

Luís M. Bettencourt, Ph.D.  
Mansueto Institute for Urban Innovation  
The University of Chicago  
1155 E. 60th St. Room 218  
Chicago, IL, 60637 USA.

Tel: 1-773-834-4676  
bettencourt@uchicago.edu  
[@BettencourtLuis](https://voices.uchicago.edu/luisbettencourt)

## CURRENT TITLES

---

Inaugural Director  
The Mansueto Institute for Urban Innovation, The University of Chicago

Professor  
Ecology and Evolution and the College, The University of Chicago

Associate Faculty and Special Friend  
Sociology, The University of Chicago

Member-at-Large  
AAAS Section Social, Economic and Political Sciences

External Professor of Complex Systems  
Santa Fe Institute

## PROFILE

---

**Luís M. A. Bettencourt** is the Inaugural Director the Mansueto Institute for Urban Innovation at the University of Chicago and Professor of Ecology and Evolution at the College. He is also Associate Faculty of the Department of Sociology and External Professor at the Santa Fe Institute. He conducts interdisciplinary research on complex adaptive systems in biology and society and leads research and education programs in Urban Science and Sustainable Development. His research focuses on the identification, modeling and theory of the systemic processes and properties that create and sustain cities. This work uses interdisciplinary concepts together with many different forms of evidence and data to create new theoretical and methodological syntheses that account for the complex properties of urban environments and produce new science-based solutions. This work also involves partnerships and collaborations with international networks of researchers, local governments and NGOs to understand and systematize urban knowledge, and to foster processes of sustainable development. His work is well-known academically and has been influential in developing new theory and new creative approaches to challenges of urbanization worldwide.

## WORK EXPERIENCE

---

2017 – present	Inaugural Faculty Director UNIVERSITY OF CHICAGO (Chicago, IL) Mansueto Institute for Urban Innovation
2017 – present	Professor UNIVERSITY OF CHICAGO (Chicago, IL) Department of Ecology and Evolution and the College
2017 – present	Associate Faculty (and Special Friend) UNIVERSITY OF CHICAGO (Chicago, IL) Department of Sociology
2011 – 2017	Professor of Complex Systems SANTA FE INSTITUTE (Santa Fe, NM)
2005 – 2011	Scientist 4 LOS ALAMOS NATIONAL LABORATORY (Los Alamos, NM) Theoretical Division – T-5 (Applied Mathematics)
2007 – 2011	External Professor and Research Faculty (part-time) SANTA FE INSTITUTE (Santa Fe, NM)
2003 – 2005	Technical Staff Member [Research Scientist] LOS ALAMOS NATIONAL LABORATORY (Los Alamos, NM) Computer and Computational Division
2000 – 2003	Senior Postdoctoral Fellow MASSACHUSETTS INSTITUTE OF TECHNOLOGY (Cambridge, MA) Center for Theoretical Physics
1997 – 2001	Slansky Distinguished Postdoctoral Fellow and Director's Postdoctoral Fellow LOS ALAMOS NATIONAL LABORATORY (Los Alamos, NM) Theoretical Division
1996 – 1997	Postdoctoral Fellow HEIDELBERG UNIVERSITY (Heidelberg, Germany) Institute for Theoretical Physics

## EDUCATION

---

1992 – 1996	Doctor of Philosophy (Ph.D.) Department of Theoretical Physics Imperial College, University of London, London, UK
1987 – 1992	Licenciatura (5 years) Department of Engineering Physics, First Class Honors, Instituto Superior Técnico, Lisbon, Portugal

## SELECTED RESEARCH NEWS COVERAGE

---

2022	Argonne National Laboratory to establish center on climate change impact in Chicago <a href="#">UChicago News</a>
------	---

- 2021
- How the UN aims to save humanity, with Chris Williams and Luis Bettencourt (Ep. 79) [UChicago Big Brains Podcast](#)
- UChicago Focuses on the Future of Cities in a Post-COVID-19 World [WTTW News](#)
- Study Finds Large Cities Promote Lower Rates of Depression [WTTW News](#)
- How do cities impact mental health? A new study finds lower rates of depression [UChicago News](#)
- Living in the big city may help fight depression [The Times London](#)
- How the Pandemic Is Still Ruining Our Plans [Axios](#)
- The Bigger the City, the Lower the Depression Rates? [US News](#)
- “On Cities” Masterclass Series [e-Flux Architecture](#)
- 2020
- The city will survive covid19 [Newsday](#)
- COVID 2025: How COVID-19 will challenge and change cities, with Luis Bettencourt [UChicago News](#)
- This is one key metric Utah should track as the state considers easing coronavirus restrictions [The Salt Lake Tribune](#)
- Coronavirus Attack Rate Increases With City Size. How Should Large Cities Respond? [SciTech Daily](#)
- Why isn't California's coronavirus crisis as bad as New York's? Size doesn't tell the whole story [The Globe and Mail](#)
- Map Reveals Hidden U.S. Hotspots of Coronavirus Infection [Scientific American](#)
- Covid-19 spreads much faster in big cities [Futurity: Research News](#)
- Coronavirus is hitting larger cities harder. How should they respond? [UChicago News](#)
- State-level data misses growing coronavirus hot spots in U.S., including in the South [UChicago News](#)
- Mapping Tech Could Formalize Settlements for One Billion People [Next City](#)
- The Metric We Need to Manage COVID-19 [Systrom](#)

The physics that set out to study a million neighborhoods to improve cities [El País](#)

Uber and Lyft Are Convenient, Competitive and Highly Carbon Intensive [Inside Climate News](#)

Act Locally, Learn Globally: Luis Bettencourt on Building from the Community Up [TheCityFix](#)

Concern mounts over new Lagos physical planning, building control regulations [The Guardian Nigeria](#)

2019 Mapping Fast-growing Informal Settlements in Africa [GIM International](#)

African slum map exposes true scale of urban poverty [Reuters](#)

Big Brains Podcast Saving Our Cities By Studying A Million Neighborhoods With Luis Bettencourt (Ep. 34) [UChicago News](#)

In fight against global poverty, researchers map fast-growing informal settlements in Africa [UChicago News](#)

UChicago and UN to host global symposium on sustainable cities and neighborhoods [UChicago News](#)

Urban October at University of Chicago to Focus on Urgent Challenges Facing Global Cities [PR Newswire](#)

The Evolution of the Galápagos [The College News](#)

On Cities Workshop 2019 – Public Debates [Norman Foster Foundation](#)

The Fabric of Our Lives [Siam News](#)

Science and Culture: Can the principles of topology help improve the world's slums? [PNAS](#)

Why a 1925 book is still relevant to urban sociology [UChicago News](#)

Bettencourt to Deliver Buthman Lecture March 28 [Hendrix College News](#)

The Excruciating, Impossible Science of Airport Delays [Wired](#)

From the Technician to the world. It is in physics that a new generation of Portuguese geniuses is born [dn insider](#)

2018 How mapping the Galápagos could create more sustainable cities [UChicago News](#)

Math Helps Sprawling Cities Grow Sustainably And Reduce Slum Conditions [Forbes](#)

Scientists develop tools to bring infrastructure to slums [UChicago News](#)

Mansueto Institute Seminar: Juval Potugali [Dialogo](#)

Here Are 5 Predictions for the Future of Our Cities [Brink News](#)

The Future of Urban Innovation [Apple Podcasts](#)

Podcast: Science combines with data to reveal complexity of cities  
[UChicago News](#)

The circular economy could save life on Earth – starting with our cities  
[World Economic Forum](#)

The Math Behind a Localized Approach to the UN's Sustainable  
Development Goals [Next City](#)

2017 The city is not a massive machine, says Luis Bettencourt [LiveMint](#)

Why Even the Hyperloop Probably Wouldn't Change Your Commute Time  
[NY Times](#)

Luis Bettencourt named inaugural director of Mansueto Institute for Urban  
Innovation [UChicago News](#)

The New Urban Science [The Chronical of Higher Education](#)

Understanding Our Cities, Thanks To Beautiful Maps [Forbes](#)

