

# Dr. Séverin Lemaignan

A strategic vision towards  
Socially-Driven Autonomous Robots for Real-World HRI

# SHORT BIO

- **2008–2012** Joint French (LAAS-CNRS) German (TU Munich) PhD  
AI & Cognitive Robotics  
Prix GdR Meilleure thèse
- **2013–2015** Post-doc at EPFL  
Creation of an internationally recognised HRI team
- **2015–2018** Post-doc + lecturer at Plymouth University, UK  
EU Marie Curie fellowship  
Social Cognition in Robotics
- **2018–** Associate Prof. at Bristol Robotics Lab



situation assessment

symbolic grounding

symbolic reasoning

## SYMBOLIC SOCIAL COGNITION FOR ROBOTS

ontologies

perspective taking

cognitive architectures

social situation assessment

joint action

ROS4HRI

natural language processing

## REAL-WORLD SOCIAL AUTONOMY

learning of social policies

theory of mind

human-in-the-loop ML

responsible AI

child-robot interaction

persuasion



## DATA-DRIVEN HRI

large datasets

group dynamics

social robotics

experimental robotics

## HUMAN FACTORS

participatory design

engagement

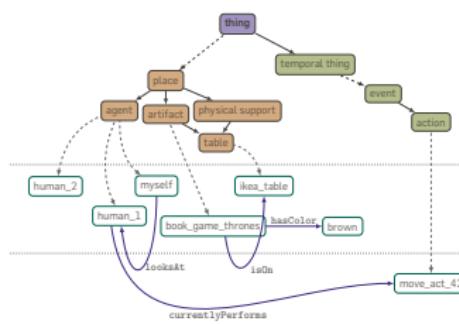
anthropomorphism

robotics for learning

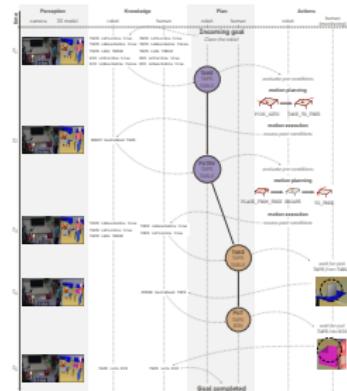
# SYMBOLIC SOCIAL COGNITION FOR REAL-WORLD AUTONOMY



- real-time situation assessment
- geometric reasoning
- perspective-taking

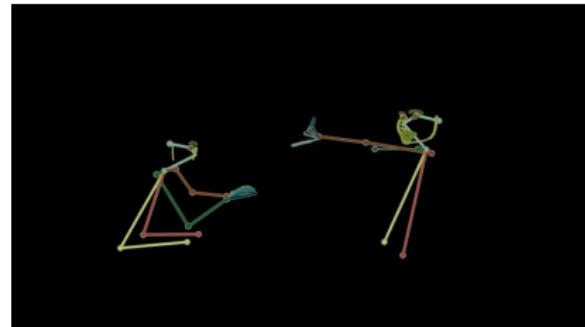


- ontologies
- real-time symbolic reasoning
- theory of mind

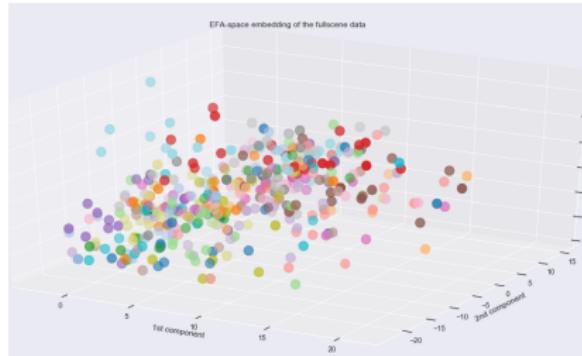


- Complete cognitive architecture
- Autonomy in semantic-rich social environments

