

Could the principles governing collective intelligence in animal groups be used to enhance collaboration and cooperation in human groups?

Proposed by Guy Theraulaz

URL: <https://escmp.euroscience.org/proposal/view/637>

Status: Submitted

Programme: Scientific Programme

Format: Workshop

Duration: 1h15

Theme: A digital world

Abstract: Many animal species living in groups or in organized societies have developed various forms of collective intelligence. In social insects like ants, termites and some species of bees and wasps, coordination emerges from simple interactions rules that take place among individuals. These interactions permit groups of individuals to achieve collective tasks that are far beyond single individuals' capabilities. From the traffic management on a foraging network to the building of efficient nest architectures, along with the dynamic task allocation between workers, the examples of complex and sophisticated collective intelligent behaviors are numerous and diverse among social insects.

In the recent years, collective human behavior studies underwent considerable growth due to the development of new digital tracking technologies. These technologies have revolutionized the observation and quantification of many facets human behavior such as mobility patterns, social interactions and individual decisions, improving to unprecedented levels the variety and precision of available data. Many companies are currently processing these massively abundant data in the hope to reveal the hidden rules of human behavior. But can this knowledge be used to improve coordination or collaboration in human information systems? And can we get inspiration from the way animal societies process information and coordinate their actions to develop new information systems and regulate collective dynamics in human systems? Such information systems could provide in real time groups of individuals with the right pieces of information that will enable them to self-organize and improve their mobility or their collective decisions.

This workshop will contribute to the XSYS dynamics and will promote an interdisciplinary approach to tackle these challenging questions and to favor cross-disciplinary Scientists, Industry & Business, Policy makers, General public, Students

Target audience:

Cross-cutting approaches:

Relevance of the selected approaches:

Special requirements and demands:

Does the session organiser (or a speaker of the session) envisage to propose an event in the Science in the City festival (same dates as ESOF) about the same topic oriented towards the public (this should be in French or in English and French) ? :
No

Does the session organiser (or speakers of the session) envisage to participate in an event in the Science in the City festival on a topic related to that of the session (this should be in French or in English and French)?: No

Status	Name	Email	Gndr	Position	Organisation	Country	Role	Reason for inviting
Submitter	Guy Theraulaz	guy.theraulaz@univ-tlse3.fr	M	Directeur de recherches	Centre National de la Recherche Scientifique	FRANCE	Submitter	
Contacted	Clément Sire	clement.sire@irsamc.ups-tlse.fr	M	Reserach Director	Centre National de la Recherche Scientifique	FRANCE	Keynote speaker	Clément Sire is an expert in Social physics. His researches focus on the quantitative analysis and computational modeling of collective behavior in human
Not yet contacted	Dirk Helbing	dirk.helbing@gess.ethz.ch	M	Professor of Computational Social	ETH Zurich	SWITZERLAND	Keynote speaker	Helbing was the Principal Investigator on a project named FuturiCT Knowledge Accelerator and Crisis Relief System, a computing system working on big data sets, conceived as sort of a crystal ball of the world. The core of the system is t a computing machine attempting "to model global-scale systems — economies, governments, cultural trends, epidemics, agriculture, technological developments, and more — using torrential data streams, sophisticated algorithms, and as
Not yet contacted	Anita Williams Woolley	awoolley@cmu.edu	F	Associate Professor of Organizational Behavior and Theory	Carnegie Mellon University	UNITED STATES	Keynote speaker	Anita Woolley explores the existence of a general collective intelligence factor in

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Not yet contacted	Pierre Lévy	plevy@uOttawa.ca	M	Professor , Chair in Collective Intelligence	University of Ottawa	CANADA	Keynote speaker	Pierre Lévy is a French philosopher, cultural theorist and media scholar who specializes in the understanding of the cultural and cognitive implications of digital technologies and the phenomenon of human collective
Contacted	Adrien Blanchet	adrien.blanchet@tse-fr.eu	M	Assistant Professor in Economic	Toulouse School of Economics	FRANCE	Keynote speaker	Adrien Blanchet is a mathematician and he focuses his research toward applications of mathematics to economics and social sciences. His works in economics are mainly devoted to the understanding of emergence

