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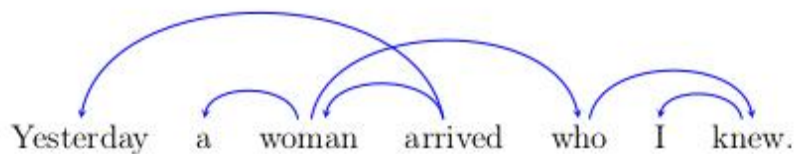
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Lead researcher of the [Quantitative, Mathematical and Computational Linguistics Research Group](#) (UPC - Catalan level) and head of the [Complexity and Quantitative Linguistics \(CQL\) Lab](#). Department of Computer Science, Universitat Politècnica de Catalunya, Barcelona, Catalonia (Spain).



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PNAS

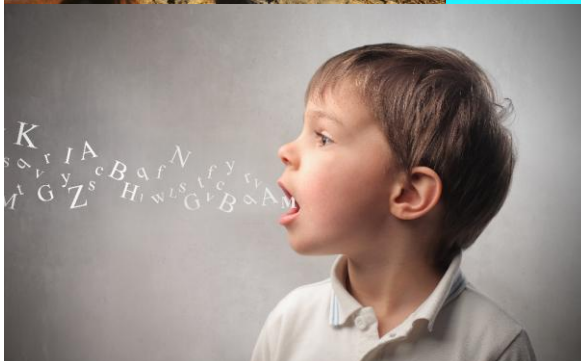
Proceedings of the National Academy of Sciences of the United States of America

www.pnas.org

Gelada vocal call patterns



Stem cell and placenta syncytiotrophoblast generation
Regulation of cytoskeleton organization in dendrites
Pituitary development in females
Anthropogenic disturbance and conservation



Who am I?

I am an unconventional linguist. I am a bridge between disciplines. Hence, who are you? Look for a field that matters to you below to learn about me (what follows are just highlights, do not expect my whole research to be summarized).

LINGUISTICS

I am the vice president of the International Quantitative Linguistics Association. My major contributions to linguistics are four-fold.

Patterns – Universals. I have been investigating statistical patterns of languages, the so-called linguistic laws, e.g. Zipf's law for word frequencies, Zipf's law of abbreviation. Various linguistic laws are candidates for linguistic universals although they are usually neglected when discussing if universals exist or not (Evans & Levinson 2009 BBS). We demonstrated that Zipf's law of abbreviation is a candidate for a linguistic universal (Bentz & Ferrer-i-Cancho 2015). See the BIOLOGY highlights below for my research on other species.

Principles. I have promoted thinking in terms of principles to understand the origins of linguistic laws and other phenomena. Principles can have multiple manifestations. I have proposed the principle of compression as the explanation for Zipf's law of abbreviation and Menzerath's law (Gustison et al 2016, Ferrer-i-Cancho et al 2022). I have put forward various word order principles: the principle of dependency distance minimization (Ferrer-i-Cancho 2004) and the principle of swap distance minimization (Ferrer-i-Cancho & Namboodiripad, 2023). I have shown that swap distance minimization explains the couple of primarily alternating word orders that many languages exhibit while the standard model of typology fails (Ferrer-i-Cancho 2016). I translated G. K. Zipf's view about the origins of Zipf's law for word frequencies into the language of information theory and put forward a family of models that show the emergence of Zipf's law from a trade-off between the principle of surprisal minimization and the principle of mutual information maximization (Ferrer-i-Cancho & Solé 2003, Ferrer-i-Cancho 2005 EPJB). I showed the correlation between the exponent of the law and increasing cognitive capacity (Ferrer-i-Cancho 2005 EPJB). I have led the 1st large-scale analyses of the degree of optimality of languages from the perspective of distinct principles: compression (Ferrer-i-Cancho & Bentz 2018 Evolang12, Petrini et al 2026, Glottometrics) and syntactic dependency distance minimization (Ferrer-i-Cancho et al 2022 PRE). The latter introduced a powerful optimality score for dependency distances and a ranking method for quantitative typology. See also the PHYSICS highlights below.

Predictions – Theory construction. I put forward the hypothesis that the scarcity of crossing dependencies is an epiphenomenon of the principle of dependency distance minimization (Ferrer-i-Cancho 2006, Gómez-Rodríguez & Ferrer-i-Cancho 2017). I have been investigating interactions between principles. I was the 1st to mathematically prove a conflict between syntactic dependency distance minimization and surprisal minimization (Ferrer-i-Cancho 2017 Glottometrics). I predicted and have confirmed that dependency distance minimization is surpassed by surprisal minimization in short sequences especially if elements are small (Ferrer-i-Cancho 2024 JQL). I have put forward a general theory of language that can be summarized as a directed acyclic graph where leaves are manifestation and edges connect principles or a principle with a manifestation (Ferrer-i-Cancho & Gómez-Rodríguez 2021, Carrera-Casado & Ferrer-i-Cancho 2021).

Origins of language, Language & Evolution. I put forward the hypothesis of the emergence of syntax and symbolic reference as a side-effect of Zipf's law for word frequencies (Ferrer-i-Cancho et al 2005, Ferrer-i-Cancho 2006 Biosystems). I have argued that verb medial orders are less likely to be found in early stages of evolution and argued for a bias for verb final orders over verb initial orders (Ferrer-i-Cancho 2017 Glottometrics, Ferrer-i-Cancho 2024 under review). I have shown that the main path observed in the evolution of the order of S, O and V (Gellmann & Ruhlen 2011) aligns with the structure of the space of possible permutations and so does word order variation in languages (Ferrer-i-Cancho 2016 Evolang11).

Challenges

I have challenged the standard model of word order in typology (Ferrer-i-Cancho 2015 Evolang11), the belief in hard constraints on word order variation (Ferrer-i-Cancho 2026, JQL). I have challenged the uniform information density and related hypotheses (Ferrer-i-Cancho 2017 Glottometrics, Ferrer-i-Cancho et al 2023 JSTAT, Ferrer-i-Cancho & Moscoso del Prado Martín 2011). We have shown that

formal constraints on syntactic dependency structures are likely to be a side-effect of memory limitations (Gómez-Rodríguez et al 2022 Glottometrics). I have argued that dependency is more neurophysiologically supported than constituency (Chen et al 2018).

As an unconventional linguist, I develop theory using views and tools that are not standard in theoretical linguistics (see the *PHYSICS* and *COMPUTER SCIENCE* highlights) and also investigate the communication systems of other species and other natural systems (see the *BIOLOGY* highlights).

PHYSICS

I am a member of the Catalan Association for the Study of Complex Systems.

Power laws. I have been investigating the origins of Zipf's law for word frequencies, the power-law that characterizes the distribution of word frequencies in many languages. I put forward a family of models of Zipf's law for word frequencies that exhibit a sharp transition between systems that cannot communicate (for minimizing cognitive cost too much) and models that communicate perfectly but paying the maximum cognitive cost (Ferrer-i-Cancho & Solé 2003, Ferrer-i-Cancho 2005 EPJB). The statistical properties of that sharp change resemble a continuous phase transition. Although researchers have criticized the most popular and cited model (Ferrer-i-Cancho & Solé 2003) for failing to reproduce Zipf's law for word frequencies accurately enough (Prokopenko et al 2010 JSTAT, Dickman et al 2012 JSTAT), the other model (Ferrer-i-Cancho 2005 EPJB) shows Zipf's law clearly (Carrera-Casado 2021) and accounts for the evolution of the exponent of Zipf's law in children (Baixeries et al 2013), the correlation between the frequency of a word and its age according to historical records (Carrera-Casado 2021) and how children hypothesize the meaning of new words (Ferrer-i-Cancho 2016 Glottometrics). These facts invalidate the claim that models of Zipf's law do not generate predictions (Piantadosi 2014). I demonstrated that random typing has difficulties reproducing the actual distribution of word frequencies contrary to the view of B. Mandelbrot, G. Miller and N. Chomsky (Ferrer-i-Cancho & Elvevåg 2010). I have shown that those differences are more visible in the frequency spectrum (Ferrer-i-Cancho & Gavalda 2009). Although random typing is seen as a simple way of reproducing Zipf's law without any optimization (Miller & Chomsky 1963, Li 1998), I have shown that random typing is an optimal coding system (Ferrer-i-Cancho et al 2022 JQL), a view that goes back to Mandelbrot's pioneering research. I have also investigated correlations in the behavioral or vocal sequences that dolphins produce to shed light on the complexity of the underlying process and to rule out random typing as a potential explanation for the presence of linguistic laws (Ferrer-i-Cancho & Lusseau 2006; Ferrer-i-Cancho & McCowan 2012).

Networks. I was involved in early developments in the emerging field of network science. I conceived a network optimization model that sheds light on the space of possible networks: networks with exponential degree distribution, networks with power-law degree distributions, star graphs and complete graphs (Ferrer-i-Cancho & Solé 2003 LNP). I pioneered research on large-scale linguistic networks (Ferrer-i-Cancho et al 2004 PRE, Ferrer-i-Cancho & Solé 2001). I coauthored a review of the importance of a network perspective for the cognitive sciences (Baronchelli et al 2013 TICS). I created and maintained a repository on the topic (<https://cqlab.upc.edu/biblio/networks/>) until that research exploded and became impossible to track manually.

I have been contributing to the theory of spatial networks in one dimension. My motivation was the syntactic structure of a sentence, that is a particular case of spatial network where the structure is a tree formed by the syntactic dependencies between words and the space is the linear order of words in a sentence. I put forward the 1st model for the exponential decay of that distribution in real sentences applying maxent (Ferrer-i-Cancho 2004 PRE) and investigated the actual two-regime decay (Ferrer 2004 PRE, Petrini & Ferrer-i-Cancho 2025). I have been investigating the distribution of the distance between linked vertices in real sentences, in random permutations of the vertices and also in optimal orders, that minimize or maximize these distances. I have investigated parallel problems for the number of edge crossings. This research is explained in greater detail in the *COMPUTER SCIENCE* highlights below.