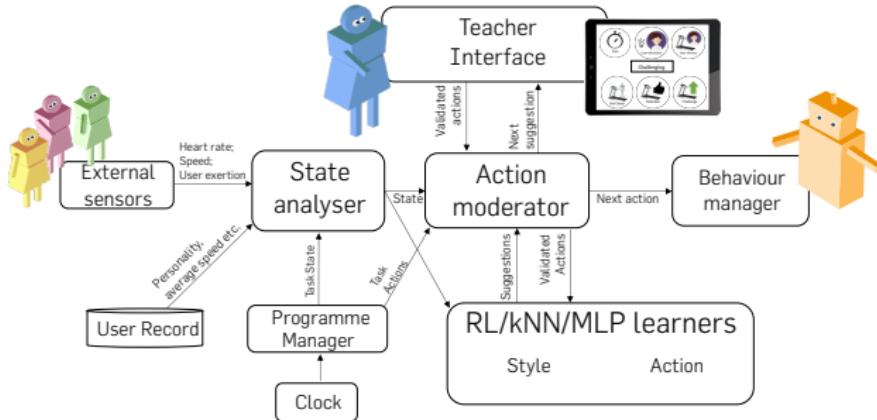
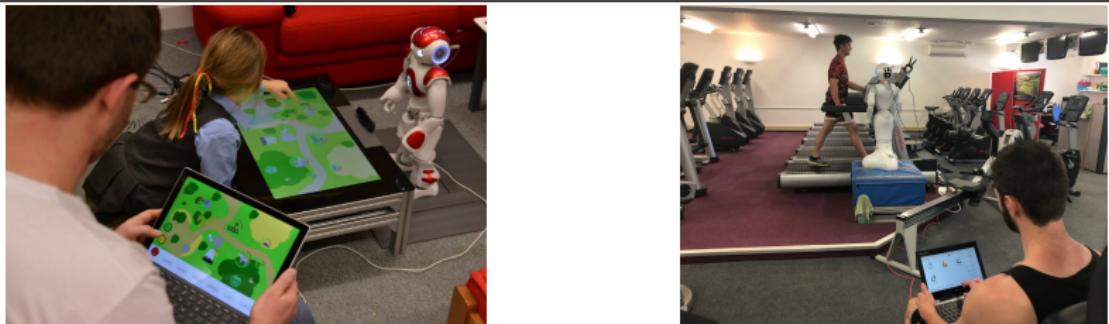
# DATA-DRIVEN HRI – dataset of natural interactions



- PInSoRo dataset: 45h+ and 2M frames of annotated natural interactions
- new data analysis techniques to estimate internal state from body language
- first-in-kind dataset for data-driven study of social interactions in robotics



# DATA-DRIVEN HRI – expert-in-the-loop machine learning



[Senft et al. **Teaching robots social autonomy from in situ human guidance** Science Robotics 2019]

[Winkle et al. **In-Situ Learning from a Domain Expert for Real World Socially Assistive Robot Deployment** RSS 2020]

# HUMAN FACTORS – experimental work

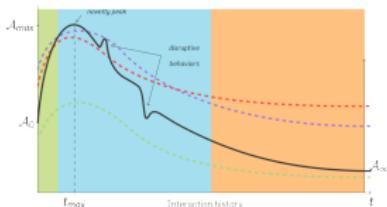
Extensive experimental work:

- over 25 field experiments over the past 10 years
- mixed methods; focus on real-world experiments (eg schools, gyms)
- child-robot interaction expertise: worked with 200+ children



# HUMAN FACTORS – expertise

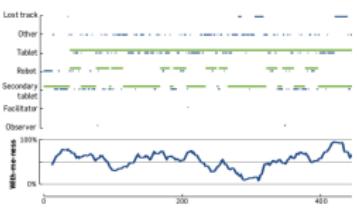
## Understanding interaction



## Robots for Learning



## Methodology



# SCIENTIFIC IMPACT

Contributions to basic research, experimental methodology and technology:

1. **ontologies** for robot knowledge modeling and symbolic reasoning
2. **perspective taking** and **theory of mind**: generate and maintain symbolic knowledge models for all the agents
3. framing & implementing **cognitive architecture for social interaction**
4. leading role in **shaping the emergent field of data-driven HRI: large datasets**; transdisciplinary **data-driven behaviour analysis**
5. major advances towards **learning autonomous social policies** for service robots
6. transdisciplinary expertise; number of **cross-disciplinary experimental work** and literature surveys;
7. **Child-robot interaction** expert in Europe
  - **80+ publications** (2900+ citations, h-index=26 on Google Scholar), incl. *Artificial Intelligence, Science Robotics*
  - Prix GdR Meilleure thèse
  - Best Paper awards at RoMan, HRI
  - major contributions to open-source robotics (core ROS dev); 150+ GitHub repos

# MANAGEMENT OF RESEARCH

- **Associate professor in AI and Social Robotics**
- **Supervising 2 groups** at BRL (embodied cognition and autonomous vehicles), **≈15 researchers**
- Responsible for **defining and implementing their research strategy**
- Currently managing **>€1M funding**
- Previously **established and led cHRI group at EPFL**; now internationally recognised
- Supervised or co-supervised **10 PhDs** to date
- **10+ years of teaching experience**; currently teaching HRI at Master level

# IMPACT IN THE SCIENTIFIC COMMUNITY

## Editorial activities

- Currently **Programme committee/editorial board** of FrontiersIn Robotics and AI; HRI; RSS; IROS; IJCAI
- Invited member of the **Steering committee + Organisation committee** of ACM/IEEE HRI since 2016

## Bids and grants:

- PI or Co-I on **19 grant submissions** since 2013, incl. 4 EU ICT bids; 1 EU FET bids; **5 successful to date**
- **EU H2020 Marie-Curie fellowship** on Theory of Mind in 2015
- First **ERC Consolidator submission** in 2019

# IMPACT ON THE BROADER SOCIETY

Policy making:

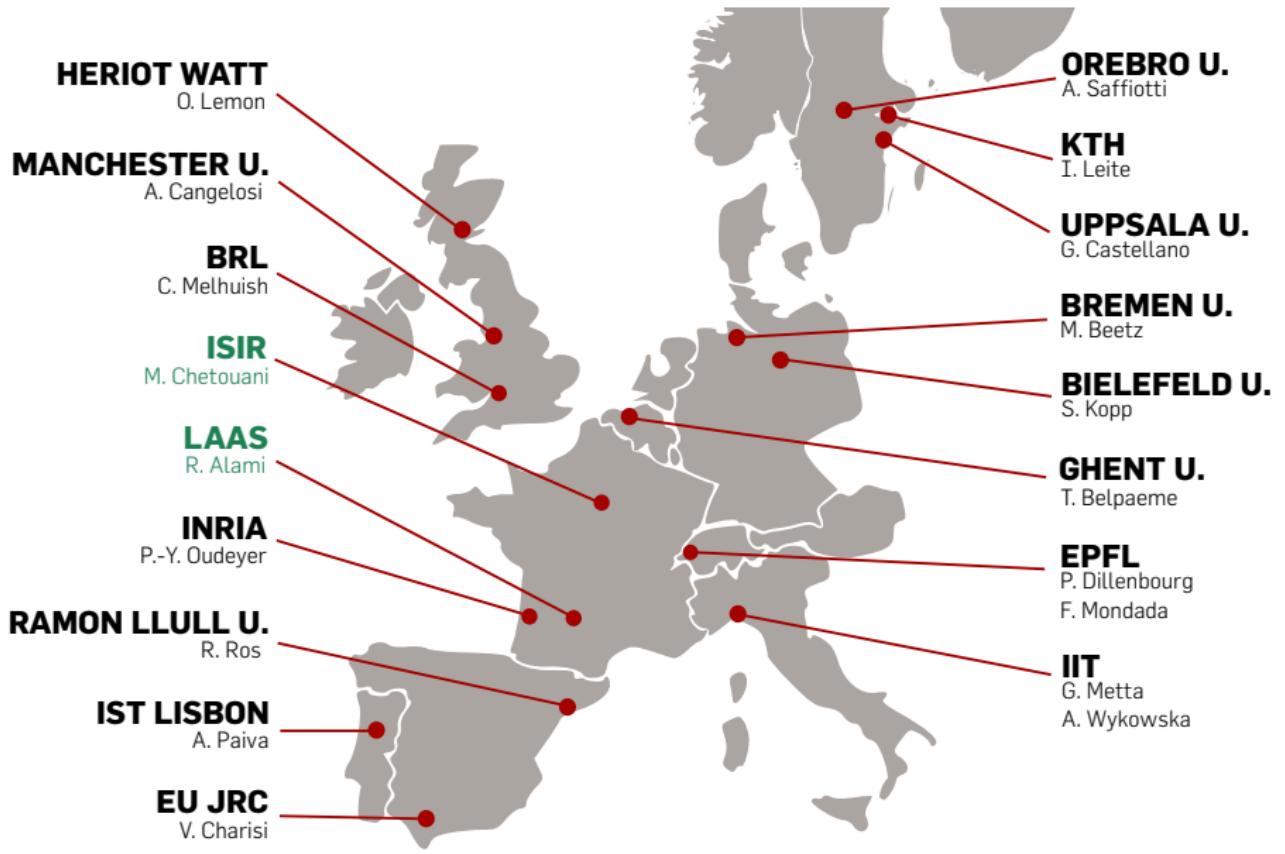
- **Invited expert to EU** on child-robot interaction
- **Scientific advisor for UNICEF** on ethics of cHRI