Canada needs a fuller house to thrive – but population growth isn't  
enough [The Globe and Mail](#)

2016 Y Combinator's Plan to Build a New City? Not Actually Crazy [Wired](#)

The Relationships Between Skyscrapers and Great Cities [City Lab](#)

Urban Transit's Uncertain Future [Nova](#)

These Cities Could Lead the Driverless Car Revolution [Fortune](#)

Policy: Urban physics [Nature](#)

Medieval cities not so different from modern European cities, according  
to study [Phys Org](#)

What might Jane Jacobs say about smart cities? [The Conversation](#)

Applied Mathematics To Design The Perfect Future City [WorldCrunch](#)

2015 A Planet of Cities [Christian Science Monitor](#)

Ancient and modern cities aren't so different [EurekAlert!](#)

As World Crowds In, Cities Become Digital Laboratories [Wall Street  
Journal](#)

History Repeats Itself: Ancient Cities Grew Much Like Modern Ones [Live Science](#)

Creating an Equation for Cities May Solve Ecological Conundrums [The Smithsonian Magazine](#)

The Typical Lifespan of a Business, According to Science [BAI](#)

This is how long your business will last, according to science [Fortune](#)

Follow Friday: The Secrets of How Cities Work [Wired](#)

2014 What Ancient Aztecs Shared with Modern New Yorkers [Time](#)

What Is a City? [The Atlantic](#)

Is Civilization Natural? [NPR](#)

Ancient settlements and modern cities follow same rules of development [Science Daily](#)

Easy Solutions to S.F.'s Housing Crisis? Beware Unintended Consequences [San Francisco Public Press](#)

Beyond Bricks and Mortar: Building More Inclusive Cities to Lift the Urban Poor [World Bank News](#)

Suicide rates drop in big cities [Science News](#)

Proposed Philly Ban Would Impact One-Third of Neighborhood's Businesses [Next City](#)

What a 1967 Government Pamphlet Predicted About the Future of U.S. Cities [Next City](#)

2013 Scientific Proof that Cities are like Nothing Else in Nature [City Lab](#)

Life in the City is Essentially one Giant Math Problem [Smithsonian](#)

Solar and wind innovation reflected in booming patents [USA Today](#)

Scientists Looking to Solve the Problem of Slums Devise a New Way to Look at Big Data [TXchnologist](#)

Cities are a new kind of complex system: Part social reactor, part network [Science Daily](#)

The city triumphs, again [The Economist](#)

A Mathematical Guide to the World's Most Livable Cities [Scientific American](#)

Cities Grow And Behave As Coherent Entities [Inside Science](#)

- All That 'Anonymous' Cell Phone Data Tracking Can Actually Identify You [Business Insider](#)
- Innovative Cities Superlinear and Progressive [Net News Ledger](#)
- 2012 The laws of the city [The Economist](#)
- Sustainability in the new urban age [BBC](#)
- Gigalopolises: Urban Land Area May Triple by 2030 [Scientific American](#)
- 2011 Too Hard for Science? Simulating the human brain [Scientific American](#)
- Collaboration: the mother of invention [Boston Globe](#)
- It's biology: all cities are alike [Sydney Morning Herald](#)
- 2010 A Physicist Solves The City [NY Times](#)
- A unified theory of urban living [Nature](#)
- 2009 Math and the City The New York Times Map of Knowledge [The New York Times](#)
- Knowledge, in Real Time [SEED Magazine](#)
- Web usage data outline map of knowledge [Nature News](#)
- A New Picture of the Two Cultures [SEED Magazine](#)
- Map of Science Looks Like Milky Way [Wired Science](#)
- Why the future of humanity and the long-term sustainability of the planet are inextricably linked to the fate of our cities. [SEED Magazine](#)
- How the Crash Will Reshape America [The Atlantic](#)
- User Clickstreams Lead To A 'Map Of Science' [Science 2.0](#)
- 2008 Computer just might reveal the secrets of the brain [Santa Fe New Mexican](#)
- Scientists examine new way to track outbreaks [Santa Fe New Mexican](#)
- Modeling the Emergence and Development of Scientific Fields [U.S. Department of Energy: Office of Scientific and Technical Information](#)
- 2007 To escape flu - move to the country [Telegraph.co.uk](#)
- The urban organism [Nature News and Views](#)
- If You Can Make it There: Cities Are the Greatest Generators of Innovation and Wealth [Scientific American](#)

Big cities need a fast-paced life to grow [Nature News](#)

Innovation and Growth: Size Matters [Breakthrough Ideas for 2007: Harvard Business Review](#)

Ideas: the lifeblood of cities [New Scientist](#)

The Living City: A new science applies metabolism to the metropolis  
[SEED Magazine](#)

## PROJECTS AND GRANTS

---

2021 – present	“PRESUR: Planning a Resilient and Equitable State Using Real-time data” (Co-Investigator, Principal Investigator Isabel Cruz) Discovery Partners Institute, \$125,000, University of Illinois at Chicago/University of Chicago/University of Illinois at Urbana-Champaign.
2016-2021	“Information Networks and the Evolution of Social Organizations” (Co-Investigator, Principal Investigator D. Wolpert) National Science Foundation, \$770,000, Santa Fe Institute.
2014 - 2016	“Human Development and Community Dynamics in Cities Around the World,” (Principal Investigator, Luís Bettencourt), The John D. and Catherine T. MacArthur Foundation, \$182,381, 1/1/2014 – 1/1/2016, Santa Fe Institute.
2012 - 2014	“Collection, Organization and Analyses of Community Based Survey Data from informal Settlements,” (Principal Investigator, Luís Bettencourt), Bill and Melinda Gates Foundation, \$1,025,572, 11/1/2012 – 12/31/2014, Santa Fe Institute.
2010 – 2012	“Energy and Environmental Drivers of Stress and Conflict in Multi-scale Models of Human Social Behavior,” (Principal Investigator, Luís Bettencourt), Army Research Office, \$400,000, 3/15/2010 – 3/15/2012, Santa Fe Institute.
2010	“Comprehensive Program to Develop Theory and Applications of Urban Organization and Dynamics,” (Co-Principal Investigator, Luís Bettencourt), Rockefeller Foundation, \$203,043, 4/1/2010 – 9/30/2010, Santa Fe Institute.
2010 – 2015	“Predictive Modeling of the Emergence Development of Scientific Fields,” (Co-Principal Investigator, Luís Bettencourt),



MIT / NSF, \$92,664, 7/1/2010 – 6/30/2012, Santa Fe Institute, Investigator: REU Site SFI's Transdisciplinary Research through Computational Modeling in the Social, Biological, and Physical Sciences Program

NSF, \$623,856, 06/01/10 – 05/31/2015, Santa Fe Institute.

- 2010 – 2011 “Innovation and Growth of Human Social Organizations from Cities to Corporations,” (Co-Principal Investigator, Luís Bettencourt), NSF, \$106,425, 04/01/10 – 3/31/2011, Santa Fe Institute.
- 2009 – 2012 “Towards a Predictive Theory of Social Organization and Dynamics in Cities,” (Principal Investigator, Luís Bettencourt), James S. McDonnell Foundation, \$437,131, 9/1/2009 – 8/31/2012, Santa Fe Institute.
- 2008 – 2011 “Mapping the Structure and Evolution of Sustainability Science,” (Principal Investigator, Luís Bettencourt), NSF, \$82,802, 8/1/2008 – 1/31/2011, Santa Fe Institute.
- 2008 – 2011 “Synthetic Cognition through Petascale Models of the Primate Visual Cortex,” (Principal Investigator, Luís Bettencourt), Department of Energy, \$4,700,000, October 2008 – October 2011, Los Alamos National Laboratory
- 2009 – 2012 “Robust unsupervised operation under uncertainty through information theoretic optimization,” (Co-Principal Investigator, Luís Bettencourt), Los Alamos National Laboratory LDRD, \$1,110,900, 10/01/2009 – 10/01/2012, Los Alamos National Laboratory
- 2004 – 2007 “Modeling the structure and dynamics of neural networks grown in vitro,” (Principal Investigator, Luís Bettencourt), Los Alamos National Laboratory LDRD, \$900,000, 10/01/2004 – 10/01/2007, Los Alamos National Laboratory

## HONORS AND AWARDS

---

- 2019 Elected “Member-at-Large” American Association for the Advancement of Science, Section K: Social, Economic and Political Sciences
- 2016 Invited to White House Frontiers Conference.
- 2015 Member of PCAST's (President's Council of Advisors on Science and Technology) Working Group on “Technology and the Future of Cities.”
- 2015 Member of the World Cities Summit Young Leaders (WCSYL) network.
- 2014 Kavli Fellow of the US National Academies of Science Presentation at Frontiers in Science Japan-USA, Tokyo.

