Welcome to the proceedings of the Tenth International Conference on Simulation of Adaptive Behavior (SAB 2008). A symbolic creature in the SAB 2008 poster is based on GAKUTENSOKU, Japan's first modern robot created in 1928 by Makoto Nishimura. The robot, Gakutensoku (or "learning from natural law"), was 7’ 8” tall, painted gold, could open and close its eyes, could smile, could puff out its cheeks, and at the beginning of each performance would touch its mace to its head and then begin to write (from http://www.robmacdougall.org/index.php/2008/04/gakutensoku/). Gakutensoku was actuated by pneumatics and seems to have been "a sort of early Japanese animatronics." Designed 80 years ago, it still stimulates researchers’ minds.

This year, we received 110 submissions, among which we selected 30 for oral presentations and 21 for posters. In the main conference, we had four very interesting plenary talks: "Modelling Adaptive and Intelligent Behaviour: Some Historical and Epistemological Issues" by Roberto Cordeschi, "Insect-Machine Hybrid System for Understanding an Adaptive Behavior" by Ryohei Kanzaki, "Body Shapes Brain – Emergence and Development of Behavior and Mind from Embodied Interaction Dynamics" by Yasuo Kuniyoshi, and "Thinking and Learning Close to the Sensory-Motor Surface Creates Knowledge That Transcends the Here and Now" by Linda Smith. On the second day, we had a special joint session with the British Council featuring special talks by Giacomo Rizzolatti and Ron Chrisley followed, by a panel discussion. After the main conference, we had a workshop and two tutorials.

Minoru Asada
Jun Tani
Organization

From Animals to Animats 10: The Tenth International Conference on the Simulation of Adaptive Behavior (SAB 2008) was organized by the JST ERATO Asada Project and ISAB (International Society for Adaptive Behavior).

Executive Committee

General Chair
Minoru Asada, Osaka University, Japan
Program Chair
Jun Tani, RIKEN, Japan
General Co-chairs
John Hallam, University of Southern Denmark, Denmark
Jean-Arcady Meyer, University of Paris 6 – CNRS, France

Program Committee

Hussein Abbass
Alberto Acerbi
Ronald Arkin
Angelo Arleo
Minoru Asada
Gianluca Baldassarre
Christian Balkenius
Luc Berthouze
Aude Billard
Eleonora Bilotta
Joanna Bryson
Seth Bullock
Angelo Cangelosi
Thomas Collett
Nikolaus Correll
Kerstin Dautenhahn
Marco Dorigo
Michael Dyer
Dario Floreano
Luca Gambardella
Philippe Gaussiaer
Agnes Guillot
John Hallam
Osam Hanagata
Inman Harvey

Gillian Hayes
Phil Husbands
Fumiya Iida
Hiroyuki Iizuka
Auke Jan Ijspeert
Takashi Ikegami
Akio Ishiguro
Koji Ito
Masato Ito
Naoto Iwashashi
Frederic Kaplan
Kuniaki Kawabata
Toshiyuki Kondo
Robert Kozma
Jeffrey L. Krichmar
Hanspeter Mallot
Davide Marocco
Alcherio Martinoli
Gianluca Massera
Mariagiovanna Mazzapedia
Chris Melhuish
Jean-Arcady Meyer
Marco Mirolli
Francesco Mondada
Kazuyuki Murase
Ryohei Nakano
Chrystopher L. Nehaniv
Stefano Nolfi
Tetsuya Ogata
Pietro Pantano
Frank Pasemann
Jan Peters
Rolf Pfeifer
Eric Postma
Tony Prescott
Miki Sagara
Matthew Schlesinger
Gregor Schoner
Noel Sharkey
Tomohiro Shibata
Olivier Sigaud
Olaf Sporns
Kenji Suzuki
Jun Tani
Charles Taylor
Tim Taylor
Guy Theraulaz
Vadim Tikhanoff
Peter Todd
Vito Trianni
<table>
<thead>
<tr>
<th>Name</th>
<th>Name</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kazuo Tsuchiya</td>
<td>Paul Vogt</td>
<td>Myra S. Wilson</td>
</tr>
<tr>
<td>Elio Tuci</td>
<td>Hiroaki Wagatsuma</td>
<td>Rachel Wood</td>
</tr>
<tr>
<td>Richard Vaughan</td>
<td>Janet Wiles</td>
<td>Tom Ziemke</td>
</tr>
</tbody>
</table>
# Table of Contents

