A connective differentiation of textual production in interaction networks

Renato Fabbri[a)]
Instituto de Física de São Carlos, Universidade de São Paulo (IFSC/USP)

(Dated: 23 December 2014)

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

PACS numbers: 89.75.Fb,05.65.+b,89.65.-s
Keywords: complex networks, natural language processing, social network analysis, statistical physics

I. INTRODUCTION

Textual production has received considerable attention from the 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 interesting hypothesis about verbal differentiation of network sections and groups, derived from a previous article by the same author[?] , 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 registering the moment the message was sent, and the textual content. 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 I.

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 author was received by the responder (that had to read, process its contents and render a relevant textual response). Therefore, an edge from first author to the second author (responder) is considered. This is the "information network" of the system. Edges can be considered in the reverse order, from the responder to the original sender, representing 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.

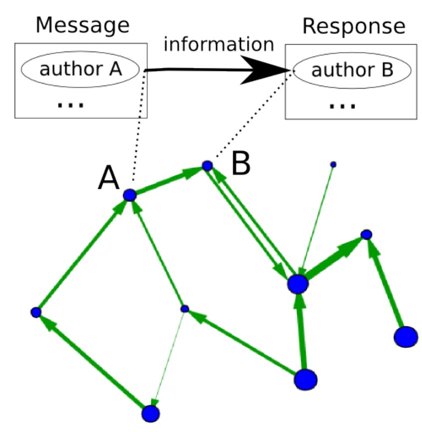

FIG. 1. Formation of interaction network. The edges are directed as information flows, from an original message's author to the observed responder. Further information is given in Section II A

a)Electronic mail: fabbri@usp.br

B. Verbal observations

Each message has a textual content. Analysis this content can observe 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, independent messages were considered. For sections (hubs, intermediary and peripheral), all messages written by authors in each section were considered together.

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

III. METHODOLOGY

An article was written for reporting stability in such networks from the topological viewpoint[?] . This article is dedicated to reporting differentiation in the textual production of the network as conectivity changes. Here, the observance of primary textual statistics is needed, and both overall incidences, and correlation to topological aspects, were tackled.

It is coherent to have participants as vertexes and as references for the messages sent, for the text produced and for activity (related to time and date). This way, to observe the text produced in a 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.

A. Network measurements and partitioning

Basic network measures of connectivity, in the same networks, were oberved in a previous article[?] . The present article uses the same topological measures to observe correlations, PCA formation and network sectioning in peripheral, intermediary and hub sectors, through strengh measure. The "exclusivist criteria" for such partitionin is found to be the closest to literature predictions (5% of hubs, 15% of intermediary and 80% of peripheral vertex). Even so, strengh-based criteria is simpler and yields reasonable results (5-10%, 5-25%, 65-90%). Beyond that, changing the sectioning to a degree or a compound criteria did not significantly change the presented results.

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 interests. These measures include frequency of individual letters and punctuations (Tables II), of words and tokens (Table III), sizes of tokens, sentences and messages (Table IV, V and VI) and POS (Part-Of-Speech) tags (Table VII). Other measures envisioned are in subsection V A.

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 complex behaviors subtle aspects. A preliminary study, with all the work from Machado de Assis[?] , made clear that these measures vary with respect to style.

Considered measures are:

- Frequency of characters: letters, vogals, punctuations and uppercase. Table II is dedicated to such measures.
- Number of tokens, frequency of puntcuations, of known words, of words that has wordnet synsets, of tokens that are stopwords, of words that return synsets and are stop words, etc. Table III is dedicated to measures of this kind.
- Mean and standard deviation for word and token sizes. Table IV is dedicated to these measures.
- Mean and standard deviation of sentence sizes. Table V is dedicates to this sort of measures.
- Mean and standard deviation of message sizes. Table VI presents some of these measures.
- Fraction of morphosyntactic classes, such as adverbs, adjectives and nouns, represented by POS (Part-Of-Speech) tags. Table VII displays such measures.

C. Topological measures

Degree (in, out and total), strength (in, out and total), betweenness centrality and clustering coefficient were measured for each vertex in the interaction network. This served two purposes:

- Obtaining sound partitioning of the network in peripheral, intermediary and hub sectors. This was developed in a previous article by the same author[?] .
- Observance of correlation with textual measures and principal components formation.

These measures are not developed here extensively as they are very consolidated, simple, and was the core of the previous article on the subject of email interaction networks[?] .

D. 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 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.
3. PCA to gain further insights about how measures combine in principal components formation.

Criteria for this choice include integration with previous topological results, lack of concise results that could substantiate correlations of topological and textual traces, and common sense as a long-time integrant of these networks.

First task, of textual production observance in hubs, intermedary and peripheral sectors, is observed by Tables II-XV. An adaptation of the Kolmogorov-Smirnof test was used to observe diferences in textual productions, as exposed in Appendix A.

Second task is addressed by the correlation matrix with both textual and topological measurements of each participant, in Tables XVI-XVIII. Third, principal components composition are used to deepen understanding of measurements interrelation, in Tables XIX-XXIII.

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 B. Most importantly: conectivity has strong influence in textual production of participants in the network. For example: hubs use more contractions, more adjectives, more common words, and less punctuation if compared to the rest of the network, specially the peripheral sector. In general, rise or fall of a measure was costant, by some of them reached extreme values in the intermedary sector.

Next subsections exhibit particular results of interests. Nevertheless, many other results were encountered, some of them had no immediate explanation, to which is dedicated Appendix C and part of section V.

A. General characteristics of activity distribution among participants

Hubs and peripheral sectors swap fraction of 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 slightly 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 (see Appendix B 1).

Further information is given in Table II.

C. Tokens and words

Largest size of tokens is with the most wordy list (ELE). This implies that is has more characters and 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 can be noticed 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 less abundant in hubs, and discrepancies here are larger that with characters comparrisons (subsection IV B). 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.

D. 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. Larger words seems to be related to intermediary sector, which might be related to cultured vocabulary.

Further information is given in Table IV.

E. Sizes of 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.

F. Messages

Regarding characters and tokens, connectivity was related to smaller messages. ELE list displayed an inverse situation: the more conected the sector, the longer the messages are. This was considered a peculiarity of the culture bonded with the political subject of ELE list, to be further verified. Regarding sentences, the size of messages seem to hold steady until hubs are reached.

Further information is given in Table VI.

G. POS tags

Lower connectivity delivers 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 VII.

H. Differentiation of measures

The Kolmogorov-Smirnov test was adapted for our need to compare measures. Results suggests that the texts produced by each sector is very distinct. Counterintuitively, intermediary sector sometimes yields a greater difference from periphery that hubs (Tables VIII and XII).