Although physicists usually do not find useful random layouts or layouts where the distance between vertices is random or maximized in spaces of two or more dimensions, real sentences show orders that are consistent with a random layout or a layout that maximizes distances under certain conditions (Ferrer-i-Cancho & Gómez-Rodríguez 2021, Ferrer-i-Cancho et al 2022 PRE, Petrini & Ferrer-i-Cancho 2025). I put forward a statistically robust score to measure the degree of optimality of one-dimensional

embeddings that can be adapted to higher dimensions or to other problems in network science (Ferrer-i-Cancho et al 2022 PRE).

BIOLOGY

I have been promoting research on “linguistic” laws in other species. My contribution is four-fold. First, jointly with D. Lusseau and N. Forns, I published a couple of seminal papers on the presence of “linguistic” laws in dolphins (Ferrer-i-Cancho & Lusseau 2009) and genomes (Ferrer-i-Cancho & Forns 2009). The goal of these short articles was to stimulate research on parallels between human language and other natural systems. This is what really happened (Semple et al 2022 TREE). I have continued that research line mainly on dolphins, geladas and chimpanzees. Second, I lead the hard work to free research on linguistic laws outside human languages from prejudices about the utility and the meaningfulness of that kind of research or prejudices about the complexity of the sequences that other species produce. I investigated the span of dependencies in the sequences that dolphins produce (Ferrer-i-Cancho & Lusseau 2006, Ferrer-i-Cancho & McCowan 2012) to show that the presence of Zipf’s law in dolphin whistles cannot be explained by random typing and that long-distance dependencies are not uniquely human (Ferrer-i-Cancho et al 2008, Evolang7). We demonstrated that the presence of Menzerath’s law in genomes is not an inevitable consequence of the definition of the variables involved and cannot be reduced to a simple random breakage mechanism (Ferrer-i-Cancho et al 2013 Complexity, Ferrer-i-Cancho et al 2014 SAGMB). Thirdly, I lead the development of a general mathematical theory based on the principle of compression and a further generalization to shed light on the ubiquity of Zipf’s law of abbreviation and Menzerath’s law in nature (Gustison et al 2016, Ferrer-i-Cancho, Bentz & Seguin 2022). This theory supports the current research on linguistic laws in other species. It has the virtue of reducing the assumptions with respect to classic information theory (Cover & Thomas 2005). As a result of that collective effort, that research on linguistic parallels is flourishing. I coauthored a review on this topic (Semple et al 2022 TREE) and maintain a repository of related research (<https://cqlab.upc.edu/biblio/laws/>).

COMPUTER SCIENCE

I have introduced various classic combinatorial optimization problems into language research, e.g., the minimum linear arrangement problem (Ferrer-i-Cancho 2004 PRE) and another variant of the quadratic assignment problem (Ferrer-i-Cancho 2025, under review). The minimum linear arrangement problem (minLA) is the problem of finding the minimum sum of edge lengths over all the possible linear arrangements of a given graph. The maximum linear arrangement problem (maxLA) is the opposite problem, namely, the maximum sum over all possible linear arrangements of that graph. In the domain of minLA on trees, we corrected Shiloach’s algorithm (Esteban & Ferrer-i-Cancho 2017). We have also investigated linear time algorithms for the constrained minLA, improving the algorithm for projective minLA and showing its connection with planar minLA (Alemany-Puig et al 2022). We reported a logarithmic scaling of the optimal value of minLA as a function of tree size (Ferrer-i-Cancho et al 2016). In the domain of maxLA, we have investigated linear time algorithms for maxLA under projectivity and planarity constraints (Alemany-Puig et al 2024). As for the hard problem, i.e. the unconstrained maxLA, we have obtained some promising theoretical and experimental results (Alemany-Puig et al under review). We have also investigated formulae and fast algorithms to calculate various aspects of the distribution over all possible linear arrangements (focusing on expectation and variance) of two statistics: the sum of edge distances under various constraints (Ferrer-i-Cancho 2019 JSTAT, Alemany-Puig & Ferrer-i-Cancho 2022, Alemany-Puig & Ferrer-i-Cancho 2024) and the number of edge crossings (Ferrer-i-Cancho 2017, Alemany-Puig & Ferrer-i-Cancho 2020, Alemany-Puig & Ferrer-i-Cancho under review). I have also characterized the lower and upper limit of the variation of the sum of edge lengths and the number of crossings over all linear arrangements of all trees of same size (Ferrer-i-Cancho 2023 Glottometrics, Ferrer-i-Cancho et al 2021 JSTAT). By trying to understand the general problem of the variance of crossings, we came up with a characterization that can be applied to any space, not only linear arrangements. We applied that characterization to the variance of the number of crossings when vertices are placed on the surface of space (Alemany-Puig et al 2020), a problem originally investigated by J. W. Moon (1965), improving on his pioneering research. Many of these contributions are L. Alemany-Puig’s merit, are condensed in his PhD thesis (Alemany-Puig 2024) and the corresponding algorithms are available in the Linear Arrangement Library (Alemany-Puig et al 2021), which includes, among many, the 1st public implementation of Shiloach’s classic algorithm.

BIO

Born in Lleida (Catalonia) in 1973.

EDUCATION

- 2007 Master degree in applied physics (Universitat Politècnica de Catalunya, UPC)
- 2003 PhD in computer science (UPC). Thesis title: [Language: universals, principles and origins](#). Supervisor: Ricard V. Solé
- 1997 Degree in computer science (UPC)

LANGUAGES SPOKEN

- Catalan, Spanish, English, French and Italian.

EMPLOYMENT

- July 2011 – present. Associate professor (tenured). Department of Computer Science. Universitat Politècnica de Catalunya (Barcelona).
- August 2007 – July 2011. Lecturer. Same department.
- January 2006 – August 2007 “Juan de la Cierva” postdoctoral fellow at the PhysComp² (Physics and Computation of Complex Systems). Department of Fundamental Physics, Universitat de Barcelona. Research leader: Albert Diaz-Guilera.
- 2005 Postdoctoral researcher in the ECAgents European Project. Gruppo PIL. Department of Physics. Università “La Sapienza”, Rome (Italy). Research leader: Vittorio Loreto.
- 2004 Postdoctoral researcher. Gruppo PIL. Department of Physics. Università “La Sapienza”, Rome (Italy). Research leader: Guido Caldarelli.
- 2000-2003 Predoctoral Researcher. Complex Systems Lab. Initially at Universitat Politècnica de Catalunya (Department of Applied Physics) and finally at Universitat Pompeu Fabra (Department of Experimental and Health Sciences / IMIM). Barcelona. Research leader: Ricard V. Solé.
- 1998-April 2000. Research collaborator (unpaid collaboration) at the Complex Systems Lab at Universitat Politècnica de Catalunya (Department of Applied Physics). Research leader: Ricard V. Solé.
- October-December 1997. Predoctoral Researcher. Department of Basic Psychology. Universitat de Barcelona. Research leader: Josep Maria Sopena Sisquella.

OTHER POSITIONS

- 2025-present. Vice president of International Quantitative Linguistics Association (IQLA).
- 2023-2024, 2014-2021. Council member at large of the IQLA.
- 2022-present. Academic Secretary of the Department of Computer Science at UPC.
- 2021-present. Faculty member of IMTech (Institute of Mathematics of UPC-BarcelonaTech).
- 2020-present. External member of the scientific committee of the *Linguistics and Digital Humanities* doctoral program (Department of Linguistics, Palacky University, Olomouc, Czech Republic).
- 2019-present. Member of the Catalan Association of Language and Literature.
- 2017-2022. Treasurer of the Catalan Association for the Study of Complex Systems (complexitat.cat). Plain member before.
- 2012-present. Member of the Academic Committee of the Master in Informatics Engineering, School of Informatics Engineering (*Comissió Acadèmica del Màster en Enginyeria Informàtica, Facultat d'Informàtica de Barcelona*), Universitat Politècnica de Catalunya.
- 2008-2016 Member of the permanent committee of the Evolution of Language Conference (EVOLANG).

AWARDS

- Sabbatical leave (1 September 2018 – 31 August 2019) granted by Universitat Politècnica de Catalunya.
- Barcelona City Research Prize 2003 for the article "Least effort and the origins of scaling in human language" (PNAS 100, 788-791). Award to the best scientific article published in 2003 by Catalan researchers.

- Joan Lluís Vives Prize 2003 (mathematical, physical and life sciences, and engineering) for the article "On the uniqueness of human language" ("Sobre la singularitat del llenguatge humà"). The winning article was published in the journal "El Temps" (number 1041, May 2004).
- Extraordinary Doctoral Award from Universitat Politècnica de Catalunya (*Premi extraordinari de doctorat, curs 2003-2004*) for the PhD thesis: "Language: universals, principles and origins".

DISTINCTIONS

- The article "A stronger null hypothesis for crossing dependencies" was selected by the editors of Europhysics Letters for inclusion in the exclusive 'Highlights of 2014' collection. Also known as EPL Editor's choice articles.
- Accreditation of Advanced Research issued by AQU Catalunya in 2015 (needed for a full professorship in the Catalan system).