Supporting documents

- 1 Curriculum Vitae — Guy Theraulaz

Curriculum Vitae — Guy Theraulaz

1. General information, Education and Academic appointments

Guy THERAULAZ

Born in Rumilly (France) on February, 3rd, 1962

Nationality: French

Centre de Recherches sur la Cognition Animale, CNRS UMR 5169, Université Paul Sabatier, 118, route de Narbonne, 31062 Toulouse Cedex 04, France

email: guy.theraulaz@univ-tlse3.fr

- PhD. in Neurosciences and Ethology, Université de Provence, Marseille, France (1991)
- Habilitation Thesis, Université Paul Sabatier Toulouse III, Toulouse, France (2002)
- 1st class Research Director, CRCA, UPS, Toulouse, France (since October 2009)
- Head of the team Complex Dynamics and Interaction Networks in Animal Societies, 8 permanent researchers and 2 technical engineers (1999-2014)
- Coordinator of the Computational and Systems Biology Axis (20 research teams) within the Center for Integrative Biology, Université Paul Sabatier, Toulouse (2014-present)
- Web page: http://cognition.ups-tlse.fr/_guyt/index.html
- Phone (Direct Number): +33617707530; (Office Number): +33561556732

2. Summary of scientific records

- 105 articles in international peer-reviewed journals, including 1 *Nature*, 2 *Science* and 4 *PNAS*, Co-author of six books, among which *Swarm Intelligence: From Natural to Artificial Systems* (Oxford University Press, 1999) and *Self-organization in biological systems* (Princeton University Press, 2001) now considered as reference textbooks.
- 25200 citations (h-index of 56, source: Google Scholar (which includes books, book chapters and proceedings) and 5400 citations (h-index of 37; source: ISI web of knowledge):
- 85 invited talks and 18 Keynotes at international conferences/workshops
- PhD Supervision: A. Lioni (2000), R. Jeanson (2003), J. Buhl (2004), M. Challet (2005), S. Garnier (2008), S. Motsh (2009), M. Moussaïd (2010), N. Perozzo (2011), S. Weitz (2012), U. Lopez (2015), L. Jiang (2017).
- Associate Editor of *Advances in Complex Systems* (since 1998, Vol.1, No.1), *Interaction Studies* (since 2004, Vol.5, No.1), *Swarm Intelligence* (since 2007), *Frontiers in Comparative Psychology* (since 2011) and *Movement Ecology* (since 2013)

2. Main research themes

Guy Theraulaz is an expert in the study of collective intelligence and collective behaviors in animal and human groups. He is also a leading researcher in the field of swarm intelligence, primarily studying social insects but also distributed algorithms, e.g. for collective robotics, directly inspired by nature. His researches focus on the understanding of a broad spectrum of collective behaviors in animal societies and human groups by quantifying and then modeling the individual level behaviors and interactions, thereby elucidating the mechanisms generating the emergent, group-level properties. He is one of the main characters of the development of quantitative social ethology and collective intelligence in France.

3. Awards

- Bronze Medal of the CNRS 1996 for Neurosciences, Behavioral and Cognitive Sciences
- 2010-2013: CNRS scientific excellence award

4. Selected invited talk and Keynotes (Past 5 years)

- JEB Symposium on Evolution of Social Behavior, Mürren, Switzerland, March 20-24, 2016 — *Quantitative analysis and 3D modeling of collective nest construction in ants* (invited talk).
- Complexity, Criticality, and Computation (C3) International Biannual Symposium, Charles Perkins Centre, University of Sydney, November 26-27, 2015 — *Computational analysis and modeling of 3D stigmergic construction in ant colonies* (invited talk).
- 7th International Conference on Computational Collective Intelligence Technologies and Applications, Madrid, Espagne, September 21-23, 2015 — *Collective information processing in fish schools: from data to computational models* (**keynote**).
- International Conference on Mathematical Modeling and Applications 2014 'Crowd Dynamics', Meiji Institute for Advanced Study of Mathematical Sciences (MIMS), Tokyo, Japan, January 10-12, 2015 — *From individual to collective information processing in fish schools* (**keynote**).

