# Curriculum Vitae: Prof. Dr. rer. nat. Dr. h.c. Dirk Helbing

## Professional preparation

| Institution | Field of Study / Activity | Degree | Year |
|---|---|---|---|
| Georg-August University Göttingen | Physics | First diploma (B.Sc.) | 1986 |
| Georg-August University Göttingen | Physics (Pedestrian Dynamics) | Diploma (M.Sc.) | 1990 |
| University of Stuttgart, Germany | Physics (Collective Social Behavior) | Ph.D. | 1992 |
| University of Stuttgart, Germany | Theoretical Physics (Traffic Modeling) | Habilitation | 1996 |
| University of Stuttgart, Germany | Assistant Professor | | 1997 |
| Weizmann Institute of Science, Israel | Visiting Scientist | | 1997 |
| Xerox Palo Alto Research Center | Consultant | | 1998 |
| Eötvös University, Hungary | Visiting Scientist | | 1998 |
| Tel Aviv University, Israel | Visiting Scientist | | 1999 |
| Collegium Budapest, Hungary | Senior Fellow | | 2000 |
| Dresden University of Technology | Full Professor | | 2000 |
| INRETS, Paris | Visiting Scientist | | 2004 |
| ETH Zurich, Switzerland | Full (Ordinary) Professor | since | 2007 |
| Harvard University | Visiting Scientist | | 2010 |
| University of Oxford | Visiting Scientist | | 2010 |
| TU Delft | Affiliate Professor | | 2015 |

**Current position:** Professor of Computational Social Science at ETH Zurich, Department of Humanities, Social and Political Sciences, and affiliate professor at the Department of Computer Science at ETH Zurich as well as the Department of Technology, Policy and Management at TU Delft. Director of the PhD school in „Engineering Social Technologies for a Responsible Digital Future“ at TU Delft.

**Research** at the Professorship of Computational Social Science is focused on complexity science, social and information systems, digital society, and global systems science. It aims at a three-fold integration:

(1) bringing modeling and computer simulation of techno-socio-economic processes and phenomena together with related theoretical, experimental, and data-driven work,
(2) combining perspectives of different scientific disciplines (e.g. social, computer, and complexity science; socio- and econophysics),
(3) bridging between fundamental and applied work.

Moreover, the professorship is also engaged in the study of systemic risks and possible measures of risk reduction and disaster response, including epidemic spreading scenarios.

**Recent Research Projects**

- Coping with Crises in Complex Socio-Economics Systems (ETH, ETH Foundation)
- Visioneer – Envisioning a Socio-Economic Knowledge Collider: From Computational Social Science to Social Computing
- QLectives – Socially Intelligent Systems for Quality Collectives (EU)
- FuturICT – FET Flagship Pilot Project (EU)
- 2013-: MOMENTUM – ERC Advance Investigator Grant (EU)
- 2014-: CIMPLEX – Bringing citizens, models and data together in participatory, interactive social exploratories (EU)
- 2015-: SoBigData – Social Mining and Big Data Ecosystem (EU)
- 2016-: ASSET – Instant Gratification for Collective Awareness and Sustainable Consumerism (EU)
- 2016-: Anatomy of Systemic Financial Risk (SNSF)

**Professional Activities and Committees**

- Author of over 450 publications, among them about 250 articles in peer-reviewed journals, including Nature (8), Science (3), PNAS (7). In addition several review articles and 5 monographs (2 on the Digital Society). More than 500 talks, about half of them invited talks at various international conferences. More than 700 reports in newspapers, on radio or TV.

**Honors / Positions**

- 1992: Two research prizes for PhD Thesis
- 1996: Heisenberg postdoc scholarship by the German Research Foundation
- 2000: Managing Director, Institute of Transport & Economics, Dresden University of Technology
- 2001: Co-founder of the Physics of Socio-Economic Systems Division of the German Physical Society (DPG)
- 2005-2011: Member External Faculty, Collegium Budapest, Institute for Advanced Study
- 2008: Founder of the ETH Competence Center "Coping with Crises in Complex Socio-Economic Systems"
- 2008: Elected member of the German Academy of Sciences "Leopoldina"
- 2009-2012: External Faculty Member of the Santa Fe Institute
- 2011: Co-founder of the ETH Risk Center
- 2012: Golden Idea Award by IDEE-SUISSE® for the project: «Self-Controlling Traffic Lights»
- 2012-2014: Elected member of the World Economic Forum’s Global Agenda Council on Complex Systems
- 2013: Member of the board of the Global Brain Institute, Brussels
- 2013: ERC Advanced Investigator Grant “MOMENTUM”
- 2014: Member, Expert Committee of the International Centre for Earth Simulation (ICES)
- 2014: Honorary PhD by TU Delft
- 2014: Member of the national science committee on "digitalization" established by the German Academy of Sciences "Leopoldina"
- 2015: Coordination of the PhD program "Engineering social technologies for a responsible digital future" at TU Delft
- 2015: Member of the Swiss federal expert committee on "data processing and data security"
- 2016: Affiliated member of the Robotics Institute at TU Delft