ADVISOR

PhD theses:

- 2024 "Theory, Algorithms and Applications of Linear Arrangements of Trees: Generation, Expectation and Optimization" by L. Alemany-Puig. 2026 Extraordinary Doctoral Award from Universitat Politècnica de Catalunya.
- 2014 "The laws of linguistics in communication systems" ("*Las leyes de la lingüística en los sistemas de comunicación*") by A. Hernández-Fernández (advised jointly with F. Diéguez-Vide).

Master theses:

- 2026 "The quadratic assignment problem in word order", J. Ríos-El-Yazidi, MIRI, UPC.
- 2025 "Finding the root of a syntactic dependency structure using machine learning methods". Y. Yao (advised jointly with M. Arias), MDS, UPC.
- 2024 "Unsupervised categorization of killer whale pulsed calls", M. Paraskeva (advised jointly with M. Arias), MDS, UPC.
- 2022 "The distribution of dependency distances", S. Petrini, Master in Data Science and Economics, Università Degli Studi di Milano (advised jointly with N. Cesa-Bianchi).
- 2021 "Generalized optimization models of linguistic laws", D. Carrera-Casado, MIRI, UPC.
- 2021 "The optimality of word lengths", J. Moreno-Fernández (advised jointly with C. Bentz), MIRI.
- 2020 "Dolphin communication. A quantitative linguistics approach", A. Vradi, MIRI.
- 2020 "Human language through the lens of large word co-occurrence networks", S. Mosquera Dopico, MIRI.
- 2019 "Edge crossings in linear arrangements: from theory to algorithms and applications", L. Alemany-Puig. MIRI, UPC.
- 2015 "Categorization of dolphin whistles", C. Pimentel Seguin (advised jointly with M. Arias). Master in Data Mining and Knowledge Management.

ORGANIZER OF SCIENTIFIC EVENTS

- Quantitative Dependency Syntax (one of the events of the SyntaxFest). Paris, August 26, 2019. Organized jointly with X. Chen.
- The origins and evolution of word order. A multidisciplinary workshop. A satellite workshop of Evolang XII. Torun, Poland, 16 April 2018. Organized jointly with M. Fedzechkina.
- Statistics of languages: theories and experiments. An interdisciplinary workshop. Warsaw, Poland, 19-22 July 2017. Organized jointly with L. Debowski and K. Tanaka-Ishii.
- Round Table: The future of research on language (*Taula rodona: El futur de la recerca en llenguatge*), Universitat Pompeu Fabra, 16 September 2015. Organized jointly with A. Badia
- 3rd meeting of the Catalan Association for the Study of Complex Systems (*III Jornada complexitat.cat*). Universitat Politècnica de Catalunya, 19 June 2014. Organized jointly with A. Hernández-Fernández.
- (as **local coordinator**) **7th International Evolution of Language Conference (Evolang 2008)**, Barcelona (March 11-15, 2008).
- Meeting on Brain and Language (*Jornada de Cervell i Llenguatge*). Universitat de Barcelona, 2 July 2007.

- Meeting on Animal Cognition and Communication (*Jornada de Comunicació i Cognició Animal*), Universitat de Barcelona, 3 July 2006.

TEACHING

EXPERIENCE

- 2022 – present **Introduction to Quantitative Linguistics**. Master in Innovation and Research in Informatics (MIRI) and Master in Data Science (MDS), Universitat Politècnica de Catalunya (UPC).
- 2020-2022 Algorithms and Data Structures. Bioinformatics degree. Universitat Pompeu Fabra (UPF).
- Fall 2019-present Computing and Intelligent Systems. Master in Informatics Engineering, UPC.
- 2016-present (as professor and **coordinator**) Information Retrieval & Recommender Systems. MDS, UPC.
- 2016-present (as professor and **coordinator**) Search and Analysis of Massive Information (*Cerca i anàlisi d'informació massiva*). Computer Science Degree, UPC.
- 2013-present (as professor and **coordinator**) Complex and Social Networks. MIRI, UPC.
- 2010-2017 Introduction to Programming 2 (*Programació 2*). Computer Science Degree, UPC. **Co-coordinator between 2013 and 2016 (the course had about 300 students and a team of about 13 professors).**
- 2009-2010 Compilers (*Compiladors*). Computer Science Degree, UPC
- 2007-2008 Introduction to Programming 1 (*Programació 1*). Computer Science Degree, UPC.
- 2007-2007 Mechanics Laboratory. Physics Degree, Universitat de Barcelona.

COMMUNICATION AND IMPACT

INVITED TALKS

1. 2026 “The Optimal Assignment Principle”, Linguistics and English Language Seminar. University of Manchester (Manchester, 5 February 2026).
2. 2025 (**keynote speaker**) “A few things I have learnt about the origins of Zipf's law for word frequencies”. XII Complexitat Day (Barcelona, 16 May 2025).
3. 2024 “The functional origins of the complexity of human languages”, Autogramm project event (Paris, France, 1 February 2024).
4. 2023 “The optimality of word lengths: facts, theory and predictions”, Communicative efficiency workshop, (Leipzig, Germany, 17 April 2023).
5. 2023 “How cost minimization shapes languages and other animal communication systems”. Language: from tabula rasa to biological determinism. Frontiers Dialogues. Academia Europaea – Barcelona Knowledge Hub (Barcelona, 22 November 2023).
6. 2022 “The optimality of languages”. Complexity in language variation and change. Satellite session for the Conference on Complex Systems (Palma de Mallorca, Spain, 20 October 2022).
7. 2022 (**inaugural lecture**) “How cost minimization and trade-offs shape language”. Cognitive Science and Language postgraduate program (master and PhD) co-organized by five Catalan universities (Barcelona, 29 September 2022).
8. 2022 (**inaugural lecture**; online) “Human language and animal communication. An insight from quantitative linguistics and comparative psychology”. Postgraduate Program in Animal Biology. Universidade Federal do Rio Grande do Sul (Porto Alegre, Brazil, 2 September 2022).
9. 2022 “Caminando sobre la pirámide de construcción de teoría (lingüística)”. Grupo de Estadística para el Estudio del Lenguaje, GESEL (Buenos Aires, Argentina, 23 July 2022; online).
10. 2022 “Human language and animal communication. An insight from quantitative linguistics and comparative psychology”. PhD Program in Linguistics, Literature and Translation. School of Philosophy and Literature (Málaga, Spain, 12 May 2022).
11. 2021 (**keynote speaker**) “Trekking on the pyramid of (linguistic) theory construction”. Xth Peripatetic Conference on Cognitive Systems Modeling (Zakopane, Poland, 21-23 October).
12. 2019 (**keynote/plenary speaker**) “Dependency distance minimization: facts, theory and predictions.” Syntax Fest 2019 (Paris, France). August 25-30.
13. 2018 “Statistical laws of language in humans, other species and genomes: amusement or real science?”, Conference on Quantitative Approaches to Language Studies (Warwick, UK). 25-26 September. Bridges Programme.

14. 2017 “A breakpoint in the decay of the distribution of syntactic dependency lengths”. Cognitive Network Science. A satellite of NetSci 2017 (Indianapolis, USA). Organized by N. M. Beckage, Y. N. Kenett, M. Stella & M. S. Vitevitch.
15. 2016 “Word order in light of network theory”. Winer Conference on Network Science in Cognitive Structures. 8-9 October. University of Purdue (USA). Organized by M. Vitevitch & R. Sweickert.
16. 2015 "Parallels of human language in the behavior of dolphins", International Meeting Consciousness & Communication in Dolphins", Genoa (Italy). 7 May. Organized by Università degli Studi di Genova (Roberta Mandich).
17. 2013 “Linguistic theory from information theory”. Workshop Language and Information. University of Utrecht. 12 September. Organized by Sergey Avrutin & M. van Egmond.
18. 2013 “Information theoretic principles of human language and animal behavior”, Analyzing Animal Vocal Sequences. NIMBioS Investigative Workshop. 21-23 October. Organized by D. Blumstein, M. A. Roch, and A. Kershenbaum.
19. 2013 "Scaling laws of human language: divertimento or real science?" Journée IXXI sur les lois de puissance", Lyon (France). 7 March. Organized by IXXI (<http://www.ixxi.fr/?p=1943>).
20. 2011 “The world war of word orders. Insights from complex systems science”. ANNUAL Workshop Cognitive Science and Language master. Barcelona.
21. 2011 “Statistical patterns of language outside human language: facts and open issues”. 1st International work-conference on linguistics, biology and computer science (LBCSI 2011). 14-18 March. Facultat de Lletres, Universitat Rovira i Virgili. Tarragona, Catalonia (Spain). Organized by G. Bel-Enguix, V. Dahl and M. D. Jiménez-López,
22. 2011 “Word order as a constraint satisfaction problem: A mathematical approach.” Complexity in Language: Developmental and Evolutionary Perspectives, Collegium de Lyon, May 23 - 24, 2011.
23. 2010 (**keynote speaker**) “Linguistic Networks and Quantitative Linguistics” at Leipzig Linguistic Network Meeting (LLNM 2010), Leipzig (Germany). Organized jointly by Leipzig University and Bielefeld University. 26 January (<http://llnm.informatik.uni-leipzig.de/>).
24. 2010. “Statistical linguistics: divertimento or real science?” VII Jornada IULA: Lingüística i estadística. Barcelona, Catalonia (Spain). Organized by IULA - Universitat Pompeu Fabra.
25. 2009. Myths about Zipf's law for word frequencies. Symposium - Scaling laws in cognitive science (Cogsci 2009). Organized by Chris Kello, Cognitive Science Society. Amsterdam (The Netherlands).
26. 2008 “Language for free”. NET-ACE conference. 17-19 September. Brunel University.
27. 2008 “Estalvi energètic a les llengües”. Encontre Internacional Noves Fronteres de la Ciència, l'art i el pensament. En Ressonància. Barcelona, Catalonia.
28. 2007 (**keynote speaker**) “The architecture of language”, I Seminário de Pesquisa CONES (“1st CONES Research Seminar”). 3-4 December. Salvador de Bahia, Brasil. The other invited speakers were Miguel Nicolelis (US) and Sidarta Ribeiro (Brazil).
29. 2005 “A theory of Zipf's law in natural communication systems”, Animal behavior, cognition and communication: the role of networks and information (Workshop). Santa Fe Institute. Santa Fe (New Mexico, USA)

MEETINGS

Quantitative linguistics

- Quantitative Linguistics Conference (Qualico; the official meeting of the IQLA): 2025 (Brno, Czechia), 2023 (Lausanne, Switzerland), 2021 (Tokyo, Japan; online), 2018 (Wrocław, Poland), 2016 (Trier, Germany), 2014 (Olomouc, Czech Republic), 2012 (Belgrade, Serbia), 2009 (Graz, Austria).
- 5th Trier Symposium on Quantitative Linguistics (2007), Trier, Germany.
- Modern methods in Linguistics (2006), Budmerice, Slovakia.
- 4th Trier Symposium on Quantitative Linguistics (2003), Trier, Germany.

