94	5.89	5.98	5.92	5.86	5.22	5.27	5.06	5.24
VBZ	3.94	3.89	3.80	3.97	3.97	3.60	3.87	4.07	3.77	3.48	3.58	3.88	4.16	3.79	4.14	4.20
VBP	3.17	3.07	3.17	3.18	2.84	2.63	2.86	2.87	3.23	2.93	3.11	3.32	2.68	2.64	2.67	2.68
VBN	2.00	2.14	2.06	1.97	1.78	1.85	1.93	1.74	1.74	1.78	1.75	1.72	1.87	2.02	1.80	1.86
VBD	1.52	1.64	1.49	1.50	1.38	1.43	1.47	1.35	1.71	1.64	1.69	1.74	1.49	1.41	1.48	1.51
VBG	1.50	1.66	1.41	1.50	1.57	1.69	1.58	1.54	1.66	1.76	1.71	1.63	1.51	1.59	1.55	1.50
MD	2.20	1.78	2.09	2.28	2.31	2.07	2.20	2.38	2.16	1.99	2.07	2.22	2.44	2.25	2.16	2.51
+	20.58	20.42	20.32	20.66	19.75	18.99	19.82	19.89	20.16	19.55	19.84	20.37	19.37	18.98	18.87	19.48
IN	12.60	12.49	12.08	12.73	12.15	12.17	12.18	12.14	11.97	11.70	11.99	12.02	13.11	13.18	13.06	13.12
DT	10.76	10.96	10.33	10.82	10.81	10.56	10.81	10.86	10.45	10.28	10.48	10.48	11.57	11.77	11.55	11.55
PRP	3.62	2.83	3.02	3.87	4.06	3.40	3.85	4.25	4.34	3.48	3.95	4.63	3.56	3.06	3.21	3.66
PRP$	0.73	0.85	0.56	0.75	0.99	1.01	1.00	0.99	1.15	1.15	1.16	1.14	0.97	0.96	1.04	0.96
PDT	0.08	0.08	0.07	0.08	0.08	0.07	0.09	0.08	0.08	0.06	0.09	0.08	0.10	0.08	0.12	0.10
TO	2.93	2.94	2.87	2.94	3.16	3.19	3.20	3.14	3.13	3.15	3.20	3.10	2.92	2.95	2.91	2.92
CC	2.77	2.97	2.54	2.79	3.52	3.55	3.56	3.50	3.61	3.63	3.66	3.59	3.03	2.94	3.16	3.03
WRB	0.58	0.68	0.56	0.56	0.59	0.51	0.55	0.61	0.59	0.60	0.58	0.58	0.64	0.57	0.58	0.66
WDT	0.54	0.53	0.55	0.54	0.54	0.48	0.49	0.56	0.48	0.42	0.45	0.50	0.60	0.56	0.59	0.61
WP	0.32	0.28	0.29	0.33	0.44	0.35	0.41	0.46	0.47	0.42	0.41	0.49	0.58	0.50	0.50	0.60
WP$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.02	0.02
+	34.93	34.62	32.87	35.42	36.34	35.29	36.13	36.61	36.26	34.89	35.98	36.62	37.12	36.60	36.74	37.22
CD	0.38	0.37	0.36	0.38	0.44	0.41	0.44	0.45	0.42	0.37	0.43	0.43	0.79	0.78	0.81	0.79
EX	0.27	0.28	0.29	0.27	0.33	0.29	0.28	0.35	0.33	0.33	0.29	0.34	0.35	0.34	0.31	0.36
UH	0.07	0.04	0.08	0.07	0.04	0.03	0.04	0.04	0.04	0.03	0.04	0.05	0.01	0.01	0.01	0.01
FW	0.01	0.03	0.00	0.00	0.02	0.02	0.03	0.02	0.03	0.09	0.02	0.01	0.00	0.01	0.00	0.00
+	0.72	0.71	0.74	0.72	0.84	0.74	0.78	0.86	0.82	0.82	0.79	0.83	1.16	1.14	1.13	1.17

TABLE VII. Incidence of Brown Tags. Used Brill tagger with ≈ 85% of correctly identified tags on the Brown Corpus. Most explicit is the peripheral incidence of nouns and hubs incidence of adjectives, adverbs and verbs.

list\measure	H-P	H-I	I-P
CPP	5.58	2.54	7.82
LAD	7.67	2.07	8.35
LAU	6.23	1.63	5.98
ELE	3.42	0.77	2.81

TABLE VIII. Kolmogorov $c(\alpha)$ values for substantives.

	CPP-LAD	CPP-LAU	CPP-ELE	LAD-LAU	LAD-ELE	LAU-ELE
P	1.35	4.05	5.80	3.00	5.41	4.94
I	1.27	0.78	4.01	0.84	3.84	3.94
H	0.98	1.94	3.17	1.32	3.82	4.47

TABLE IX. Kolmogorov $c(\alpha)$ values for substantives. Comparrison of the same sector between lists, each author is an observation.

list\measure	H-P	H-I	I-P
CPP	2.76	2.33	0.25
LAD	4.22	2.88	1.02
LAU	4.30	2.45	1.34
ELE	4.77	1.69	2.86

TABLE X. Kolmogorov $c(\alpha)$ values for adjectives.

	CPP-LAD	CPP-LAU	CPP-ELE	LAD-LAU	LAD-ELE	LAU-ELE
P	0.44	0.34	2.57	0.20	2.32	2.37
I	0.74	0.99	3.72	0.32	3.37	3.10
H	0.26	0.32	3.72	0.29	4.36	4.24

TABLE XI. Kolmogorov $c(\alpha)$ values for adjectives. Comparrison of the same sector between lists, each author is an observation.

list\measure	H-P	H-I	I-P
CPP	7.01	4.89	7.95
LAD	9.82	6.13	8.58
LAU	9.66	5.44	7.45
ELE	5.78	2.84	4.69

TABLE XII. Kolmogorov $c(\alpha)$ values for stopwords.

	CPP-LAD	CPP-LAU	CPP-ELE	LAD-LAU	LAD-ELE	LAU-ELE
P	3.31	3.26	6.68	0.57	5.36	5.41
I	1.45	1.08	5.16	0.91	5.00	4.92
H	0.98	0.68	4.35	1.05	4.73	5.01

TABLE XIII. Kolmogorov $c(\alpha)$ values for stopwords. Comparrison of the same sector between lists, each author is an observation.

list\measure	H-P	H-I	I-P
CPP	1.53	0.89	1.45
LAD	2.32	0.97	2.09
LAU	2.10	0.78	1.68
ELE	1.51	1.32	1.15

TABLE XIV. Kolmogorov $c(\alpha)$ values for punctuations/char.

	CPP-LAD	CPP-LAU	CPP-ELE	LAD-LAU	LAD-ELE	LAU-ELE
P	5.74	4.88	8.28	2.23	5.37	6.60
I	3.23	2.49	4.16	0.96	3.40	3.51
H	2.49	1.87	4.02	1.36	3.05	3.71

TABLE XV. Kolmogorov $c(\alpha)$ values for punctuations/char. Comparrison of the same sector between lists, each author is an observation.