At the core of the results presented on this article, are two strong and immediate interpretations that follows Tables VIII-XV:

- Differences detected are very very big, as can be noticed from the values on these tables, beyond reference values used for understanding if the null hypothesis can be discarted (see Appendix A).
- Differences between sectors on the same network (Tables VIII, X, XII and XIV) are bigger than differences between same sector from distinct lists (Tables IX, XI, XIII and XV).

I. Correlation of measures

Correlation of degree (how many participants the participant related to) and strength (how many interactions) measures is substantially smaller for intermediary sector. This raises interesting inquiries, to which the reader is invited, along with further analysis of Tables XVI, XVII and XVIII. As detailing their interpretation goes beyond the scope of this article. Noteworthy is the negative correlation of degree and message size (number of characters, tokens or sentences) that intermediaries presented.

J. Formation of principal components

Principal components formation seem to be the less stable of all features considered. First component, with $\approx 25\%$ of dispersion, relies heavelly on POS tags, and slightly on sizes of tokens, sentences and messages. Second component, with almost 12% of dispersion, blends topology, POS tags and size measures. Third component, with about 8.5% is based on nouns frequency and size measures. Fourth and fifth components present less than 5% of total dispersion, but are included for completeness of exposition.

Tables XIX-XXIII exhibit these and further insights.

K. Results still to be interpreted

These networks yield diverse characteristics, some of which were not of core importance for this step of the research. Even so, at least one of these characteristics was found interesting enough to be considered a result and an example of interesting artifacts found.

Histogram differences of incident and existent word sizes were found constant. That is, in each list, when a histogram of word sizes were made with all words written, and another histogram made with sizes of all *different* words, the cumulative difference of the two histograms were found constant for all lists analysed. When all known english words were considered, the difference was always ≈ 1.0. When stopwords were disconsidered, the difference found was different, but still constant, slightly above 0.5. Whem only stopwords were considered, the difference was ≈ 0.6. When only known english words that did not have wordnet synsets were used, this difference is ≈ 1.2.

These results currently lacks substantial interpretation, which is provocative and should lead at least to a research note. Section C and Figures 2-6 are dedicated to this histogram differences.

V. FINAL REMARKS

Human interaction networks yield diverse linguistic peculiarities reported by its members. This is a first sistematic exploratin of such peculiarities with primitive connective sectors in mind, as far the author knows. Results were regarded as stronger than envisioned from start, which poses diverse en intriguing questions.

All the data used is public, all scripts used are online (see Appendix D. This results, confluent with recent research and development, some by the current author, are of core importance for social technologies and transformations, such as collection and diffusion and information, and open processes of legal documents refinement[?] [?] [?] [?] [?] .

A. Further work

Results suggests that less connected participants bring external content and concepts, while hubs qualify the content. This hold mainly as periphery uses more nouns while hubs present more adjectives. This should be further verified, maybe with a dedicated article.

Similarity measures of texts in message-response threads has been thought about by the author, and some results are being organized. These are two hypothesis obtained from recent experiments:

- existence of information "ducts" through similarity measures. These might coincide with asymmetries of edges between vertexes pairs, with homophily or with message-response threads, to point just a few possibilites.
- valuable insights can be driven from autossimilarity of messages by same authors, of messages sent at the same period of the day, etc. This includes incidences of word sizes, incidences of tags and morphosintactic classes, incidences of particular wordnet synset characterisctics and wordnet word distances.

Given current results, diversity and self-similarity should vary with respect to connectivity. Literature usually assumes that periphery holds greater diversity[?] , which should be further verified.

Other directions for nexts steps are:

- Word sets are very useful to derive and confirm hipothesis. As an example, one can observe most occurent or most basic words and word types in the English language.
- Interpretation of various invealed results, such as the one exposed in Appendix[?] , and Figures 2, 3, 4, 5 and 6.
- Extend word class observations to include plurals, gender, common prefixes and suffixes, etc.
- Date and time should also be addressed in textual production of interaction networks, as potentially linked to participation habits and purposes (e.g. low dispersion of sent time). This was tackled by the author for interaction networks[?] , but left aside in this article.
- Balance token diversity with corpus size, as pointed in section IV C.
- The textual features distributions are likely to be have more than one peak or other non-trivial characteristic. Therefore, further analysis should be made for comparing measures of interest.
- Extend analysis to the windowed approach used in the article where hub, peripheral and intermediary sectors where topologically characterized[?] .
- For ELE list, the more conected the sector, the longer the messages are. This is the inverse of what was found in the other lists, and was considered a peculiarity of the culture bonded with the political subject of ELE list, to be further verified.
- Tackle Portuguese analysis of interaction networks, as this research have ongiong implications in Brazil[?] .
- Analyse other lists.
- Analyse other interaction networks, from Twitter, Facebook, LinkedIn, Diaspora, etc.
- Emotion classification has not been done and considered out of the scope for this stage of development, but should be addressed in a near future.

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

- Incidence of hypernyms, hyponyms, holonyms and meronyms.
- Use and development of similarity measures of words, phrases and messages, by use of semantic criteria (Wordnet) and bag of words.

VI. ACKNOWLEDGMENTS

Renato Fabbri is grateful to CNPq (project 870336/1997-5) and the Postgraduate Committee of the IFSC/USP.

[1]Common vocabulary of social participation with standard class and property names. `http://webprotege.stanford.edu/#Edit:projectId=716e3e1d-0783-42d7-8ddd-aa2f8b53bed8`. Accessed: 2013-11-06.

[2] Complete owl implementation of the common vocabulary of social participation with standard class and property names and with missing classes, properties and restrictions. http://webprotege.stanford.edu/#Edit:projectId=3cd4408b-5d6c-4b73-a19b-e79b8545b441. Accessed: 2013-11-06.

[3] Complete owl implementation of the common vocabulary of social participation with standard class and property names and with missing classes, properties and restrictions. owl text file. http://webprotege.stanford.edu/#Edit:projectId=3becd68f-8f35-48a7-a287-f1a32b37b7c4. Accessed: 2013-11-06.

[4] Complete owl implementation of the common vocabulary of social participation with standard class and property names and with missing classes, properties and restrictions. webprotege interface to the ontology. http://webprotege.stanford.edu/#Edit:projectId=3becd68f-8f35-48a7-a287-f1a32b37b7c4. Accessed: 2013-11-06.

[5] e-ping homepage. http://www.governoeletronico.gov.br/acoes-e-projetos/e-ping-padroes-de-interoperabilidade. Accessed: 2013-10-21.