SyntaxFest:

- 2021 (Sofia, Bulgaria, online), 2019 (Paris, France).

Evolution of Language International Conference (Evolang):

- 2026, Plovdiv (Bulgaria), 2024 (Madison, USA), 2020 (Brussels, Belgium; cancelled by Covid), 2018 (Torun, Poland), 2016 (New Orleans, USA), 2014 (Vienna), 2012 (Kyoto), 2010 (Utrecht), 2008 (Barcelona), 2006 (Rome), 2004 (Leipzig).

International School and Conference on Network Science (NetSci):

- 2018 (Paris, France), 2017 (Indianapolis, USA), 2015 (Zaragoza, Spain; Language & Networks satellite).

Complex systems and network science:

- Complexity in Language Variation and Change (COMPILA): 2022 (satellite of CCS 2022).
- (European) Conference on Complex Systems (ECCS): 2013 (Barcelona), 2005 (Paris, France).
- Annual meetings of Complexitat,cat

- Modeling Linguistic Networks: from Language Structures to Communication Processes. 2012 (Frankfurt, Germany).
- Statistical Mechanics of Complex Networks. XVIII Sitges Conference. 2002 (Sitges, Catalonia).

Cognitive science:

- Statistical Learning: 2026 (Donostia, Spain).
- Architectures and Mechanisms for Language Processing (AMLAP): 2024 (Edinburgh, Scotland).
- Annual Meeting of the Cognitive Science Society (Cogsci): 2013 (Berlin, Germany), 2009 (Amsterdam, The Netherlands).
- Reappraising the role of linear structure in language. Lorentz Center, 2015 (Leiden, The Netherlands).

Other conferences:

- 2023 Communicative Efficiency Workshop (Leipzig).
- 2018 Societas Linguistica Europaea (SLE) 2018 (Tallinn, Estonia).
- 2016 Graph-TA 4 (Barcelona, Catalonia).
- 2015 Causality in the language sciences. Max Planck Institute for Mathematics in the Sciences. (Leipzig, Germany).
- 2013 NIMBioS Investigative Workshop Analyzing Animal Vocal Sequences (Knoxville, USA).
- 2011 Complexity in language: developmental and evolutionary perspectives (Lyon, France).
- 2009 ATACD conference. Changing Cultures: Cultures of Change (Barcelona, Catalonia).
- 2005 International School on Semiotic Dynamics, Language and Complexity (Erice, Italy).
- 2005 Approaches to Complexity in Language (Helsinki, Finland).
- 2004 Origins of Language & Psychosis. SANE POWIC and Language Origins Society (LOS) (Oxford, UK).

Some talks at research institutions:

- 2017,2019 Xi'an Jiaotong University, School of Foreign Studies (Xi'an, China).
- 2019 University of Tübingen, Department of Linguistics (Tübingen, Germany); Universidad Autónoma de México.
- 2016 University of Zürich (Switzerland), Centre de Recerca Matemàtica (Barcelona, Catalonia).
- 2013 University of California at Davis (Davis, USA).
- 2012 Centre d'Estudis Avançats de Blanes (Blanes, Catalonia).
- 2007 Institute for Cross-Disciplinary Physics and Complex Systems, IFISC (Palma de Mallorca, Spain).
- 2006 Universitat de Barcelona (Barcelona, Catalonia).
- 2004 Universitat Pompeu Fabra (Barcelona, Catalonia).
- 2003 University of Edinburgh (Scotland).
- 2002 Rockefeller University (New York, USA), Institute for Advanced Studies (Princeton, USA).

OUTREACH

An overview of the impact of selected publications

Gómez-Rodríguez, C. & Ferrer-i-Cancho, R. (2017). Scarcity of crossing dependencies: a direct outcome of a specific constraint?

- Meet the Scientist Using Physics Techniques to Solve Linguistic Mysteries (January 3, 2018). Buzz Blog at Physics Central.

Gustison, M.L, Semple, S., Ferrer-i-Cancho, R. & Bergman, T. J. (2016). Gelada vocal sequences follow Menzerath's linguistic law.

- This Primate's Calls Obey a Linguistic Law by Christopher Intagliata on April 21, 2016. 60 - second science. Scientific American.
- Ethiopian monkey study offers clues into how human speech evolved. All things considered, National Public Radio (April 18, 2016).
- (in Catalan) *Micos i humans tenen semblances quan vocalitzen*. Ara (1 de maig del 2016).
- (in Catalan) *Les seqüències vocals de micos i humans comparteixen patró*. El Punt Avui (23 d'abril del 2016).

Kello, C. T., Brown, G. D. A., Ferrer-i-Cancho, R., Holden, G., Linkenkaer-Hansen, K., Rhodes, T. & Van Orden, G. C. (2010). Scaling laws in cognitive sciences.

- "Corpo e pensiero. L'attività è scandita da regole matematiche", by Massimo Piattelli-Palmarini on the Italian newspaper "Il Corriere della Sera" (14 September 2010).

Ferrer-i-Cancho, R., Riordan, O. & Bollobás, B. (2005). The consequences of Zipf's law for syntax and symbolic reference.

- Nature news and views, 7 March 2005.

Ferrer-i-Cancho, R. & Solé, R. V. (2003). Least effort and the origins of scaling in human language.

- Nature science update, 22 January 2003.
- “Law of conversations explained”, by Siri Carpenter. Science Now, 22 January 2003.
- Awarded with the Barcelona City Research Prize 2003.

Ferrer-i-Cancho, R. & Lusseau, D. (2009). Efficient coding in dolphin surface behavioral patterns.

- The 1st author was interviewed for Superquark, the Italian prime time science TV program. Documentary "Erased words" ("Parole cancellate") from RAI Uno). Broadcasted on 26 August 2010.
- The 2nd author was interviewed (live) in the Channel 4 news (UK) in 2009 (August 3).
- The 1st author was interviewed on Onda Regional de Murcia (programa Adelantos), 31 July 2009.
- Selected by the Spanish Service of Information and Scientific News (SINC).

As popular science author (in Spanish)

- **Hernández-Fernández, A. & Ferrer-i-Cancho, R. (2019). Lingüística cuantitativa. La estadística de las palabras (*Quantitative linguistics. The statistics of words*). Grandes ideas de las matemáticas EMSE EDAPP y Prisanoticias Colecciones. Published also in **Italian and Romanian** (forthcoming in **Catalan and Portuguese**).**

As popular science author (in Catalan)

- (2023) amb A. Hernández Fernández. *Lingüística quantitativa i lleis lingüístiques. De la lingüística a la intel·ligència artificial i la tecnològica*. Terminàlia 27, 72-79.
- (2010). *Què tenen en comú els dofins dels fiords de Nova Zelanda i els macacos de Taiwan?* Revista Nodels (Butlletí de l'Associació Catalana d'Intel·ligència Artificial) 46, 16-17.
- (2009). *L'estalvi energètic a les llengües*. En *ressonància: noves fronteres de la ciència, l'art i el pensament*, C. Massip and J. Perelló (eds.) pp. 190-198
- (2006). *La llengua i el gènere* (Cartes del lector) El Periódico de Catalunya, dimecres 6 de desembre.
- (2004). *Sobre la singularitat del llenguatge humà*. El Temps (number 1041, May 2004). Based on the PhD thesis “Ferrer i Cancho, R. (2003). [Language: universals, principles and origins](#). PhD Thesis. Barcelona: Universitat Politècnica de Catalunya.

Other

- (in Spanish) *¿Sueñan los delfines con clases de inglés?* by Iñaki Berazaluze. Yorokobu 28 (April 2012), pp. 31.
- (in Catalan) *Llengües i sons dels animals podrien compartir característiques* by Michele Catanzaro. El Periódico (25 April 2011).

As organizer of popular science events:

- Mysteries surrounding the origins of human language (*Enigmes al voltant dels orígens del llenguatge humà*). Evening of the Science Museum (“*Vespre del Museu de la Ciència*”). Science Museum (Barcelona), 11 March 2008.

EDITORIAL AND REVIEWER WORK

EDITORIAL BOARDS

2023-2026. Section editor of Encyclopedia of Language and Linguistics (3rd edition). Section “Interaction with Physics and Mathematics”.

- 2022 – Glottometrics.
- 2021 – Journal of Quantitative Linguistics. Indexed by Web of Science.
- 2019 – 2026 Lingua (Elsevier).
- 2017 – present Linguistic Frontiers (De Gruyter).
- 2009 – 2022 Entropy (MDPI). Indexed by Web of Science.
- 2011 – 2020 Language Dynamics and Change (Brill). Indexed by Web of Science and Scopus.
- 2008 – 2010 Glottotheory. Currently published by Akademie Verlag.