2017	Best Paper European Complex Systems Society annual meeting.
2003	Computer Research Association International Conference award "Grand Research Challenges in Information Security and Assurance", Airlie House, Warrenton, Virginia.
2000	Slansky Distinguished Postdoctoral Fellowship, Theoretical Division. Los Alamos National Laboratory, for interdisciplinary research.
1998 – 2000	Director's Postdoctoral Fellowship. Los Alamos National Laboratory. Portuguese National Science Foundation (JNICT)
1992 – 1996	Post-graduate Award, to conduct postgraduate studies leading a PhD degree.
1990 – 1992	Fellowship for Young Researchers, by INIC, Portuguese National Institute for Scientific Research, while an undergraduate.

## GRADUATE SUPERVISION AND TEACHING EXPERIENCE

---

2019 – current	Jordan Kemp, Physics Doctoral student research mentorship and degree sponsorship, Mansueto Institute for Urban Innovation, University of Chicago, Chicago, U.S.A.
2019 – current	Suraj Sheth, MD/PhD Ecology and Evolution Doctoral student research mentorship and degree sponsorship, University of Chicago, Chicago, U.S.A.
2019 – 2020	Cooper Nederhood, Graduate Thesis and Institute Research Supervision Masters Computational Social Science, Mansueto Institute for Urban Innovation, University of Chicago, Chicago, U.S.A.
2019 – 2020	Satej Soman, Graduate Thesis and Institute Research Supervision Masters in Computational Analysis and Public Policy, Mansueto Institute for Urban Innovation, University of Chicago, Chicago, U.S.A.
2018 – 2020	Daniel Zuend, Postdoctoral Fellow Supervision and Mentorship, Mansueto Institute for Urban Innovation, University of Chicago, Chicago, U.S.A.
2019	External Mentor: Santa Fe Institute Omidyar Fellow Vicky Chuqiao Yang, Santa Fe Institute, Santa Fe, U.S.A.
2019	Workshop Mentor: Norman Foster Foundation On Cities Workshop, Norman Foster Foundation, Madrid, Spain.

2018 – current	Professor: Theoretical Ecology Graduate Student Courses, Department of Ecology and Evolution, University of Chicago, Chicago, U.S.A.
2018, 2019	Guest Professor: The School of Architecture and Interior Design of the University of San Francisco de Quito, International Architecture Studio in The Galapagos Islands, "Cities in Natural Protected Areas."
2016	Curriculum Committee: ASU / SFI Masters in Complex Systems
2016	Faculty Director Global Sustainability Summer School: Urban Sustainability (2016).
2011, 2014	Lecturer Santa Fe Institute Complex Systems Summer School.
2014	Lecturer Lipari Summer School "Smart Cities."
1999-2003,	Supervisor and mentor for summer students at SFI and LANL.
2007-2011	These are Summer graduate programs for undergraduates and graduate students to experience research at LANL and SFI
1997	Tutor at BUSSTEP., British Universities Summer School in Theoretical High Energy Physics, University of Sussex, Falmer, U.K. September 9-24, 1997. Tutors are selected among promising senior postdocs to cover the materials in the school's syllabus. These reflect the perceived basic and new exciting fields of high energy Physics and Cosmology. My field of expertise was non-equilibrium quantum fields.
1994 – 1995	Teaching Assistant in Dynamical Systems and Chaos, Imperial College, London, England. October 1994-January 1995.
1993 – 1994	Teaching Assistant in Quantum Mechanics, Imperial College, London, England. October 1993-January 1994.
1992	Teaching Assistant in Thermodynamics, Instituto Superior Tecnico, Lisbon, Portugal. February 1992-July 1992.
1991 – 1992	Assistant in Classical Electrodynamics Instituto Superior Tecnico, Lisbon, Portugal. October 1991-January 1992.
1996 – 1997	Assisted with final examinations for Physics undergraduates at the University of Heidelberg, between October 1996 and November 1997.

## PROFESSIONAL MEMBERSHIPS

---

Member of the College Council at the University of Chicago.

Advisory Committee Environmental Community (Eco) Network at the University of Chicago.

Member of Committee on the Environment, Geography and Urbanization (CEGU) at the University of Chicago.

Member of Scientific Discovery through Advanced Computing (SciDAC) at the University of Chicago.

Head of Committee on Urban Science and Sustainability at the University of Chicago.

Member of Center for Data and Computing (CDAC) Steering Committee at the University of Chicago.

Member of Urban Architecture and Design (UAD) Committee at the University of Chicago.

Member of Program on Global Environment (PGE) at the University of Chicago.

American Association for the Advancement of Science (AAAS). Member American Association Geographers Member of Executive Committee of the Center for Non-linear Studies (Los Alamos National Laboratory). Member-at-Large for Section K (Social, Economic & Political Sciences).

Advisory Council member of Foundation for Food and Agriculture Research (FFAR).

Member of Committee on Geographical Sciences at the University of Chicago.

Member of Social Reactors Working Group CU Boulder Department of Anthropology and ASU/SFI Center for Biosocial Complex Systems.

Member of Search Committee Deputy Division Leader, Theoretical Division. Los Alamos National Laboratory.

Member of Editorial Board of Mathematics in Computer Science and Sustainability.

## **OTHER SCIENTIFIC ACTIVITIES**

---

Speaker, Annual Applied Complexity Network and Board of Trustees Symposium "The 21st Century Question: Emergently Engineering the Future," Santa Fe Institute, Santa Fe U.S.A., November 2022.

Moderator and Organizer, Impact on Human Health panel | A Joint Forum on Addressing the Climate & Energy Challenge, UChicago Global, Chicago, U.S.A., October 2022.

Speaker, SatSummit 2022, Washington DC, U.S.A., September 2022.

Speaker, Cornell Mui Ho Center for Cities Launch Symposium, Cornell University, Ithaca, U.S.A., September 2022.

Participant, Strengthening the role of Cities in the Global Sustainable Development Agenda, Indian Intitute for Human Settlements, New York City, September 2022.

Science of Cities Knowledge Council Member and Speaker, World Cities Summit, Centre for Liveable Cities, Singapore, August 2022

Speaker, Workshop on Quantitative Human Ecology, International Centre for Theoretical Physics, Trieste, Italy, July 2022.

Organizer, The 8th International Conference on Computational Social Science, University of Chicago, Chicago, U.S.A., July 2022.

Organizer, Kreisman for Housing Law and Policy Symposium – “Beyond the Single-Family Home: Zoning, Equity, and Access,” University of Chicago, Chicago, U.S.A., May 2022.

Organizer, Metrolab, University of Chicago, Chicago, U.S.A., April 2022.

Speaker, Distinguished Webinar Series—Urban Systems Forum, The University of Hong Kong, Hong Kong, Virtual, April 2022.

Speaker, Lecture in Planning Series (LiPS), Columbia University Graduate School of Architecture, Planning and Preservation, New York City. U.S.A., Virtual, March 2022.

Speaker, New York University Center for Urban Science and Progress Seminar Series, New York City. U.S.A., Virtual, March 2022.

Speaker, Futuro Remoto 2021, Napoli, Italy, Virtual, November 2021.

Keynote, The Geography of Neighborhoods: Understanding the Human Geography Fabric of Neighborhoods, World-Wide Human Geography Data Working Group (WWHGD), Virtual, November 2021.

