

## Curriculum vitae

### PERSONAL INFORMATION

Name: Tria Francesca

Nationality: Italian

### EDUCATION

2003, PhD in Physics, Univ. of Naples Federico II (Supervisor: Prof. Luca Peliti). Final thesis: Statistical models of evolution: Game theory and virus-immune system coevolution.

2000, *Laurea* in Physics (cum laude), Sapienza University of Rome (Supervisor: Prof. Giorgio Parisi). Final thesis: Spin glasses in diluted lattices.

### CAREER

2016 Feb.-present, researcher (RtdA) at Sapienza University of Rome

2010 Feb.-2016 Jan., Research Scientist at ISI Foundation, Complex Systems Lab, Torino, Italy (local coordinator of the research group directed by prof. Vittorio Loreto).

2006 Nov.-2010 Feb., Post-doctoral at ISI Foundation, Torino, Italy.

2004 Jan.-2006 Jan., Post-doctoral at the International Centre of Theoretical Physics (ICTP), Trieste, Italy.

### CAREER BREAKS

2016 Nov.-2017 April, Maternity leave.

2012 Nov.-2013 April, Maternity leave.

### OTHER POSITIONS AND HABILITATIONS

2017, Scientific National Habilitation (ASN) for Associate Professor in two different sectors of Theoretical Physics: Condensed Matter (FIS 02/B2) and Fundamental Interactions (FIS 02/A2), and in Applied Physics (FIS 02/D1).

2016- present, external faculty member of the Complexity Science Hub in Vienna (<https://www.csh.ac.at>).

2017 April-Sept., Visiting at ISI Foundation, Torino, Italy.

2015 April-May, Visiting at the SONY Computer Science Lab (SONY-CSL) in Paris ([www.csl.sony.fr](http://www.csl.sony.fr)).

2011 April, Visiting at the Yeshiva University in New York, United States.

2009 August, Visiting at the Theoretical Physics Dep. of the Centro Atómico Bariloche, Argentina.

2002 Nov.-Dec., Visiting at the Institute for Theoretical Physics, Univ. of Cologne, Germany.

### FUNDED PROJECTS

2019 University project (Progetto d'Ateneo), small: Data, Models and Bayesian Inference. Role: PI.

2018-2020 Consultancy contract between SONY Computer Science Laboratory (Paris) and the Physics Department at Sapienza Università di Roma. Theme: Innovation dynamics and Digital platform for sustainability and forecasting. Role: scientific manager.

2017 University project (Progetto d'Ateneo), big: Modelling complex systems in the digital era. Role: participant.

2014 - 2017 Kreyon - Unfolding the dynamics of creativity, novelties and innovation - funded by the Templeton Foundation. Role: local coordinator at ISI.

2014 – 2015 Elise - Environment Live Sensing - funded in the framework of Programma operativo regionale (POR FESR) of Regione Piemonte. Role: participant and local coordinator at ISI.

2011 – 2014 EveryAware - Enhancing environmental awareness through social information technologies - ([www.everyaware.eu](http://www.everyaware.eu)), funded by the EU 7th Framework Programme (FP7). Role: participant and local coordinator at ISI.

### TEACHING ACTIVITIES

a.y. 2020-2021, *Physics of Complex Systems* (2<sup>nd</sup> year master students in Physics), at Sapienza Università di Roma, Physics Department. Language: English.

a.y. 2019-2020, *Fisica dei sistemi complessi* (2<sup>nd</sup> year master students in Physics), at Sapienza Università di Roma, Physics Department.

a.y. 2018-2019, *Entropia, Complessità, Informazione*. Short course (8 hours) for the Honours Programme, (3<sup>rd</sup> year, Bachelor in Physics) at Sapienza Università di Roma, Physics Department.

a.y. 2018-2019, *Fisica dei sistemi complessi* (2<sup>nd</sup> year master students in Physics), at Sapienza Università di Roma, Physics Department.