PEER REVIEWER

Multidisciplinary science: - Proceedings of the National Academy of Sciences USA - PLoS ONE - Entropy Biology: - Proceedings of the Royal Society B - Acta Acustica united with Acustica - Biology Letters - Animal Behavior - Bioacoustics - Biosystems	Cognitive science: - Nature Human Behavior - Trends in Cognitive Sciences - Cognition - Cognitive Science - Psychonomic Bulletin and Review - Frontiers in Psychology - Journal of Psycholinguistic Research - Language Learning Linguistics: - Linguistic Vanguard,
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- Naturwissenschaften - Journal of Theoretical Biology - Bulletin of Mathematical Biology - Computational Biology and Chemistry - Journal of Bioinformatics and Sequence Analysis Physics: - Nature Communications Physics - Physical Review E - Journal of Statistical Mechanics: theory and experiment. - Europhysics Letters - European Physical Journal B - Physica A Complex Systems - Complex & Intelligent Systems - Complexity (Wiley/Hindawi) - Advances in Complex Systems - European Conference on Complex Systems (ECCS) 2013 Philosophy - Erkenntnis	- Lingua - Interaction Studies - Digital Scholarship in the Humanities - Journal of Quantitative Linguistics - Language Sciences - Traitement Automatique des Langues Naturelles (TALN) 2014 - Evolution of Language Conference 2006, 2010, 2012, 2014, 2016, 2018 - Glottotheory - Book “Towards a theoretical framework for analyzing complex linguistic networks”, Mehler, A., Lücking, A., Banisch, S., Blanchard, P. & Job, B. (eds.). Springer (Berlin) - Corpus Linguistics and Linguistic Theory - Cambridge Encyclopaedia of the Language Sciences Computer science: - Transactions on Pattern Analysis and Machine Intelligence - Computer Speech and Language - Computational Linguistics - Neurocomputing - COLING 2018 Other: Cortex, Adaptive Behavior, Current Anthropology, Revista de Economía del ICE
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Reviewer for institutions

- Jeremy Collier Foundation & Tel Aviv University, Israel.
- Department of Psychology and Cognitive Science, University of Trento, Italy.
- Programa de Atracción de Talento, Comunidad de Madrid, Spain.
- Zukunftskolleg Fellowship Programme, University of Konstanz, Germany.
- National Science Foundation (USA).
- European Research Council.
- Linguistics and Philosophy Departments/SASC, University of California, Santa Barbara.
- Department of Population Health and Reproduction. School of Veterinary Medicine. Davis, California (USA).

Evaluation committee of PhD theses:

- M. Courtin, “From treebanks to partial syntactic structure induction”, Université Sorbonne Nouvelle, 31 January 2024.
- M. Van Egmond, “Zipf’s law in aphasic speech”. University of Utrecht, 26 October 2018.
- I. Ros, “Minimizing dependencies across languages and speakers”. University of the Basque Country, 17 September 2018.
- R. Amato, “Human collective behavior models: language, cooperation and social conventions”. Universitat de Barcelona, 13 April 2018.
- F. Font-Clos, “On the scale invariance of certain complex systems”. Universitat Autònoma de Barcelona, 2 July 2015.

RESEARCH FUNDING AND RECOGNITIONS

As principal investigator (PI):

- 2025-2027. Linguistic systems: unraveling patterns in languages and animal communication. Funded by MICIN/AEI (80.000€). PID2024-155946NB-I00
- 2022-2025. Support for research groups (AGRUPS). Funded by Universitat Politècnica de Catalunya (7.000€ in 2022, 5.000€ in 2023, 2.657€ in 2024 and 5.284,12€ in 2025).
- 2021-2023. Quantitative, Mathematical and Computational Linguistics Research Group. Research group recognized by AGAUR (SGR 2021).
- (jointly with J. Larriba Pey) 2017-2019 Management and Analysis of Complex Data (*Gestión y análisis de datos complejos*). Funded by MINECO (138.303€). TIN2017-89244-R.
- 2017-2019 Management and Analysis of Complex Data. Research group recognized by AGAUR (SGR 2017).
- 2010-2012 Phase transitions in the genesis of communication (*Transicions de fase en la gènesi de la comunicació*). Funded by Universitat Politècnica de Catalunya (8000€). Ref. 0-INCREC-03.

Research contracts:

- 2021-2022 Research Agreement with Telefónica I+D (6500€). Researchers in charge: R. Ferrer-i-Cancho (UPC) & J. Luque Serrano (Telefónica I+D).

Participation in international research projects and programs:

- 2017 Search for Extraterrestrial Intelligence (SETI) Institute VI Call for White Papers: Search for Intelligent Life in the Universe, and the Creation of a Multidisciplinary Virtual Institute for SETI Research. Selected White Paper “What animal studies can tell us about detecting intelligent messages from outside Earth” (Kershenbaum et al.)
- 2017 Recruitment program of foreign experts (2017ZD070). Xi'an Jiaotong University). Funded by State Administration of Foreign Experts Affairs P. R. China. PI: X. Chen.
- 2005 ECAGents (Embodied communicating agents). Funded by European Union (7.12 Million €). Ref. FP6 - IST-2003-1940. PI: E. Nolfi.
- 2003-2004 COSIN (Coevolution and self-organization in dynamical networks). Funded by European Union (1.2 Million €). PI: G. Caldarelli

Participation in projects funded by Spanish or Catalan agencies:

- 2022-2024. Semantics of Catalan words (Semàntica de les paraules del català). Funded by Institut d'Estudis Catalans (5000 €). Ref. PRO-2022-S03-HERNANDEZ. PI: A. Hernández-Fernández.
- 2021. Applications of Quantitative Linguistics in Catalan (Aplicacions de la lingüística quantitativa en el català). Funded by Institut d'Estudis Catalans (3000 €). Ref. PRO-2021-S03-HERNANDEZ. PI: A. Hernández-Fernández.
- 2019-2020. Quantitative Linguistics (Lingüística quantitativa). Funded by Institut d'Estudis Catalans (6000 €). Ref. RCO03080. PI: A. Hernández-Fernández.
- 2014-2016 Management and Analysis of Complex Data (*Gestió i Anàlisi de Dades Complexes*). Funded by AGAUR (45.000€). Ref. 2014 SGR 890. PI: R. Gavalda.
- 2014-2016 Aprendizaje computacional y comunicación (APCOM). Funded by MINECO (74.700€). Ref. TIN2014-57226-P. PI: M. Arias & G. Morrill.
- 2012-2014 Data mining in biological and social data: algorithms, theory and implementation “*Minería en datos biológicos y sociales: algoritmos, teoría e implementación*”, BASMATI. Funded by MICINN (98.736€). Ref. TIN2011-27479-C04-03. PI: R. Gavalda.
- 2010-2013 Hybrid machine translation and advanced evaluation (*Traducción automática híbrida y evaluación avanzada*). Funded by MICINN (178.354€). Ref. TIN2009-14675-C03-03. PI: L. Màrquez.
- 2009-2011 Symbolic sequences: analysis, learning, mining and evolution (*Secuencias simbólicas: análisis, aprendizaje, minería y evolución*) SESAAME-BAR. Funded by MICINN (204.490€). Ref. TIN2008-06582-C03-01. PI: R. Gavalda.
- 2007-2009 Dynamic evolution of systems with non-linear interactions defined over complex networks. Theoretical development (*Evolución dinámica de sistemas con interacciones no lineales definidos en redes complejas. Desarrollo teórico*). Funded by MEDU - Ministerio de Educación y Ciencia (49.000,00€). Ref. FIS2006-13321-C02-01. PI: C. J. Pérez.
- 2006-2007. Connectivity effects and dynamics in biological and social networks (*Efectos de conectividad y dinámica en redes biológicas y sociales*). Funded by MCTE - Ministerio de Ciencia y Tecnología (49,200,00€). Ref. BFM2003-08258-C02-02. PI: A. Díaz-Guilera
- 2001-2003. Phase transitions and evolution of graphs in complex systems (*Transiciones de fase y evolución de grafos en sistemas complejos*). Funded by MCYT (48982,49 €). Ref. BFM2001-2154. PI: R. Vicente.
- 1997 Psychological validation of a neural model for language processing (*Validación psicológica de un modelo neuronal para el procesamiento del lenguaje*). Funded by MCYT. PI: J. Sopena

SOFTWARE

[The Linear Arrangement Library](#) (2021). A library in Python and C++ for research in quantitative dependency syntax and related fields (as PI and designer; jointly with L. Alemany-Puig and J. L. Esteban).

PUBLICATION RECORD

SUMMARY (full publication list at the end of this document)

(Co)author of 137 publications	Listed in the Stanford Top 2% Ranking (2024, 2025).
83 publications as 1st author (marked with * below). 20 diamond open access publications.	10181 citations , 44 h-index (Google Scholar) 102 publications indexed within Web of Science.

Milestones: 2 articles in PNAS (IF 12.2), 2 articles in Trends in Cognitive Sciences (IF 15.4) and 1 article in Trends in Ecology and Evolution (IF 17.5).