**The Animat Approach to Adaptive Behaviour**

Extended Homeostatic Adaptation: Improving the Link between Internal and Behavioural Stability ........................................... 1  
*Hiroyuki Iizuka and Ezequiel A. Di Paolo*

Evolution of Valence Systems in an Unstable Environment ............... 12  
*Matthijs Snel and Gillian M. Hayes*

Flexible Control Mechanism for Multi-DOF Robotic Arm Based on Biological Fluctuation .................................................. 22  
*Ippei Fukuyori, Yutaka Nakamura, Yoshio Matsumoto, and Hiroshi Ishiguro*

Neural Noise Induces the Evolution of Robust Behaviour by Avoiding Non-functional Bifurcations ......................................... 32  
*Jose A. Fernandez-Leon and Ezequiel A. Di Paolo*

Integration of an Omnidirectional Visual System with the Control Architecture of Psikharpax ........................................... 42  
*Loic Lacheze, Ryad Benosman, and Jean-Arcady Meyer*

**Evolution**

Stability of Coordination Requires Mutualty of Interaction in a Model of Embodied Agents ................................................ 52  
*Tom Froese and Ezequiel A. Di Paolo*

Internal and External Memory in Neuroevolution for Learning in Non-stationary Problems ........................................ 62  
*Francisco Bellas, Jose A. Becerra, and Richard J. Duro*

Evolving Vision Controllers with a Two-Phase Genetic Programming System Using Imitation ................................................. 73  
*Renaud Barate and Antoine Manzanera*

Embodiment and Perceptual Crossing in 2D: A Comparative Evolutionary Robotics Study ................................................. 83  
*Marieke Rohde and Ezequiel Di Paolo*

**Navigation and Internal World Models**

Adaptive Optimal Control for Redundantly Actuated Arms ............. 93  
*Djordje Mitrovic, Stefan Klanke, and Sethu Vijayakumar*
Monostable Controllers for Adaptive Behaviour ........................................ 103
Christopher L. Buckley, Peter Fine, Seth Bullock, and Ezequiel Di Paolo

Bifurcation Angles in Ant Foraging Networks: A Trade-Off between Exploration and Exploitation? .......................................................... 113
Luc Berthouze and Alexander Lorenzi

Episodes in Space: A Modeling Study of Hippocampal Place Representation .......................................................... 123
Balázs Ujfalussy, Péter Erős, Zoltán Somogyvári, and Tamás Kiss

Modelling the Cortical Columnar Organisation for Topological State-Space Representation, and Action Planning .................................... 137
Louis-Emmanuel Martinet, Benjamin Fouque, Jean-Baptiste Passot, Jean-Arcady Meyer, and Angelo Arleo

Adaptive Olfactory Encoding in Agents Controlled by Spiking Neural Networks ..................................................................................... 148
Nicolas Oros, Volker Steuber, Neil Davey, Lola Cañamero, and Rod Adams

Theta Phase Coding and Acetylcholine Modulation in a Spiking Neural Network .................................................................................. 159
Daniel Bush, Andrew Philippides, Phil Husbands, and Michael O’Shea

Interest of Spatial Context for a Place Cell Based Navigation Model ... 169
Nicolas Cuperlier, Philippe Gaussier, and Mathias Quoy

Linked Local Visual Navigation and Robustness to Motor Noise and Route Displacement .............................................................. 179
Lincoln Smith, Andrew Philippides, Paul Graham, and Phil Husbands

Second Order Conditioning in the Sub-cortical Nuclei of the Limbic System ......................................................................................... 189
Adedoyin Maria Thompson, Bernd Porr, Christoph Kolodziejski, and Florentin Wörgötter

Perception and Control

Synthesising Novel Movements through Latent Space Modulation of Scalable Control Policies .............................................................. 199
Sebastian Bitzer, Ioannis Havoutsis, and Sethu Vijayakumar

Incremental Evolution of Animats’ Behaviors as a Multi-objective Optimization .................................................................................. 210
Jean-Baptiste Mouret and Stéphane Doncieux
Integrating Epistemic Action (Active Vision) and Pragmatic Action (Reaching): A Neural Architecture for Camera-Arm Robots .................................................. 220
  Dimitri Ognibene, Christian Balkenius, and Gianluca Baldassarre

Neural Coding in the Dorsal Visual Stream .................................................. 230
  Eris Chinellato and Angel P. del Pobil

Learning and Adaptation

Modeling the Bat LSO Tonotopical Map Refinement during Development .......................................................... 240
  Bertrand Fontaine and Herbert Peremans

A Reinforcement Learning Technique with an Adaptive Action Generator for a Multi-robot System .................................................. 250
  Toshiyuki Yasuda and Kazuhiro Ohkura

