

# 2021 INTERNATIONAL WORKSHOP ON EMBODIED INTELLIGENCE

## 24 March 2021

### MORNING SESSION

09:00 – 09:30	Introduction and Welcome: <b>Fumiya lida</b> (UoC)
09:30 – 10:15	Plenary Talk: <b>Yasuo Kuniyoshi</b> (University of Tokyo)
10:15 – 10:30	<b>Coffee Break</b>
10:30 – 12:00	<b>Short talks and Panel discussions:</b> Cecilia Laschi (National University Singapore) Andy Clark (University of Sussex) Jun Tani (OIST) Matt Crosby (Imperial College) Barbara Webb (University of Edinburgh)
12:00 – 13:00	<b>Lunch and Break-out sessions</b>

### AFTERNOON SESSION

13:00 – 13:15	Day 1 Morning session summary: <b>Josh Bongard</b> (University of Vermont)
13:15 – 13:45	Plenary talk: <b>Karl Friston</b> (UCL)
13:45 – 15:30	<b>Short talks and Panel discussions:</b> Lakshminarayanan Mahadevan (Harvard University) Daniela Rus (MIT) Metin Sitti (Max Planck Institute) Nihat Ay (Max Planck Institute) Lucy Cheke (UoC) Hod Lipson (Columbia University)
15:30 – 15:45	<b>Coffee Break</b>
15:45 – 16:30	Plenary talk: <b>Olaf Sporns</b> (Indiana University)
16:30 – 17:00	Day 1 discussion
17:00 – 18:00	Break-out sessions

## 25 March 2021

### MORNING SESSION

08:00 – 09:15	Break-out Sessions
09:15 – 09:30	Day 1 Summary: <b>Kohei Nakajima</b> (University of Tokyo)
09:30 – 10:15	Plenary Talk: <b>Takashi Ikegami</b> (UoT)
10:15 – 10:30	<b>Coffee Break</b>
10:30 – 12:00	<b>Short talks and Panel discussions:</b> Stoyan Smoukov (Queen Mary University) Dario Floreano (EPFL) Barbara Mazzolai (Italian Institute of Technology) Jonathan Rossiter (University of Bristol) Yukie Nagai (University of Tokyo)
12:00 – 13:00	<b>Lunch and Break-out sessions</b>

### AFTERNOON SESSION

13:00 – 13:15	Day 2 Morning session summary: <b>Josie Hughes</b>
13:15 – 13:45	Plenary talk: <b>Pietro Cicuta</b> (UoC)
13:45 – 15:30	<b>Short talks and Panel discussions:</b> Thrish Nanayakkara (Imperial College) Rebecca Kramer-Bottiglio (Yale University) Daniel Goldman (Georgia Tech) Mirko Kovac (Imperial College) Oliver Brock (Technische Universität Berlin)
15:30 – 15:45	<b>Coffee Break</b>
15:45 – 16:30	Plenary talk: <b>Robert Shepherd</b> (Cornell University)
16:30 – 17:00	Day 2 discussion
17:00 – 18:00	Break-out sessions

## 26 March 2021

### MORNING SESSION

09:00 – 09:15	Day 2 Summary: <b>Fumiya lida</b> (UoC)
09:15 – 10:45	<b>Short talks and Panel discussions:</b> Jamie Paik (EPFL) Helmut Hauser (University of Bristol) Kyujin Cho (Seoul National University) Li Wen (Beihang University) Yoshiyuki Sankai (University of Tsukuba, CYBERDYNE Inc.)
10:45 – 11:00	<b>Coffee Break</b>
11:00 – 11:45	Plenary Talk: <b>Hiroshi Ishiguro</b> (Osaka University)
11:45 – 12:15	Workshop Summary: <b>Fumiya lida</b> (UoC)
12:15 – 13:00	<b>Lunch</b>

### AFTERNOON SESSION

13:00 – onwards	<b>OPEN DISCUSSION</b> • Community coordination: What next? • Research Collaborations • Open Problems and Research Discussion <b>SUMMARY SESSION</b>
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## 24 April 2021

13:00 – 15:00	Public Outreach Event <b>'Future of Robotics'</b>
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**NOTE THE TIMINGS GIVEN IN GMT  
(Greenwich Mean Time)**

**ADDITIONAL INFO ON THE WORKSHOP WEBSITE**

**REGISTER HERE**

Join us on ZOOM  
**24 – 26 MARCH 2021**  
and 24 April 2021  
(Public Engagement)

# 2021 INTERNATIONAL WORKSHOP ON EMBODIED INTELLIGENCE

24 March 2021

LUNCH TIME BREAK-OUT SESSIONS (12-1pm GMT)

## Session 1: Cognitive Developmental Robotics

Chair: Perla Maiolino, Co-Chair: Matej Hoffmann  
 Technical Support: Peter Miles