ALL SCIENCE PUBLICATIONS¹ (high impact journals indicated in bold type)

- Komori, S., Sugiura, M., Ferrer-i-Cancho, R. & Alemany-Puig, L. & Li, W. (2026). A novel normalized dependency distance score finds progression in proficiency in second language learners. Mean dependency distance does not, in preparation.
- *Ferrer-i-Cancho, R. & Quattoni, A. & Hobaiter, C. (2026). On the feasibility of dependency parsing of non-human sequences. Is learning with small datasets possible in other species?, in preparation.
- *Ferrer-i-Cancho, R. & Hobaiter, C., Gustison, M. & Bergman, T. (2026). On the feasibility of dependency parsing of non-human sequences without a gold standard. Is evaluation possible in other species? <https://arxiv.org/abs/2607.06542>.
- García-Casademont, E. & Ferrer-i-Cancho, R. (2026). Ease of dependency distance minimization in star-like structures. <https://arxiv.org/abs/2604.28034>
- Ríos-El-Yazidi, J. & Ferrer-i-Cancho, R. (2026). Swap distance minimization shapes the order of subject, object and verb in languages of the world, under review <https://arxiv.org/abs/2604.26726>
- *Ferrer-i-Cancho, R. (2026). How to measure the optimality of word or gesture order with respect to the principle of swap distance minimization. <https://arxiv.org/abs/2604.01938>
- Alemany-Puig, L., Esteban, J. L & Ferrer-i-Cancho, R. (2026). Maximum Linear Arrangement: exact algorithms for specific classes of graphs and approximation algorithms for wide classes of graphs, Journal of Combinatorial Optimization, in press <https://arxiv.org/abs/2312.04487>
- Lluís Alemany-Puig, L. & Ferrer-i-Cancho, R. (2026). Baselines in dependency syntax. International Encyclopedia of Language and Linguistics (3rd Edition), H. Nesi & P. Milin (eds.), 233-240.
- *Ferrer-i-Cancho, R. & Arias, M. (2026). Who is the root in a syntactic dependency structure? Applied Network Science 11, 20.
- Petrini, S., Casas-i-Muñoz, A., Cluet-i-Martinell, J., Wang, M., Bentz, C. & Ferrer-i-Cancho, R. (2026). The optimality of word lengths. Theoretical foundations and an empirical study. Glottometrics 60, 77–149.
- *Ferrer-i-Cancho, R. (2026). The exponential distribution of the orders of demonstrative, numeral, adjective and noun. Journal of Quantitative Linguistics, in press <https://arxiv.org/abs/2502.06342>
- Franco-Sánchez, V., Martí-Llobet, A. & Ferrer-i-Cancho, R. (2026). Swap distance minimization beyond entropy minimization in word order variation. Journal of Quantitative Linguistics, in press <http://arxiv.org/abs/2404.14192>.
- *Ferrer-i-Cancho, R. (2025). On the class of coding optimality of human languages and the origins of Zipf's law. Europhysics Letters 151(6), 62001.
- Petrini, S. & Ferrer-i-Cancho, R. (2025). The distribution of syntactic dependency distances. Glottometrics 58, 35-94.
- *Ferrer-i-Cancho, R. (2024). Predictability maximization and the origins of word order harmony. <https://arxiv.org/abs/2408.16570>
- Safryghin, A., Badihi, G., Ferrer-i-Cancho, R., Grund, C., Hayashi, M., Soldati, A., Rodrigues, E.D., Zuberbühler, K. & Hobaiter C. (2024). Testing methodological and population-specific influences on the detection of Zipf's law of brevity in chimpanzee gestures. <https://doi.org/10.1101/2025.11.21.689682>
- *Ferrer-i-Cancho, R. (2024). The optimal placement of the head in the noun phrase. The case of demonstrative, numeral, adjective and noun. Journal of Quantitative Linguistics 32(1), 26–53.
- Alemany-Puig, L. & Ferrer-i-Cancho, R. (2024). The expected sum of edge lengths in planar linearizations of trees. Theory and applications. Journal of Language Modelling 12 (1), 1–42.
- Alemany-Puig, L., Esteban, J. L & Ferrer-i-Cancho, R. (2023). On the Maximum Linear Arrangement Problem for trees. <https://arxiv.org/abs/2312.04487v5>
- *Ferrer-i-Cancho, R. & Namboodiripad, S. (2023). Swap distance minimization in SOV languages. Glottometrics 55, 59-88.
- Alemany-Puig, L., Esteban, J. L & Ferrer-i-Cancho, R. (2024). The Maximum Linear Arrangement Problem for trees under projectivity and planarity. Information Processing Letters 183, 106400.
- Petrini, S., Casas-i-Muñoz, A., Cluet-i-Martinell, J., Wang, M., Bentz, C. & Ferrer-i-Cancho, R. (2023). Direct and indirect evidence of compression of word lengths. Zip's law of abbreviation revisited. Glottometrics 54, 58-87.
- Safryghin, A., Cross, C., Fallon, B., Heesen, R., Ferrer-i-Cancho, R. & Hobaiter, C. (2022). Variable expression of linguistic laws in ape gesture: a case study from chimpanzee sexual solicitation. Royal Society Open Science 9, 220849.
- Gómez-Rodríguez, C., Christiansen, M. & Ferrer-i-Cancho, R. (2022). Memory limitations are hidden in grammar. Glottometrics 52, 39-64.
- *Ferrer-i-Cancho, R., Lusseau, D. & McCowan, B. (2022). Parallels of human language in the behavior of bottlenose dolphins. Linguistic Frontiers 5(1), 1-7.
- *Ferrer-i-Cancho, R., Bentz, C & Seguin, C. (2022). Optimal coding and the origins of Zipfian laws. Journal of Quantitative Linguistics 29(2), 165-194.
- 27. Semple, S., Ferrer-i-Cancho, R. & Gustison, M. (2022). Linguistic laws in biology. Trends in Ecology and Evolution 37(1), 53-66.**
- Alemany-Puig, L., Esteban, J. L & Ferrer-i-Cancho, R. (2022). Minimum projective linearizations of trees in linear time. Information Processing Letters 74, 106204.
- Alemany-Puig, L. & Ferrer-i-Cancho, R. (2022). Linear time calculation of the expected sum of edge lengths in projective linearizations of trees. Journal of Computational Linguistics 48 (3): 491–516.
- *Ferrer-i-Cancho, R., Gómez-Rodríguez, Esteban, J.L. & Alemany-Puig, L. (2022). Optimality of syntactic dependency distances. Physical Review E 105, 014308.
- *Ferrer-i-Cancho, R. & Gómez-Rodríguez, C. (2021). Dependency distance minimization predicts compression. Proceedings of the Second Workshop on Quantitative Syntax (Quasy, SyntaxFest 2021), 45-57.
- Alemany-Puig, L., Esteban, J. L & Ferrer-i-Cancho, R. (2021). The linear arrangement library. A new tool for research on syntactic dependency structures. Proceedings of the Second Workshop on Quantitative Syntax (Quasy, SyntaxFest 2021), 1-16.

¹ See outreach for other publications. Excluding abstracts in proceedings unless it is necessary for their impact.