[6] Etherpads used in elaboration of the comon vocabulary of social participation. http://corais.org/vocabulariodaparticipacao/texts. Accessed: 2013-11-06.

[7] Gtinda: Grupo de trabalho da infraestrutura nacional de dados abertos. http://wiki.gtinda.ibge.gov.br/. Accessed: 2013-10-21.

[8] Large english vocabulary word lists. http://www.manythings.org/vocabulary/lists/l/. Accessed: 2013-11-15.

[9] The organization ontology. http://www.w3.org/TR/vocab-org/. Accessed: 2013-10-21.

[10] Vocabulário comum de participação social. http://corais.org/vocabulariodaparticipacao. Accessed: 2013-10-21.

[11] Vocabulário controlado do governo eletrônico. http://www.governoeletronico.gov.br/acoes-e-projetos/e-ping-padroes-de-interoperabilidade. Accessed: 2013-10-21.

[12] R. Albert and A.-L. Barabási. Topology of evolving networks: local events and universality. *Physical review letters*, 85(24):5234, 2000.

[13] R. A. J. D. W. Wichern. *Applied Multivariate Statistical Analysis*. Prentice Hall, 2007.

[14] R. O. D. P. E. Hart D. G. Stork. *Pattern Classification*. Wiley-Interscience, 2000.

[15] A. P. S. U. Pillai. *Probability, Random Variables and Stochastic Processes*. McGraw Hill Higher Education, 2002.

[16] R. Arp and B. Smith. Function, role, and disposition in basic formal ontology. *Nature Preceedings*, pages 1–4, 2008.

[17] J. P. Bagrow, D. Wang, and A.-L. Barabasi. Collective response of human populations to large-scale emergencies. *PloS one*, 6(3):e17680, 2011.

[18] B. Ball and M. E. Newman. Friendship networks and social status. *arXiv preprint arXiv:1205.6822*, 2012.

[19] A. Barros, D. R. CANABARRO, and M. CEPIK. Para além da e-ping: o desenvolvimento de uma plataforma de interoperabilidade para e-serviços no brasil. *Panorama da Interoperabilidade. Brasília: Ministério do Planejamento, Orçamento e Gestão*, pages 137–157, 2010.

[20] N. Blumm, G. Ghoshal, Z. Forró, M. Schich, G. Bianconi, J.-P. Bouchaud, and A.-L. Barabási. Dynamics of ranking processes in complex systems. *Physical Review Letters*, 109(12):128701, 2012.

[21] J. Candia, M. C. González, P. Wang, T. Schoenharl, G. Madey, and A.-L. Barabási. Uncovering individual and collective human dynamics from mobile phone records. *Journal of Physics A: Mathematical and Theoretical*, 41(22):224015, 2008.

[22] A. Clauset, C. Moore, and M. E. Newman. Hierarchical structure and the prediction of missing links in networks. *Nature*, 453(7191):98–101, 2008.

[23] A. Clauset, C. R. Shalizi, and M. E. Newman. Power-law distributions in empirical data. *SIAM review*, 51(4):661–703, 2009.

[24] L. da F. Costa R. M. C. Jr. *Shape Analysis and Classification: Theory and Practice (Image Processing Series)*. CRC Press, 2000.

[25] H. P. P. F. I. L. S. R. A. P. M. e. R. B. d. L. Dalton Martins, Frederico Bortolato. Modelagem conceitual publicada! verso 0.1 em linguagem natural, 2013.

[26] R. B. de Luna. Metodologia de trabalho comentada e publicada!, 2013.

[27] F. de Saussure. *Course in General Linguistics*. Books LLC, 1916.

[28] F. G. G. Deleuze. *What Is Philosophy?* Simon and Schuster Touchstone, 1991.

[29] G. Deleuze. *Difference and Repetition*. Continuum, 1968.

[30] B. Deliyska and R. Ilieva. Ontology-based model of e-governance. *Annual of Section Informatics of the Union of Bulgarian Scientists*, 4:103–19, 2011.

[31] G. Ghoshal, N. Blumm, Z. Forro, M. Schich, G. Bianconi, J.-P. Bouchaud, and A.-L. Barabasi. Dynamics of ranking processes in complex systems. 2012.

[32] M. Horridge. Review of protege and protege-owl. *Ontogenesis*, 2010.

[33] M. Horridge, S. Jupp, G. Moulton, A. Rector, R. Stevens, and . Wroe. Ontologia inglesa proposta como formalizacao publica das responsabilidades de cada funcionatio publico, 2011.

[34] M. Horridge, S. Jupp, G. Moulton, A. Rector, R. Stevens, and . Wroe. A practical guide to building owl ontologies using protegé 4 and co-ode tools. edition 1.2. the university of manchester, 2011.

[35] T. Jia and A.-L. Barabási. Control capacity and a random sampling method in exploring controllability of complex networks. *Scientific reports*, 3, 2013.

[36] R. T. Khasawneh and E. Abu. E-government and social media sites: The role and impact. *World Journal of Computer Application and Technology*, 1:10–17, 2013.

[37] E. A. Leicht, G. Clarkson, K. Shedden, and M. E. Newman. Large-scale structure of time evolving citation networks. *The European Physical Journal B*, 59(1):75–83, 2007.

[38] E. A. Leicht and M. E. Newman. Community structure in directed networks. *Physical review letters*, 100(11):118703, 2008.

[39] Y.-Y. Liu, J.-J. Slotine, and A.-L. Barabási. Controllability of complex networks. *Nature*, 473(7346):167–173, 2011.

[40] Y.-Y. Liu, J.-J. Slotine, and A.-L. Barabási. Control centrality and hierarchical structure in complex networks. *Plos one*, 7(9):e44459, 2012.

[41] M. Newman. Communities, modules and large-scale structure in networks. *Nature Physics*, 8(1):25–31, 2011.

[42] M. Newman. Complex systems: A survey. *arXiv preprint arXiv:1112.1440*, 2011.

[43] M. Newman. Community detection and graph partitioning. *arXiv preprint arXiv:1305.4974*, 2013.

[44] M. E. Newman. Assortative mixing in networks. *Physical review letters*, 89(20):208701, 2002.

[45] M. E. Newman. Analysis of weighted networks. *Physical Review E*, 70(5):056131, 2004.

[46] M. E. Newman. Modularity and community structure in networks. *Proceedings of the National Academy of Sciences*, 103(23):8577–8582, 2006.

[47] M. E. Newman. Random graphs with clustering. *Physical review letters*, 103(5):058701, 2009.

[48] M. E. Newman, S. H. Strogatz, and D. J. Watts. Random graphs with arbitrary degree distributions and their applications. *Physical Review E*, 64(2):026118, 2001.