-	CPP				LAD				LAU				ELE		
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.
d - d_i	0.9972	0.8188	0.9477	1.0162	0.9927	0.8268	0.9028	0.9952	0.9906	0.8045	0.7900	0.9948	0.9752	0.8331	0.9057
d - d_o	0.9932	0.8517	0.9381	1.0126	0.9907	0.8697	0.8696	0.9904	0.9842	0.8624	0.6289	0.9798	0.9529	0.8760	0.5669
d - s	0.9572	0.9167	0.8598	0.9835	0.9525	0.9685	0.8991	0.9592	0.9741	0.9715	0.9066	0.9811	0.9010	0.9557	0.5912
d - s_i	0.9539	0.7715	0.8329	0.9893	0.9420	0.8068	0.8366	0.9451	0.9628	0.7926	0.7378	0.9748	0.8695	0.8142	0.6811
d - s_o	0.9547	0.7662	0.7574	0.9692	0.9516	0.8406	0.7230	0.9572	0.9668	0.8452	0.4615	0.9575	0.8785	0.8218	0.0913
d - bc	0.9698	0.5773	0.7471	0.9921	0.9488	0.4707	0.6327	0.9603	0.9561	0.4917	0.5860	0.9635	0.9277	0.7236	0.8108
d - $triangles$	0.9716	0.7773	0.9342	0.9742	0.9789	0.8035	0.8644	0.9981	0.9752	0.7987	0.8110	0.9856	0.9889	0.9213	0.9455
d_i - d_o	0.9787	0.3936	0.7615	1.0031	0.9647	0.4389	0.5605	0.9473	0.9481	0.3905	0.0068	0.9283	0.8524	0.4521	0.0925
d_i - s	0.9595	0.7348	0.8066	0.9757	0.9529	0.7929	0.7852	0.9548	0.9700	0.7766	0.6592	0.9646	0.8809	0.7564	0.4000
d_i - s_i	0.9601	0.9315	0.8802	0.9838	0.9529	0.9675	0.9298	0.9565	0.9749	0.9744	0.9613	0.9800	0.8918	0.9633	0.8697
d_i - s_o	0.9523	0.3664	0.6185	0.9587	0.9408	0.4299	0.4345	0.9357	0.9433	0.4010	-0.1314	0.9136	0.8045	0.4266	-0.278
d_i - bc	0.9780	0.4765	0.7036	0.9970	0.9453	0.4052	0.6128	0.9463	0.9612	0.4369	0.5146	0.9617	0.9283	0.7161	0.7301
d_i - $triangles$	0.9599	0.5910	0.8621	0.9634	0.9713	0.6370	0.7540	0.9780	0.9683	0.5342	0.5127	0.9636	0.9526	0.6953	0.7154
d_o - s	0.9413	0.7934	0.8052	0.9866	0.9338	0.8477	0.8041	0.9329	0.9505	0.8405	0.6325	0.9587	0.8488	0.8652	0.5383
d_o - s_o	0.9457	0.8894	0.8084	0.9770	0.9455	0.9626	0.8712	0.9509	0.9682	0.9656	0.9106	0.9759	0.8999	0.9401	0.6816
d_o - bc	0.9452	0.4872	0.6967	0.9749	0.9346	0.3945	0.4971	0.9451	0.9211	0.3879	0.2974	0.9207	0.8457	0.5296	0.4184
d_o - $triangles$	0.9756	0.7021	0.8903	0.9825	0.9686	0.7215	0.7741	0.9888	0.9550	0.7799	0.6628	0.9710	0.9506	0.8638	0.7274
s - s_i	0.9985	0.7926	0.9230	1.0162	0.9951	0.8225	0.8694	1.0002	0.9928	0.8061	0.7107	0.9970	0.9799	0.7942	0.5159
s - s_o	0.9971	0.8764	0.9345	1.0146	0.9942	0.8785	0.8727	0.9987	0.9891	0.8795	0.6317	0.9898	0.9631	0.9069	0.7149
s - $triangles$	0.9298	0.6961	0.8118	0.9518	0.9616	0.7829	0.7600	0.9471	0.9741	0.7713	0.7583	0.9613	0.8933	0.8715	0.5878
s_i - s_o	0.9886	0.3980	0.7088	1.0062	0.9764	0.4482	0.5053	0.9732	0.9617	0.4246	-0.1088	0.9506	0.8801	0.4528	-0.281
s_i - $triangles$	0.9227	0.5365	0.7822	0.9552	0.9492	0.6210	0.6608	0.9281	0.9625	0.5225	0.4700	0.9455	0.8553	0.6719	0.4366
s_o - $triangles$	0.9321	0.6209	0.7191	0.9410	0.9626	0.7058	0.6569	0.9504	0.9672	0.7570	0.5478	0.9505	0.8799	0.7989	0.2907
bc - $triangles$	0.9055	0.4769	0.6933	0.9031	0.9555	0.2694	0.4095	0.9467	0.9409	0.2329	0.2844	0.9129	0.9255	0.7423	0.7459
IC - IP	-1.0010	-1.0012	0.0000	0.0000	-1.0008	-1.0011	0.0000	0.0000	-1.0008	-1.0011	0.0000	0.0000	-1.0033	-1.0045	0.0000

TABLE XVI. Correlation of topological measures.

