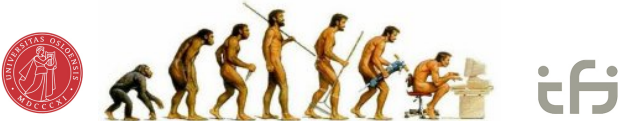


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Bio-inspired Computing for Robots and Music

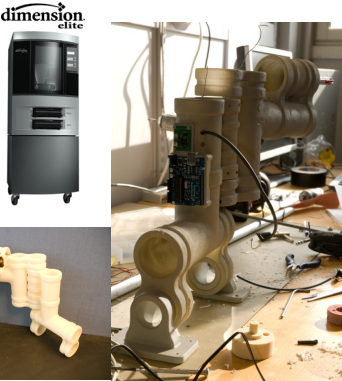
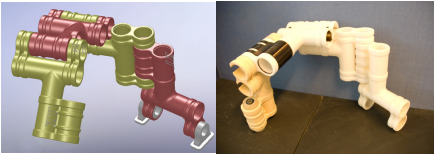
Jim Tørresen
Research group Robotics and Intelligent Systems



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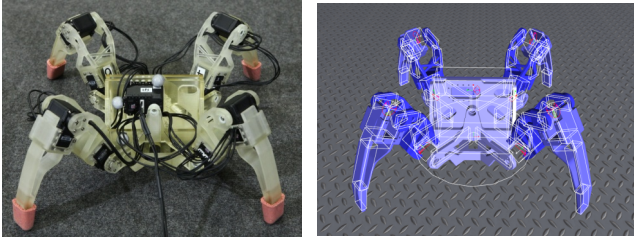
State-of-the-art Rapid Prototyping Facilities

- 3D printers and milling machines
- Large potential for developing innovative robot systems.

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Robot Simulation in NVIDIA PhysX

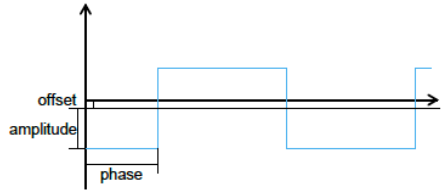


- Work with real robot and simulator/models
- Co-evolve robot shape and walking pattern
- Study and try to reduce gap between reality and simulation

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Evolved Control Systems

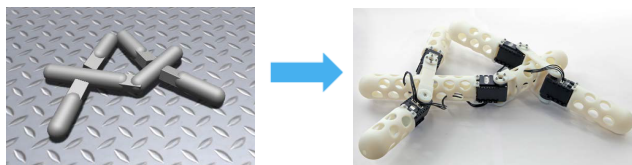
- We can evolve movement patterns!
 - Parameterize periodic functions for each joint
 - Evolve all those parameters



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Evolved Robot Design

- Robot bodies could be difficult to design by hand.
- We use evolutionary algorithm to evolve both body and control system simultaneously.



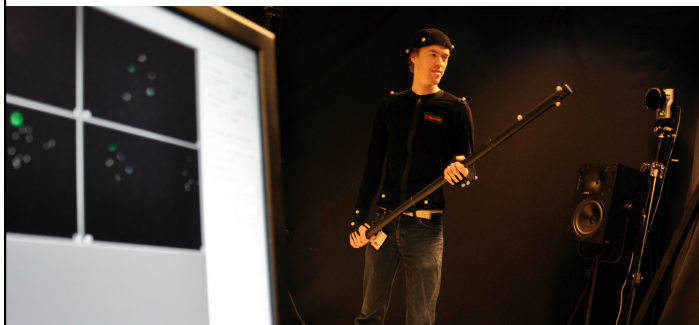
Bio-inspired Computing for Music



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State-of-the-art Motion Capture Facilities

- Allows precise tracking of human and robot motion
- Camera-based and on-body motion capture




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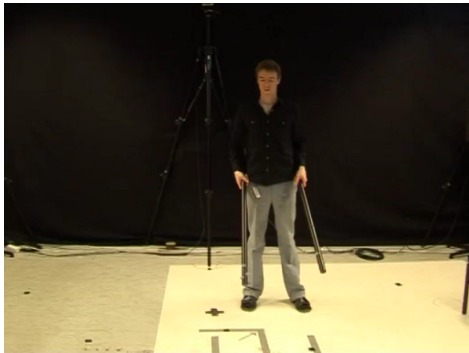
Sound Saber



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Sound Saber



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Visit of Minister and University Administration 17 April, 2012

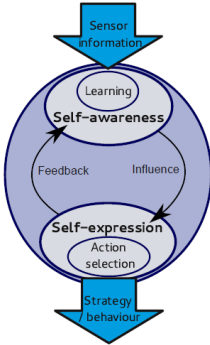


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EPiCS – Self-aware systems (EU proj.)



epiCS
Engineering Proprioception
in Computing Systems



- Human/nature-inspired algorithms for self-awareness and self-expression
- Application: active music
- Collab: 8 European partners

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(Inter) Active Music

Direct Control

- o Navigate within the song
- o Control certain instruments (e.g. keep playing the chorus drumbeat in the verse)
- o Change the tempo of the song

Indirect Control

- o Use on-body sensors to adapt the music to the mood of the user
- o Listen to music that pushes you to work out harder
- o Fuse the musical preferences of multiple users into one song

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Ant Colony Optimization (ACO)

- Ants find shortest path to food source from nest.
- Ants deposit pheromone along traveled path which is used by other ants to follow the trail.
- This kind of indirect communication via the local environment is called stigmergy.

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Funky Sole Music

		current state			
		1-FullRelease	2-ToePress	3-HeelPress	4-FullPress
previous state	1-FullRelease	2	0	1	0
	2-ToePress	1	2	0	0
	3-HeelPress	0	0	1	1
	4-FullPress	0	1	1	1

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Funky Sole Music

Active music control by a sensor sole

- Combination of sound samples and synthesis
- Hierarchy of loops, controlled by the user
- Various sound effects are controllable when in different "states" (i.e., for different walking patterns)

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PheroMusic: Navigating a Musical Space

The diagram shows a graph with 7 nodes arranged in a circle, labeled 1 through 7. Node 6 is at the top, 1 is on the right, 2 is at the bottom, 3 is at the bottom-left, 4 is on the left, 5 is at the top-left, and 7 is at the top-right. Each node is connected to its immediate neighbors and to several other nodes, creating a dense network. Each node also has a self-loop arrow. To the right, a hand holds a smartphone displaying the PheroMusic app interface, which shows a simplified version of this graph with nodes 1, 2, 3, 4, 5, and 6 visible.

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Direct + Indirect Control Combined: PheroMusic

fourMs
Music, Mind, Motion, Machines

EPICS
Engineering Proprioception
in Computing Systems

Last ned og prøv musikkappen
til ROBIN-gruppen:
PheroMusic

A QR code is located in the bottom left corner, and a 'Download on the App Store' badge is in the bottom right corner. To the right, a hand holds a smartphone displaying the PheroMusic app interface, showing a graph with nodes 1, 2, 3, 4, 5, and 6.

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