[49] M. E. J. Newman. The structure and function of complex networks. *SIAM REVIEW*, 45:167–256, 2003.

[50] J.-P. Onnela, S. Arbesman, M. C. González, A.-L. Barabási, and N. A. Christakis. Geographic constraints on social network groups. *PLoS one*, 6(4):e16939, 2011.

[51] V. Palchykov, K. Kaski, J. Kertész, A.-L. Barabási, and R. I. Dunbar. Sex differences in intimate relationships. *Scientific re-*

ports, 2, 2012.
[52] G. Palla, A.-L. Barabási, and T. Vicsek. Quantifying social group evolution. *Nature*, 446(7136):664–667, 2007.
[53] D. Papineau. *Philosophy*. Oxford University Press, 2009.
[54] M. Pita and G. Paixao. Arquitetura de busca semântica para governo eletrônico. In *II Workshop de Computação Aplicada em Governo Eletrônico & Congresso da Sociedade Brasileira de Computação, Belo Horizonte*, 2010.
[55] B. Russel. *A History of Western Philosophy*. Simon and Schuster Touchstone, 1967.
[56] P. Salhofer, B. Stadlhofer, and G. Tretter. Ontology driven e-government. In *Software Engineering Advances, 2009. ICSEA'09. Fourth International Conference on*, pages 378–383. IEEE, 2009.
[57] D. Sarantis and D. Askounis. Knowledge exploitation via ontology development in e-government project management. *International Journal of Digital Society*, 1(4):246–255, 2010.
[58] C. W. Therrien. *Discrete Random Signals and Statistical Signal Processing*. Prentice Hall, 1992.
[59] C. Vassilakis and G. Lepouras. An ontology for e-government public services. *Encyclopedia of E-Commerce, E-Government and Mobile Commerce*, pages 865–870, 2006.
[60] A. Vázquez, J. G. Oliveira, Z. Dezsö, K.-I. Goh, I. Kondor, and A.-L. Barabási. Modeling bursts and heavy tails in human dynamics. *Physical Review E*, 73(3):036127, 2006.
[61] D. Wang, Z. Wen, H. Tong, C.-Y. Lin, C. Song, and A.-L. Barabási. Information spreading in context. In *Proceedings of the 20th international conference on World wide web*, pages 735–744. ACM, 2011.
[62] S.-H. Yook, H. Jeong, A.-L. Barabási, and Y. Tu. Weighted evolving networks. *Physical Review Letters*, 86(25):5835, 2001.

Appendix A: Adaptation of the Kolmogotov-Smirnof test

Appendix B: Support information

1. Brief description of GMANE and the email lists chosen

2. Meaning of achronims in the following tables

3. Tables

-	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	16.1
$100\frac{\|known\ words=kw\|}{\|tokens\|-\|punct\|}$	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	90.6
$100\frac{\|kw\neq\|}{kw}$	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	73.3
$100\frac{\|kw\ that\ are\ stopwords=kwsw\|}{\|kw\|}$	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	49.4
$100\frac{\|unknown\ words\ that\ are\ sw=ukwsw\|}{\|kw\|}$	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	25.3
$100\frac{\|stopwords\ without\ synsets\|}{\|kw\|}$	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	24.1
$100\frac{\|contractions\|}{\|kw\|}$	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	48.0

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.	h.
$\mu(size\,of\,known\,word = skw)$	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	4.63
$\sigma(skw)$	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	2.51
$\mu(\neq skw)$	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	7.91
$\sigma(\neq skw)$	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	2.61
$\mu(skwss)$	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	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	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	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	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	2.88
$\sigma(ssw)$	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	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	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	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	2.99
$\sigma(snsssw)$	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	1.23
$\mu(\neq snsssw)$	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	7.30
$\sigma(\neq snsssw)$	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	3.39

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	1993.42
$\sigma\left(\frac{\|chars\|}{msg}\right)$	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	2819.96
$\mu\left(\frac{\|tokens\|}{msg}\right)$	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	417.36
$\sigma\left(\frac{\|tokens\|}{msg}\right)$	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	593.08
$\mu\left(\frac{\|sents\|}{msg}\right)$	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	18.05
$\sigma\left(\frac{\|sents\|}{msg}\right)$	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	25.80