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
nc-nt	1.000	0.978	0.992	1.018	1.000	0.994	1.001	1.008	1.000	0.940	0.995	1.007	[illegible]	[illegible]	[illegible]	[illegible]
np/(nc-ne)-ntp/nt	0.934	0.936	0.930	0.983	0.893	0.890	0.956	0.932	0.933	0.934	0.961	0.911	0.963	0.963	1.012	0.940
nt-ntd	0.927	0.870	0.837	0.988	0.943	0.918	0.954	0.967	0.956	0.921	0.947	0.967	0.807	0.946	0.948	0.923
Nwss/Nkw-Nwss_/Nkw_	0.805	0.862	-0.107	-0.401	0.877	0.922	0.882	-0.040	0.880	0.920	0.958	-0.010	0.824	0.869	-0.319	-0.394
Nwsw/Nkw-Nwsssw/Nwss	0.890	0.882	0.960	0.995	0.903	0.899	0.935	0.941	0.915	0.912	0.956	0.912	0.931	0.931	0.989	0.884
mtkw-mtkwnsw	0.855	0.868	0.386	0.388	0.941	0.943	0.943	0.769	0.944	0.943	0.971	0.826	0.937	0.940	0.927	0.758
mtkw-mtkwnsw_	0.849	0.878	0.447	0.125	0.915	0.939	0.929	0.426	0.913	0.935	0.951	0.409	0.823	0.904	0.622	0.238
mtkw-mtams	0.855	0.867	0.434	0.450	0.942	0.944	0.946	0.786	0.945	0.944	0.974	0.837	0.951	0.954	0.940	0.785
mtkw-mtams_	0.846	0.873	0.483	0.120	0.916	0.939	0.930	0.428	0.913	0.935	0.953	0.404	0.842	0.922	0.620	0.244
dtkw-dtkw_	0.962	0.969	0.739	0.612	0.979	0.984	0.942	0.660	0.977	0.982	0.966	0.605	0.963	0.972	0.786	0.399
dtkw-mtkwnsw	0.851	0.854	0.788	0.814	0.927	0.926	0.942	0.920	0.919	0.916	0.966	0.836	0.938	0.941	0.956	0.924
dtkw-dtkwnsw	0.903	0.904	0.890	0.833	0.936	0.936	0.952	0.902	0.941	0.940	0.975	0.873	0.938	0.944	0.810	0.902
dtkw-mtkwnsw_	0.833	0.845	0.778	0.564	0.908	0.923	0.920	0.457	0.903	0.916	0.935	0.478	0.837	0.914	0.674	0.399
dtkw-dtkwnsw_	0.879	0.888	0.620	0.507	0.917	0.923	0.917	0.598	0.923	0.927	0.953	0.564	0.924	0.942	0.655	0.358
dtkw-mtams	0.848	0.850	0.825	0.815	0.929	0.929	0.945	0.921	0.921	0.918	0.970	0.848	0.937	0.939	0.965	0.942
dtkw-dtams	0.887	0.887	0.882	0.805	0.928	0.928	0.948	0.902	0.936	0.935	0.972	0.872	0.930	0.935	0.778	0.892
dtkw-mtams_	0.826	0.838	0.784	0.555	0.910	0.925	0.921	0.457	0.904	0.917	0.937	0.475	0.846	0.921	0.673	0.410
dtkw-dtams_	0.867	0.875	0.610	0.506	0.911	0.916	0.914	0.607	0.920	0.923	0.952	0.577	0.921	0.937	0.661	0.385
mtkw_-mtkwnsw_	0.871	0.907	0.912	1.007	0.913	0.941	0.964	0.993	0.916	0.941	0.976	0.993	0.943	0.946	1.002	1.021
mtkw_-mtams_	0.863	0.899	0.901	1.008	0.912	0.941	0.964	0.993	0.915	0.940	0.976	0.995	0.932	0.934	1.002	1.019
mtkw_-mtsw_	0.823	0.773	0.753	0.743	0.889	0.861	0.876	0.790	0.904	0.879	0.945	0.839	0.933	0.935	0.650	0.748
mtkw_-mtsw2_	0.838	0.768	0.774	0.897	0.901	0.867	0.871	0.856	0.906	0.871	0.941	0.860	0.944	0.946	0.744	0.844
dtkw_-mtkwnsw	0.821	0.829	0.598	0.598	0.915	0.917	0.908	0.632	0.905	0.903	0.964	0.563	0.908	0.914	0.686	0.321
dtkw_-dtkwnsw	0.896	0.901	0.687	0.518	0.940	0.941	0.942	0.625	0.939	0.942	0.950	0.540	0.928	0.936	0.736	0.537
dtkw_-mtkwnsw_	0.851	0.860	0.765	0.752	0.920	0.929	0.935	0.696	0.920	0.922	0.974	0.823	0.849	0.912	0.639	0.478
dtkw_-dtkwnsw_	0.929	0.930	0.935	0.992	0.951	0.951	0.993	0.989	0.959	0.957	1.002	0.993	0.971	0.978	0.971	1.004
dtkw_-mtams	0.822	0.829	0.641	0.623	0.917	0.919	0.909	0.625	0.907	0.905	0.965	0.570	0.906	0.911	0.693	0.345
dtkw_-dtams	0.877	0.882	0.679	0.531	0.933	0.934	0.939	0.628	0.934	0.937	0.946	0.534	0.922	0.929	0.708	0.523
dtkw_-mtams_	0.845	0.853	0.770	0.752	0.922	0.931	0.936	0.693	0.921	0.924	0.974	0.824	0.857	0.918	0.656	0.506
dtkw_-dtams_	0.914	0.914	0.929	0.994	0.945	0.944	0.991	0.989	0.955	0.953	1.000	0.993	0.968	0.973	0.978	1.007
mtkwnsw-mtkwnsw_	0.940	0.968	0.754	0.633	0.972	0.990	0.959	0.567	0.968	0.986	0.980	0.609	0.904	0.968	0.767	0.534

-	CPP				LAD				LAU		
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.
mtkwnsw-mtams	[illegible]	[illegible]	[illegible]	[illegible]	0.998	0.998	1.001	1.004	0.997	0.997	1.0
mtkwnsw-mtams_	0.930	0.957	0.734	0.620	0.970	0.988	0.958	0.565	0.965	0.982	0.9
dtkwnsw-dtkwnsw_	0.959	0.968	0.661	0.459	0.979	0.985	0.939	0.579	0.973	0.981	0.9
dtkwnsw-dtams	0.988	0.988	0.993	1.007	0.994	0.994	1.001	1.005	0.992	0.992	1.0
dtkwnsw-dtams_	0.951	0.960	0.645	0.441	0.973	0.978	0.937	0.573	0.966	0.973	0.9
mtkwnsw_-mtams	0.938	0.965	0.772	0.630	0.969	0.987	0.955	0.562	0.966	0.983	0.9
mtkwnsw_-mtams_	0.993	0.992	1.000	1.018	0.998	0.999	1.004	1.007	0.998	0.998	1.0
dtkwnsw_-dtams	0.946	0.954	0.648	0.481	0.973	0.978	0.935	0.579	0.965	0.973	0.9
dtkwnsw_-dtams_	0.990	0.990	0.991	1.010	0.995	0.995	1.002	1.000	0.994	0.993	1.0
mtams-mtams_	0.945	0.973	0.764	0.626	0.971	0.990	0.956	0.562	0.968	0.986	0.9
dtams-dtams_	0.958	0.967	0.650	0.466	0.979	0.984	0.936	0.579	0.972	0.980	0.9
mtsw-mtsw2	0.885	0.885	0.840	0.494	0.957	0.957	0.980	0.894	0.967	0.965	0.9
mtsw_-mtsw2_	0.901	0.885	0.904	0.808	0.952	0.952	0.942	0.783	0.961	0.959	0.9
mtsw2_-dtsw2_	0.820	0.746	0.871	0.970	0.848	0.784	0.836	0.932	0.841	0.779	0.9
mtTS-mtsTS	0.977	0.977	0.979	1.009	0.981	0.982	0.989	0.990	0.871	0.873	0.9
dtTS-dtsTS	0.979	0.980	0.976	1.010	0.956	0.957	0.956	0.990	0.889	0.905	0.9
mtsTSkw-mtsTSpv	0.962	0.962	0.967	0.953	0.968	0.969	0.980	0.966	0.961	0.961	0.9
dtsTSkw-dtsTSpv	0.969	0.967	0.981	1.003	0.973	0.975	0.959	0.925	0.948	0.945	0.9
mtmT-mttmT	0.962	0.957	0.996	1.001	0.991	0.991	0.997	1.002	0.877	0.872	0.9
dtmT-dttmT	0.989	0.976	0.997	1.015	0.982	0.980	0.984	0.994	0.874	0.863	0.9
mtwss-dtwss	0.804	0.809	0.792	0.648	0.852	0.852	0.889	0.823	0.841	0.837	0.9
mtamH-mprof	0.994	0.995	1.004	1.016	0.997	0.997	1.001	1.006	0.997	0.997	1.0
dtamH-dprof	0.996	0.997	1.001	1.016	0.999	0.999	1.003	1.000	0.999	0.999	1.0