Keynote Lecture, The European Colloquium on Theoretical and Quantitative Geography, The University of Manchester, November 2021.

Speaker, Geopalooza 2.0, Bill & Melinda Gates Foundation, Virtual, October 2021.

Speaker, USS Lecture Series, Institute of Urban Environment, China Academy of Science, Virtual, Oct 2021.

Speaker, “Thought Leadership Dialogue” with Singapore’s Minister for National Development, Mr. Desmond Lee, Centre for Liveable Cities, Singapore, Virtual, October 2021.

Speaker, Complexity Science Research Community Workshop, Centre for Liveable Cities, Singapore, Virtual, October 2021.

Organizing Committee, Data-Informed Societies Achieving Sustainability Workshop, National Academies of Science, Engineering and Medicine, WSHING TON DC, U.S.A., Virtual, September 2021.

Speaker, Multi-Sector Dynamics Community of Practice Workshop, Oak Ridge National Laboratory, Virtual, July 2021.

Visiting Virtual Fellow, Centre for Liveable Cities, Singapore, Virtual, July 2021.

Speaker, 4th Tripartite ACP/EC/UN-Habitat Conference, Land, Housing and Shelter Section, Urban Practices Branch | UN-HABITAT, Virtual, July 2021.

Keynote Speaker, Sustainability Science Days 2021, University of Helsinki, Virtual, May 2021.

Speaker, America Resilient Climate Conference, Argonne National Laboratory, Virtual, April 2021.

Participant and Speaker, Lausanne Workshop - Healthy Urban Systems Workshop and MOOC, University of Lausanne, Virtual, September 2020.

Speaker, Microsoft Urban Futures Summer Workshop, Microsoft Corporation, Virtual, July 2020.

Organizer, Speaker, and Exhibitor at WUF 10, Mansueto Institute for Urban Innovation, University of Chicago, UN Habitat, Abu Dhabi, UAE, February 2020.

Invited Lecturing Guest Urban Thought Leader Symposium, Cornell University, Ithaca, U.S.A., February 2020.

Member of Institute of Design External Review Committee, Illinois Institute of Technology, Chicago, U.S.A. January 2020

Invited Member of External Review Team, Urban Resources Initiative and the Hixon Center Yale University, New Haven, U.S.A., Jan 2020.

Presenter, Conference on "Improving Lives of the Urban Poor" at the University of Chicago Center in Delhi, Delhi, India, December 2019.

Speaker, Advancing Urban Sustainability in China and the United States  
A National Academies Workshop in Collaboration with the Chinese Academy of Sciences, Washington, DC, U.S.A., December 2019.

Speaker and Participant, City Managers Days 2019: Digitalization of Metropolitan Spaces, Barcelona, Spain, November 2019.

Participant, 'The City 2.0: smart People, Places, Planning' held at the Kennedy School of Harvard University in Cambridge, Boston, U.S.A., November 2019.

Organizer, Speaker, Moderator, Global Symposium on Sustainable Cities and Neighborhoods, Mansueto Institute for Urban Innovation, University of Chicago, Chicago, U.S.A., October 2019.

Participant, Global Urban Network Workshop, University of Toronto, Toronto, Canada, October 2019.

Participant, Graduate Education for a New Sustainable Urban Systems Science: Designing a New PhD Curriculum Integrating Sustainability Science and Urban Science, Arizona State University, Tempe, U.S.A., September 2019.

Speaker and Participant, CURES Connections Workshop: New Voices and Paths to Urban Sustainability, Discovery Partners Institute, Chicago, U.S.A., August 2019.

Organizer, Moderator, Speaker, Lecturer, Global Sustainability Summer School, Santa Fe Institute, Santa Fe, U.S.A., July 2019.

Speaker, 2019 Pritzker Forum on Global Cities, Chicago Council on Global Affairs, Chicago, U.S.A., June 2019.

Participant, Workshop on Urban Scale Processes and their Representation in High Spatial Resolution Earth System Models, Argonne National Laboratory, Lemont, U.S.A., May 2019.

Speaker, University of Toronto Department of Civil+Mineral Engineering 2018/2019 Distinguished Lecture series, University of Toronto, Toronto, Canada, April 2019.

Speaker, Participant, University of Chicago—Tel Aviv University Workshop on Cities and Urbanism, City Center—Research Center for Cities and Urbanism, Tel Aviv University, April 2019.

Organizer, Speaker, Cities and Urbanization in China Workshop, Mansueto Institute for Urban Innovation, University of Chicago, March 2019.

Speaker and Visiting Lecturer at Lee Kuan Yew Centre for Innovative Cities, Singapore, Republic of Singapore, January 2019.

Member and Guest Expert, Urban Solutions and Sustainability International Advisory Panel (USS IAP) Singapore, Republic of Singapore, January 2019.

Speaker, Participant for the NASEM Data, Modeling, Simulation for Urban Sustainability Workshop, Washington, DC, January 2019.

Moderator by Invitation, Conference on "Life in India's Slums" at the University of Chicago Center in Delhi, Delhi, India, December 2018.

Keynote, Urban Transitions 2017, Scientific Committee, Elsevier, Sitges, Barcelona, Spain, November 2018.

Speaker, Association of Collegiate Schools of Planning (ACSP) Annual Conference, Buffalo Niagara Convention Center, Buffalo, U.S.A., October 2018.

Invited Participant, Project discussion group with Nicholas Negro Ponte and the Norman Foster Foundation, On the Future of Cities, MIT, Boston, MA, October 2018.

Speaker, Life in India's Slums Conference, Delhi, India, September 2018.

Opening Keynote, Energy Innovation Trends, NREL Partner Forum, Golden, U.S.A., August 2018.

Invited to participate in an Analytic Exchange titled “Trends in Urbanization in Sub-Saharan Africa” on the “Building Sustainable Cities” Panel co-sponsored by the Bureau of Intelligence and Research of the U.S. Department of State and the National Intelligence Council, July 2018.

Guest, 2018 HLPF Local and Regional Governments' Forum, New York City, U.S.A., July 2018.

Speaker, Civitas at Large: A Public Conversation, Dimensions of Citizenship, University of Chicago and the School of the Art Institute of Chicago, U.S. Pavilion, Venice Biennale, Venice, Italy, May 2018.

Panel Member, Today’s “Smart” City, Rockefeller CityXChange, Bellagio Center, Italy, May 2018.

Speaker, Participant, Smart Cities Week Silicon Valley, Santa Clara, CA, May 2018.

Speaker, WRI Ross Center for Sustainable Cities, Washington, DC, February 2018.

Organizer and Speaker, US-China Forum, Mansueto Institute for Urban Innovation, University of Chicago, Chicago, U.S.A., October 2017.

Consultant for Department of Energy, Office of Science and Technology Information (OSTI).

Reviewer for Department of Energy, National Science Foundation, National Institutes of Health, UK’s EPSERC, Netherlands Organization for Scientific Research and Swiss National Science foundation.

Member of the American Physical Society (APS), Society for Pure and Applied Mathematics (SIAM), Society for Neuroscience (SfN), and Society for American Archeology (SAA).

Scientific Committee of “International Conference on mathematical aspects of Computer and information Sciences” (MACIS 2006), Beijing, China, July 2006 and of several other International conferences in Information Sciences, Computer Science and complex Systems.

Organizing Committee of “Opportunities and Challenges in Distributed Sensor Networks”, LANL/CNLS March 2006.

Organizer of "Information Processing in Complex Systems" Seminar series, held at the Center for Non-Linear Science, LANL.

Referee for Science, Nature, Proceedings of the National Academy of Sciences (USA), Nature Physics, Complexity, Chaos, Physical Review Letters, Physical Review A, Physical Review D, Physical Review E, Physics Letters A, Annals of Physics, Physics of Plasmas, Journal of Statistical Physics, Physica A, Quantum and Classical Gravity, Journal of Artificial Societies and Social Simulation, Urban studies and several others.

Scientific Secretary of School and A.S.I. in Current Topics in Astro-fundamental Physics, Erice, September 1994.