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 $\approx 85\%$ 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.	h.
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	0.9791
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	0.8636
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	0.8480
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	0.8588
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	0.7152
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	0.9057
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	0.9969
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	0.6616
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	0.7913
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	0.8654
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	-0.2781	0.5651
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	0.8838
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	0.9152
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	0.7486
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	0.8175
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	0.7291
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	0.9073
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	0.9919
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	0.9383
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	0.7889
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	-0.2813	0.8041
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	0.7793
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	0.6970
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	0.8793
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	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	1.003	1.002	1.025	1.025
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				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
mtkwnsw-mtams	0.985	0.985	0.986	0.994	0.998	0.998	1.001	1.004	0.997	0.997	1.005	1.003	0.999	1.000	1.025	1.014
mtkwnsw-mtams_	0.930	0.957	0.734	0.620	0.970	0.988	0.958	0.565	0.965	0.982	0.980	0.603	0.911	0.971	0.761	0.539
dtkwnsw-dtkwnsw_	0.959	0.968	0.661	0.459	0.979	0.985	0.939	0.579	0.973	0.981	0.941	0.520	0.943	0.967	0.678	0.497
dtkwnsw-dtams	0.988	0.988	0.993	1.007	0.994	0.994	1.001	1.005	0.992	0.992	1.003	1.002	0.997	0.999	1.019	1.012
dtkwnsw-dtams_	0.951	0.960	0.645	0.441	0.973	0.978	0.937	0.573	0.966	0.973	0.942	0.533	0.943	0.963	0.695	0.527
mtkwnsw_-mtams	0.938	0.965	0.772	0.630	0.969	0.987	0.955	0.562	0.966	0.983	0.978	0.606	0.891	0.959	0.768	0.533
mtkwnsw_-mtams_	0.993	0.992	1.000	1.018	0.998	0.999	1.004	1.007	0.998	0.998	1.006	1.007	1.001	1.001	1.027	1.024
dtkwnsw_-dtams	0.946	0.954	0.648	0.481	0.973	0.978	0.935	0.579	0.965	0.973	0.938	0.514	0.940	0.963	0.666	0.490
dtkwnsw_-dtams_	0.990	0.990	0.991	1.010	0.995	0.995	1.002	1.000	0.994	0.993	1.005	1.004	0.999	1.000	1.018	1.018
mtams-mtams_	0.945	0.973	0.764	0.620	0.971	0.990	0.956	0.562	0.968	0.986	0.979	0.602	0.903	0.969	0.763	0.542
dtams-dtams_	0.958	0.967	0.650	0.466	0.979	0.984	0.936	0.579	0.972	0.980	0.941	0.530	0.949	0.968	0.690	0.516
mtsw-mtsw2	0.885	0.885	0.840	0.494	0.957	0.957	0.980	0.894	0.967	0.965	0.997	0.826	0.989	0.990	0.904	0.920
mtsw_-mtsw2_	0.901	0.885	0.904	0.808	0.952	0.952	0.942	0.783	0.961	0.959	0.980	0.825	0.906	0.967	0.796	0.740
mtsw2_-dtsw2_	0.820	0.746	0.871	0.970	0.848	0.784	0.836	0.932	0.841	0.779	0.914	0.938	0.930	0.855	0.943	0.968
mtTS-mtsTS	0.977	0.977	0.979	1.009	0.981	0.982	0.989	0.990	0.871	0.873	0.987	1.002	0.970	0.972	0.985	0.988
dtTS-dtsTS	0.979	0.980	0.976	1.010	0.956	0.957	0.956	0.990	0.889	0.905	0.926	0.992	0.962	0.949	1.010	1.019
mtsTSkw-mtsTSpv	0.962	0.962	0.967	0.953	0.968	0.969	0.980	0.966	0.961	0.961	0.965	0.998	0.974	0.976	0.984	0.981
dtsTSkw-dtsTSpv	0.969	0.967	0.981	1.003	0.973	0.975	0.959	0.925	0.948	0.945	0.976	0.955	0.956	0.966	0.952	0.973
mtmT-mttmT	0.962	0.957	0.996	1.001	0.991	0.991	0.997	1.002	0.877	0.872	0.995	1.000	0.995	0.996	1.016	1.023
dtmT-dttmT	0.989	0.976	0.997	1.015	0.982	0.980	0.984	0.994	0.874	0.863	0.960	0.996	0.992	0.997	1.007	0.994
mlwss-dlwss	0.804	0.809	0.792	0.648	0.852	0.852	0.889	0.823	0.841	0.837	0.925	0.854	0.904	0.909	0.802	0.906
mtamH-mprof	0.994	0.995	1.004	1.016	0.997	0.997	1.001	1.006	0.997	0.997	1.004	1.005	1.000	1.001	1.026	1.023
dtamH-dprof	0.996	0.997	1.001	1.016	0.999	0.999	1.003	1.000	0.999	0.999	1.006	1.003	1.002	1.003	1.021	1.022

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

-	CPP				LAD				LAU				ELE			
	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.	g.	p.	i.	h.
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.

Appendix C: Histograms of existent and incident words

Appendix D: Online scripts and data

[1] Common vocabulary of social participation with standard class and property names. `http://webprotege.stanford.edu/#Edit:projectId=716e3e1d-0783-42d7-8ddd-aa2f8b53bed8`. Accessed: 2013-11-06.

[2] Complete owl implementation of the common vocabulary of social participation with standard class and property names and with missing classes, properties and restrictions. `http://webprotege.stanford.edu/#Edit:projectId=3cd4408b-5d6c-4b73-a19b-e79b8545b441`. Accessed: 2013-11-06.

[3] Complete owl implementation of the common vocabulary of social participation with standard class and property names and with missing classes, properties and restrictions. owl text file. `http://webprotege.stanford.edu/#Edit:projectId=3becd68f-8f35-48a7-a287-f1a32b37b7c4`. Accessed: 2013-11-06.

[4] Complete owl implementation of the common vocabulary of social participation with standard class and property names and with missing classes, properties and restrictions. webprotege interface to the ontology. `http://webprotege.stanford.edu/#Edit:projectId=3becd68f-8f35-48a7-a287-f1a32b37b7c4`. Accessed: 2013-11-06.

[5] e-ping homepage. `http://www.governoeletronico.gov.br/acoes-e-projetos/e-ping-padroes-de-interoperabilidade`. Accessed: 2013-10-21.

[6] Etherpads used in elaboration of the comon vocabulary of social participation. `http://corais.org/vocabulariodaparticipacao/texts`. Accessed: 2013-11-06.

[7] Gtinda: Grupo de trabalho da infraestrutura nacional de dados abertos. `http://wiki.gtinda.ibge.gov.br/`. Accessed: 2013-10-21.

[8] Large english vocabulary word lists. `http://www.manythings.org/vocabulary/lists/l/`. Accessed: 2013-11-15.

[9] The organization ontology. `http://www.w3.org/TR/vocab-org/`. Accessed: 2013-10-21.

[10] Vocabulário comum de participação social. `http://corais.org/vocabulariodaparticipacao`. Accessed: 2013-10-21.

[11] Vocabulário controlado do governo eletrônico. `http://www.governoeletronico.gov.br/acoes-e-projetos/e-ping-padroes-de-interoperabilidade`. Accessed: 2013-10-21.

[12] R. Albert and A.-L. Barabási. Topology of evolving networks: local events and universality. *Physical review letters*, 85(24):5234, 2000.

[13] R. A. J. D. W. Wichern. *Applied Multivariate Statistical Analysis*. Prentice Hall, 2007.

[14] R. O. D. P. E. Hart D. G. Stork. *Pattern Classification*. Wiley-Interscience, 2000.

[15] A. P. S. U. Pillai. *Probability, Random Variables and Stochastic Processes*. McGraw Hill Higher Education, 2002.

-	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: $|val| > 0.05$).

[16] R. Arp and B. Smith. Function, role, and disposition in basic formal ontology. *Nature Preceedings*, pages 1–4, 2008.

[17] J. P. Bagrow, D. Wang, and A.-L. Barabasi. Collective response of human populations to large-scale emergencies. *PloS one*, 6(3):e17680, 2011.

[18] B. Ball and M. E. Newman. Friendship networks and social status. *arXiv preprint arXiv:1205.6822*, 2012.

[19] A. Barros, D. R. CANABARRO, and M. CEPIK. Para além da e-ping: o desenvolvimento de uma plataforma de interoperabilidade para e-serviços no brasil. *Panorama da Interoperabilidade. Brasília: Ministério do Planejamento, Orçamento e Gestão*, pages 137–157, 2010.

[20] N. Blumm, G. Ghoshal, Z. Forró, M. Schich, G. Bianconi, J.-P. Bouchaud, and A.-L. Barabási. Dynamics of ranking processes in complex systems. *Physical Review Letters*, 109(12):128701, 2012.

[21] J. Candia, M. C. González, P. Wang, T. Schoenharl, G. Madey, and A.-L. Barabási. Uncovering individual and collective human dynamics from mobile phone records. *Journal of Physics A: Mathematical and Theoretical*, 41(22):224015, 2008.