33. Català, N., Baixeries, J., Ferrer-i-Cancho, R., Padró, L. & Hernández-Fernández, A. (2021). Zipf's law of meaning in Catalan, PLoS ONE, 16(12), e0260849.
34. Carrera-Casado, D. & Ferrer-i-Cancho, R. (2021). The advent and fall of a vocabulary learning bias from communicative efficiency. Biosemiotics 14, 345-375.
35. *Ferrer-i-Cancho, R. & Gómez-Rodríguez, C. (2021). Anti dependency distance minimization in short sequences. A graph theoretic approach. Journal of Quantitative Linguistics 28 (1), 50-76.
36. *Ferrer-i-Cancho, R., Gómez-Rodríguez, C. & Esteban, J.L. (2021). Bounds of the variation of the sum of edge lengths in linear arrangements of trees. Journal of Statistical Mechanics, 023403.
37. Alemany-Puig, L. & Ferrer-i-Cancho, R. (2020). Fast calculation of the variance of edge crossings in random linear arrangements. <https://arxiv.org/abs/2003.03258>
38. Corral, A., Serra, I. & Ferrer-i-Cancho, R. (2020). Distinct flavors of Zipf's law and its maximum likelihood fitting: Rank-size and size-distribution representations. Physical Review E 102, 052113.
39. Alemany-Puig, L. & Mercè, M. & Ferrer-i-Cancho, R. (2020). Reappraising the distribution of the number of edge crossings of graphs on a sphere. Journal of Statistical Mechanics, 083401.
40. Alemany-Puig, L. & Ferrer-i-Cancho, R. (2020). Edge crossings in random linear arrangements, Journal of Statistical Mechanics, 023403.
41. *Ferrer-i-Cancho, R. (2019). The sum of edge lengths in random linear arrangements, Journal of Statistical Mechanics, 053401.
42. Heesen, R., Hobaiter, C., Ferrer-i-Cancho, R., Semple, S. (2019). Linguistic laws in chimpanzee gestural communication. **Proceedings of the Royal Society B: Biological Sciences**, 20182900.
43. Casas, B., Hernández-Fernández, A., Català, N., Ferrer-i-Cancho, R. & Baixeries, J. (2019). Polysemy and brevity versus frequency in language, Computer Speech and Language 58, 19-50.
44. *Ferrer-i-Cancho, R., Bentz, C. & Seguin, C. (2018). Compression and the origins of Zipf's law of abbreviation. <http://arxiv.org/abs/1504.04884>
45. Casas, B., Català, N., Ferrer-i-Cancho, R., Hernández-Fernández, A. & Baixeries, J. (2018). The polysemy of the words that children learn over time. Interaction Studies 19 (3), 389-426.
46. *Ferrer-i-Cancho, R. & Vitevitch, M. S. (2018). The origins of Zipf's meaning-frequency law. Journal of the Association for Information Science and Technology 69 (11), 1369-1379.
47. Hernández-Fernández, A. & Ferrer-i-Cancho, R. (2018). José María de Oleza Arredondo, S.J. (1887-1975). Glottometrics 41, 80-86.
48. Chen, X., Gómez-Rodríguez, C. & Ferrer-i-Cancho, R. (2018). A dependency look at the reality of constituency. Glottometrics 40, 104-106.
49. *Ferrer-i-Cancho, R., Gómez-Rodríguez, C. & Esteban, J. L. (2018). Are crossing dependencies really scarce? Physica A 493, 311-329.
50. *Ferrer-i-Cancho, R. (2018). Optimization models of natural communication. Journal of Quantitative Linguistics 25 (3), 207-237.
51. *Ferrer-i-Cancho, R. & Bentz, C. (2018). The evolution of optimized language in the light of standard information theory. In C. Cuskley, M. Flaherty, H. Little, Luke McCrohon, A. Ravignani, and T. Verhoef, editors, The Evolution of Language: Proceedings of the 12th International Conference (EVLANGXII). NCU Press.
52. Gómez-Rodríguez, C. & Ferrer-i-Cancho, R. (2017). The scarcity of crossing dependencies: a direct outcome of a specific constraint? Physical Review E 96, 062304.
53. Elvevåg, B., Foltz, P., Rosenstein, M., Ferrer-i-Cancho, R., De Deyne, S., Mizraji, E. & Cohen, A. (2017). Thoughts about disordered thinking: measuring and quantifying the laws of order and disorder. Schizophrenia Bulletin 43 (3), 509-513.
54. *Ferrer-i-Cancho, R. (2017). Towards a theory of word order. Comment on "Dependency distance: a new perspective on syntactic patterns in natural language" by Haitao Liu et al. Physics of Life Reviews 21, 218-220.
55. *Ferrer-i-Cancho, R. (2017). The placement of the head that maximizes predictability. An information theoretic approach. Glottometrics 39, 38-71.
56. Bentz, C., Alikaniotis, D., Cysouw, M. & Ferrer-i-Cancho, R. (2017). The entropy of words – learnability and expressivity across more than 1000 languages. Entropy 19(6), 275.
57. Esteban, J. L. & R. Ferrer-i-Cancho, R. (2017). A correction on Shiloach's algorithm for minimum linear arrangement of trees. SIAM Journal of Computing 46(3), 1146-1151.
58. *Ferrer-i-Cancho, R. (2017). A commentary on “The now-or-never bottleneck: a fundamental constraint on language”, by Christiansen and Chater (2016). Glottometrics 38, 107-111.
59. *Ferrer-i-Cancho, R. (2017). Random crossings in dependency trees. Glottometrics 37, 1-12.
60. *Ferrer-i-Cancho, R. (2016). The optimality of attaching unlinked labels to unlinked meanings. Glottometrics 36, 1-16.
61. *Ferrer-i-Cancho, R. (2016). The meaning-frequency law in Zipfian optimization models of communication. Glottometrics 35, 28-37.
62. *Ferrer-i-Cancho, R. (2016). Compression and the origins of Zipf's law for word frequencies. Complexity 21, 409-411.
63. *Ferrer-i-Cancho, R. & Gómez-Rodríguez, C. (2016). Crossings as a side effect of dependency lengths. Complexity 21, 320-328.
64. Hernández-Fernández, A., Casas, B., Ferrer-i-Cancho, R. & Baixeries, J. (2016). Testing the robustness of laws of polysemy and brevity versus frequency. 4th International Conference on Statistical Language and Speech Processing (SLSP 2016). P. Král and C. Martín-Vide (eds.). LNAI 9918, pp. 1-11.
65. Lozano, A., Casas, B., Bentz, C. & Ferrer-i-Cancho, R. (2016). Fast calculation of entropy with Zhang's estimator. In: Issues in Quantitative Linguistics 4. Dedicated to Reinhard Köhler on the occasion of his 65th birthday, E. Keli, R. Knight, J. Macutek and A. Wilson (eds.). No. 23 of the series “Studies in Quantitative Linguistics”. Lüdenscheid: RAM-Verlag. pp. 273-285.
66. Esteban, J. L., Ferrer-i-Cancho, R., & Gómez-Rodríguez, C. (2016). The scaling of the minimum sum of edge lengths in uniformly random trees. Journal of Statistical Mechanics, 063401.
67. Gustison, M.L., Semple, S., Ferrer-i-Cancho, R. & Bergman, T. J. (2016). Gelada vocal sequences follow Menzerath's linguistic law. **Proceedings of the National Academy of Sciences USA** 113 (19), E2750-E2758.
68. *Ferrer-i-Cancho R. (2016). Kauffman's adjacent possible in word order evolution. In S.G. Roberts, C. Cuskley, L. McCrohon, L. Barceló-Coblijn, O. Feher & T. Verhoef (eds.). The Evolution of Language: Proceedings of the 11th International Conference (EVLANG11). New Orleans, USA, March 21-24.
69. *Ferrer-i-Cancho, R. (2016). Non-crossing dependencies: least effort, not grammar. In: Towards a theoretical framework for analyzing complex linguistic networks, Mehler, A., Lücking, A., Banisch, S., Blanchard, P. & Job, B. (eds.). Springer (Berlin), pp. 203-234.
70. Hernández-Fernández, A. & Ferrer-i-Cancho, R. (2016). The infochemical core. Journal of Quantitative Linguistics 23 (2), 133-153.
71. Kershenbaum, A., Blumstein, D. T. & Roch, M. A. et al (2016). Acoustic sequences in non-human animals: A tutorial review and prospectus. **Biological Reviews** 91 (1), 13-52.
72. *Ferrer-i-Cancho, R. & Gómez-Rodríguez, C. (2016). Liberating language research from dogmas of the 20th century. Glottometrics 33, 33-34.
73. Bentz, C. & Ferrer-i-Cancho, R. (2015). Zipf's law of abbreviation as a language universal. Capturing Phylogenetic Algorithms for Linguistics. Lorentz Center Workshop, Leiden, October 2015
74. Corral, A., Boleda, G. & Ferrer-i-Cancho, R. (2015). Zipf's law for word frequencies: word forms versus lemmas in long texts. PLoS ONE 10 (7), e0129031.