a.y. 2017-2018, *Fisica dei sistemi complessi* (2<sup>nd</sup> year master students in Physics), at Sapienza Università di Roma, Physics Department.

a.y. 2015-2016, assistant professor for the course *Fisica I*, (1<sup>st</sup> year, Bachelor in Chemistry), at Sapienza Università di Roma, Chemistry Department.

a.y. 2015-2016, lecturer (6 hours) at the course *Fisica dei sistemi complessi* (2<sup>nd</sup> year master students in Physics), at Sapienza Università di Roma, Physics Department. Theme of the lessons: *Innovation dynamics*.

a.y. 2013-2014, lecturer (4 hours) at the course *Fisica dei sistemi complessi* (2<sup>nd</sup> year master students in Physics), at Sapienza Università di Roma, Physics Department. Theme of the lessons: *Power laws, Polya urns and Innovation*.

a.y. 2012-2011, lecturer (8 hours) at the course *Fisica dei sistemi complessi* (2<sup>nd</sup> year master students in Physics), at Sapienza Università di Roma, Physics Department. Theme of the lessons: *Evolutionary models and phylogenetic reconstruction*.

a.y. 2010-2011, lecturer (6 hours) at the course *Survey of Contemporary Physics (Honors Program)* at the Yeshiva University, Physics Department. Theme of the lessons: *Evolutionary models and phylogenetic reconstruction*.

a.y. 2010-2011, lecturer (6 hours) at the course *Fisica dei sistemi complessi* (2<sup>nd</sup> year master students in Physics), at Sapienza Università di Roma, Physics Department. Theme of the lessons: *Phylogenetic reconstruction and applications in biology and linguistics*.

## **SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS**

### **Co-supervisor:**

#### Post-doctoral fellows:

Hamed Mahmoudi (2009), Animesh Mukherjee (2009-2011), Alina Sirbu (2011 - 2014), Alvaro Ruiz-Serrano (2014-2015), Christine Cuskley (2014-2015), Indaco Biazzo (2014-2017), Bernardo Monechi (2014-2017).

#### Phd students:

Simone Pompei (2009-2012). Phd thesis: *Phylogenetic trees: inference, analysis and modeling*. University of Turin, PhD Programme in Complexity in Post-Genomic Biology. Giovanna Chiara Rodi (2013-2017) Phd thesis: *Human exploration of complex knowledge spaces*. Department of Mathematical Sciences, Dottorato di Ricerca in Applied Mathematics – XXIX Ciclo.

#### Undergraduate students for the master degree thesis:

(2009) Simone Pompei. Thesis: *Comparative analysis of the efficiency of phylogenetic algorithms*. Sapienza University of Rome, physics department. (2010) Lorenzo Taggi. Thesis: *Percolation processes inspired by epidemic spreading*. Sapienza University of Rome, physics department. (2011) Martina Pugliese. Thesis: *Modeling viral evolutionary dynamics with epistatic interactions*. Sapienza University of Rome, physics department. (2012) Roberta Amato. Thesis: *A model for interacting random walkers*. Sapienza University of Rome, physics department. (2013) Marco Pietrosanto. Thesis: *Agent based study of cooperative effects and social norms*. Sapienza University of Rome, physics department. (2013) Giovanna Chiara Rodi. Thesis: *Statistical modeling of learning paths*. Sapienza University of Rome, physics department. (2015) Greta Greco. Thesis: *Super-diffusive processes in innovation dynamics*. Università degli Studi di Torino, physics department.

#### Undergraduate students for the bachelor thesis:

(2017) Pietro Pasanisi. Thesis: *Spazi delle possibilità nei modelli di emergenza delle novità*. Sapienza Università di Roma, physics department.

### **Supervisor:**

#### Phd students:

Giulio Tani (2019-present). Topic: Innovation dynamics, the Poisson-Dirichlet processes and authorship attribution.