TABLE XVII: Correlation of textual measures

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
ncont-d_o	0.923	0.335	0.459	0.934	0.836	0.405	0.265	0.744	0.851	0.455	0.476	0.775	0.510	0.682	0.371	0.414
ncont-s	0.915	0.480	0.554	0.904	0.863	0.448	0.345	0.790	0.868	0.486	0.411	0.784	0.531	0.694	0.617	0.379
ncont-s_o	0.907	0.420	0.568	0.888	0.858	0.462	0.380	0.781	0.874	0.484	0.515	0.793	0.575	0.776	0.826	0.457
nc-d	0.930	0.362	0.259	0.930	0.921	0.316	0.368	0.877	0.921	0.371	0.209	0.866	0.592	0.604	-0.064	0.380
nc-d_i	0.923	0.220	0.151	0.917	0.907	0.180	0.259	0.852	0.900	0.209	-0.113	0.831	0.535	0.266	-0.302	0.285
nc-d_o	0.929	0.377	0.342	0.942	0.918	0.346	0.400	0.877	0.922	0.396	0.480	0.876	0.616	0.733	0.398	0.463
nc-s	0.951	0.441	0.359	0.962	0.932	0.353	0.415	0.905	0.923	0.400	0.310	0.878	0.734	0.695	0.517	0.620
nc-s_i	0.946	0.258	0.207	0.961	0.915	0.208	0.291	0.881	0.896	0.224	-0.100	0.842	0.717	0.296	-0.311	0.600
nc-s_o	0.951	0.458	0.448	0.957	0.938	0.378	0.427	0.916	0.936	0.431	0.545	0.895	0.704	0.805	0.834	0.568
nc-tri	0.935	0.312	0.276	0.941	0.912	0.312	0.346	0.862	0.922	0.328	0.233	0.877	0.605	0.648	0.090	0.392
nt-d	0.926	0.348	0.244	0.925	0.921	0.326	0.366	0.876	0.923	0.428	0.221	0.865	0.597	0.608	-0.066	0.382
nt-d_i	0.919	0.205	0.144	0.912	0.908	0.188	0.255	0.852	0.901	0.238	-0.113	0.830	0.538	0.275	-0.301	0.282
nt-d_o	0.926	0.369	0.320	0.938	0.918	0.355	0.401	0.875	0.924	0.459	0.498	0.875	0.624	0.731	0.392	0.472
nt-s	0.946	0.424	0.335	0.956	0.932	0.364	0.415	0.905	0.924	0.457	0.317	0.877	0.737	0.701	0.520	0.620
nt-s_i	0.941	0.240	0.195	0.956	0.916	0.215	0.290	0.881	0.897	0.257	-0.106	0.843	0.717	0.309	-0.313	0.597
nt-s_o	0.945	0.447	0.415	0.950	0.937	0.390	0.429	0.914	0.936	0.490	0.561	0.894	0.711	0.804	0.838	0.573
nt-bc	0.865	0.247	0.085	0.845	0.851	0.128	0.180	0.774	0.857	0.173	0.086	0.768	0.501	0.305	-0.185	0.238
nt-tri	0.933	0.295	0.268	0.938	0.911	0.321	0.340	0.859	0.922	0.379	0.241	0.875	0.611	0.649	0.093	0.394
ntd-d	0.905	0.430	0.402	0.903	0.917	0.437	0.428	0.860	0.921	0.557	0.256	0.863	0.827	0.708	-0.039	0.409
ntd-d_i	0.882	0.267	0.292	0.892	0.895	0.272	0.319	0.826	0.886	0.351	-0.086	0.820	0.731	0.403	-0.322	0.286
ntd-d_o	0.925	0.443	0.468	0.912	0.924	0.458	0.446	0.871	0.939	0.563	0.521	0.885	0.882	0.780	0.486	0.536
ntd-s	0.851	0.527	0.537	0.919	0.857	0.474	0.461	0.858	0.881	0.579	0.346	0.856	0.812	0.781	0.518	0.638
ntd-s_i	0.833	0.322	0.372	0.914	0.842	0.298	0.340	0.837	0.847	0.365	-0.084	0.818	0.735	0.436	-0.346	0.574
ntd-s_o	0.867	0.536	0.612	0.919	0.863	0.493	0.459	0.866	0.902	0.590	0.577	0.878	0.855	0.833	0.863	0.654
ntd-bc	0.811	0.243	0.195	0.819	0.806	0.166	0.204	0.751	0.830	0.226	0.085	0.770	0.690	0.399	-0.144	0.282
ntd-tri	0.923	0.363	0.427	0.930	0.868	0.413	0.409	0.851	0.892	0.480	0.284	0.889	0.810	0.708	0.156	0.406
ntd-*in cent*	0.523	0.036	-0.019	0.451	0.631	0.096	0.105	0.318	0.666	0.123	0.103	0.367	0.583	0.138	-0.007	0.158
ntd-sector	0.686	0.000	0.000	0.000	0.778	0.000	0.000	0.000	0.784	0.000	0.000	0.000	0.837	0.000	0.000	0.000
ntd/nt-sector	-0.547	0.000	0.000	0.000	-0.603	0.000	0.000	0.000	-0.571	0.000	0.000	0.000	-0.603	0.000	0.000	0.000
mtsw2_-sector	0.555	0.000	0.000	0.000	0.546	0.000	0.000	0.000	0.502	0.000	0.000	0.000	0.683	0.000	0.000	0.000

TABLE XVIII: Correlation of textual and topological measures.