# Publication List of Dirk Helbing (2011-2016)

For a full publication list see http://scholar.google.com/citations?user=ebrNfPAAAAAJ&hl=en, subject-specific lists are provided here: http://www.coss.ethz.ch/publications.html

## Peer-Reviewed Articles since 2011, by field[1]

*Systemic Risks, Global Systems Science, and Data Science*

Helbing, D., E. Pournaras (2015) "Society: Build digital democracy." Nature 527(7576): 33-34.

Pournaras E., I. Moise and D. Helbing (2015) "Privacy-Preserving Ubiquitous Social Mining via Modular and Compositional Virtual Sensors." Advanced Information Networking and Applications (AINA), 2015 IEEE 29th International Conference on, Gwangiu, 332–338.

Pournaras, E., I. Moise, and D. Helbing (2015) "Privacy-preserving Ubiquitous Social Mining via Modular and Compositional Virtual Sensors." Proceedings of the 29th IEEE International Conference on Advanced Information Networking and Applications 2015, Gwangju, March 2015: 332–338.

Schich, M., C. Song, Y. Y. Ahn, A. Mirsky, M. Martino, A. L. Barabási, and Helbing, D. (2014) "A network framework of cultural history." Science 345(6196): 558-562.

Brockmann, D. and D. Helbing (2013) "The hidden geometry of complex, network-driven contagion phenomena". Science 342(6164): 1337–1342.

Helbing, D. (2013) "Globally networked risks and how to respond." Nature, 497, 51–59.

Helbing, D., and A. Carbone, eds. (2012) "Participatory Science and Computing for our Complex World". EPJ Special Topics 214: 1-666.

Helbing, D. (2012) "The FuturICT knowledge accelerator: Towards a more resilient and sustainable future." EPJ Special Topics 214: 5–9.

Helbing, D., S. Bishop, R. Conte, P. Lukowicz and J.B. McCarthy (2012) "FuturICT: Participatory computing to understand and manage our complex world in a more sustainable and resilient way." EPJ Special Topics 214: 11–39.

Helbing, D. (2012) "Accelerating scientific discovery by formulating grand scientific challenges." EPJ Special Topics 214: 41–48.

Giannotti, F., D. Pedreschi, A. Pentland, P. Lukowicz, D. Kossmann, J. Crowley and D. Helbing (2012) "A planetary nervous system for social mining and collective awareness." EPJ Special Topics 214: 49–75.

Buckingham Shum, S., K. Aberer, A. Schmidt, S. Bishop, P. Lukowicz, S. Anderson, Y. Charalabidis, J. Domingue, S. de Freitas, I. Dunwell, B. Edmonds, F. Grey, M. Haklay, M. Jelasity, A. Karpištšenko, J. Kohlhammer, J. Lewis, J. Pitt, R. Sumner and D. Helbing (2012) "Towards a global participatory platform: Democratising open data, complexity science and collective intelligence." EPJ Special Topics 214: 109–152.

van den Hoven, J., D. Helbing, D. Pedreschi, J. Domingo-Ferrer, F. Gianotti and M. Christen (2012) "FuturICT - The road towards ethical ICT." EPJ Special Topics 214: 153–181.

van Harmelen, F., G. Kampis, K. Börner, P. van den Besselaar, E. Schultes, C. Goble, P. Groth, B. Mons, S. Anderson, S. Decker, C. Hayes, T. Buecheler and D. Helbing (2012) "Theoretical and technological building blocks for an innovation accelerator." EPJ Special Topics 214: 183–214.