#### Undergraduate students for the master degree thesis:

(2017-2018) Ambra D'amico. Thesis: *Inference and machine learning approach to the facial beauty perception process*. Sapienza Università di Roma, physics department. Co-supervisor: Miguel Ibanez Berganza.

(2017-2018) Margherita Lalli. Thesis: *Authorship attribution via sequence compression methods*. Sapienza Università di Roma, physics department. Advisor: Vittorio Loreto.

(2017-2018) Gian Luca Lancia. Thesis: *Studio dell'apprendimento non supervisionato in reti neurali di tipo Boltzmann Machine*. Sapienza Università di Roma, physics department. Co-supervisor: Miguel Ibanez Berganza.

(2017-2018) Mattia Eluchans. Thesis: *Algoritmi di inferenza bayesiana per l'identificazione di topic nei testi*. Sapienza Università di Roma, physics department. Co-supervisor: Miguel Ibanez Berganza.

(2018-2019) Silvia Rognone. Thesis: *Analysis of statistical properties of written texts and models for predictions*.

(2018-2019) Leonardo Pizzirani. Thesis: *A bayesian approach to authorship attribution*.

(2018-2019) Luca Mariani. Thesis: *Overfitting and underfitting in Principal Component Analysis with applications to the face codification*. Co-supervisor: Miguel Ibanez Berganza.

(2019-2020) Camilla Cancrini. Thesis: *Inferring selection from an ensemble of trajectories. A new theoretical approach based on the Wright- Fisher model*. Co-supervisor: Simone Pompei.

Undergraduate students for the bachelor thesis:

(2020) Edoardo Alviani. Thesis: *Power laws in innovation processes*. Sapienza Università di Roma, physics department.

## **ORGANISATION OF CONFERENCES AND WORKSHOPS**

2011, PRIN Meeting 2008: Language, texts and keys. Bagnovignoni (Siena).

2015, the first public event of the Kreyon project, Palazzo delle Esposizioni, Rome (<http://www.kreyon.net/kreyonDay/>)

2015, Kreyon workshop, at Sapienza Univ. of Rome (<http://www.kreyon.net/kreyonWorkshop/>).

2016, Satellite workshop “CreativEvolang: Creativity and innovation in language evolution” at EvolangXI, New Orleans.

2016, Satellite workshop “Determinants of Creativity and Innovation in Science, Art and Technology” at CCS2016, Amsterdam, (<http://www.kreyon.net/ccs2016/>).

2016, the second public event of the Kreyon project (<http://www.kreyon.net/kreyonDays/>).

2017, Kreyon conference, “Unfolding the dynamics of creativity and innovation”, Palazzo delle Esposizioni, Rome (<http://kreyon.net/kreyonConference/>), and the open conference “The complexity of the future”, Palazzo delle Esposizioni, Rome (<http://kreyon.net/kreyonOpenConference/>).

## **EDITORIAL RESPONSIBILITIES**

Co-editor of the book Language Dynamics, Special Issue of Advances in Complex Systems 15 (03n04) (<http://dx.doi.org/10.1142/S0219525912030026>).

Co-editor of the book Participatory Sensing, Opinions and Collective Awareness, Series Understanding Complex Systems, Springer International Publishing AG Editors: Loreto, V., Haklay, M., Hotho, A., Servedio, V.D.P., Stumme, G., Theunis, J., Tria, F. (Eds.), 2017, (ISBN 978-3-319-25658-0).

**Referee activity for the international journals:** Europhysics Letters, Physics A, EPJB, JSTAT, Cognitive Science, Language Dynamics and Change, Scientific Reports, Physical Review Letters, Advances in Complex Systems, Royal Society Open Science, PLOS ONE, Nature Communication Physics.