Technology transfer:

- **Scientific expert** for EU TERRINET, EU SABRE and 3 UK-based industry-led projects
- **Scientific advisor** for start-up KickSum Ltd
- US **patent** US20190016213A1 on haptic locomotion

Public engagement:

- Cluster **lead for outreach** at UWE
- Significant **media engagement** (TV, radio, press; eg CoWriter, Couck25K projects)
- Scientific engagement with public institutions, eg **London Science Museum**



+ **YALE**  
B. Scasselatti

**WASHINGTON U.**  
M. Cakmak

**COLORADO U.**  
T. Williams

**J. HOPKINS U.**  
C.-M. Huang

**SYDNEY**  
M.-A. Williams  
W. Johal

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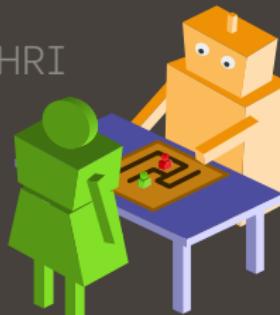
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anthropomorphism

participatory design



# RESEARCH PROJECT: SOCIAL ROBOTICS

Creating interactive robots that are **embedded and understand their (human) social context; generate and adopt appropriate social behaviours; have a positive impact on human society.**

⇒ designing and implementing the **assistant and companion robots** for tomorrow.

Direct impact on ageing society, education, customer service. **Major socio-economic challenge + European priority** ⇒ need to develop capacity and assert leadership



# RESEARCH PROJECT: SOCIAL ROBOTICS

## Autonomous social robot: beyond state-of-the-art

### Major scientific challenges:

- Understand and sustain long-term autonomous social interactions;
- Closing the interaction loop;
- Real-world algorithmic robustness;
- Complex ethical landscape;
- ⇒ cross-disciplinary & holistic approach required