Assistant Coordinator of A.S.I. in Electroweak Physics and The Early Universe, Sintra, Portugal, March 1994.

## ALGORITHMIC AND COMPUTATIONAL EXPERIENCE

---

Expertise in deep learning networks, bayesian inference methods, information theoretic optimization, numerical methods for ordinary and partial Differential Equations, stochastic systems, nonlinear dynamics, statistical inference from data, time series analyses, scaling analyses, and graph theory.

I know Unix/Linux, OS X operating systems and Python, PERL, c, HTML, D3 and several other data analysis, plotting and symbolic manipulation platforms: such as Mathematica, R, MATLAB.

## LANGUAGE PROFICIENCY

---

I have native proficiency in Portuguese and English. I have fluent communication skills in Spanish, French and German and some oral proficiency in Italian.

## PATENTS

---

Image fusion using sparse over-complete feature dictionaries, S. P. Brumby, L. M. A. Bettencourt, G. T. Kenyon, R. Chartrand, B. Wohlberg. USPTO patent number 9152881 (2015).

## PUBLICATION LIST

---

147. Kemp, J. T., & Bettencourt, L. (2022). The Bayesian Origins of Growth Rates in Stochastic Environments. arXiv preprint arXiv:2209.09492.
146. Kaufmann, T., Radaelli, L., Bettencourt, L. M., & Shmueli, E. (2022). Scaling of urban amenities: generative statistics and implications for urban planning. EPJ Data Science, 11(1), 50.
145. Lobo, J., Whitelaw, T., Bettencourt, L. M., Wiessner, P., Smith, M. E., & Ortman, S. (2022). Scaling of Hunter-Gatherer Camp Size and Human Sociality. Current Anthropology, 63(1), 68-94.
144. Taajamaa, V., Joensuu, M., Karanian, B., & Bettencourt, L. (2022). Seven Steps to Strategic SDG Sensemaking for Cities. Administrative Sciences, 12(1), 33.
143. Stier, A. J., Schertz, K. E., Rim, N. W., Cardenas-Iniguez, C., Lahey, B. B., Bettencourt, L. M., & Berman, M. G. (2022). Reply to Huth et al.: Cities are defined by their spatially aggregated socioeconomic networks. Proceedings of the National Academy of Sciences, 119(2), e2119313118.

142. Lobo, J., Alberti, M., Allen-Dumas, M., Bettencourt, L., Beukes, A., Bojórquez Tapia, L. A., ... & Wu, J. (2021). A convergence research perspective on graduate education for sustainable urban systems science. *npj Urban Sustainability*, 1(1), 1-5.
141. Kemp, J. T., & Bettencourt, L. M. (2022). Statistical dynamics of wealth inequality in stochastic models of growth. *Physica A: Statistical Mechanics and its Applications*, 607, 128180.
140. Bettencourt, L. M. (2021). New Empirically Driven Approaches to Inclusive Human Development in Cities. In *Sustainable Development Goals and Indian Cities* (pp. 119-136). Routledge India.
139. Bettencourt, L. M. (2021). *Introduction to Urban Science: Evidence and Theory of Cities as Complex Systems*. MIT Press.
138. Fulminante, F., Hanson, J. W., Ortman, S. G., & Bettencourt, L. M. (Eds.). (2021). *Where Do Cities Come From and Where Are They Going To? Modelling Past and Present Agglomerations to Understand Urban Ways of Life*. Frontiers Media SA.
137. Stier, A. J., Schertz, K. E., Rim, N. W., Cardenas-Iniguez, C., Lahey, B. B., Bettencourt, L. M., & Berman, M. G. (2021). Evidence and theory for lower rates of depression in larger US urban areas. *Proceedings of the National Academy of Sciences*, 118(31).
136. Bettencourt, L. M. (2021). Complex networks and fundamental urban processes. In *Handbook of Cities and Networks*. Edward Elgar Publishing.
135. Stier, A. J., Berman, M. G., & Bettencourt, L. M. (2021). Early pandemic COVID-19 case growth rates increase with city size. *npj Urban Sustainability*, 1(1), 1-6.
134. Sahasranaman, A., & Bettencourt, L. M. (2021). Life between the city and the village: Scaling analysis of service access in Indian urban slums. *World Development*, 142, 105435.
133. Tian, A., Zünd, D., & Bettencourt, L. (2021). Estimating rooftop solar potential in urban environments: A generalized approach and assessment of the Galapagos Islands. *Frontiers in Sustainable Cities*, 49.
132. Tandel, V., Gandhi, S., Patranabis, S., Bettencourt, L., & Malani, A. (2021). Infrastructure, enforcement and COVID-19 in Mumbai slums: A first look. *Mansueto Institute for Urban Innovation Research Paper*, (27).
131. Schertz, K. E., Saxon, J., Cardenas-Iniguez, C., Bettencourt, L. M., Ding, Y., Hoffmann, H., & Berman, M. G. (2021). Neighborhood street activity and greenspace usage uniquely contribute to predicting crime. *npj Urban Sustainability*, 1(1), 1-10.
130. Zünd, D., & Bettencourt, L. (2021). Street View Imaging for Automated Assessments of Urban Infrastructure and Services. In *Urban Informatics* (pp. 29-40). Springer, Singapore.
129. Elmqvist, T., Andersson, E., McPhearson, T. et al. Urbanization in and for the Anthropocene. *npj Urban Sustain* 1, 6 (2021).

128. Brandtner, C., Bettencourt, L. M., Berman, M. G., & Stier, A. J. (2021). Creatures of the state? Metropolitan counties compensated for state inaction in initial US response to COVID-19 pandemic. *PloS one*, 16(2), e0246249.
127. Bettencourt, L., & Soman, S. (2020). Systems Architecture for Real Time Epidemiological Prediction and Control. *Mansueto Institute for Urban Innovation Research Paper*, (26).
126. Soman, S., Beukes, A., Nederhood, C., Marchio, N., & Bettencourt, L. (2020). Worldwide detection of informal settlements via topological analysis of crowdsourced digital maps. *ISPRS International Journal of Geo-Information*, 9(11), 685.
125. Bettencourt, L. M., & Zünd, D. (2020). Demography and the emergence of universal patterns in urban systems. *Nature communications*, 11(1), 1-9.
124. Bettencourt, L. M. (2020). Urban growth and the emergent statistics of cities. *Science advances*, 6(34).
123. Malani, A., Soman, S., Asher, S., Novosad, P., Imbert, C., Tandel, V., ... & Bettencourt, L. M. (2020). *Adaptive control of COVID-19 outbreaks in India: local, gradual, and trigger-based exit paths from lockdown* (No. w27532). National Bureau of Economic Research.
122. Bettencourt, L. (2020). The Quantitative Relation between National Levels of Urbanization and Economic Growth. *Mansueto Institute for Urban Innovation Research Paper*, (18).
121. Bettencourt, L. M., Yang, V. C., Lobo, J., Kempes, C. P., Rybski, D., & Hamilton, M. J. (2020). The interpretation of urban scaling analysis in time. *Journal of the Royal Society Interface*, 17(163), 20190846.
120. Lobo, J., Alberti, M., Allen-Dumas, M., Arcaute, E., Barthelemy, M., Bojorquez Tapia, L. A., ... & Youn, H. (2020). Urban science: Integrated theory from the first cities to sustainable metropolises.
119. Bettencourt, L., & Lobo, J. (2019). Quantitative Methods for the Comparative Analysis of Cities in History. *Frontiers in Digital Humanities*, 6, 17.
118. Lobo, J., Bettencourt, L. M., Smith, M. E., & Ortman, S. (2020). Settlement scaling theory: Bridging the study of ancient and contemporary urban systems. *Urban Studies*, 57(4), 731-747.
117. Lobo, J., Alberti, M., Allen-Dumas, M., Bettencourt, L., Beukes, A., Neal, Z. P., ... & Wu, J. (2019). Graduate education for a new sustainable urban systems science: Designing a new PhD curriculum integrating sustainability science and urban science. *Mansueto Institute for Urban Innovation Research Paper*, (14).
116. Bettencourt, L. M., & Zünd, D. (2020). Demography and the emergence of universal patterns in urban systems. *Nature communications*, 11(1), 1-9.