## **INVITED TALKS IN INTERNATIONAL SCHOOLS AND CONFERENCES**

2020 September, Network Science Society Conference (NetSci2020), online conference. Keynote speaker.

2019 September, Lake Como School of Advanced Studies “Model-Guided Data Science”, Como, Italia.

2019 July, International workshop “Complex Networks: from socio-economic systems to biology and brain”, Lipari, Italia.

2018, CSH Public Conference: “Complexity – Where do we go from here?”, Complexity Science Hub, Vienna. (<https://www.csh.ac.at/news-external-faculty-where-to-go-from-here/>)

2017, Kreyon conference, “Unfolding the dynamics of creativity and innovation”, Palazzo delle Esposizioni, Rome (<http://kreyon.net/kreyonConference/>).

2016, Satellite of the Conference on Complex System 2016 (CCS2016) "Determinants of Creativity and Innovation in Science, Art and Technology".

2016, International Summer School at lake Como School of Advanced Study, “Creativity and evolution. Games, language, robots, life, art”.

2016, International workshop in Lipari “Complex Networks: from socio-economic systems to biology and brain”.

2015, Lorentz Center in Leiden, workshop: “Capturing Phylogenetic Algorithms for Linguistics”.

2015, Italian Physical Society (SIF) Congress, “Complex Systems” section.

2014, SigmaPhi2014 - International Conference on Statistical Physics 2014, Rhodes, Greece: “Complex Network workshop”.

2014, Evolang X, Vienna: workshop “How grammaticalization processes create grammar: From historical corpus data to agent-based models”.

2014, German Physical Society (DPG) meeting, Dresden: Section of Condensed Matter.

2014, Sapienza Univ. of Rome, workshop “On the emergence of consensus and misunderstanding”.

2010, INdAM Meeting - Hyperbolic Dynamical Systems in the Sciences. Corinaldo, Italy.

2007, Summer school: Statistical Physics of Gene Regulation - From Networks Expression Data and Back, Jacobs University, Bremen.

### **TALKS IN INTERNATIONAL CONFERENCES**

2016 Conference on Complex Systems 2016 (CCS2016) Title: The dynamics of innovation through the expansion in the adjacent possible.

2016 STATPHYS26 : 26nd International Conference on Statistical Physics, Lyon, France, 2016. Title: The dynamics of innovation through the expansion in the adjacent possible.

2014 SigmaPhi2014 - International Conference on Statistical Physics 2014, Rhodes, Greece, main conference. Title: The dynamics of correlated novelties.

2012 Evolang IX - the 9th International Conference on the Evolution of Language, Kyoto, Japan. Title: Naming a structured world: a cultural route to duality of patterning.

2011 ECAL Satellite Workshop on Alife Approaches to Artificial Language Evolution, Paris, France. Title: Naming a structured world: a cultural route to duality of patterning. *Best paper prize.*

2010 BIOCAMP'10 - The 2010 International Conference on Bioinformatics & Computational Biology, Las Vegas. Title: A Fast Noise Reduction Driven Distance-Based Phylogenetic Algorithm.

2008 5th European Conference on Complex Systems (ECCS), Jerusalem. Title: A message-passing approach for graphs alignment.

2007 Jacobs University, Bremen. Workshop: Interfaces between physics and computer science. Bremen. Title: Classification of cancer tissues from microarray expression data.

2005 Workshop on Infectious Disease: Theoretical, Ecological and Economic Approaches, ICTP, Trieste. Title: A minimal model for influenza A evolution.

2005 Les Houches, France: Statistical Physics of Glasses, Spin Glasses, Information Processing and Combinatorial Optimisation. Title: On the Talagrand theorem in spherical p-spin models.

### **POSTER PRESENTATION IN INTERNATIONAL CONFERENCES**

2004 STATPHYS22 : 22nd International Conference on Statistical Physics, Bangalore, India.

2002 Unifying Concepts in Glass Physics. Accademia dei Lincei, Roma.

### **INVITED LECTURES**

Mantova, seminario pubblico nell'ambito di “Mantova Scienza” (<http://www.mantovascienza.it/>) (2017).

Medical University of Vienna, Section for Science of Complex Systems (in the framework of seminars on “Analysis of Complex Systems”) (2015).

Yeshiva University, NY, Psychology Dept. (2010, 2011) and Physics Dept. (2011).