- Angelo Cangelosi: Embodiment and Developmental Robotics
- Joni Zhong: Towards an embodied robot model for ASD
- Nicholas Wilkinson: Active beamforming - sensory array theory for embodied action-perception
- Matej Hoffmann: Learning body models: from humans to humanoids
- Alex Pitti: System 1/System 2: from discovering structure in the world to self-structuring the brain itself
- Verena Hafner: Embodied AI approach to an artificial self
- Perla Maiolino: Embodied Intelligence for Tactile Perception

## Session 2: Beyond Bio-Inspired Robotics and Control

Chair: Simon Hauser, Co-Chair: Utku Culha  
 Technical Support: Josie Hughes

- Alona Kharchenko: MUSC 3.0: an open-source modular musculo-skeletal robotics toolkit
- Federico Renda: Flagellate Underwater Robotics at the Macroscale
- Stephane Violette: Multimodal locomotion in robotics: an origami approach
- Francesco Giorgio-Serchi: Embodied elasticity enables optimal propulsive efficiency in bioinspired pulsed-jet vehicles
- Utku Culha: Learning how to walk on milliscale soft robots
- Carlos Herrera Perez: Making sense of robotic dance
- Gwangpil Jung: A Highly Mobile Chameleon-inspired Long-Distance Manipulator
- Hugo Marques: Demystifying the role of the cerebellum in motor coordination

## Session 3: Open Crazy Topics

Chair: Marwa ElDiwiny Co-Chair: Kieran Gilday  
 Technical Support: Toby Howison

- Joni Mici: Assembly Paradigms for Cellular Machines
- Fabio Giardina/S Ganga Prasath: Emergent cooperative escape in ants and robots
- Rana Faryad Ali: Stimuli-responsive soft robotics: Where can these robots take us, and where can we take them?
- Grzegorz Sochacki: Touch, smell, taste and sound sensing in robotic kitchen
- S.M.Hadi Sadati: A Morphological Observers for Hard-to-Model/Observe/Measure System States: Case of A Helical Stiffness Controllable Interface
- Toby Howison: Evolving balloons
- John Rieffel: Revisiting Brooks and Embodied Intelligence
- Simon McGregor: Translating Between The Mental And The Physical

# 2021 INTERNATIONAL WORKSHOP ON EMBODIED INTELLIGENCE

24 March 2021

AFTERNOON BREAK-OUT SESSIONS (5pm-onwards, GMT)

## SESSION 1: Kinds of Intelligence

Chair: Thilina Lalitharatne, Co-Chair: Thomas George-Thuruthel

Technical Support: Greg Sochacki

- Lola Canamero:** Embodied Emotion, Cognition and Interaction: The Tangled Knot of Embodied Intelligence
- Sam Kriegman:** Living Robots
- Oswald Berthold:** Flatcat, your next robot is a pet
- Fritz Vollrath:** Spiders using regenerated legs
- Sonia Roberts:** Designing robots to exploit affordances
- Matteo Cianchetti:** Embodied intelligence for resilient soft robots
- Jesse Parent:** A Decade in Review: Computational Modelling of Embodied Cognition
- Peter Bently:** Morphogenesis: Distributed Intelligence for Generative Design
- Paul Verschure:** The Distributed Adaptive Control of Volition in Humans and Robots: from embodied cognitive architectures, to neurocomputational models and intracranial physiology
- Nicoletta Risi:** Spike-based stereo with mixed-signal neuromorphic hardware

## SESSION 2: Embodied Intelligence in Soft Robotics

Chair: Hadi Sadati, Co-Chair: Fabio Giardina

Technical Support: Grzegorz Sochacki

- Cosimo Della Santina:** Nonlinear modal analysis as a mean for describing Embodied Intelligence in Soft Robots
- Aditya Bhatt:** How the body shapes the way we manipulate
- Bert Van Raemdonck:** FONS: a modelling tool for simulating morphological control in fluidic systems
- Maria Elena Giannaccini:** Variable compliance for effective robot design in unstructured environments
- Vincent Wall:** Acoustic Sensing for Soft Pneumatic Actuators
- Xiaoguang Dong:** Embodying coordinated behaviors in collective soft robots
- John Rieffel:** Behavioural Repertoires for Soft Robotics

# 2021 INTERNATIONAL WORKSHOP ON EMBODIED INTELLIGENCE

25 March 2021

## MORNING BREAK-OUT SESSIONS (8-9am GMT)

### SESSION 1: Self-organisation and Bio-Inspired Robotics (Group 1)

Chair: Shuhei Miyashita, Co-Chair: Suryz Nurzaman  
Technical Support: Toby Howison