115. Sahasranaman, A., & Bettencourt, L. M. (2021). Economic geography and the scaling of urban and regional income in India. *Environment and Planning B: Urban Analytics and City Science*, 48(3), 540-554.
114. Zünd, D., & Bettencourt, L. (2018). Growth and urban development in prefecture-level China. *Mansueto Institute for Urban Innovation Research Paper*, (1).
113. Sahasranaman, A., & Bettencourt, L. M. (2021). Life between the city and the village: Scaling analysis of service access in Indian urban slums. *World Development*, 142, 105435.
112. Romero Lankao, P., Wilson, A., Sperling, J., Miller, C., Zimny-Schmitt, D., Bettencourt, L., ... & Zünd, D. (2019). Urban electrification: Knowledge pathway toward an integrated research and development agenda.
111. Hanson, J. W., Ortman, S. G., Bettencourt, L. M., & Mazur, L. C. (2019). Urban form, infrastructure and spatial organisation in the Roman Empire. *antiquity*, 93(369), 702-718.
110. Bettencourt, L. M. (2019). Towards a statistical mechanics of cities. *Comptes Rendus Physique*, 20(4), 308-318.
109. Bettencourt, L. M. (2019). Designing for complexity: the challenge to spatial design from sustainable human development in cities. *Technology/Architecture+ Design*, 3(1), 24-32.
108. Sahasranaman, A., & Bettencourt, L. M. (2019). Urban geography and scaling of contemporary Indian cities. *Journal of the Royal Society Interface*, 16(152), 20180758.
107. Bettencourt, L. M. (2019). Critical Paths to Sustainability: The Research Challenge from Island Urban Systems. In *Urban Galapagos* (pp. 155-160). Springer, Cham.
106. Batty, M., Bettencourt, L. M., & Kirley, M. (2019). Understanding coupled urban-natural dynamics as the key to sustainability: the example of the Galapagos. In *Urban Galapagos* (pp. 23-41). Springer, Cham.
105. Brelsford, C., Martin, T., Hand, J., & Bettencourt, L. M. (2018). Toward cities without slums: Topology and the spatial evolution of neighborhoods. *Science advances*, 4(8), eaar4644.
104. Brelsford, C., Lobo, J., Hand, J., & Bettencourt, L. M. (2017). Heterogeneity and scale of sustainable development in cities. *Proceedings of the National Academy of Sciences*, 114(34), 8963-8968.
103. Bettencourt, L. M., & Gonzales, J. (2016). Science and practice for thriving cities. *Innovations: Technology, Governance, Globalization*, 11(1-2), 20-30.
102. Bettencourt, L.M. (August 22, 2016). *Make it Bigger: Science for the Age of Digital Social Technologies*. SSRC Items Insight from the Social Sciences. <https://items.ssrc.org/parameters/make-it-bigger-science-for-the-age-of-digital-social-technologies/>

101. Schlöpfer, M., Lee, J., & Bettencourt, L. (2015). Urban skylines: building heights and shapes as measures of city size. *arXiv preprint arXiv:1512.00946*.
100. Brelsford, C., Martin, T., & Bettencourt, L. M. (2019). Optimal reblocking as a practical tool for neighborhood development. *Environment and Planning B: Urban Analytics and City Science*, 46(2), 303-321.
99. Bettencourt, L. M., & Lobo, J. (2016). Urban scaling in Europe. *Journal of The Royal Society Interface*, 13(116), 20160005.
98. Cesaretti, R., Lobo, J., Bettencourt, L. M., Ortman, S. G., & Smith, M. E. (2016). Population-area relationship for Medieval European cities. *PloS one*, 11(10), e0162678.
97. Bettencourt, L. M., Hand, J., & Lobo, J. (2015). Spatial Selection and the Statistics of Neighborhoods. *Santa Fe Institute Working Paper 2015-06-020*: 1–67.
95. Brelsford, C., Martin, T., Hand, J., & Bettencourt, L. M. (2015). The topology of cities. Santa Fe Institute Working Paper XXX
95. Bettencourt, L., & Kaiser, D. I. (2015). Formation of scientific fields as a universal topological transition. *arXiv preprint arXiv:1504.00319*.
94. Bettencourt, L.M. (September 21, 2015). *Opportunities for Social Theory in the Age of Big Data*. SSRC City Papers. <http://citiespapers.ssrc.org/opportunities-for-social-theory-in-the-age-of-big-data/>
93. Bettencourt, L., Lobo, J., & Youn, H. (2013). The hypothesis of urban scaling: formalization, implications and challenges. *arXiv preprint arXiv:1301.5919*.
92. Youn, H., Strumsky, D., Bettencourt, L. M., & Lobo, J. (2015). Invention as a combinatorial process: evidence from US patents. *Journal of the Royal Society interface*, 12(106), 20150272.
91. Ortman, S. G., Cabaniss, A. H., Sturm, J. O., & Bettencourt, L. M. (2015). Settlement scaling and increasing returns in an ancient society. *Science advances*, 1(1), e1400066.
90. Bettencourt, L. M., & Brelsford, C. (2015). Industrial ecology: The view from complex systems. *Journal of Industrial Ecology*, 19(2), 195-197.
89. Bettencourt, L. M. (2015). Cities as complex systems. *Modeling complex systems for public policies*, 217-236.
88. Wang, Y., Kang, C., Bettencourt, L. M., Liu, Y., & Andris, C. (2015). Linked activity spaces: Embedding social networks in urban space. In *Computational approaches for urban environments* (pp. 313-336). Springer, Cham.
87. Bettencourt, L. (2013). The kind of problem a city is. *Die Stadt Entschlüsseln: Wie Echtzeitdaten Den Urbanismus Verändern: Wie Echtzeitdaten den Urbanismus Verändern*, 175-187.

86. Daepf, M. I., Hamilton, M. J., West, G. B., & Bettencourt, L. M. (2015). The mortality of companies. *Journal of The Royal Society Interface*, 12(106), 20150120.
85. Andris, C., & Bettencourt, L. M. (2014). Development, information and social connectivity in Côte d'Ivoire. *Infrastructure Complexity*, 1(1), 1-18.
84. Bettencourt, L. M. (2014). Impact of changing technology on the evolution of complex informational networks. *Proceedings of the IEEE*, 102(12), 1878-1891.
83. Bettencourt, L. M. (2014). The uses of big data in cities. *Big data*, 2(1), 12-22.
82. Ortman, S. G., Cabaniss, A. H., Sturm, J. O., & Bettencourt, L. M. (2014). The pre-history of urban scaling. *PloS one*, 9(2), e87902.
81. Bettencourt, L. M., Samaniego, H., & Youn, H. (2014). Professional diversity and the productivity of cities. *Scientific reports*, 4(1), 1-6.
80. Schläpfer, M., Bettencourt, L. M., Grauwin, S., Raschke, M., Claxton, R., Smoreda, Z., ... & Ratti, C. (2014). The scaling of human interactions with city size. *Journal of the Royal Society Interface*, 11(98), 20130789.
79. Bettencourt, L. M. (2013). The origins of scaling in cities. *science*, 340(6139), 1438-1441.
78. Lobo, J., Bettencourt, L. M., Strumsky, D., & West, G. B. (2013). Urban scaling and the production function for cities. *PLoS One*, 8(3), e58407.
77. Gomez-Lievano, A., Youn, H., & Bettencourt, L. M. (2012). The statistics of urban scaling and their connection to Zipf's law. *PloS one*, 7(7), e40393.
76. Landecker, W., Thomure, M. D., Bettencourt, L. M., Mitchell, M., Kenyon, G. T., & Brumby, S. P. (2013, April). Interpreting individual classifications of hierarchical networks. In 2013 IEEE Symposium on Computational Intelligence and Data Mining (CIDM) (pp. 32-38). IEEE.
75. Schultz, P. F., Bettencourt, L. M., & Kenyon, G. T. (2012, April). A symmetry-breaking generative model of a simple-cell/complex-cell hierarchy. In *2012 IEEE Southwest Symposium on Image Analysis and Interpretation* (pp. 89-92).
74. Bettencourt, L. M., & West, G. B. (2011). Bigger cities do more with less. *Scientific American*, 305(3), 52-53.
73. Gintautas, V., Ham, M. I., Kunsberg, B., Barr, S., Brumby, S. P., Rasmussen, C., ... & Kenyon, G. T. (2011). Model cortical association fields account for the time course and dependence on target complexity of human contour perception. *PLoS computational biology*, 7(10), e1002162.
72. Burnside, W. R., Brown, J. H., Burger, O., Hamilton, M. J., Moses, M., & Bettencourt, L. M. (2012). Human macroecology: Linking pattern and process in big-picture human ecology. *Biological Reviews*, 87(1), 194-208.
71. Bettencourt, L. M., Trancik, J. E., & Kaur, J. (2013). Determinants of the pace of global innovation in energy technologies. *PloS one*, 8(10), e67864.