Johnson, J., S. Buckingham Shum, A. Willis, S. Bishop, T. Zamenopoulos, S. Swithenby, R. MacKay, Y. Merali, A. Lorincz, C. Costea, P. Bourgine, J. Louçã, A. Kapenieks, P. Kelley, S. Caird, J. Bromley, R. Deakin Crick, C. Goldspink, P. Collet, A. Carbone and D. Helbing (2012) "The FuturICT education accelerator." EPJ Special Topics 214: 215–243.

San Miguel, M., J.H. Johnson, J. Kertesz, K. Kaski, A. Díaz-Guilera, R.S. MacKay, V. Loreto, P. Érdi and D. Helbing (2012) "Challenges in complex systems science." EPJ Special

[1] some papers fall in two categories - these may be listed twice

Topics 214: 245–271.
Doyne Farmer, J., M. Gallegati, C. Hommes, A. Kirman, P. Ormerod, S. Cincotti, A. Sanchez and D. Helbing (2012) "A complex systems approach to constructing better models for managing financial markets and the economy." EPJ Special Topics 214: 295–324.
Conte, R., N. Gilbert, G. Bonelli, C. Cioffi-Revilla, G. Deffuant, J. Kertesz, V. Loreto, S. Moat, J.-P. Nadal, A. Sanchez, A. Nowak, A. Flache, M. San Miguel and D. Helbing (2012) "Manifesto of computational social science." EPJ Special Topics 214: 325–346.
Cederman, L.-E., R. Conte, D. Helbing, A. Nowak, F. Schweitzer and A. Vespignani (2012) "Exploratory of society." EPJ Special Topics 214: 347–360.
Ferscha, A., K. Farrahi, J. van den Hoven, D. Hales, A. Nowak, P. Lukowicz and D. Helbing (2012) "Socio-inspired ICT: Towards a socially grounded society-ICT symbiosis." EPJ Special Topics 214: 401–434.
Helbing, D., and S. Balietti (2011) "From social data mining to forecasting socio-economic crises." EPJ Special Topics 195: 3–68.
Helbing, D., and S. Balietti (2011) "From social simulation to integrative systems design." EPJ Special Topics 195: 69–100.
Helbing, D., and S. Balietti (2011) "How to do agent-based simulations in the future: From modeling social mechanisms to emergent phenomena and interactive systems design." Santa Fe Institute Working Paper #11-06-024**.**
Helbing, D., and S. Balietti (2011) "How to create an innovation accelerator." EPJ Special Topics 195: 101–136.
Helbing, D., S. Balietti, S. Bishop, and P. Lukowicz (2011) "Understanding, creating, and managing complex techno-socio-economic systems: Challenges and perspectives." EPJ Special Topics 195: 165–186.

*Game Theory*

Nax, H. H., M. Perc, A. Szolnoki, and D. Helbing (2015) “Stability of cooperation under image scoring in group interactions.” Scientific Reports, 5: 12145.
Ciampaglia, G. L., S. Lozano, and D. Helbing (2014) “Anonymous sharing behaviour in Web experiments with different balance of power.” QLectives Working Paper: 35.
Roca, C. P. and D. Helbing (2011) “Emergence of Social Cohesion in a Model Society of Greedy, Mobile Individuals.” Proceedings of the National Academy of Sciences USA (PNAS) 108(28): 11370-11374.

*Social Sciences*

Böttcher, L., Araújo, N. A., Nagler, J., Mendes, J. F., Helbing, D., & Herrmann, H. J. (2016). Gender gap in the ERASMUS mobility program. *PLoS ONE*, *11*(2), e0149514.
Helbing, D., and G. Herbert (2015) “Homo Socialis: An Analytical Core for Sociological Theory.” Review of Behavioral Economics 2(1-2): 1–59.
Helbing, D. (2015) “Homo Socialis: The Road Ahead.” Review of Behavioral Economics 2(1-2): 239–253.
Helbing, D. (2015) “Societal, Economic, Ethical and Legal Challenges of the Digital Revolution: From Big Data to Deep Learning, Artificial Intelligence, and Manipulative Technologies.” Jusletter IT, May 2015.
Efferson, Ch., C. P. Roca, S. Vogt, and D. Helbing (2015) “Sustained cooperation by running away from bad behavior.” Accepted for publication in: Evolution and Human Behavior.
Balietti, S., M. Mäs, and D. Helbing (2015) “On Disciplinary Fragmentation and Scientific Progress.” PLoS one 10(3), e0118747.
Helbing, D., W. Yu, K. D. Opp, and H. Rauhut (2014) “Conditions for the Emergence of Shared Norms in Populations with Incompatible Preferences.” PLOS one, 9(8), e104207.