Meeting PRIN 2008: Language, texts and keys. Bagnovignoni (2011).

Centro Atómico Bariloche, San Carlos de Bariloche, Argentina (2009).

### **SHORT DESCRIPTION OF MY RESEARCH ACTIVITIES**

My training is in statistical physics and physics of complex systems, with particular attention to interdisciplinary applications, of both biological interest and related to social sciences. In particular, my main lines of research have been:

#### Problems of biological interest:

#### ***Evolutionary dynamics of Influenza A virus.***

I firstly faced this problem during my PhD thesis and I then came back to it during the research period at ISI. Understanding the evolutionary dynamics of the influenza virus is crucial for the development of control and prevention strategies, as well as an interesting theoretical problem. My main activities in this area were: (i) modeling and data analysis (viral RNA sequences encoding the HA protein, mainly involved in the interaction between virus and immune system): in this contest, we have highlighted the role of dynamic correlations in mutations in the evolutionary dynamics of the virus; (ii) phylogenetic analysis and study of the topology of the phylogenetic tree (according to an approach that links the topology of the phylogenetic

tree to the evolutionary dynamics of the virus, in particular to the type of selective pressure to which it is subjected). We have introduced effective measures to quantify the imbalance of viral phylogenetic trees.

### ***Phylogenetic reconstruction.***

The phylogenetic reconstruction is a particular inverse problem whose relevance has recently been rediscovered in various research fields such as immunodynamics, epidemiology, linguistics. I dealt in particular with methods for phylogenetic reconstruction based on distance. We have introduced an algorithmic scheme for the reconstruction of phylogenesis by combining a statistical mechanics approach (Monte Carlo techniques) with the exploitation of mathematical properties of distances on trees. We tested the algorithm implemented on synthetic data, demonstrating its competitiveness with respect to the state of the art, especially in the presence of a high level of noise (backward mutations and / or horizontal transfer). We then applied our algorithmic scheme for the reconstruction of language trees and phylogenetic trees of RNA viruses.

### ***Inference on micro-array data.***

I worked on the classification of cancerous tissues based on gene expression data, using an approach based on statistical mechanics methods for the supervised classification of high-dimensional data.

### **Social dynamics:**

#### ***Language dynamics.***

In this context, language is seen as an emergent property of a population of individuals, arising from social interactions aimed at communication. In particular, according to the scheme of linguistic games proposed by Wittgenstein, I proposed different modeling schemes aimed at accounting for different properties of human language. Among these: (i) the (universal) hierarchy observed in the order in which the names for the basic colors appear in different cultures; (ii) the nature both combinatorial and compositional of human language; (iii) the emergence of Creole languages, particularly in the colonial states of North and Central America; (iv) the evolution of the complexity of language, in particular of its regular and irregular forms, looking at data on English verbs.

#### ***Opinion dynamics.***

As part of the EveryAware project, I participated in the creation of a new technological platform aimed at allowing citizens themselves to collect data on different environmental parameters (in this case pollution from fine dust and noise pollution). On the one hand, this has allowed to create detailed maps to convey the data gathered, on the other hand, to involve citizens in the monitoring work, according to the idea of participation aimed at giving awareness. In this context, a web computing platform was also created, Experimental Tribe (XTribe, [www.tribibe.eu](http://www.tribibe.eu)), to run games/experiments based on the web, as a tool for understanding human individual and collective behaviors. In parallel, we pursued a modeling activity through agent-based models aimed at understanding the relative role of external information and social pressure on collective changes of opinion.

### **Other research activities:**

#### ***Automatic generation of music.***

In this context we worked on a proof of concept, applying on the one hand methods of maximum entropy and on the other hand methods from information theory, to capture the composer's style and to generate artificial music "in the manner of ..".

The work was motivated by a collaboration with the SONY Computer Science Lab (SONY-CSL) in Paris.