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
λ	17.71	18.46	19.44	30.20	24.14	24.77	24.63	17.28	24.51	24.76	32.44	19.75	27.72	29.35	17.90	18.23
mtkwnsw_	0.09	-1.13	-2.89	0.94	-0.29	-1.85	0.56	0.17	-0.25	1.40	-5.10	0.37	1.97	-0.79	1.40	-1.24
mtsw_	-0.34	1.56	0.86	-0.09	-0.37	-2.48	1.97	-0.55	-1.80	-2.90	1.88	-2.21	-0.85	1.08	6.66	3.57
mtsTS	0.35	-1.20	-2.17	3.16	-1.07	-1.33	1.87	2.74	1.49	-5.17	-1.69	0.84	-0.04	-2.37	-0.90	0.32
dtsTS	0.45	-1.20	-1.49	0.63	0.34	1.72	-0.51	1.06	0.47	-2.67	1.50	5.08	1.47	-1.28	1.12	0.32
mtsTSkw	-0.11	-2.19	0.59	-2.85	0.61	6.11	-0.72	-2.06	1.06	-1.68	-6.03	-1.35	1.75	0.32	-0.35	0.01
dtmT	0.77	8.15	-3.14	0.39	0.17	-1.94	-6.75	2.78	0.74	0.32	2.43	-0.28	-0.69	-0.18	0.09	0.79
dttmT	-0.43	2.51	2.88	1.45	-9.19	5.03	-2.94	-2.30	0.97	-0.84	-0.08	-1.32	-0.41	-2.07	2.13	0.57
mtsmT	-0.45	-2.04	1.25	-1.22	6.29	6.63	-1.57	0.03	2.87	1.75	-2.80	0.37	1.54	-8.42	2.13	0.57
dtsmT	-3.39	1.44	-1.29	0.49	4.84	-2.34	-0.85	1.59	-0.22	-3.08	-3.17	-4.01	-4.11	-5.75	-0.58	-1.05
NN	-2.70	0.60	-4.54	-0.45	-0.16	2.97	3.84	-2.46	5.20	-4.38	-2.69	-2.07	0.52	0.33	-0.58	-1.05
JJR	0.54	3.13	-0.51	-0.51	1.51	-0.94	-1.40	-2.82	-0.00	6.45	0.72	1.21	1.78	-1.02	0.13	0.10
JJS	-8.43	0.16	-3.34	0.59	1.47	0.40	-0.77	-4.28	-0.24	-1.26	1.53	-4.44	2.09	0.55	0.13	0.10
RB	4.07	1.34	2.33	0.59	14.45	-3.72	-0.55	0.94	-0.24	0.50	-0.52	3.25	0.91	-1.73	0.49	-0.00
RBS	0.49	-1.54	-0.87	0.66	-3.89	0.99	-0.82	-0.26	7.90	-0.53	0.54	1.11	7.59	0.81	0.27	-0.92
VBD	1.48	0.09	-0.80	-1.11	-1.23	0.48	0.11	-0.03	1.05	-0.19	0.10	5.06	0.44	-0.01	0.00	0.00
VBG	0.19	-0.68	1.10	-1.29	0.18	0.89	0.37	0.90	5.63	-0.40	0.46	-4.17	-1.61	-1.30	0.00	0.00
IN	-1.74	0.32	-0.56	-1.24	1.55	0.44	-0.23	1.27	-5.74	-0.44	-1.66	-0.60	1.09	0.32	0.00	0.00
PRP$	6.51	0.22	0.29	0.41	-0.77	-0.18	-0.11	0.25	-0.26	0.22	0.14	-0.08	0.14	0.34	0.00	0.00
PDT	5.12	0.11	0.24	0.41	-0.14	-0.15	0.19	-0.25	0.31	0.56	-0.43	0.40	-1.40	-0.37	0.00	0.00

TABLE XIX: Composition of first component (threshold that —val—¿0.05).

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
λ	11.48	10.25	12.23	15.72	11.97	9.39	12.05	13.19	11.87	9.76	11.42	11.26	12.49	11.17	15.75	13.31
nc	-5.21	-3.60	3.06	-4.12	4.62	-3.49	2.30	0.94	4.49	3.76	-2.75	-0.53	2.87	-2.66	-3.97	-0.03
Nwsssw/Nwss	0.43	0.34	0.35	-0.66	0.21	-0.10	0.93	-0.30	0.07	0.20	0.23	-0.54	1.10	-0.44	-5.11	4.46
dtsmT	-5.57	0.29	1.79	-1.41	2.42	3.05	2.04	-0.28	-0.33	0.01	-0.16	-1.67	3.51	1.08	0.50	1.02
JJR	0.22	-4.19	0.73	1.98	0.14	1.31	-0.09	-0.11	-0.53	-5.38	-1.45	1.64	-0.69	0.81	0.63	0.11
RB	-0.68	-2.74	0.90	0.22	-6.12	2.64	0.65	-0.29	-0.16	-0.89	-1.69	-1.06	0.30	-0.63	0.21	-0.52
IN	0.46	0.98	-0.35	-0.54	-2.09	1.97	0.19	-0.68	5.08	2.39	2.17	-0.31	-0.45	-1.22	0.00	0.00
WP$	-0.15	1.52	2.10	0.00	-5.22	-0.63	-2.09	0.13	4.57	-1.19	-1.36	-0.94	0.21	0.12	-0.05	-1.11
CD	-5.85	0.15	1.02	0.00	0.78	0.70	-4.05	-0.25	0.05	0.88	-3.35	-1.58	-0.48	-0.76	0.03	-1.11
mtamH	0.31	-0.93	-3.67	0.00	-0.57	3.99	1.73	1.03	-0.23	-0.76	-2.07	6.02	-0.14	2.64	0.41	0.05
dtamH	0.10	-0.35	-1.14	0.21	0.51	-1.88	-5.96	-0.50	-0.31	-6.22	1.31	1.95	-0.74	-0.98	0.41	0.05
mprof	-3.63	2.72	-1.61	0.21	0.20	0.72	-0.57	-2.39	0.81	-1.40	0.49	0.56	0.26	5.42	-0.06	-0.29
dprof	-0.73	1.16	-2.33	0.24	-0.52	0.75	0.44	-1.12	1.18	3.76	7.77	2.01	-0.19	-5.61	-0.06	-0.29
d_o	-0.02	-0.01	-4.02	1.06	0.29	0.64	-0.65	8.56	0.39	1.44	0.35	-1.46	-0.12	1.40	0.03	-0.28
s_o	-0.71	2.39	-1.52	0.25	0.20	8.51	-0.11	0.23	-1.57	-6.21	1.25	-0.36	-1.08	0.47	-0.04	0.08
bc	0.70	1.55	0.11	-0.18	-11.23	-0.12	-0.17	0.05	-11.59	0.59	0.42	0.76	-9.01	-0.59	-0.20	0.78
tri	-0.07	8.58	0.00	-0.45	-5.88	-0.46	0.00	0.00	-2.17	0.02	0.00	-0.00	-3.52	-0.25	-0.98	0.03
in cent	15.09	-0.00	0.00	0.53	-0.06	0.00	0.00	0.00	0.15	-0.00	0.00	0.00	-0.79	-0.00	0.06	1.25

TABLE XX: Composition of second component (threshold that —val—¿0.05).