Ciampaglia, G.L., S. Lozano, and D. Helbing (2014) “Power and fairness in a generalized ultimatum game.” PLOS ONE, 9(6), e99039.
Helbing, D., D. Brockmann, T. Chadefaux, K. Donnay, U. Blanke, O. Woolley-Meza, M. Moussaid, A. Johansson, J. Krause, S. Schutte, and M. Perc (2014) “Saving Human Lives: What Complexity Science and Information Systems can Contribute.” Journal of Statistical Physics, 1-47.
Bhavnani, R., K. Donnay, D. Miodownik, M. Mor, and D. Helbing (2014) “Group segregation and urban violence.” American Journal of Political Science 58(1), 226-245.
Perc, M., K. Donnay and D. Helbing (2013) “Understanding recurrent crime as system-immanent collective behavior.” PLOS ONE 8(10), e76063.
Helbing, D., and T. U. Grund (2013) “Editorial: Agent-Based Modeling And Techno-Social Systems.” Advances in Complex Systems 16(04n05).
Grund, T., C. Waloszek and D. Helbing (2013) “How natural selection can create both self- and other-regarding preferences, and networked minds.” Scientific Reports, 3, 1480.
Winter, F., H. Rauhut and D. Helbing (2012) “How norms can generate confict: an experiment on the failure of cooperative micro-motives on the macro-level.” Social Forces 90(3): 919-946.
Chadefaux, T., D. Helbing (2012) “The rationality of prejudices.” PLoS ONE 7(2): e30902.
Berger, R., H. Rauhut, S. Prade, and D. Helbing (2012) “Bargaining over waiting time in ultimatum game experiments.” Social Science Research 41: 372-379.
Lorenz, J., H. Rauhut, F. Schweitzer, and D. Helbing (2011) “How Social Influence can Undermine the Wisdom of Crowd Effect.” Proceedings of the National Academy of Sciences USA (PNAS) 108(22): 9020-9025.
Wu, J., Sergi Lozano, and D. Helbing (2011) “Empirical study of the growth dynamics in real career h-index sequences.” Journal of Informetrics 5(4): 489-497.
Helbing, D., W. Yu, and H. Rauhut (2011) “Self-organization and Emergence in Social Systems: Modeling the Coevolution of Social Environments and Cooperative Behavior.” Journal of Mathematical Sociology 35:177-208.
Mazloumian, A., Y-H. Eom, D. Helbing, S. Lozano, and S. Fortunato (2011) “How citation boosts promote scientific paradigm shifts and Nobel Prizes.“ PLoS ONE 6(5): e18975.

*Pedestrians and Crowds*

Haase, K., H. Z. Al Abideen, S. Al-Bosta, M. Kasper, M. Koch, S. Müller, and D. Helbing (2016). „Improving pilgrim safety during the Hajj: An analytical and operational research approach”. Interfaces, 46(1), 74-90.
Oliveira, C. L. N., A. P. Vieira, D. Helbing, Jr, J. S. Andrade, and H. J Herrmann (2016). “Keep-left behavior induced by asymmetrically profiled walls”. Physical Review X, 6(1), 011003.
Mani, R., L. Böttcher, H. J. Herrmann, and D. Helbing (2014) “Extreme power law in a driven many-particle system without threshold dynamics.” *Physical Review E*, 90(4), 042201.
Heliövaara, S., H. Ehtamo, D. Helbing, T. Korhonen (2013) “Patient and impatient pedestrians in a spatial game for egress congestion.” Physical Review E 87: 012802.
Helbing, D. and P. Mukerji (2012) “Crowd disasters as systemic failures: Analysis of the Love Parade disaster.” EPJ Data Science 1:7.
Moussaïd, M., D. Helbing, and G. Theraulaz (2011) “How simple rules determine pedestrian behavior and crowd disasters.” Proceedings of the National Academy of Sciences USA (PNAS) 108(17): 6884-6888.
Roggen, D., M. Wirz, G. Tröster, and D. Helbing (2011) “Recognition of crowd behavior from mobile sensors with pattern analysis and graph clustering methods.” Networks and Heterogeneous Media (NHM) 6(3): 521-544.