[22] A. Clauset, C. Moore, and M. E. Newman. Hierarchical structure and the prediction of missing links in networks. *Nature*, 453(7191):98–101, 2008.

[23] A. Clauset, C. R. Shalizi, and M. E. Newman. Power-law distributions in empirical data. *SIAM review*, 51(4):661–703, 2009.

[24] L. da F. Costa R. M. C. Jr. *Shape Analysis and Classification: Theory and Practice (Image Processing Series)*. CRC Press, 2000.

[25] H. P. P. F. I. L. S. R. A. P. M. e. R. B. d. L. Dalton Martins, Frederico Bortolato. Modelagem conceitual publicada! verso 0.1 em linguagem natural, 2013.

[26] R. B. de Luna. Metodologia de trabalho comentada e publicada!, 2013.

[27] F. de Saussure. *Course in General Linguistics*. Books LLC, 1916.

[28] F. G. G. Deleuze. *What Is Philosophy?* Simon and Schuster Touchstone, 1991.

[29] G. Deleuze. *Difference and Repetition*. Continuum, 1968.

[30] B. Deliyska and R. Ilieva. Ontology-based model of e-governance. *Annual of Section Informatics of the Union of Bulgarian Scientists*, 4:103–19, 2011.

[31] G. Ghoshal, N. Blumm, Z. Forro, M. Schich, G. Bianconi, J.-P. Bouchaud, and A.-L. Barabasi. Dynamics of ranking processes in complex systems. 2012.

[32] M. Horridge. Review of protege and protege-owl. *Ontogenesis*, 2010.

[33] M. Horridge, S. Jupp, G. Moulton, A. Rector, R. Stevens, and . Wroe. Ontologia inglesa proposta como formalizacao publica das responsabilidades de cada funcionatio publico, 2011.

[34] M. Horridge, S. Jupp, G. Moulton, A. Rector, R. Stevens, and . Wroe. A practical guide to building owl ontologies using protegé 4 and co-ode tools. edition 1.2. the university of manchester, 2011.

[35] T. Jia and A.-L. Barabási. Control capacity and a random sampling method in exploring controllability of complex networks. *Scientific reports*, 3, 2013.

[36] R. T. Khasawneh and E. Abu. E-government and social media sites: The role and impact. *World Journal of Computer Application and Technology*, 1:10–17, 2013.

[37] E. A. Leicht, G. Clarkson, K. Shedden, and M. E. Newman. Large-scale structure of time evolving citation networks. *The European Physical Journal B*, 59(1):75–83, 2007.

[38] E. A. Leicht and M. E. Newman. Community structure in directed networks. *Physical review letters*, 100(11):118703, 2008.

[39] Y.-Y. Liu, J.-J. Slotine, and A.-L. Barabási. Controllability of complex networks. *Nature*, 473(7346):167–173, 2011.

[40] Y.-Y. Liu, J.-J. Slotine, and A.-L. Barabási. Control centrality and hierarchical structure in complex networks. *Plos one*, 7(9):e44459, 2012.

[41] M. Newman. Communities, modules and large-scale structure in networks. *Nature Physics*, 8(1):25–31, 2011.

[42] M. Newman. Complex systems: A survey. *arXiv preprint arXiv:1112.1440*, 2011.

-	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: $|val| > 0.05$).

-	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: $|val| > 0.05$).

[43] M. Newman. Community detection and graph partitioning. *arXiv preprint arXiv:1305.4974*, 2013.

[44] M. E. Newman. Assortative mixing in networks. *Physical review letters*, 89(20):208701, 2002.

[45] M. E. Newman. Analysis of weighted networks. *Physical Review E*, 70(5):056131, 2004.

[46] M. E. Newman. Modularity and community structure in networks. *Proceedings of the National Academy of Sciences*, 103(23):8577–8582, 2006.

[47] M. E. Newman. Random graphs with clustering. *Physical review letters*, 103(5):058701, 2009.

[48] M. E. Newman, S. H. Strogatz, and D. J. Watts. Random graphs with arbitrary degree distributions and their applications. *Physical Review E*, 64(2):026118, 2001.

[49] M. E. J. Newman. The structure and function of complex networks. *SIAM REVIEW*, 45:167–256, 2003.

[50] J.-P. Onnela, S. Arbesman, M. C. González, A.-L. Barabási, and N. A. Christakis. Geographic constraints on social network groups. *PLoS one*, 6(4):e16939, 2011.

[51] V. Palchykov, K. Kaski, J. Kertész, A.-L. Barabási, and R. I. Dunbar. Sex differences in intimate relationships. *Scientific reports*, 2, 2012.

[52] G. Palla, A.-L. Barabási, and T. Vicsek. Quantifying social group evolution. *Nature*, 446(7136):664–667, 2007.

[53] D. Papineau. *Philosophy.* Oxford University Press, 2009.

-	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: $|val| > 0.05$).

-	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	3.68	3.04	-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: $|val| > 0.05$).

[54] M. Pita and G. Paixao. Arquitetura de busca semântica para governo eletrônico. In *II Workshop de Computação Aplicada em Governo Eletrônico & Congresso da Sociedade Brasileira de Computação, Belo Horizonte*, 2010.

[55] B. Russel. *A History of Western Philosophy.* Simon and Schuster Touchstone, 1967.

[56] P. Salhofer, B. Stadlhofer, and G. Tretter. Ontology driven e-government. In *Software Engineering Advances, 2009. ICSEA'09. Fourth International Conference on*, pages 378–383. IEEE, 2009.

[57] D. Sarantis and D. Askounis. Knowledge exploitation via ontology development in e-government project management. *International Journal of Digital Society*, 1(4):246–255, 2010.

[58] C. W. Therrien. *Discrete Random Signals and Statistical Signal Processing.* Prentice Hall, 1992.

[59] C. Vassilakis and G. Lepouras. An ontology for e-government public services. *Encyclopedia of E-Commerce, E-Government and Mobile Commerce*, pages 865–870, 2006.

[60] A. Vázquez, J. G. Oliveira, Z. Dezsö, K.-I. Goh, I. Kondor, and A.-L. Barabási. Modeling bursts and heavy tails in human dynamics. *Physical Review E*, 73(3):036127, 2006.

[61] D. Wang, Z. Wen, H. Tong, C.-Y. Lin, C. Song, and A.-L. Barabási. Information spreading in context. In *Proceedings of the 20th international conference on World wide web*, pages 735–744. ACM, 2011.

[62] S.-H. Yook, H. Jeong, A.-L. Barabási, and Y. Tu. Weighted evolving networks. *Physical Review Letters*, 86(25):5835, 2001.