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
λ	8.97	7.53	7.71	7.19	8.28	8.07	7.97	10.58	8.45	7.40	6.61	8.45	6.56	6.01	11.01	9.85
Nkw/nt	1.81	1.26	-1.38	0.76	-0.58	-0.52	-0.32	-3.03	0.85	1.13	-1.00	-5.90	-1.77	-1.15	5.75	-0.20
mtsw2_	2.46	1.66	-1.23	3.90	0.17	0.55	-1.23	0.16	0.60	-1.59	0.10	6.54	0.27	0.86	0.19	-1.89
mtsTS	0.42	-0.97	-1.76	2.08	-6.73	1.74	-1.53	-1.63	0.74	-2.66	-1.48	0.68	2.08	-4.13	0.35	0.51
dtsTSkw	1.66	2.31	1.25	0.93	3.90	-5.60	-3.81	0.01	3.03	2.75	-1.19	-0.69	0.71	1.29	1.01	0.72
mtsTSpv	0.71	6.83	1.68	-0.24	2.40	-0.32	-0.64	0.14	3.85	-2.97	1.10	3.45	-2.74	0.70	-1.28	-0.08
dtsTSpv	5.50	-2.29	-2.81	0.93	-3.36	3.78	0.86	-0.23	-2.61	1.40	-2.96	1.31	-1.59	-3.64	-1.06	-1.12
mtmT	-2.90	0.60	-0.74	1.75	5.53	-2.22	-2.11	0.37	-2.22	-2.90	2.63	-2.68	-0.44	2.35	-1.06	-1.12
dtmT	1.64	-0.43	0.52	0.21	0.56	-5.70	0.33	2.14	7.11	-3.32	-1.85	-2.08	-2.93	3.07	0.43	-0.43
dttmT	0.90	-0.20	-2.54	2.69	3.68	3.77	-0.22	-0.18	-3.64	2.06	1.57	0.67	5.92	8.07	-1.52	-1.03
mtsmT	-0.33	-5.56	4.20	1.39	5.68	-4.48	2.97	2.34	3.76	-7.62	0.84	1.13	9.98	2.51	-1.52	-1.03
dtsmT	-1.96	0.77	2.26	-0.26	1.79	0.92	0.06	-0.03	5.00	1.80	-2.45	2.24	1.99	-5.87	0.34	1.25
NN	2.78	0.13	0.15	1.10	-0.60	6.82	-0.07	-0.10	-2.70	4.95	1.05	-1.69	0.46	3.08	0.34	1.25

TABLE XXI: Composition of third component (threshold that —val—¿0.05).

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
λ	3.81	4.00	6.75	5.52	4.26	4.03	5.79	6.03	3.55	3.68	5.29	7.14	5.65	5.66	7.78	8.31
ncont	2.30	2.60	-2.75	-2.62	-3.27	-3.23	-3.16	-1.59	-3.55	3.47	-2.74	1.75	-2.87	-3.16	5.14	1.67
dtsw	0.58	-0.12	-0.84	-1.52	0.38	-0.19	0.27	-0.83	-0.06	0.10	0.99	-0.62	-0.04	-0.34	12.71	1.12
WRB	-1.39	1.62	-5.39	0.00	-5.16	4.23	0.15	0.36	0.52	-1.58	1.69	1.24	1.54	-5.08	0.07	0.00
WP	-2.35	1.63	-1.44	0.00	3.75	1.90	-2.32	-0.36	7.41	-5.00	-1.92	-0.65	-2.44	-0.32	-0.62	-0.90
WP$	-4.35	2.81	-4.42	0.00	2.29	-0.54	-1.24	-0.70	-3.39	-5.06	-0.68	0.61	0.54	-2.12	-0.62	1.60
EX	-7.04	8.54	-0.88	0.00	-0.70	1.26	-1.12	-3.15	0.36	-0.35	-0.98	-2.34	-0.44	-0.51	-0.23	-0.69
UH	0.99	-1.17	-7.02	0.00	0.55	-0.90	-0.68	0.27	-0.06	-0.13	1.79	0.37	-0.19	-0.29	0.44	-0.69
FW	-1.35	5.80	1.68	0.00	-0.24	0.45	1.10	-2.52	-0.21	1.46	-0.64	-1.17	-0.06	-0.62	0.44	1.35
mlwss	0.53	1.41	-0.79	0.00	1.00	-0.55	0.48	3.77	-0.93	-0.42	-1.96	6.52	-0.39	0.34	0.02	1.66
dlwss	2.83	0.44	-1.10	0.00	0.01	0.47	2.94	-0.95	-1.30	0.85	2.89	6.23	0.82	1.81	0.42	1.66
dprof	-1.24	1.04	-0.39	-0.81	-0.38	0.56	-0.08	5.71	-0.20	-0.17	-1.31	-0.52	-0.37	-0.03	0.19	0.34
d	0.43	-0.91	-1.59	-0.81	-0.21	0.42	-2.60	-6.63	0.49	0.38	4.88	0.20	1.43	1.49	0.65	0.58
s	0.07	-0.50	-0.46	0.80	0.62	-1.12	2.74	3.75	0.30	-0.07	-6.44	1.16	1.27	-1.08	-0.87	0.23
s_i	-0.34	0.18	-0.54	1.27	-1.05	-0.90	-13.22	1.39	0.40	-1.10	9.86	1.39	0.62	-1.29	-0.86	0.23
bc	-0.17	-0.06	0.03	-0.71	-0.11	-0.14	-1.03	-0.92	0.02	0.28	5.11	-0.56	-2.46	1.63	-0.34	0.46
tri	1.09	0.11	0.00	-0.31	0.11	14.18	-0.00	-0.00	1.23	-0.40	-0.00	0.00	3.12	-1.50	-0.49	-0.24
cv	-0.24	0.24	0.00	-0.25	-2.62	-4.41	0.00	0.00	0.34	-15.74	0.00	0.00	14.09	16.09	-0.36	-0.24
in cent	0.02	-0.00	0.00	-0.25	14.87	0.00	0.00	0.00	16.34	-0.00	-0.00	0.00	3.57	-0.00	-0.36	-0.51

TABLE XXII: Composition of fourth component (threshold that —val—¿0.05).

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
λ	3.48	3.38	4.54	4.16	3.42	3.74	4.60	4.41	2.97	3.14	3.83	5.33	3.32	3.58	5.95	7.29
Nkwnssnsw/Nkw	-6.10	-3.15	0.31	0.94	-2.48	-1.57	-0.20	0.43	1.12	1.63	0.33	1.23	-2.41	-0.97	-1.30	1.91
mtsTS	-4.04	-1.67	-1.79	1.54	-1.90	0.84	-5.02	-0.15	-1.53	-1.19	0.50	0.67	1.56	-0.20	0.89	0.24
dtsTS	-0.97	3.59	-1.47	0.09	5.70	0.45	2.78	0.45	-3.19	6.97	1.40	0.12	-1.89	-1.59	-0.20	0.30
dtsTSkw	0.03	-1.95	0.87	-1.14	-5.87	-2.23	0.06	-2.74	-6.87	-4.49	-0.07	1.36	2.53	-0.85	-0.44	-0.20
dtsTSpv	1.87	-0.41	0.82	3.16	2.28	-5.32	-1.16	1.35	4.05	-4.68	3.13	-0.67	3.76	3.24	-0.58	-0.84
sector	0.00	0.00	0.00	0.48	0.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00	-0.00	-0.00	11.05	1.52

TABLE XXIII: Composition of fifth component (threshold that —val—¿0.05).