## **MAIN RESEARCH ACTIVITY AT THE MOMENT**

In recent years I start working on the **dynamics of innovation**. Here innovation is intended as the appearance in a given system of new elements on time scales comparable with that of the evolution of the system itself. From this perspective, innovation processes characterize most of the biological, social, and technological systems. Understanding the underlying mechanisms through which innovations and novelties emerge is crucial for characterizing the systems under consideration, from the evolution of a virus to mutations of cancer cells, to the emergence of new technologies.

From a theoretical point of view, the problem is to model and make predictions on systems where the relevant variables live on an evolving space whose evolution itself follows a stochastic process. A concept that has proved particularly useful in this framework is that of the Adjacent Possible, initially introduced by

Stuart Kauffman in a biological framework. The adjacent possible is the space of possibilities that are “one step away” from what actually exists (depending on the context: ideas, words, concepts, molecules, genomes, technologies, etc.). We can see innovation as an expansion of the space of actualized elements, which in turn induces an expansion of the adjacent possible, triggering further innovations.

In particular, we have modelled systems in which innovation is present through models based on Polya’s urns and random walks on dynamic and weighted graphs, accounting for observed statistical regularities in systems featuring innovation. Further, a generalization of this approach for the study of the formation of social networks demonstrated the strength and generality of the concept of the expansion of the adjacent possible.

The simpler urn model with triggering that we proposed generalizes the seminal Dirichlet and Poisson-Dirichlet processes, at the bases of state-of-the-art methods in the framework of nonparametric Bayesian inference. This parallel opens the way of rich and promising contamination between the fields of innovation dynamics and nonparametric bayesian inference. In this respect, as a proof of concept, we are investigating the potentiality of this approach for authorship attribution.

## **PUBLICATIONS**

### IN PREPARATION

G. Tani, M. Lalli, L. Pizzirani and F. Tria, *A bayesian approach to authorship attribution*.

G. De Marzo, L. Del Bono, F. Sylos Labini, F. Tria, L. Pietronero, *Zipf’s law for cosmic structures*.

### INTERNATIONAL PEER-REVIEWED JOURNALS

(The IF refers to the year of publication, as reported in Clarivate analytics database)

1. E. Ubaldi, R. Burioni, V. Loreto and F. Tria<sup>\*</sup>, *Emergence and evolution of social networks through exploration of the Adjacent Possible*. [arXiv:2003.00989v2](https://arxiv.org/abs/2003.00989v2), under review in Nature Communication Physics (2020).
2. F. Tria<sup>\*</sup>, I. Crimaldi, G. Aletti, V.D.P. Servedio, *Taylor’s Law in Innovation Processes*. Entropy **2020**, 22(5), 573 (2020).
3. F. Tria<sup>\*</sup>, V. Loreto, V.D.P. Servedio, *Zipf’s, Heaps’ and Taylor’s laws are determined by the expansion into the adjacent possible*. Entropy 2018, 20(10), 752 (2018).
4. B. Monechi, A. Ruiz-Serrano, F. Tria<sup>\*</sup>, and V. Loreto, *Waves of novelties in the expansion into the adjacent possible*. PLOS ONE 12 (6), e0179303 (2017).
5. G.C. Rodi, V. Loreto, F. Tria, *Search Strategies of Wikipedia Readers*. PLOS ONE12 (2), e0170746 (2017).
6. J. Sakellariou, F. Tria<sup>\*</sup>, V. Loreto, F. Pachet, *Maximum entropy model captures melodic styles*. Scientific Reports 7 (1), 9172 (2017).
7. B. Monechi, P. Gravino, V. D. P. Servedio, F. Tria and V. Loreto, *Significance and popularity in music production*. Royal Society Open Science 4 (7), 170433 (2017).
8. C. Cuskey, C. Castellano, F. Colaiori, V. Loreto, M. Pugliese, F. Tria, *The regularity game: Investigating rule dynamics in a population of interacting agents*. Cognition 159, 25-32 (2017).
9. F. Tria, *The dynamics of innovation through the expansion in the adjacent possible*, IL NUOVO CIMENTO C, vol.39, ISSN:2037-4909, (2016).
10. M. Pugliese, V. Loreto, S. Pompei, F. Tria, *Exploring the evolution of pathogens organised in discrete antigenic clusters*. Journal of Statistical Mechanics: Theory and Experiment 2016 (9), 093306 (2016).