75. *Ferrer-i-Cancho, R. (2015). The placement of the head that minimizes online memory. A complex systems approach. *Language Dynamics and Change* 5 (1), 114-137.
76. *Ferrer-i-Cancho, R. (2015). Reply to the commentary "Be careful when assuming the obvious", by P. Alday. *Language Dynamics and Change* 5 (1), 147-155.
77. *Ferrer-i-Cancho, R. (2014). A stronger null hypothesis for crossing dependencies. *Europhysics Letters* 108 (5), 58003.
78. *Ferrer-i-Cancho, R., Hernández-Fernández, A., Baixeries, J., Dębowski, L. & Macutek, J. (2014). When is Menzerath-Altmann law mathematically trivial? A new approach. *Statistical Applications in Genetics and Molecular Biology* 13 (6), 633-644.
79. *Ferrer-i-Cancho, R. (2014). Beyond description. Comment on "Approaching human language with complex networks" by Cong & Liu. *Physics of Life Reviews* 11 (4), 621-623.
80. *Ferrer-i-Cancho, R. & Liu, H. (2014). The risks of mixing dependency lengths from sequences of different length. *Glottology* 5 (2), 143-155.
81. *Ferrer-i-Cancho, R. (2014). What if we are not at the center? In: THE EVOLUTION OF LANGUAGE - Proceedings of the 10th International Conference (EVOLANG10), Cartmill, E. A., Roberts, S., Lyn, H. & Cornish, H. (eds.). Evolution of Language Conference (Evolang 2014). Vienna, Austria, April 14-17. p. 11
82. *Ferrer-i-Cancho, R. (2014). Why might SOV be initially preferred and then lost or recovered? A theoretical framework. In: THE EVOLUTION OF LANGUAGE - Proceedings of the 10th International Conference (EVOLANG10), Cartmill, E. A., Roberts, S., Lyn, H. & Cornish, H. (eds.). Evolution of Language Conference (Evolang 2014). Vienna, Austria, April 14-17. pp. 66-73.
83. *Ferrer-i-Cancho, R., Dębowski, L. & Moscoso del Prado Martín, F. (2013). Constant conditional entropy and related hypotheses. *Journal of Statistical Mechanics*, L07001.
84. Baronchelli, A., Ferrer-i-Cancho, R., Pastor-Satorras, R., Chater, N. & Christiansen, M. H. (2013). Networks in cognitive science. **Trends in Cognitive Sciences** 17, 348-360.
85. *Ferrer-i-Cancho, R., Hernández-Fernández, A., Lusseau, D., Agoramoorthy, G., Hsu, M. J. & Semple, S. (2013). Compression as a universal principle of animal behavior. *Cognitive Science* 37 (8), 1565-1578.
86. Semple, S., Hsu, M. J., Agoramoorthy, G., Ferrer-i-Cancho, R. (2013). The law of brevity in macaque vocal communication is not an artifact of analyzing mean call durations. *Journal of Quantitative Linguistics*, 20 (3), 209-217.
87. *Ferrer-i-Cancho, R. (2013). Hubiness, length, crossings and their relationships in dependency trees. *Glottometrics* 25, 1-21.
88. *Ferrer-i-Cancho, R. & Hernández-Fernández, A. (2013). The failure of the law of brevity in two New World primates. *Statistical caveats. Glottometrics* 4 (1), 45-55.
89. *Ferrer-i-Cancho, R., Baixeries, J. & Hernández-Fernández, A. (2013). Erratum to "Random models of Menzerath-Altmann law in genomes" (*BioSystems* 107 (3), 167-173). *BioSystems* 111 (3), 216-217.
90. Baixeries, J., Elvevåg, B. & Ferrer-i-Cancho, R. (2013). The evolution of the exponent of Zipf's law in language ontogeny. *PLoS ONE* 8 (3), e53227.
91. *Ferrer-i-Cancho, R., Forns, N., Hernández-Fernández, A., Bel-Enguix, G. & Baixeries, J. (2013). The challenges of statistical patterns of language: the case of Menzerath's law in genomes. *Complexity* 18 (3), 11-17.
92. Baixeries, J., Hernández-Fernández, A., Forns, N. & Ferrer-i-Cancho, R. (2013). The parameters of Menzerath-Altmann law in genomes. *Journal of Quantitative Linguistics* 20 (2), 94-104.
93. *Ferrer-i-Cancho, R. & McCowan, B. (2012). The span of correlations in dolphin whistle sequences. *Journal of Statistical Mechanics*, P06002.
94. Baixeries, J., Hernández-Fernández, A. & Ferrer-i-Cancho, R. (2012). Random models of Menzerath-Altmann law in genomes. *BioSystems* 107 (3), 167-173.
95. *Ferrer-i-Cancho, R. & Moscoso del Prado Martín, F. (2011). Information content versus word length in random typing. *Journal of Statistical Mechanics*, L12002.
96. Hernández-Fernández, A., Baixeries, J., Forns, N. & Ferrer-i-Cancho, R. (2011). Size of the whole versus number of parts in genomes. *Entropy* 13 (8), 1465-1480.
97. *Ferrer i Cancho, R. (2010). Information theory. In: The Cambridge encyclopedia of the language sciences, Colm Hogan, P. (ed.). Cambridge University Press, pp. 389. ISBN: 9780521866897
98. *Ferrer i Cancho, R. (2010). Network theory. In: The Cambridge encyclopedia of the language sciences, Colm Hogan, P. (ed.). Cambridge University Press, pp. 555-557. ISBN: 9780521866897
99. Kello, C. T., Brown, G. D. A., Ferrer-i-Cancho, R., Holden, G., Linkenkaer-Hansen, K., Rhodes, T. & Van Orden, G. C. (2010). Scaling laws in cognitive sciences. **Trends in Cognitive Sciences** 14 (5), 223-232.
100. *Ferrer-i-Cancho, R. & Elvevåg, B. (2010). Random texts do not exhibit the real Zipf's law-like rank distribution. *PLoS ONE* 5 (3), e9411.
101. *Ferrer-i-Cancho, R. & Forns, N. (2009). The self-organization of genomes. *Complexity* 15 (5), 34-36.
102. *Ferrer-i-Cancho, R. & McCowan, B. (2009). A law of word meaning in dolphin whistle types. *Entropy* 11 (4), 688-701.
103. *Ferrer-i-Cancho, R. & Lusseau, D. (2009). Efficient coding in dolphin surface behavioral patterns. *Complexity* 14 (5), 23-25.
104. *Ferrer-i-Cancho, R. & Gavalda, R. (2009). The frequency spectrum of finite samples from the intermittent silence process. *Journal of the American Society for Information Science and Technology* 60 (4), 837-843.
105. *Ferrer-i-Cancho, R. (2008). Some word order biases from limited brain resources. A mathematical approach. *Advances in Complex Systems* 11 (3), 394-414.
106. *Ferrer-i-Cancho, R. (2008). Some limits of standard linguistic typology. The case of Cysouw's models for the frequencies of the six possible orderings of S, V and O. *Advances in Complex Systems* 11 (3), 421-432.
107. Smith, A. D. M., Smith, K., & Ferrer i Cancho, R. (2008). The Evolution of Language: Proceedings of the 7th International Conference (EVOLANG7). Singapore: World Scientific Press.
108. *Ferrer i Cancho, R., Lorenzo, G. & Longa, V. (2008). Long-distance dependencies are not uniquely human. In: The Evolution of Language: Proceedings of the 7th International Conference (EVOLANG7). Smith, A. D. M., Smith, K. & Ferrer i Cancho, R (eds.). Singapore: World Scientific Press, pp. 115-122.
109. *Ferrer-i-Cancho, R. & Hernández Fernández, A. (2008). Power laws and the golden number. In: "Problems of general, germanic and slavic linguistics", Altmann, G., Zadorozhna, I. & Matskulyak, Y. (eds.), Chernivtsi: Books - XXI, pp. 518-523.
110. *Ferrer-i-Cancho, R. & Díaz-Guilera, A. (2007). The global minima of the communicative energy of natural communication systems. *Journal of Statistical Mechanics*, P06009.
111. *Ferrer-i-Cancho, R., Mehler, A., Pustynnikov, O. & Díaz-Guilera (2007). Correlations in the organization of large-scale syntactic dependency networks, In: TextGraphs-2: Graph-Based Algorithms for Natural Language. Association for Computational Linguistics, Rochester, NY, USA, pp. 65-72.
112. *Ferrer-i-Cancho, R., Capocci, A. & Caldarelli, G. (2007). Spectral methods cluster words of the same class in a syntactic dependency network. *International Journal of Bifurcation and Chaos* 17 (7), 2453 - 2463.
113. *Ferrer-i-Cancho, R. (2006). Why do syntactic links not cross? *Europhysics Letters* 76 1228-1235.
114. *Ferrer-i-Cancho, R. & Lusseau, D. (2006). Long-term correlations in the surface behavior of dolphins. *Europhysics Letters* 74, 1095-1101.
115. *Ferrer-i-Cancho, R. (2006). On the universality of Zipf's law for word frequencies. In: "Exact methods in the study of language and text. In honor of Gabriel Altmann", Grzybek, P. & Köhler, R. (eds.) 131-140. Berlin: Gruyter.

116. *Ferrer-i-Cancho, R. (2006). When language breaks into pieces. A conflict between communication through isolated signals and language. *BioSystems* 84, 242-253.
117. *Ferrer-i-Cancho, R. (2005). The structure of syntactic dependency networks: insights from recent advances in network theory. In: "The problems of quantitative linguistics", Altmann, G., Levickij, V. & Perebyinis, V. (eds.). Chernivtsi: Ruta. pp. 60-75.
118. *Ferrer-i-Cancho, R. (2005). Hidden communication aspects in the exponent of Zipf's law. *Glottometrics* 11, 99-119.
119. *Ferrer-i-Cancho, R. (2005). Zipf's law from a communicative phase transition. *European Physical Journal B* 47, 449-457.
120. *Ferrer-i-Cancho, R. & Servedio, V.D.P. (2005). Can simple models explain Zipf's law in all cases? *Glottometrics* 11, 1-8.
121. *Ferrer-i-Cancho, R., Riordan, O. & Bollobás, B. (2005). The consequences of Zipf's law for syntax and symbolic reference. **Proceedings of the Royal Society of London B** 272, 561-565.
122. *Ferrer-i-Cancho, R. (2005). The variation of Zipf's law in human language. *European Physical Journal B* 44, 249-257.
123. *Ferrer-i-Cancho, R. (2005). Decoding least effort and scaling in signal frequency distributions. *Physica A* 345, 275-284.
124. *Ferrer-i-Cancho, R. (2004). Euclidean distance between syntactically linked words. *Physical Review E* 70, 056135.
125. *Ferrer-i-Cancho, R., Solé, R. V. & Köhler, R. (2004). Patterns in syntactic dependency networks. *Physical Review E* 69, 051915.
126. *Ferrer-i-Cancho, R. (2003). [Language: universals, principles and origins](#). PhD Thesis. Barcelona: Universitat Politècnica de Catalunya.
127. *Ferrer-i-Cancho, R. & Solé, R. V. (2003). Least effort and the origins of scaling in human language. **Proceedings of the National Academy of Sciences USA** 100, 788-791.
128. *Ferrer-i-Cancho & Solé, R. V. (2003). Optimization in complex networks. *Statistical Mechanics of Complex Networks*, Lecture Notes in Physics Vol 625, Springer (Berlin), pp. 114-125.
129. Solé, R.V., Ferrer-i-Cancho, R., Montoya, J. M. & Valverde, S. (2002). Selection, tinkering and emergence in complex networks. *Complexity* 8, 20-33.
130. Valverde, S., Solé, R. V. & Ferrer-i-Cancho, R. (2002). Scale-free networks from optimal design. *Europhysics Letters* 60, 512-517.
131. *Ferrer-i-Cancho, R. & Solé, R. V. (2002). Zipf's law and random texts. *Advances in Complex Systems* 5, 1-6.
132. *Ferrer-i-Cancho, R. & Reina, F. (2002). Quantifying the semantic contribution of particles. *Journal of Quantitative Linguistics* 9, 35-47.
133. *Ferrer-i-Cancho, R. & Solé, R.V. (2001). The small-world of human language. **Proceedings of the Royal Society of London B**, 268, 2261-266.
134. *Ferrer-i-Cancho, R., Janssen, C. & Solé, R. V. (2001). Topology of technology graphs: small world patterns in electronic circuits. *Physical Review E* 64, 046119.
135. *Ferrer-i-Cancho, R. & Solé, R. V. (2001). Two regimes in the frequency of words and the origin of complex lexicons: Zipf's law revisited. *Journal of Quantitative Linguistics* 8, 165-173.
136. Miralles, R., Ferrer, R., Moya, A., Solé, R.V. & Elena, S. (2001). Multiple infection dynamics has pronounced effects on the virulence of RNA viruses. *Journal of Evolutionary Biology* 14, 654-662.
137. Solé, R.V., Ferrer, R., González-García, I., Quer, J. & Domingo, E. (1999). Red queen dynamics, competition and critical points in a model of RNA virus quasispecies. *Journal of Theoretical Biology* 198, 47-59.