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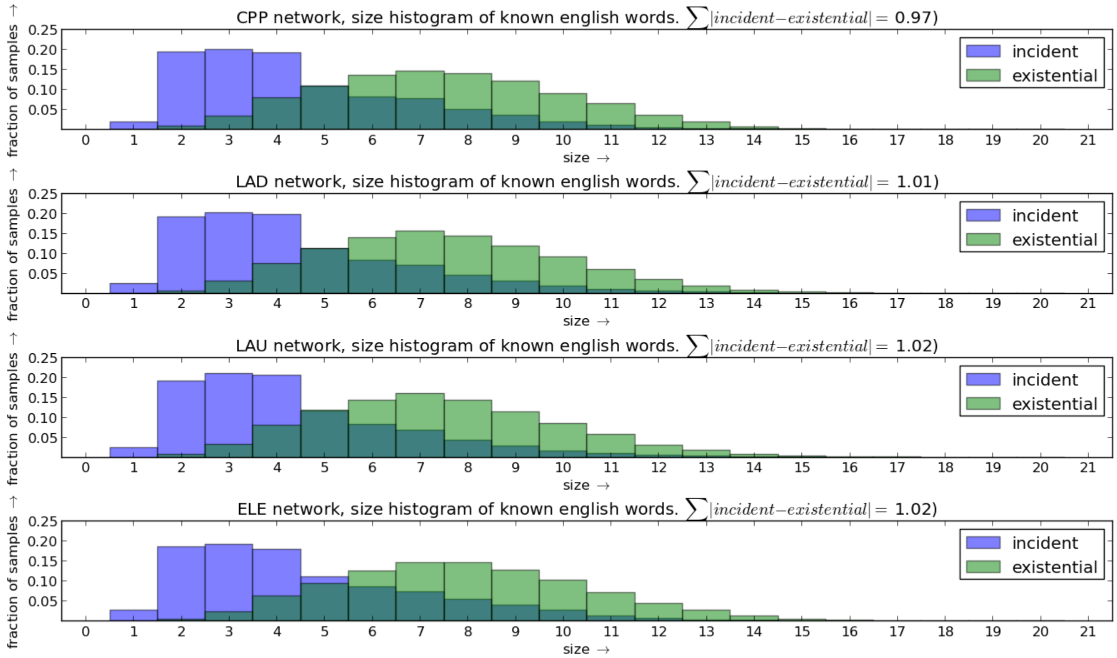

FIG. 2. Size of words that are known in English. Crossing of incident and existential sizes is around 5 (figure 3 shows a shift to length 6-7 when consideren only non stopwords). Words with three letters have maximum incidence, while most words have 7 letters.

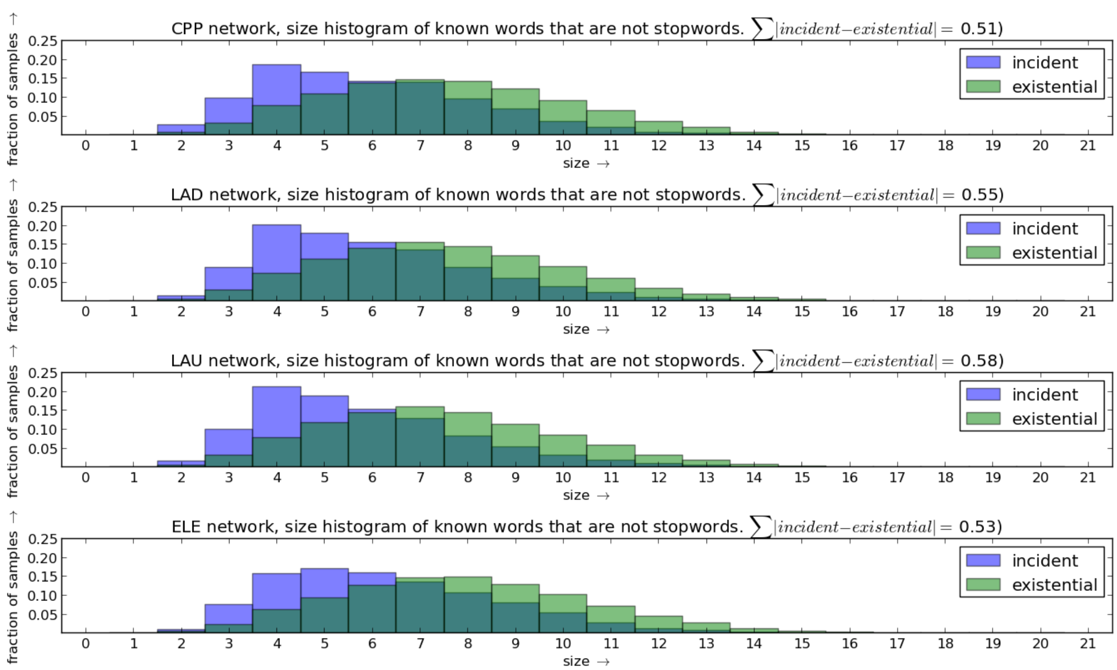

FIG. 3. Size of words that are known in English and are not stopwords. Crossing of incident and existential sizes is around 6-7 (figure 2 shows a shift to length 5 when considered stopwords). In this case, words with 4 letters have maximum incidence, while most words still have 7 letters. Exception for ELE, which exhibits maximum incidence of words with 5 letters and most words having 8 letters, which might be associated with ELE network typology discussed in tables III and .