11. V. Loreto, P. Gravino, V.D.P. Servedio and F. Tria, *On the emergence of syntactic structures: quantifying and modelling duality of patterning*, TOPICS IN COGNITIVE SCIENCE, vol. 8, p. 469-480, ISSN: 1756-8765, doi: 10.1111/tops.12193 (2016).
12. C. Cuskley, F. Colaiori, C. Castellano, V. Loreto, M. Pugliese, F. Tria, *The adoption of linguistic rules in native and non-native speakers: Evidence from a Wug task*. Journal of Memory and Language, 84, 205-223 (2015).
13. A. Sîrbu, M. Becker, S. Caminiti, B. De Baets, B. Elen, L. Francis, P. Gravino, A. Hotho, S. Ingarra, V. Loreto, A. Molino, J. Mueller, J. Peters, F. Ricchiuti, F. Saracino, V.D. P. Servedio, G. Stumme, J. Theunis, F. Tria, J. Van den Bossche, *Participatory Patterns in an International Air Quality Monitoring Initiative*. PLOS ONE, <http://dx.doi.org/10.1371/journal.pone.0136763>, (2015).
14. G.C. Rodi, V. Loreto, V.D.P. Servedio, and F. Tria, *Optimal learning paths in information networks*, Scientific Reports 5, Article number: 10286. doi:10.1038/srep10286 (2015).
15. F. Tria<sup>\*</sup>, V.D.P. Servedio, V. Loreto, and S. S. Mufwene, *Modeling the emergence of contact languages*, PLOS ONE 10(4) (2015).
16. F. Colaiori, C. Castellano, C. Cuskley, V. Loreto, M. Pugliese, F. Tria, *General three-state model with biased population replacement: Analytical solution and application to language dynamics*, Phys. Rev. E 91 (2015).
17. C. Cuskley, M. Pugliese, C. Castellano, F. Colaiori, V. Loreto, F. Tria, *Internal and External Dynamics in Language: Evidence from Verb Regularity in a Historical Corpus of English*, PLOS ONE 9(8): e102882. doi:10.1371/journal.pone.0102882 (2014).
18. F. Tria, V. Loreto, V.D.P. Servedio and S.H. Strogatz, *The dynamics of correlated novelties*, Scientific Reports 4, Article number: 5890. doi:10.1038/srep05890 (2014).
19. V. Loreto and F. Tria, *Language games: Comment on Modelling language evolution: Examples and predictions by Tao Gong, Lan Shuai, Menghan Zhang*, Physics of Life Reviews, ISSN 1571-0645, <http://dx.doi.org/10.1016/j.plrev.2014.01.006> (2014).
20. M. Becker, S. Caminiti, D. Fiorella, L. Francis, P. Gravino, M. Haklay, A. Hotho, V. Loreto, J. Mueller, F. Ricchiuti, V.D. P. Servedio, A. Sîrbu, F. Tria, (2013), *Awareness and learning in participatory noise sensing*, PLOS ONE, 8(12): e81638.
21. A. Sîrbu, V. Loreto, V.D.P. Servedio and F. Tria, *Cohesion, consensus and extreme information in opinion dynamics*, Advances in Complex Systems, 16 (1350035).
22. F. Tria<sup>\*</sup>, S. Pompei, V. Loreto, *Dynamical correlated mutations drive human Influenza A evolution*, Scientific Reports 3, Article number: 2705. doi:10.1038/srep02705. (2013).
23. S.K. Maity, A. Mukherjee, F. Tria and V. Loreto, *Emergence of fast agreement in an overhearing population: The case of naming game*, EPL (Europhysics Letters), 101, 68004 (2013).
24. A. Sîrbu, V. Loreto, V.D.P. Servedio and F. Tria, *Opinion dynamics with disagreement and modulated information*, Journal of Statistical Physics, Volume 151, Issue 1-2, pp 218-237 (2013).
25. L. Taggi, F. Colaiori, V. Loreto and F. Tria, *Dynamical correlations in the escape strategy of Influenza A virus*, EPL (Europhysics Letters), 101, 68003 (2013).
26. S. Pompei, V. Loreto and F. Tria, *Phylogenetic properties of RNA viruses*, PLOS ONE 7(9): e44849 (2012).
27. F. Tria<sup>\*</sup>, B. Galantucci and V. Loreto, *Naming a structured world: a cultural route to duality of patterning*, PLOS ONE 7(6): e37744 (2012).