*Economics, Logistics and Production*

Helbing, D., E. Mitleton-Kelly, J-P Bouchaud, F. Caccioli, J.D. Farmer, S. Keen, K. Pistor, D.J. Snower, R. Olsen, A. Ranaldo, N. Haring, and E. Fullbrook (2014) “How to improve the financial architecture and its resilience.” Complexity Council of the World Economic Forum Working Paper.
Biondo, A.E., Pluchino, A. Rapisarda and D. Helbing (2013) “Reducing financial avalanches by random investments.” Physical Review Letters 88, 062814.
Biondo, A.E., Pluchino, A. Rapisarda, D. Helbing (2013) “Are random trading strategies more successful than technical ones?”. PLoS ONE 8(7), e68344.
Helbing, D. (2013) "Economics 2.0: The natural step towards a self-regulating, participatory market society", Evolutionary and Institutional Economics Review 10, 3-41.
Helbing, D. and A. Kirman (2013) "Rethinking economics using complexity theory", Real-World Economics Review 64, 23–52.
Parisi, D.R., D. Sornette, and D. Helbing (2013) "Financial price dynamics and pedestrian counterflows: A comparison of statistical stylized facts." Physical Review E 87: 012804.
Preis, T., D. Y. Kenett, H. E. Stanley, D. Helbing, and E. Ben-Jacob (2012)
“Quantifying the behavior of stock correlations under market stress.” Scientific Reports 2: 752.

*Vehicular Traffic*

Tachet R., P. Santi, S. Sobolevsky, L. I. Reyes-Castro, E. Frazzoli, D. Helbing, C. Ratti (2016) “Revisiting Street Intersections Using Slot-Based Systems”. PLoS ONE 11(3), e0149607.
Gershenson, C., and D. Helbing (2015) “When slower is faster.” *Complexity*, *21*(2), 9-15.
Becker T., M. E. Beber, K. Windt, M-T. Hütt, and Dirk Helbing (2011) “Flow control by periodic devices: a unifying language for the description of traffic, production, and metabolic systems.” Journal of Statistical Mechanics: Theory and Experiment: P05004.
Trantopoulos, K., M. Schlaepfer, and D. Helbing (2011) “Toward Sustainability of Complex Urban Systems through Techno-Social Reality Mining.” Environ. Sci. Technol. 45(15): 6231–6232.

*Networks*

Kuhn T., M. Perc, and D. Helbing (2014) “Inheritance Patterns in Citation Networks Reveal Scientific Memes.” Physical Review X(4): 041036.
Schulz, Ch., A. Mazloumian, A. M. Petersen, O. Penner, and D. Helbing (2014) “Exploiting citation networks for large-scale author name disambiguation.” EPJ Data Science 3: 11.
Carvalho, R., L. Buzna, F. Bono, M. Masera, D. K. Arrowsmith, and D. Helbing (2014) “Resilience of natural gas networks during conflicts, crises and disruptions.” PLOS ONE, 9(3), e90265.
Mazloumian, A., D. Helbing, S. Lozano, R. P. Light and K. Börner (2013) “Global multi-level analysis of the ‘Scientific Food Web’.” Scientific Reports 3: 1167.
Helbing, D. (2013) “Globally Networked Risks and How to Respond.” Nature, 497(7447), 51–59.

*Biology*

Böttcher, L., O. Woolley-Meza, N.A.M. Araujo, H. J. Herrmann, and D. Helbing (2015) “Disease-Induced Resource Constraints Can Trigger Explosive Epidemics.” *Scientific reports*, *5*.
Manitz, J., T. Kneib, M. Schlather, D. Helbing, and D. Brockmann (2014) “Origin Detection During Food-borne Disease Outbreaks – A Case Study of the 2011 EHEC/HUS Outbreak in Germany.” PLOS Currents Outbreaks 1.

Leduc, C., K. Padberg-Gehle, V. Varga, D.Helbing, S. Diez, and J. Howard (2012) “Molecular crowding creates traffic jams of kinesin motors on microtubules.” PNAS 16: 6100-6105.
Becker, T., M. E. Beber, K. Windt, M-T. Hütt, and D. Helbing (2011) “Flow Control by Periodic Devices: A Unifying Language for the Description of Traffic, Production, and Metabolic Systems.” Journal of Statistical Mechanics: Theory and Experiment: P05004.

*Monographs*

Helbing, D. (2015) “Thinking Ahead: Essays on Big Data, Digital Revolution, and Participatory Market Society” (Springer, Berlin).
Helbing, D. (2015) “The Automation of Society is Next: How to Survive the Digital Revolution” (CreateSpace Independent Publishing Platform, North Charleston).