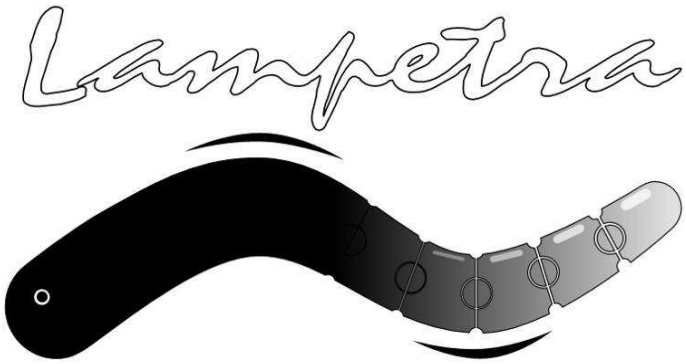
SEVENTH FRAMEWORK PROGRAMME
THEME ICT-2007.8.3 - FET proactive 3
"Bio-ICT convergence"

Grant agreement for: **Collaborative Project**
(small or medium-scale focused research project)

Project acronym: LAMPETRA
Project full title: Life-like Artefacts for Motor-Postural Experiments and Development of new Control Technologies inspired by Rapid Animal locomotion



Grant agreement no.: 216100

Project Deliverable D3.5:

Models for decision making

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The present deliverable (D3.5) encompasses the current models of decision making, integrated with the descending control mechanisms and the musculo-mechanical model of the lamprey. This deliverable is in the form of a Live DVD image which can be booted and run on any 64-bit i386-type computer with sufficient memory (min 2Gb RAM) and graphic capabilities.

The file LAMPETRA-D35.iso contains the DVD image. Use any CD-burning software to transfer this image to a DVD Rom. That DVD can then be used in a standard i386-based computer as the boot device. Alternatively, the ISO-image can be written onto a USB-stick which will then serve as a boot-device in a similar way.

When booted, this will bring up a customised Linux environment with all the appropriate software pre-installed. The hard disk of the host computer will not be touched.

The model itself is defined in a set of script files residing in the directory /lampetra. The simplest way of running the programs is by double-clicking on the icons presented on the desktop which are actually links to scripts within the /lampetra directory.

The simulation is using some 5000 integrate-and-fire model neurons, interconnected according to what is known from anatomy. The main components of the neural model is the decision making circuitry, primarily the basal ganglia, and the rhythm generating circuitry, primarily the spinal cord. The model animal lives in a virtual world and its retina is capable of detecting three classes of objects; threats, obstacles, and targets (illustrated in the animations by red, orange and blue cones, respectively).

The neural networks of the brainstem encode a set of pre-wired primitive steering behaviours making the animal steer towards targets and away from threats. It also steers away from obstacles when they are in front of the animal. The decision making from the basal ganglia circuits come into play when there are several objects present, and the animal has to decide which response to execute.

We provide six scenarios for demonstration. They all use the same neural and musculo-mechanical model; the only thing varying is the placement of the detectable objects in the virtual world.

* The first example is a single target. The lamprey will steer towards the target.

* The second example comprises two targets. The decision making mechanisms will make the animal go for the nearest target and ignore the second, until after the first is reached.

* The third scenario is a target combined with a threat. The animal will first avoid the threat and then, when at a safe distance, attack the target.

* The fourth scenario is a target behind an obstacle. The animal will first steer around the obstacle, and then approach the target from the side.

* The fifth situation is a setting with two targets, both at the same distance. The animal will arbitrarily make the decision to go for one first and the other one later.

* The sixth situation is identical to the previous one, but here the basal ganglia system is non-functional. Here, the animal is incapable of ignoring one of the targets, causing it to miss both, until it accidentally reaches one of them.

In the Videos-folder (accessible from the desktop), are animations from all these scenarios.

All the described material is available on the following URL:
http://lampetra.csc.kth.se/lampetra-d35.iso