28. V. Loreto, A. Mukherjee and F. Tria, *On the origin of the hierarchy of color names*, Proceedings of the National Academy of Sciences (PNAS) 109 (18), pag. 6819-6824, (2012).
29. A. Mukherjee, V. Loreto and F. Tria, *Why are basic color terms basic?*, Advances in Complex Systems 15, 1150016 (2012).
30. A. Baronchelli, V. Loreto and F. Tria, *Language Dynamics (Editorial)*, Advances in Complex Systems 15, 1203002 (2012).
31. S. Pompei, V. Loreto and F. Tria<sup>\*</sup>, *On the accuracy of language trees*, PLOS ONE, 6(6), e20109 (2011).
32. V. Loreto, A. Baronchelli, A. Mukherjee, A. Puglisi and F. Tria, *Statistical physics of language dynamics*, Journal of Statistical Mechanics: Theory and Experiment (2011) P04006.
33. F. Tria<sup>\*</sup>, A. Mukherjee, A. Baronchelli, A. Puglisi and V. Loreto, *A fast no-rejection algorithm for the Category Game*, Journal of Computational Science 2 (4), pag. 316-323 (2011).
34. A. Mukherjee, F. Tria, A. Baronchelli, A. Puglisi and V. Loreto, *Aging in language dynamics*, PLOS ONE, 6(2), e16677 (2011).
35. V. Loreto and F. Tria, *In Silico Linguistics: Comment on "Modeling the cultural evolution of language" by Luc Steels*, Physics of Life Reviews, 8, Issue 4, pp. 339-356, (2011).
36. S. Pompei, E. Caglioti, V. Loreto and F. Tria, *Distance-based Phylogenetic algorithms: new insights and applications*, Mathematical Models and Methods in Applied Sciences, 20 Supplementary Issue 1, pp. 1511-1532 (2010).
37. F. Tria, E. Caglioti, V. Loreto and A. Pagnani, *A stochastic local search approach to language trees reconstruction*, Diachronica XXVII:2 (2010). Special issue: Quantitative Approaches to Linguistic Diversity: Commemorating the centenary of the birth of Morris Swadesh.
38. F. Tria<sup>\*</sup>, E. Caglioti, V. Loreto and A. Pagnani, *A Stochastic Local Search algorithm for distance-based phylogeny reconstruction*, Molecular Biology and Evolution, 27, 2587-95 (2010).
39. S. Bradde, A. Braunstein, H. Mahmoudi, F. Tria, M. Weigt and R. Zecchina, *Aligning graphs and finding substructures by a cavity approach*, EPL (Europhysics Letters), 89, 37009 (2010).
40. A. Pagnani, F. Tria and M. Weigt, *Classification and sparse-signature extraction from gene-expression data*, Journal of Statistical Mechanics: Theory and Experiment, P05001 (2009).
41. S. Franz and F. Tria, *A note on the Guerra and Talagrand theorems for Mean Field Spin Glasses: the simple case of spherical models*, Journal of Statistical Physics, 122, 313-332 (2006).
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BIBLIOMETRIC INDICES

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