Control of a lower limb prosthesis by means of eye movement sequences: *a concept*
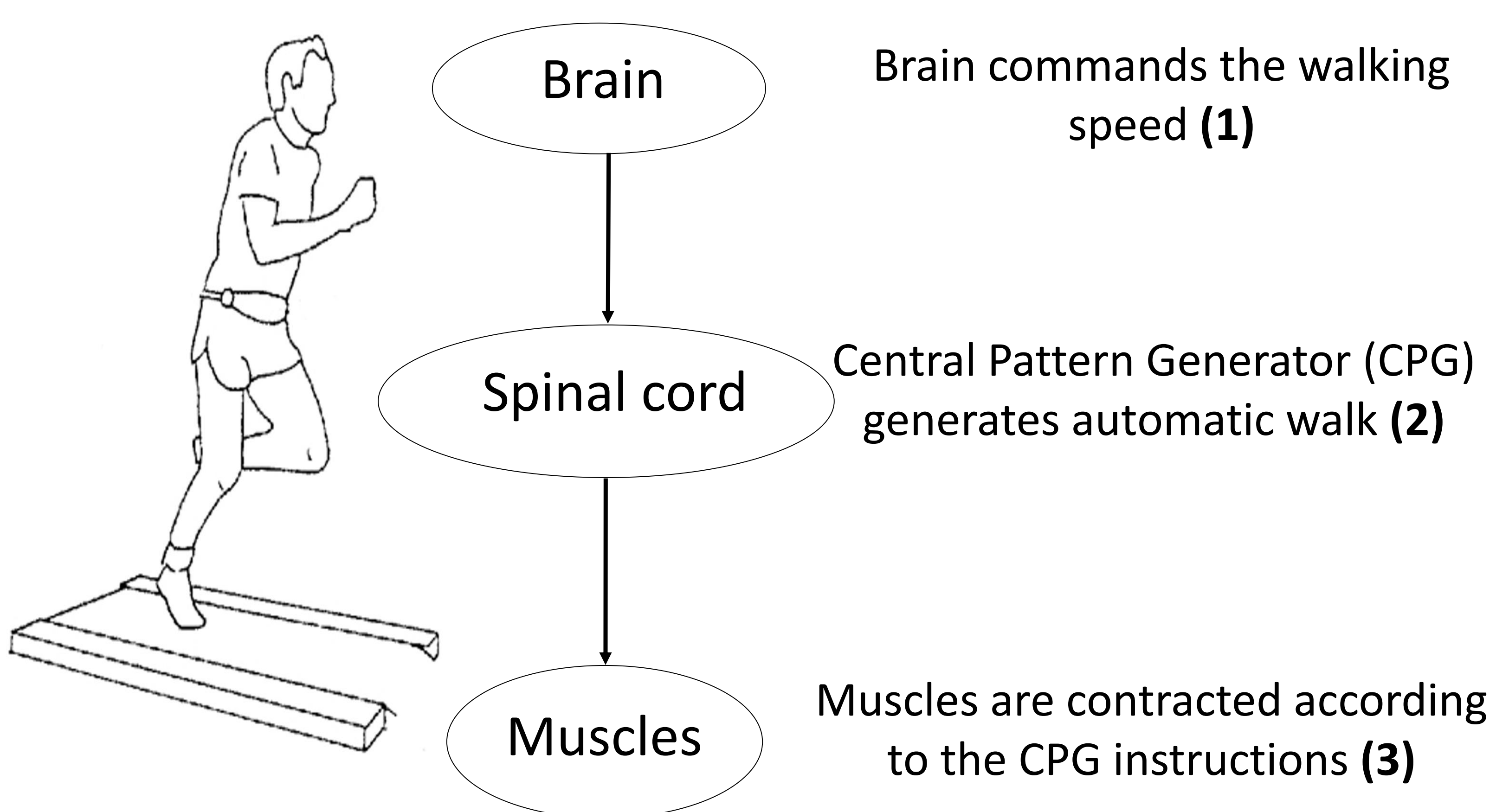
UMONS — Université de Mons