# RESEARCH PROJECT: SOCIAL ROBOTICS

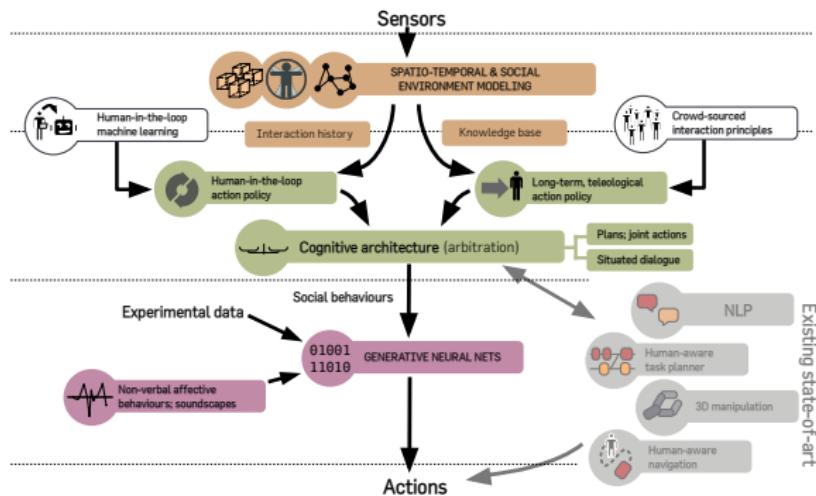
My research proposal:

**Socially-Driven Autonomous Robots  
for  
Real-world Human-Robot Interactions**



# KEY SCIENTIFIC AIMS

1. beyond state-of-art **robust real-world social modelling; social embeddings**
2. **public-in-the-loop** approach to design of **intrinsic social motivation**
3. **generative social behaviours** for robots
4. **cognitive architecture for long-term interaction**



# MIXED METHODS

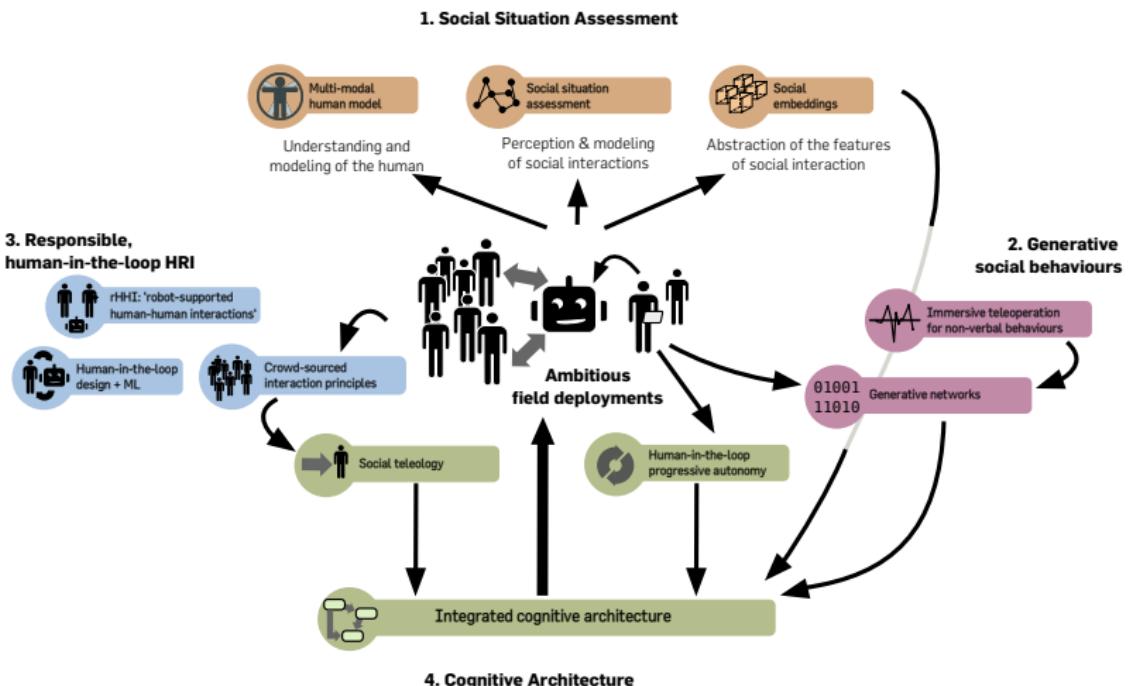
Standard methods:

- Exploratory field work/case studies
- Participatory design; co-design
- Ecologically-valid controlled studies
- Longitudinal studies
- Large-scale online crowd-sourcing