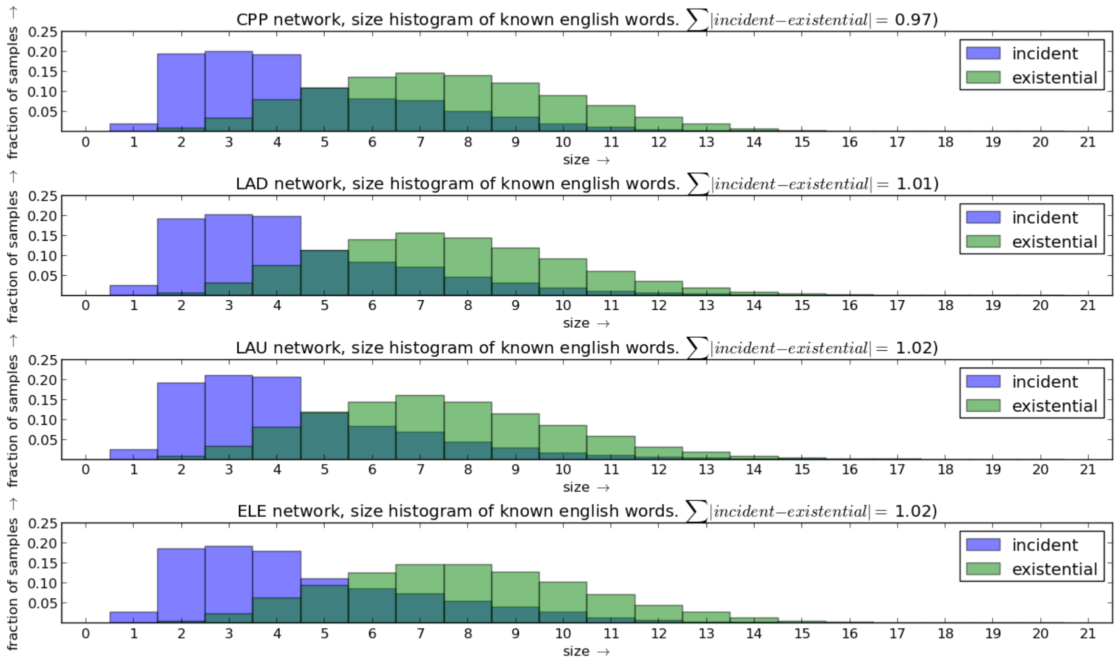

FIG. 2. Size of words that are known in English. Crossing of incident and existential sizes is around 5 (figure 3 shows a shift to length 6-7 when consideren only non stopwords). Words with three letters have maximum incidence, while most words have 7 letters.

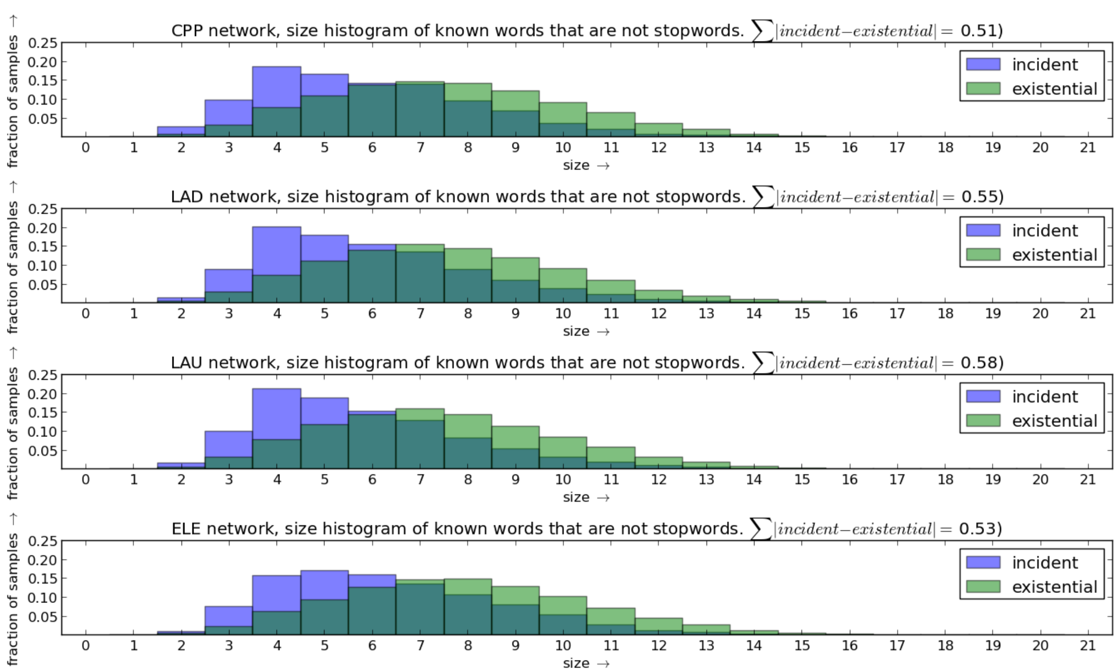

FIG. 3. Size of words that are known in English and are not stopwords. Crossing of incident and existential sizes is around 6-7 (figure 2 shows a shift to length 5 when considered stopwords). In this case, words with 4 letters have maximum incidence, while most words still have 7 letters. Exception for 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 .