- Nhan Huu Nguyen:** Study of sensing function recovery in damaged sensor structure by adaptive shape-shifting: Case of Rodent's Vibrissae
- Hermes Gadelha:** Embodied Intelligence of microorganisms
- Andy Tyrrell:** Autonomous Robot Evolution
- David Howard:** Designer Embodied Cognition
- Surya Nurzaman:** Embodied learning and optimisation in soft and multi-material robots: from aerial to ground application
- Edmund Hunt:** Collective cognition via embodied approximate Bayesian computation
- Qi An:** Motor recovery after stroke

### SESSION 2: Self-organisation and Bio-Inspired Robotics (Group 2)

Chair: Alex Schmitz, Co-Chair: Leoni Costi  
Technical Support: Simon Hauser

- Swapnil Kumar:** Stability analysis for Connected Autonomous Vehicle
- Tønnes Nygaard:** Morphology Adaptation in Real-world Robots
- Roderich Gross:** On controlling ensembles of memoryless robots
- Koh Hosoda:** Biomimetic Muscular Skeletal Robots
- Angela Faragasso:** Smart design of effective robot mechanisms and devices
- Rymen Hashem:** Soft Robotic Stomach
- Kenjiro Tadakuma:** Soft Robotic Mechanisms, - from Robotic Nemertea Proboscis into Robotic Blood Vessel Mechanism
- Alex Schmitz:** Soft Robots and Soft Sensors For Safe and Adaptive Manipulation

# 2021 INTERNATIONAL WORKSHOP ON EMBODIED INTELLIGENCE

**25 March 2021**

**LUNCH TIME BREAK-OUT SESSIONS (12-1pm GMT)**

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**SESSION 1: Biohybrid, Cyborg, Human in the loop**

Chair: Luca Scimeca, Co-Chair: Florence Leong  
 Technical Support: Leoni Costi

- Leone Costi:** Achieving complex motion primitives through smart design
- Rafael Hostettler:** Roboy 3.0 - Open-Source musculo-skeletal telepresence system
- Ilana Nisky:** Human-in-the-loop design for tele-operated robot-assisted surgery
- Kieran Gilday:** Dexterous Manipulation and the Passive Hand
- Angel P. Del Pobil:** The Challenge of Manual Robotic Intelligence
- Dana Damian:** Robot's Vulnerabilities In Vivo
- Mini Saaj:** IVF & Soft Robotics: Can we pair them?

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**SESSION 2: Open Crazy Topics**

Chair: Perla Maiolino Co-Chair: Grzegorz Sochacki  
 Technical Support: Peter Miles

- Alastair Channon:** The Open-Ended Evolution route to Embodied Intelligence
- Swapnil Kumar:** Depiction of the behaviour of Tibia bone using the concept of FEA and Data Acquisition and its development using Additive manufacturing
- Giacomo Indiveri:** Mind, Brain, and Body of Neuromorphic Cognitive Agents
- Jingyue Zhao:** Neuromorphic Closed-loop Motor Control
- Jane Loveless:** Embodied Maggots and Worms
- Gusz Eiben:** How the brain shapes the body
- Stefan Dvoretzkii:** Modelling Neural Development with Braitenberg Vehicles
- Bradly John Alicea:** Approaches to Developmental Embodied Neurosimulation

# 2021 INTERNATIONAL WORKSHOP ON EMBODIED INTELLIGENCE

**25 March 2021**

**AFTERNOON Break-out sessions (5pm-onwards, GMT)**

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## SESSION 1: Beyond Soft Robotics

Chair: Thomas George-Thuruthel, Co-Chair: Kieran Gilday  
Technical Support: Kieran Gilday

- Gaurav Singh:** Modelling and analysis of modular soft robots using muscle like linear actuators
- Abdon Pena-Francesch:** Self-healing materials in Soft Robotics
- Hiromi Mochiyam:** Rod Integration and Embodied Intelligence
- Kaspar Althoefer:** Navigating eversion robots
- Lucca Beccai:** Towards embodied versatile gripping: the PROBOSCIS approach
- Thomas George-Thuruthel:** Static modelling of temporal nonlinearities

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## SESSION 2: Links between EI and Learning

Chair: Hadi Sadati, Co-Chair: David Hardman  
Technical Support: Toby Howison

- Simon Birrell:** Using self-organised behaviours generated by Differential Extrinsic Plasticity (DEP) to guide the exploratory phase of Reinforcement Learning
- Adam Safron:** Bootstrapping off of embodied priors in Bayesian structure learning
- David Hardman:** Non-contact control of a floating object via environmental manipulation
- Andrés Méndez:** Moto-sensory contingencies set the grounds for sustained attention and the emergence of more complex forms of cognitive control
- Jorge Soto-Andrade:** Embodiment in the learning of mathematics
- Daniel Polani:** Favourable embodiments and cognitive highways

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**26 March 2021**

**OPEN DISCUSSION (12pm-onwards, GMT)**

(for the topics please see the general programme)