70. Bettencourt, L. M., & Kaur, J. (2011). Evolution and structure of sustainability science. *Proceedings of the National Academy of Sciences*, 108(49), 19540-19545.
69. Loxley, P. N., & Bettencourt, L. M. (2011). Visually-salient contour detection using a V1 neural model with horizontal connections. *arXiv preprint arXiv:1103.3531*.
68. Loxley, P. N., Bettencourt, L. M., & Kenyon, G. T. (2011). Ultra-fast detection of salient contours through horizontal connections in the primary visual cortex. *EPL (Europhysics Letters)*, 93(6), 64001.
67. Bettencourt, L., & West, G. (2010). A unified theory of urban living. *Nature*, 467(7318), 912-913.
66. Bettencourt, L. M., Lobo, J., Strumsky, D., & West, G. B. (2010). Urban scaling and its deviations: Revealing the structure of wealth, innovation and crime across cities. *PloS one*, 5(11), e13541.
65. Eagle, N., de Montjoye, Y. A., & Bettencourt, L. M. (2009, August). Community computing: Comparisons between rural and urban societies using mobile phone data. In *2009 international conference on computational science and engineering* (Vol. 4, pp. 144-150). IEEE.
64. Brumby, S. P., Kenyon, G., Landecker, W., Rasmussen, C., Swaminarayan, S., & Bettencourt, L. M. (2009, October). Large-scale functional models of visual cortex for remote sensing. In *2009 IEEE Applied Imagery Pattern Recognition Workshop (AIPR 2009)* (pp. 1-6). IEEE.
63. Bollen, J., Van de Sompel, H., Hagberg, A., Bettencourt, L., Chute, R., Rodriguez, M. A., & Balakireva, L. (2009). Clickstream data yields high-resolution maps of science. *PloS one*, 4(3), e4803.
62. Bettencourt, L. M. (2009). The rules of information aggregation and emergence of collective intelligent behavior. *Topics in Cognitive Science*, 1(4), 598-620.
61. Gintautas, V., Hagberg, A., & Bettencourt, L. M. (2009). When is social computation better than the sum of its parts?. In *Social Computing and Behavioral Modeling* (pp. 1-9). Springer, Boston, MA.
60. Bettencourt, L. M., Kaiser, D. I., & Kaur, J. (2009). Scientific discovery and topological transitions in collaboration networks. *Journal of Informetrics*, 3(3), 210-221.
59. Bettencourt, L. M. (2009). An ensemble trajectory method for real-time modeling and prediction of unfolding epidemics: analysis of the 2005 Marburg Fever outbreak in Angola. In *Mathematical and Statistical Estimation Approaches in Epidemiology* (pp. 143-161). Springer, Dordrecht.
58. Ham, M. I., Gintautas, V., Rodriguez, M. A., Bennett, R. A., Santa Maria, C. L., & Bettencourt, L. M. (2010). Density-dependence of functional development in spiking cortical networks grown in vitro. *Biological cybernetics*, 102(1), 71-80.

57. Bettencourt, L. M., Lobo, J., & West, G. B. (2009). The self similarity of human social organization and dynamics in cities. In *Complexity perspectives in innovation and social change* (pp. 221-236). Springer, Dordrecht.
56. Cintrón-Arias, A., Castillo-Chávez, C., Bettencourt, L., Lloyd, A. L., & Banks, H. T. (2008). *The estimation of the effective reproductive number from disease outbreak data*. North Carolina State University. Center for Research in Scientific Computation.
55. Bettencourt, L. M., Lobo, J., & West, G. B. (2008). Why are large cities faster? Universal scaling and self-similarity in urban organization and dynamics. *The European Physical Journal B*, 63(3), 285-293.
54. Ham, M. I., Bettencourt, L. M., McDaniel, F. D., & Gross, G. W. (2008). Spontaneous coordinated activity in cultured networks: analysis of multiple ignition sites, primary circuits, and burst phase delay distributions. *Journal of computational neuroscience*, 24(3), 346-357.
53. Bettencourt, L. M., Gintautas, V., & Ham, M. I. (2008). Identification of functional information subgraphs in complex networks. *Physical review letters*, 100(23), 238701.
52. Bettencourt, L. M., & Ribeiro, R. M. (2008). Real time bayesian estimation of the epidemic potential of emerging infectious diseases. *PloS one*, 3(5), e2185.
51. Gomes, L. H., Almeida, V. A., Almeida, J. M., Castro, F. D., & Bettencourt, L. M. (2009). Quantifying social and opportunistic behavior in email networks. *Advances in Complex Systems*, 12(01), 99-112.
50. Bettencourt, L., Kaiser, D., Kaur, J., Castillo-Chavez, C., & Wojick, D. (2008). Population modeling of the emergence and development of scientific fields. *Scientometrics*, 75(3), 495-518.
49. Chowell, G., Nishiura, H., & Bettencourt, L. M. (2007). Comparative estimation of the reproduction number for pandemic influenza from daily case notification data. *Journal of the Royal Society Interface*, 4(12), 155-166.
48. Bettencourt, L. M., Hagberg, A. A., & Larkey, L. B. (2007, June). Separating the wheat from the chaff: Practical anomaly detection schemes in ecological applications of distributed sensor networks. In *International Conference on Distributed Computing in Sensor Systems* (pp. 223-239). Springer, Berlin, Heidelberg.
47. Bettencourt, L. M., Ribeiro, R. M., Chowell, G., Lant, T., & Castillo-Chavez, C. (2007, May). Towards real time epidemiology: data assimilation, modeling and anomaly detection of health surveillance data streams. In *NSF workshop on intelligence and security informatics* (pp. 79-90). Springer, Berlin, Heidelberg.
46. Bettencourt, L. M., Lobo, J., Helbing, D., Kühnert, C., & West, G. B. (2007). Growth, innovation, scaling, and the pace of life in cities. *Proceedings of the national academy of sciences*, 104(17), 7301-7306.