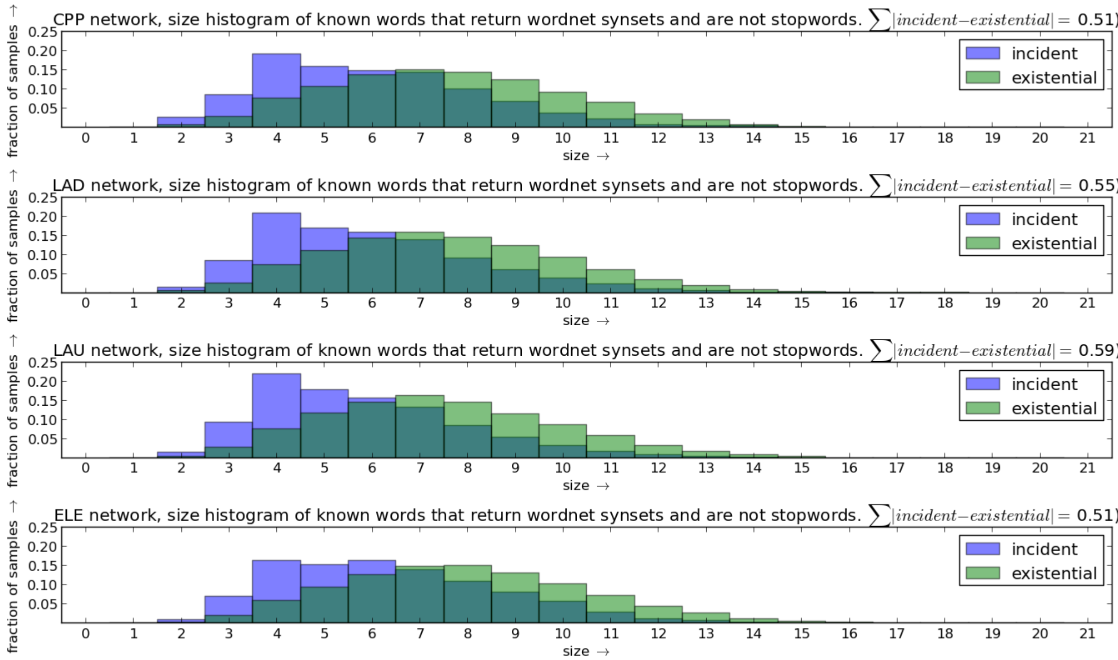

FIG. 4. Size of words that are known, are not stopwords and have synsets. Ressembles figure 3. Stopword sizes histogram are in figure 5. Differences suggests ≈ 0.5 might be constant. LAD and LAU exquisite vocabulary (GNU/Linux, programming, sound/signal processing, music) might be responsible for higher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

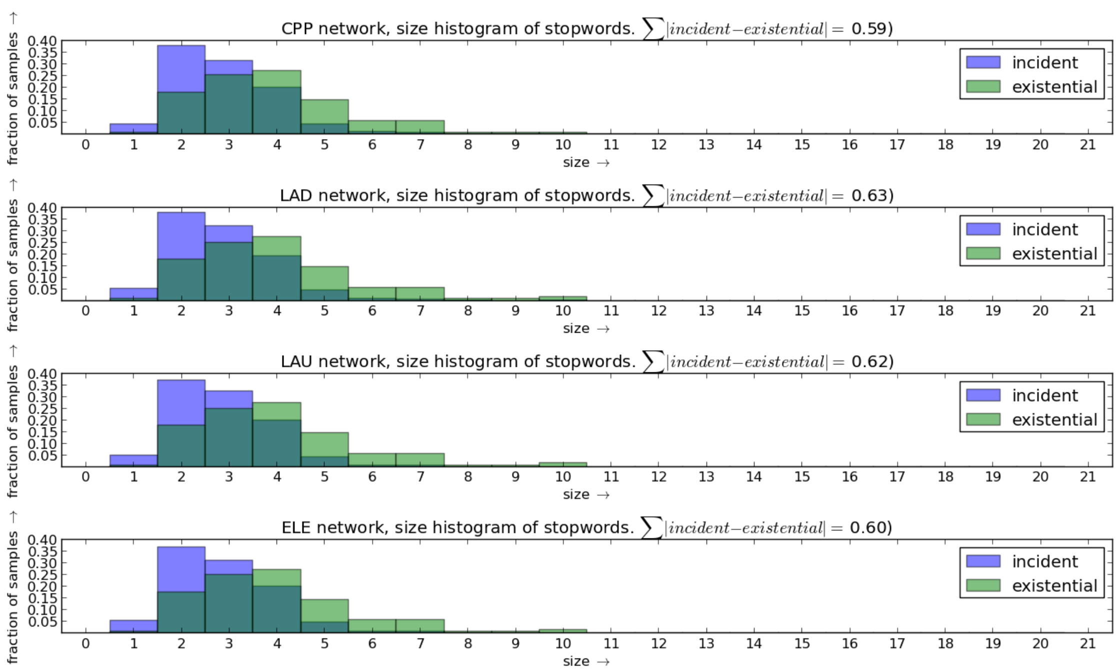

FIG. 5. Size histogram of stopwords. Stopwords with two letters are the most frequent, while most of them have four letters. Differences in distribution seem stable around ≈ 0.6.

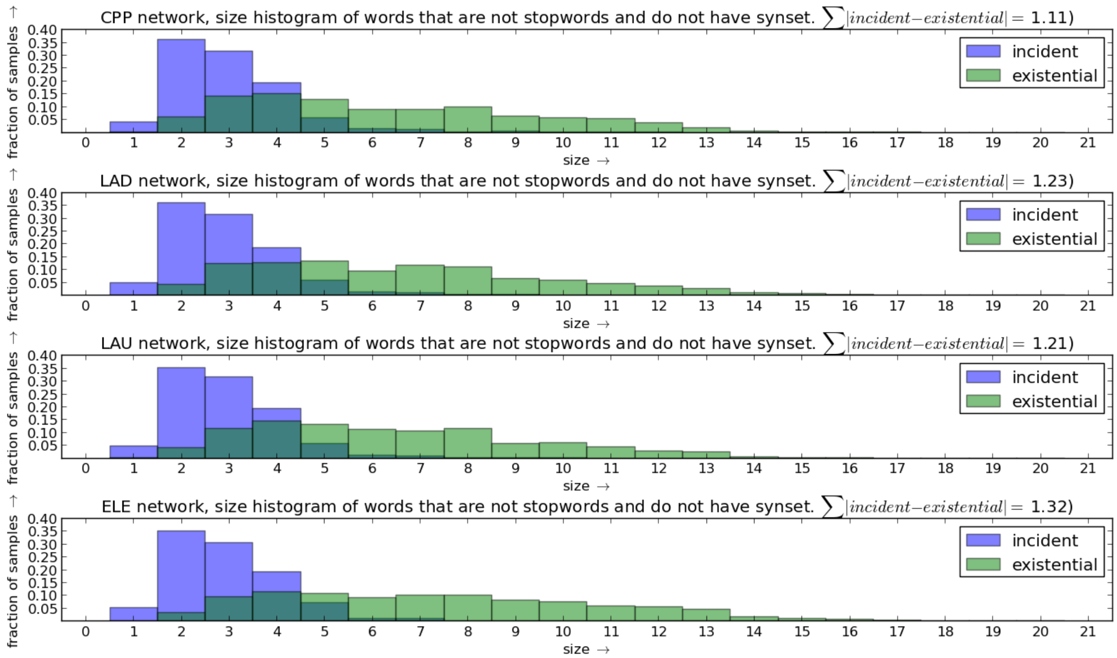

FIG. 6. Size histogram of known English words that are not stopwords and do not return synsets. Differences in distribution suggests less stable behavior, with high incidence of few words high number of existing words with many letters. Observe difference ≥ 1, as observed only with all known words, but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