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A multimodal study for modelling human motor performance and health in a Human – Robotics collaborative activity

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Cobots:

- Cobot = robot intended to interact physically with humans in a shared workplace for a common task/goal (Terveen, 1995).
- Aim of cobotics: regulate its activity according to the task variability to obtain robust solutions that provide resilience (Endsley, 1995; Vanderhaeghe, 2017).

Musculoskeletal Disorders, an industry's issue:

In France, MSDs are a major societal issue with:

- 80% of professional diseases;
- 8.4 millions days of lost work;
- Increasing about 10% a year;
- Representing a 13th month financially for the companies.



To make this collaboration a success, the question of its repercussions on the health of employees could become central.

Changes with a cobot:

The collaboration requires an adaptation of both the human and the machine, and an organization of the structure that integrates the machine.

The introduction of the cobot will transform:

- the human-task interface;
- the motor activity;
- the work performance;
- the health.



YuMi cobot – ABB group

Aims of the study at short term:

- Define a work collaborative situation (with the use case of Eclatec and Thyssenkrupp) Human vs Cobot;
- Define the hypothesis about behaviour changes by the operator;
- Define the variables which qualify the new situation.

Two orientations of research:

- Analysis of the characteristics of the motor performance:
 - Biomechanical: precision and speed of moves;
 - Physiological: stress, HRV;
 - Psychological: mental load, visual attention.
 Aim: identify and validate the variables, with their weight and valence, impacted by the cobot.

- Analysis of new risks related to the new interaction. Aim: define, extract features and train models.

Experiment:

Conditions:

Human-Human vs. Human-Cobot
With vs. Without cognitive task

Measures:

Motion capture system



Eye tracking

Questionnaire



Aims of the study at long term:

- Define and integrate the new cognitive and biomechanical human models to the cobot.

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