Introduction

Wallonie · cetic · sirris driving industry by technology · Cenaero Excellence in Simulation Technologies for Aeronautics · UMONS Université de Mons
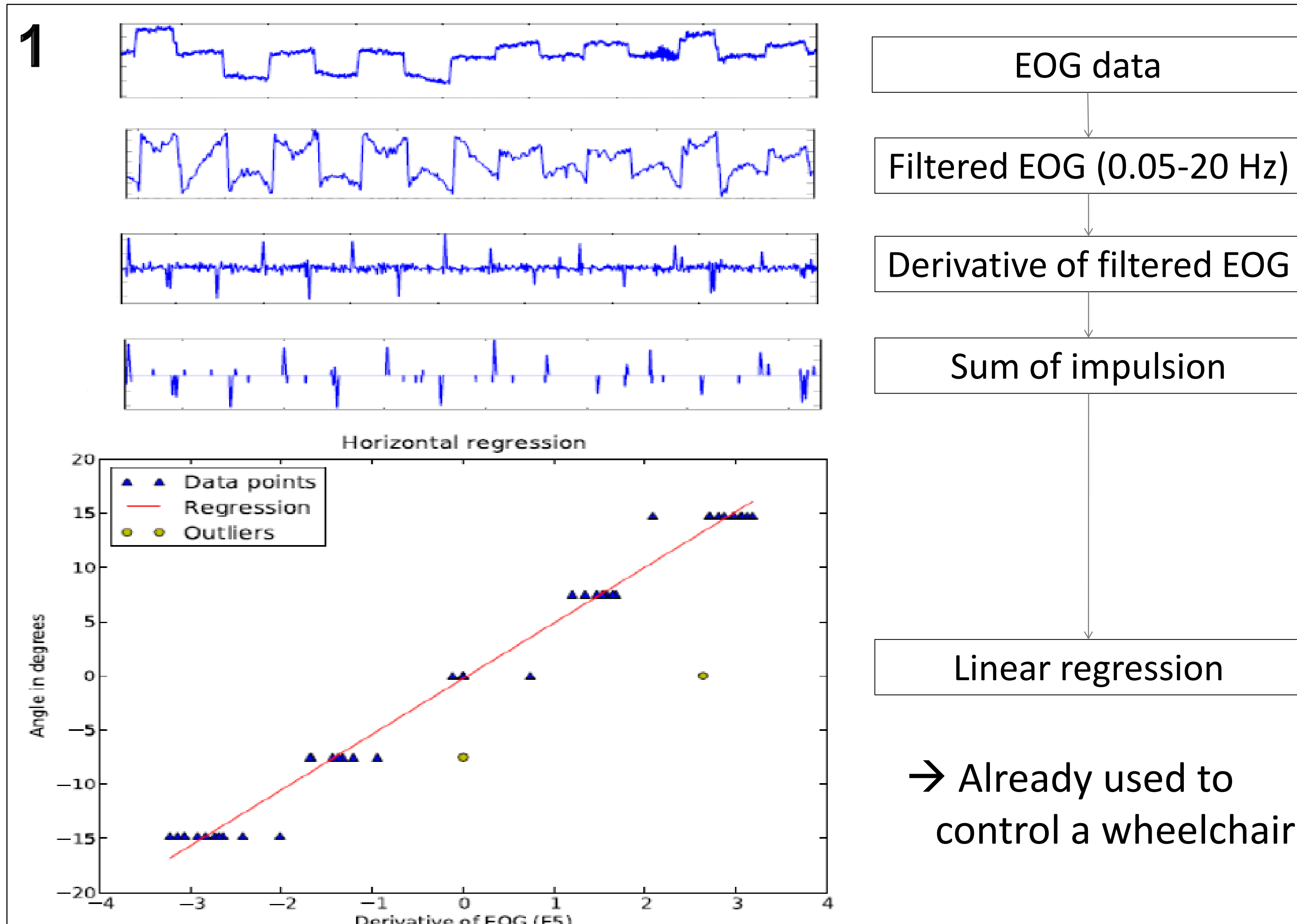
- Current prostheses do not integrate latest advances in neurophysiology, microelectronics and informatics
- The TCTS lab is developing a **biologically inspired Brain/Neuronal Computer Interface (BNCI)** for an **original lower limb prosthesis** by means of electro-encephalographic (EEG) and electro-myographic (EOG) signals
- The aim is to provide disabled patients with a real-time non-invasive active prosthesis taking into account their intentions (go faster, slower, stop, ...)
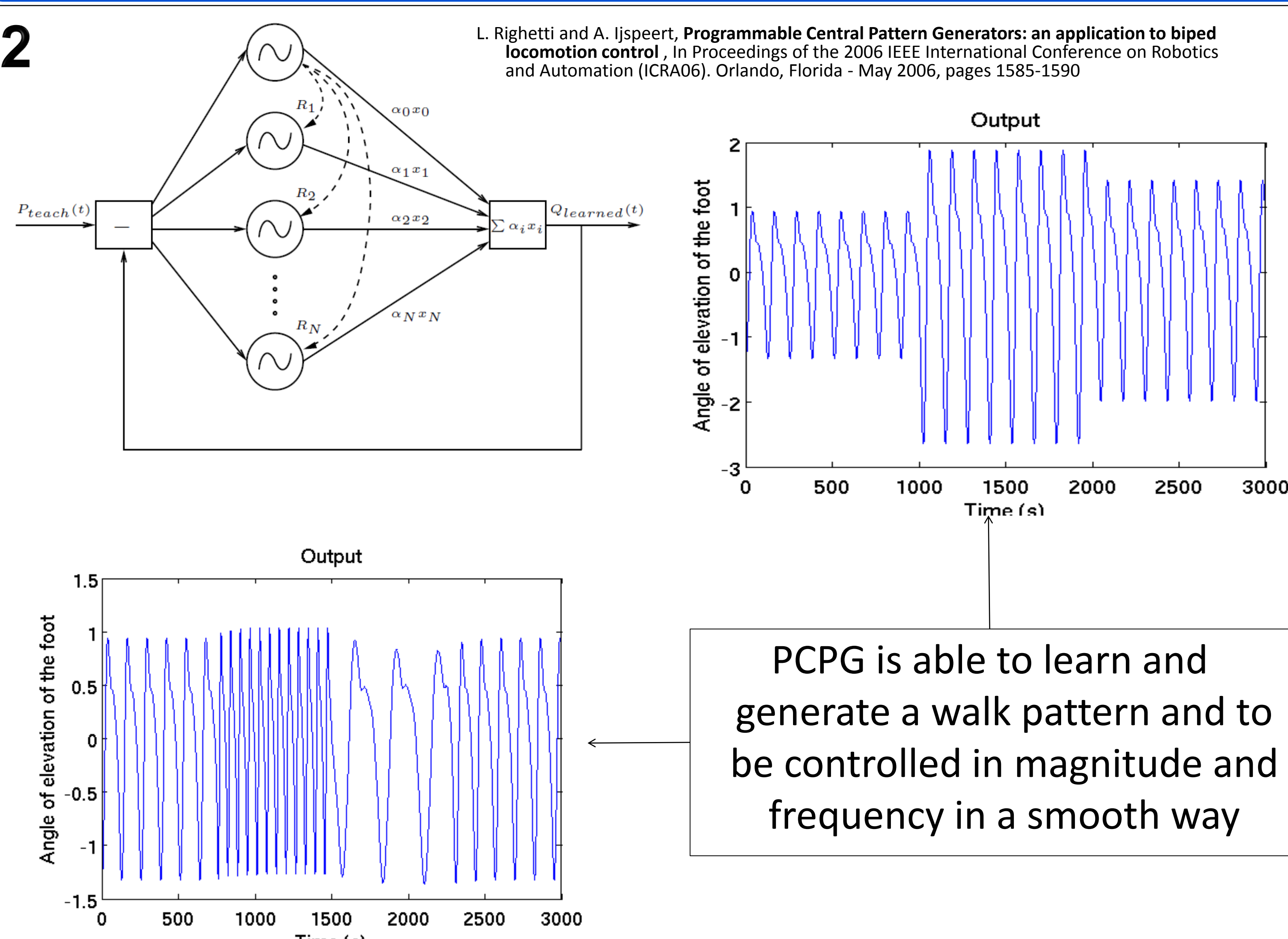
Concept

One model of human locomotive system

Brain — Brain commands the walking speed **(1)**

Spinal cord — Central Pattern Generator (CPG) generates automatic walk **(2)**

Muscles — Muscles are contracted according to the CPG instructions **(3)**

EOG eye gaze detector

1

EOG data → Filtered EOG (0.05-20 Hz) → Derivative of filtered EOG → Sum of impulsion → Linear regression

Horizontal regression
- Data points
- Regression
- Outliers

Angle in degrees vs Derivative of EOG (E5)

→ Already used to control a wheelchair

Programmable Central Pattern Generator (PCPG)

2

L. Righetti and A. Ijspeert, **Programmable Central Pattern Generators: an application to biped locomotion control**, In Proceedings of the 2006 IEEE International Conference on Robotics and Automation (ICRA06). Orlando, Florida - May 2006, pages 1585-1590

$P_{teach}(t)$ ... $Q_{learned}(t)$

Output — Angle of elevation of the foot vs Time (s)

Output — Angle of elevation of the foot vs Time (s)

PCPG is able to learn and generate a walk pattern and to be controlled in magnitude and frequency in a smooth way

Foot elevator orthosis

3

Acknowledgments

POLYTECH MONS

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