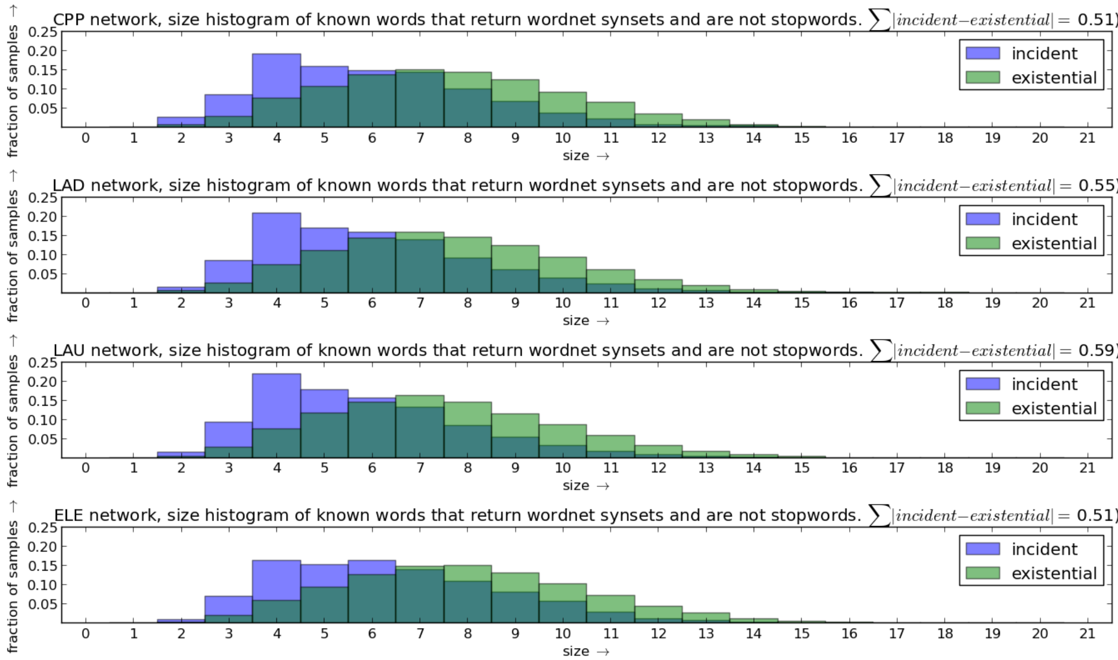

FIG. 4. Size of words that are known, are not stopwords and have synsets. Ressembles figure 3. Stopword sizes histogram are in figure 5. Differences suggests ≈ 0.5 might be constant. LAD and LAU exquisite vocabulary (GNU/Linux, programming, sound/signal processing, music) might be responsible for higher difference of distributions.

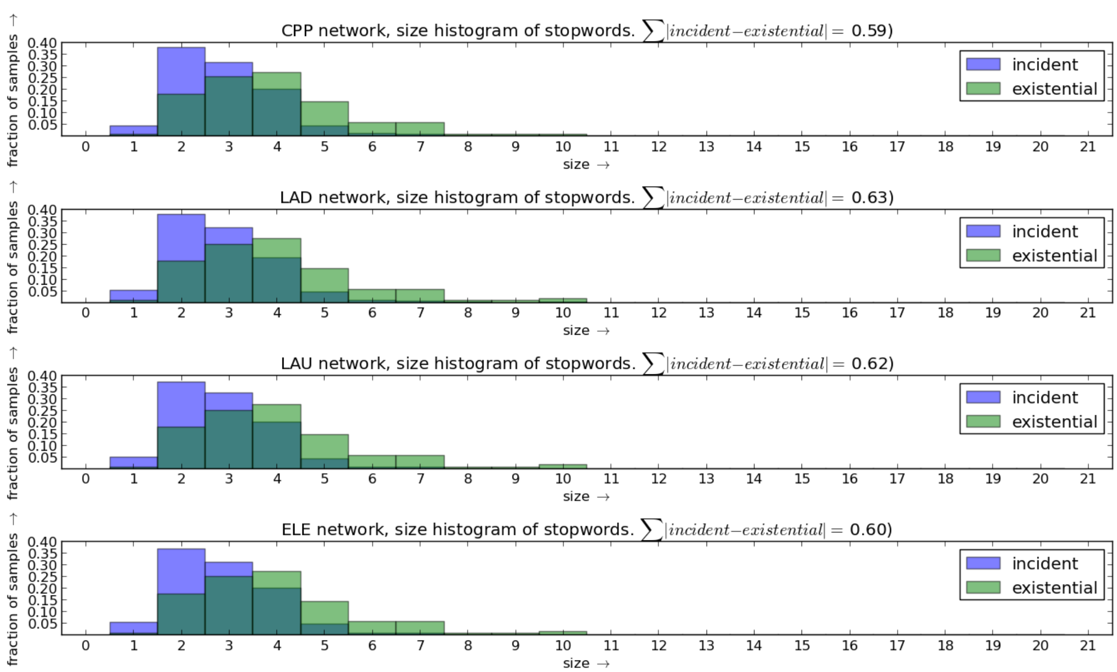

FIG. 5. Size histogram of stopwords. Stopwords with two letters are the most frequent, while most of them have four letters. Differences in distribution seem stable around ≈ 0.6.

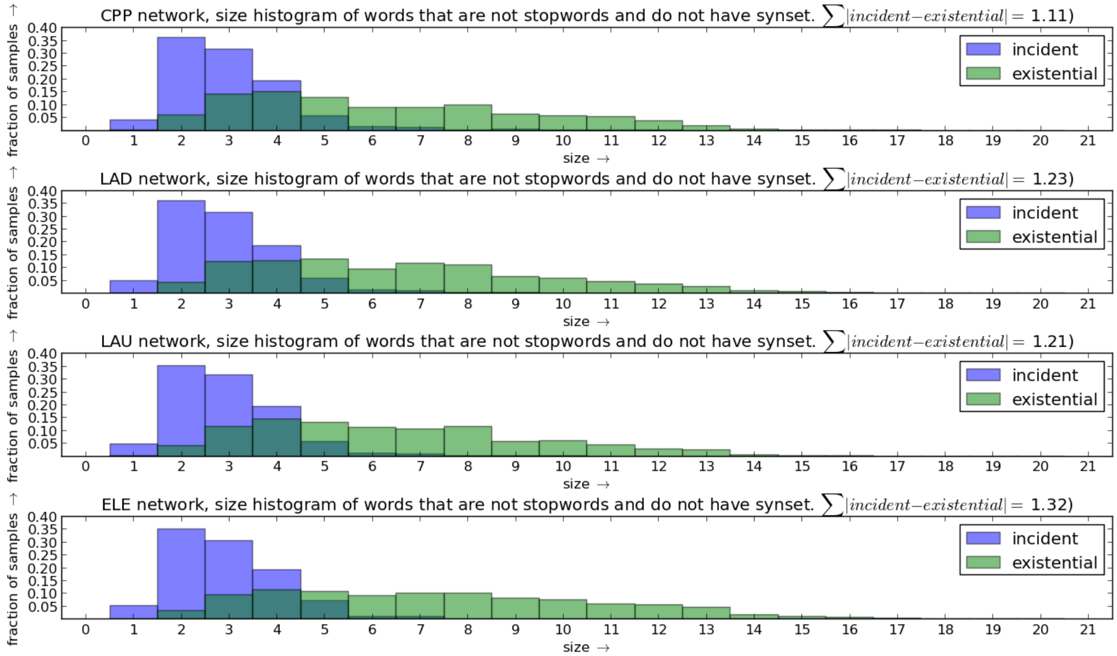

FIG. 6. Size histogram of known English words that are not stopwords and do not return synsets. Differences in distribution suggests less stable behavior, with high incidence of few words high number of existing words with many letters. Observe difference ≥ 1, as observed only with all known words, but even higher.