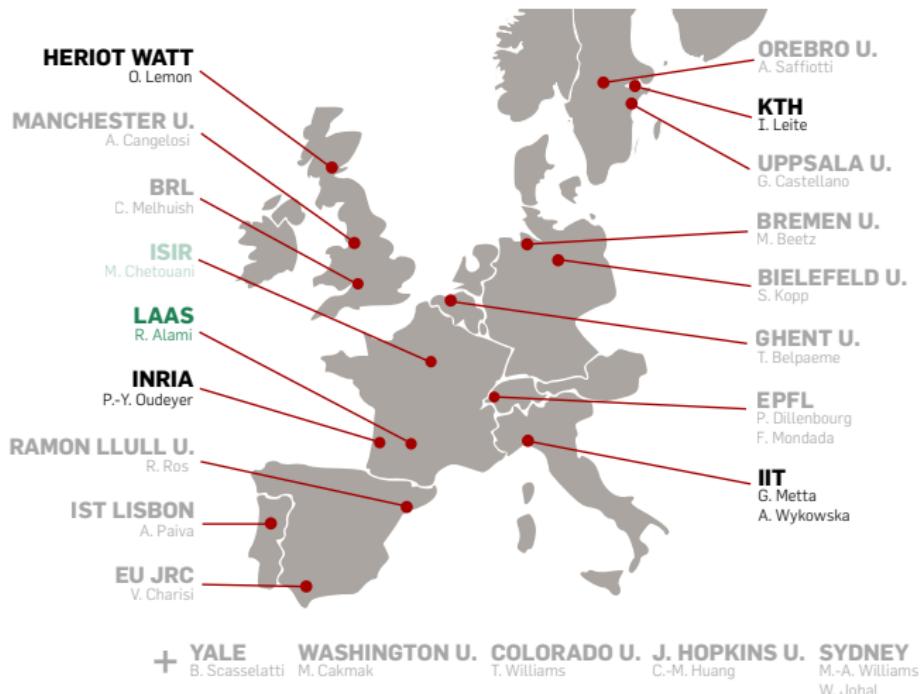
Novel methods that I introduce in my project:

- **Public-in-the-loop machine learning**
- **Immersive teleoperation and generative behaviours** with artists

# 4 AXES TO SCAFFOLD AN AMBITIOUS RESEARCH GROUP



# 2022: EU ICT BID: Socially-Driven Autonomous Robots



# INTEGRATION LAAS



- Long-standing expertise in autonomous social robots (R. Alami) → natural integration to RIS team
- Excellent infrastructure & access to robots
- Software engineering expertise almost unique in academia
- ANITI: Excellent academic environment & collaboration opportunities

# INTEGRATION LAAS

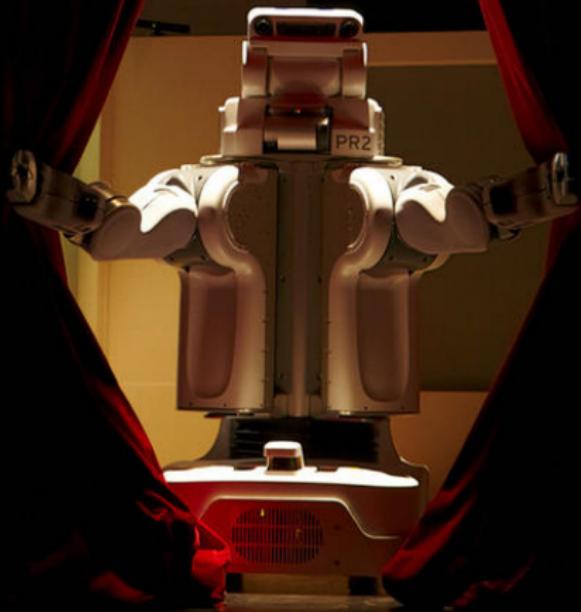


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## **What I would bring:**

- Experimental know-how with extensive expertise in real-world deployments
- Emerging theme: Data-driven HRI
- ANITI: transverse applications for AI and robotics

Thank you!



*(photo of roboscopie, a theatre play I  
created with director Nicolas Darrot  
in 2012)*