A Multi-cellular Developmental System in Continuous Space Using Cell Migration .................................................. 260
  Nicolas Bredeche

Toward a Theory of Embodied Statistical Learning .................................................. 270
  Daniel Burfoot, Max Lungarella, and Yasuo Kuniyoshi

Closing the Sensory-Motor Loop on Dopamine Signalled Reinforcement Learning .................................................. 280
  Paul Chorley and Anil K. Seth

Mutual Development of Behavior Acquisition and Recognition Based on Value System .................................................. 291
  Yasutake Takahashi, Yoshihiro Tamura, and Minoru Asada

Cognition, Emotion and Behaviour

Improving Situated Agents Adaptability Using Interruption Theory of Emotions .................................................. 301
  Clément Raïevsky and François Michaud

Dynamical Systems Account for Meta-level Cognition .................................................. 311
  Michail Maniadakis and Jun Tani

A Computational Model of the Amygdala Nuclei’s Role in Second Order Conditioning .................................................. 321
  Francesco Mannella, Stefano Zappacosta, Marco Mirolli, and Gianluca Baldassarre

Acquiring a Functionally Compositional System of Goal-Directed Actions of a Simulated Agent .................................................. 331
  Yuuya Sugita and Jun Tani
Learning to Generalize through Predictive Representations: A
Computational Model of Mediated Conditioning .......................... 342
Elliot A. Ludvig and Anna Koop

Detection of Weak Signals by Emotion-Derived Stochastic
Resonance ............................................................................... 352
Shogo Yonekura, Yasuo Kuniyoshi, and Yoichiro Kawaguchi

The Influence of Asynchronous Dynamics in the Spatial Prisoner’s
Dilemma Game ....................................................................... 362
Carlos Grilo and Luís Correia

A Study of Off-Line Uses of Anticipation ................................. 372
Giovanni Pezzulo

Collective and Social Behaviours

An Individual-Based Model of Task Selection in Honeybees ......... 383
Thomas Schmickl and Karl Crailsheim

Distributed Adaptation in Multi-robot Search Using Particle Swarm
Optimization ........................................................................... 393
Jim Pugh and Alcherio Martinoli

Homeotaxis: Coordination with Persistent Time-Loops ............... 403
Mikhail Prokopenko, Astrid Zeman, and Rongxin Li

Noise-Induced Adaptive Decision-Making in Ant-Foraging ......... 415
Bernd Meyer, Madeleine Beekman, and Audrey Dussutour

Division of Labour in Self-organised Groups ............................... 426
Roderich Groß, Shervin Nouyan, Michael Bonani, Francesco Mondada, and Marco Dorigo

Social Control of Herd Animals by Integration of Artificially Controlled
Congeners ............................................................................... 437
Nikolaus Correll, Mac Schwager, and Daniela Rus

Aggregating Robots Compute: An Adaptive Heuristic for the Euclidean
Steiner Tree Problem ................................................................ 447
Heiko Hamann and Heinz Wörn

Emergence of Interaction among Adaptive Agents .................... 457
Georg Martius, Stefano Nolfi, and J. Michael Herrmann

Adaptive Behaviour in Language and Communication

Acquisition of Human-Robot Interaction Rules via Imitation and
Response Observation ............................................................. 467
Takatsugu Kuriyama and Yasuo Kuniyoshi

On Modeling Proto-Imitation in a Pre-associative Babel ............ 477
Elpida Tzafestas
## Applied Adaptive Behaviour

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolution of General Driving Rules of a Driving Agent</td>
<td>488</td>
</tr>
<tr>
<td>Ivan Tanev, Hirotaka Yamazaki, Tomoyuki Hiroyasu, and Katsunori Shimohara</td>
<td></td>
</tr>
<tr>
<td>BehaviorSim: A Learning Environment for Behavior-Based Agent</td>
<td>499</td>
</tr>
<tr>
<td>Fasheng Qiu and Xiaolin Hu</td>
<td></td>
</tr>
<tr>
<td>Adaptive Behavioural Modulation and Hysteresis in an Analogue of a Kite Control Task</td>
<td>509</td>
</tr>
<tr>
<td>Allister Furey and Inman Harvey</td>
<td></td>
</tr>
<tr>
<td>Self-adaptive Agent-Based Dynamic Scheduling for a Semiconductor</td>
<td>519</td>
</tr>
<tr>
<td>Horng-Ren Tsai and Toly Chen</td>
<td></td>
</tr>
</tbody>
</table>

**Author Index** 529