45. Bettencourt, L. M., Lobo, J., & Strumsky, D. (2004). Invention in the city: Increasing returns to scale in metropolitan patenting. *Los Alamos National Laboratory technical Report LAUR-04-8798*.
44. Chowell, G., Bettencourt, L. M., Johnson, N., Alonso, W. J., & Viboud, C. (2008). The 1918–1919 influenza pandemic in England and Wales: spatial patterns in transmissibility and mortality impact. *Proceedings of the Royal Society B: Biological Sciences*, 275(1634), 501-509.
43. Ham, M. I., Bettencourt, L. M., McDaniel, F. D., & Gross, G. W. (2008). Spontaneous coordinated activity in cultured networks: analysis of multiple ignition sites, primary circuits, and burst phase delay distributions. *Journal of computational neuroscience*, 24(3), 346-357.
42. Bettencourt, L. M., Stephens, G. J., Ham, M. I., & Gross, G. W. (2007). Functional structure of cortical neuronal networks grown in vitro. *Physical Review E*, 75(2), 021915.
41. Collins, S. L., Bettencourt, L. M., Hagberg, A., Brown, R. F., Moore, D. I., Bonito, G., ... & McAuley, J. M. (2006). New opportunities in ecological sensing using wireless sensor networks. *Frontiers in Ecology and the Environment*, 4(8), 402-407.
40. Bettencourt, L. (2003). Tipping the balances of a small world. *arXiv preprint cond-mat/0304321*.
39. Bettencourt, L. (2002). From boom to bust and back again: the complex dynamics of trends and fashions. *arXiv preprint cond-mat/0212267*.
38. Bettencourt, L. M., Cintrón-Arias, A., Kaiser, D. I., & Castillo-Chávez, C. (2006). The power of a good idea: Quantitative modeling of the spread of ideas from epidemiological models. *Physica A: Statistical Mechanics and its Applications*, 364, 513-536.
37. Gomes, L. H., Castro, F. D., Almeida, V. A., Almeida, J. M., Almeida, R. B., & Bettencourt, L. M. (2005). Improving Spam Detection Based on Structural Similarity. *SRUTI*, 5, 12-12.
36. Gomes, L. H., Almeida, R. B., Bettencourt, L., Almeida, V., & Almeida, J. M. (2005). Comparative graph theoretical characterization of networks of spam and legitimate email. *arXiv preprint physics/0504025*.
35. Bergner, Y., & Bettencourt, L. M. (2004). Self-consistent bounce: An improved nucleation rate. *Physical Review D*, 69(4), 045012.
34. Bergner, Y., & Bettencourt, L. M. (2004). Dressing up the kink. *Physical Review D*, 69(4), 045002.
33. Bergner, Y., & Bettencourt, L. M. (2003). A step beyond the bounce: Bubble dynamics in quantum phase transitions. *Physical Review D*, 68(2), 025014.
32. Bettencourt, L. M., & Stephens, G. J. (2003). Vortex description of the first-order phase transition in the two-dimensional Abelian-Higgs model. *Physical Review E*, 67(6), 066105.

31. Antunes, N. D., Bettencourt, L. M., & Kunz, M. (2002). Role of pointlike topological excitations at criticality: From vortices to global monopoles. *Physical Review E*, 65(6), 066117.
30. Bettencourt, L. M., Cooper, F., & Pao, K. (2002). Relativistic hydrodynamic scaling from the dynamics of quantum field theory. *Physical review letters*, 89(11), 112301.
29. Stephens, G. J., Bettencourt, L. M., & Zurek, W. H. (2002). Critical dynamics of gauge systems: Spontaneous vortex formation in 2D superconductors. *Physical review letters*, 88(13), 137004.
28. Bettencourt, L. M., Pao, K., & Sanderson, J. G. (2001). Dynamical behavior of spatially inhomogeneous relativistic  $\lambda \phi^4$  quantum field theory in the Hartree approximation. *Physical Review D*, 65(2), 025015.
27. Bettencourt, L. M., Rajagopal, K., & Steele, J. V. (2001). Langevin evolution of disoriented chiral condensate. *Nuclear Physics A*, 693(3-4), 825-843.
26. Bettencourt, L. M. A. (2001). The Role of Topological Excitations at Second-Order Transitions. In *Fluctuating Paths And Fields: Festschrift Dedicated to Hagen Kleinert on the Occasion of His 60th Birthday* (pp. 589-599).
25. Bettencourt, L. M. (2001). Properties of the Langevin and Fokker-Planck equations for scalar fields and their application to the dynamics of second order phase transitions. *Physical Review D*, 63(4), 045020.
24. Antunes, N. D., Bettencourt, L. M., & Yates, A. (2001). Predicting the critical density of topological defects in  $O(N)$  scalar field theories. *Physical Review D*, 64(6), 065020.
23. Bettencourt, L. M., Antunes, N. D., & Zurek, W. H. (2000). Ginzburg regime and its effects on topological defect formation. *Physical Review D*, 62(6), 065005.
22. Mottola, E., & BETTENCOURT, L. M. (2001). The Electrical Conductivity in High Temperature QED. In *Strong And Electroweak Matter 2000* (pp. 153-159).
21. Bettencourt, L. M. (2001). Topological excitations and second order transitions in 3D  $O(N)$  models. In *Topology Of Strongly Correlated Systems* (pp. 50-61).
20. Zurek, W. H., Bettencourt, L. M. A., Dziarmaga, J., & Antunes, N. D. (2010). Shards of broken symmetry: Topological defects as traces of the phase transition dynamics. *arXiv preprint arXiv:1003.2228*.
19. Bettencourt, L. M., Habib, S., & Lythe, G. (1999). Controlling one-dimensional Langevin dynamics on the lattice. *Physical Review D*, 60(10), 105039.
18. Sasik, R., Bettencourt, L., & Habib, S. (1999). Thermal vortex dynamics in a two-dimensional condensate. *arXiv preprint cond-mat/9907501*.
17. Antunes, N. D., Bettencourt, L. M., & Zurek, W. H. (1999). Vortex string formation in a 3D  $U(1)$  temperature quench. *Physical Review Letters*, 82(14), 2824.

16. Antunes, N. D., & Bettencourt, L. M. (1998). The length distribution of vortex strings in U (1) equilibrium scalar field theory. *Physical review letters*, 81(15), 3083.
15. Bettencourt, L., & Wetterich, C. (1998). Time evolution of correlation functions for classical and quantum anharmonic oscillators. *arXiv preprint hep-ph/9805360*.
14. Bettencourt, L. M., & Wetterich, C. (1998). Time evolution of correlation functions in non-equilibrium field theories. *Physics Letters B*, 430(1-2), 140-150.
13. Antunes, N. D., Bettencourt, L. M., & Hindmarsh, M. (1998). Thermodynamics of cosmic string densities in U (1) scalar field theory. *Physical review letters*, 80(5), 908.
12. Bettencourt, L. M., Laguna, P., & Matzner, R. A. (1997). Nonintercommuting cosmic strings. *Physical review letters*, 78(11), 2066.
11. Antunes, N. D., & Bettencourt, L. M. (1997). Out of equilibrium dynamics of quench-induced spontaneous symmetry breaking and topological defect formation. *Physical Review D*, 55(2), 925.
10. Antunes, N.D. & Bettencourt, L. M. A. (1996, November). *The Dynamics of Symmetry Breaking Phase Transitions*. Sixth International Parallel Computing Workshop, Kawasaki, Japan.
9. Bender, C. M., & Bettencourt, L. M. (1996). Multiple-scale analysis of the quantum anharmonic oscillator. *Physical review letters*, 77(20), 4114.
8. Bender, C. M., & Bettencourt, L. M. (1996). Multiple-scale analysis of quantum systems. *Physical Review D*, 54(12), 7710.
7. Antunes, N.D. & Bettencourt, L. M. A. (1995, September). *Non-equilibrium Evolution of Field Theories*. 5th International Parallel Computing Workshop, London, U.K.
6. Bettencourt, L. M. A., Evans, T. S., & Rivers, R. J. (1996). Winding number correlation functions and cosmic string formation. *Physical Review D*, 53(2), 668.
5. BETTENCOURT, L. M. A. Sub-Critical Bubbles and Other Non-Perturbative Configurations at the Electroweak Phase Transition. *Thermal Field Theories*, 305.
4. Bettencourt, L. M. A. (1995). Coarse-grained fluctuation probabilities in the standard model and subcritical bubbles. *Physics Letters B*, 356(2-3), 297-306.
3. Bettencourt, L. M. A., & Rivers, R. J. (1995). Interactions between U (1) cosmic strings: an analytical study. *Physical Review D*, 51(4), 1842.
2. Bettencourt, L. M. A., & Kibble, T. W. B. (1994). Non-intercommuting configurations in the collisions of type IU (1) cosmic strings. *Physics Letters B*, 332(3-4), 297-304.
1. Bettencourt, L. M. A. THE ROLE OF LOCAL DEFECTS ON PHASE TRANSITIONS IN THE EARLY UNIVERSE INTERACTING COSMIC STRINGS. In *BANFF I CAP WORKSHOP* (p. 364).