- 7th International Workshop on Guided Self-Organization, University of Freiburg, Germany, December 16-18, 2014 — *From individual to collective information processing in fish schools (keynote)*.
- Ki-Net Conference on Collective Behavior: Macroscopic versus Kinetic Descriptions, Imperial College, London, United-Kingdom, May 19-23, 2014. — *From individual to collective information processing in fish schools* (invited talk).
- Wyss Institute, Harvard School of Engineering and Applied Sciences, Cambridge, MA, USA, March 6 2014. — *Secrets of Swarm Architecture: Deciphering Construction Rules in Ant Colonies* (invited talk).
- Okinawa Integrative Biology Course, Okinawa Institute of Science and Technology, Japan, May 15-29, 2013. — *Experimental and modeling approaches to collective behavior in groups of organisms* (two invited lectures).
- 6th IEEE International Conference on Self-Adaptive and Self-organizing Systems, Lyon, France, September 10-14 2012. — *Secrets of swarms architects: Understanding construction dynamics in ant colonies (keynote)*.
- Prospects in Theoretical Physics Program, Computation and Biology, Institute for Advanced Study, Princeton, July 9-20, 2012. — *Distributed coordination and collaboration in animal societies* (two invited lectures).
- Opening seminar Groningen Center for Social Complexity Studies, Center for Information Technology, Groningen, June 15 2012. — *Secrets of swarms architects: understanding construction dynamics in ant colonies (keynote)*.
- Workshop Collective Dynamics and Pattern Formation in Active Matter Systems, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, September 12-16, 2011. — *A three-dimensional model of ant-nest construction* (invited talk).
- Conference "Swarm Intelligence and Critical Behavior", Center for Interdisciplinary Research, Bielefeld University, Germany, March 22-24, 2011. — *Coordination mechanisms and collective motion in fish schools* (invited talk).
- Workshop Insect Self-organization and Swarming, Mathematical Biosciences Institute, Columbus, USA, March 14-18, 2011. — *Swarms as smart architects: understanding construction dynamics in ant colonies* (invited talk).
- Workshop Experimental approaches to collective behavior in groups of organisms, The Graduate Center of The City University of New-York, USA, February 8, 2011. — *Experimental approaches to collective behavior in groups of organisms* (invited talk).

5. Project coordination and grants (Past 5 years)

- Project Leader of DYNABANC, "*Response to local perturbations and spatiotemporal transmission of information in fish schools*", project funded by the Scientific Council of the University Paul Sabatier (2011-2013)
- Team Leader of TRANSCOMIGR, "*Collective lymphocyte migration*", project funded by ANR Grant N° ANR-13-BSV1-0031-02 (2014-2017)
- Project leader of SMARTCROWD, "*Experimental study and modeling of collective decision making in human groups*", project funded by The CNRS, AMI S2C3 (2016)
- Project coordinator of SYSCOB, *Bioninspired Complex Systems*, project funded by The Fondation de Coopération Scientifique Sciences et Technologies pour l'Aéronautique et l'Espace (2016-2018)

6. Organization of conferences (Past 5 years)

- Workshop *The effects of architecture on collective behavior*, with N. Pinter-Wollman (UCLA) and S. Fiore (UCL), Decision Theater, Arizona State University, Phoenix, USA, October 5-7, 2016.
- and C. Sire Laboratory of Theoretical Physics, Toulouse), Manufacture des Tabacs, Toulouse, France, April 14–15, 2016.
- Workshop *Fluid Mechanics and Collective Behavior: From Cells to Organisms* with P. Koumoutsakos (Computational Science and Engineering Laboratory, ETH Zurich) and A. Deutsch (TU Dresden), Conference Centre Monte Verità in Ascona, Switzerland, April 3-7, 2016.
- Workshop *Geometric and Graph-based Approaches to Collective Motion*, with G.F. Italiano (University of Rome "Tor Vergata"), Bettina Speckmann (TU Eindhoven) and M. van Kreveld (Utrecht University), Leibniz-Zentrum für Informatik, Schloss Dagstuhl, Wadern, Germany, January 10-15, 2016.
- Workshop "*Fluid Mechanics of Collective Behavior across Scales*", with P. Koumoutsakos (Computational Science and Engineering Laboratory, ETH Zurich). Fondation Garbald, Castasegna, Switzerland, September 22-26, 2014
- Workshop "*Interaction Networks and Collective motion in swarms, flocks and crowds*", with S. Fortunato (Department of Biomedical Engineering and Computational Science, Aalto). Open Innovation House, Espoo, Finland, May 26-28, 2014
- Workshop "*Interaction and Collective Movement Processing*", with M. Buchin (Ruhr-Universität Bochum), L. Giuggioli (University of Bristol) and M. van Kreveld (Utrecht University). Leibniz-Zentrum für Informatik, Schloss Dagstuhl, Wadern, Germany, March 23-28, 2014
- Workshop "*Collective Motion in Biological Systems: from Data to Models*", with A. Deutsch and T. Vicsek, Center for Interdisciplinary Research, University of Bielefeld, Bielefeld, November 5-9, 2012