

Human robot coactivity

Needs and protective measures analysis

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Outline

- Evolution of industrial robotics
- Goals of research
- Methodology / Samples
- Preliminary results
- Conclusion

Industrial robotics evolution

- Evolution is linked to commercial offer



- Stand-alone robot
- Separate workspace

- Physical fences (fixed guards)
- Robot stopped by switching off power
- Mechanical limiting devices



- Proximity between human and robot
- Shared workplace

- No physical fences
- Robot stopped without switching off power
- Software limiting devices

Goals of research

Commercial offer:

- Adequacy between commercial offer and needs for human robot coactivity?
 - Real needs of robot's users?
 - Origin and characteristics of coactivity
(nature, frequency, related life phases...)
- Usability of protective measures / needs of coactivity
 - Technical measures to insure worker's safety?
 - Acceptance of company and worker
(reduced speed, separation distance...)



Methodology

- Meeting with companies using industrial robots
- Identification of a robotic cell
- Semi-directive interview driven by an engineer and an ergonomist

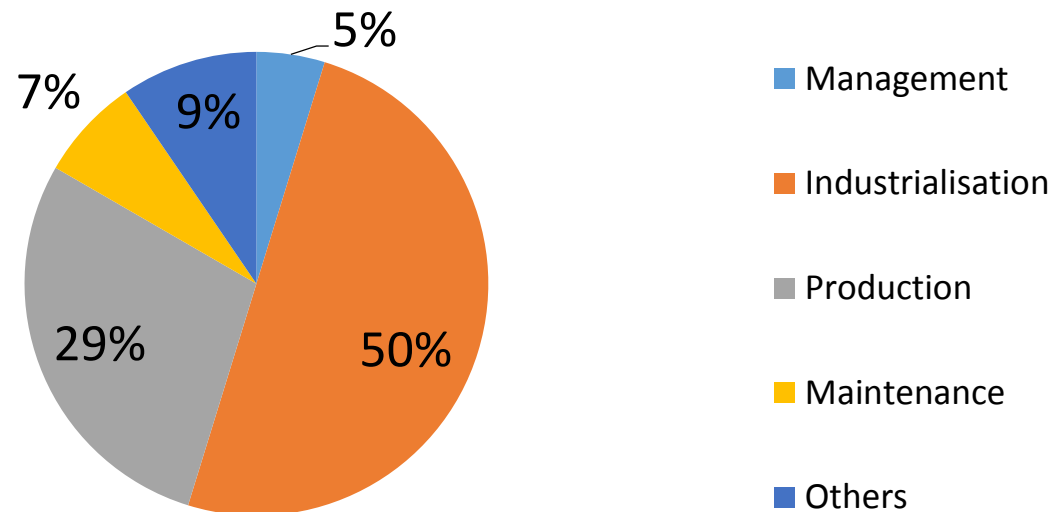
Phase ① : **Evaluation of the existing cell / possible improvements**

Phase ② : **Evaluation of the interest of coactivity**

Phase ③ : **Evaluation of limits and hazards generated by coactivity**

Samples

- Meeting with companies using industrial robots
- 42 semi-directive interviews driven by an engineer and an ergonomist



Samples

- 21 Companies

- > Different size: 1 to 5000 employees

- > Various sectors of activities

- Automotive (3)
 - Medical
 - Aeronautics (2)
 - Telecommunications
 - Home appliance
 - Metal products manufacturing (2)
 - Plastic products manufacturing (2)
 - Leather goods (2)
 - Food industry (3)
 - Wood industry (3)
 - Construction industry



Samples

- 27 robotic cells

- > Drilling
- > Welding, Gluing, Assembling
- > Control
- > Handling
(palettizing, supplying and unloading...)



- 8 collaborative robots (Yumi, UR3, UR5, UR10, Fanuc CR35iA)

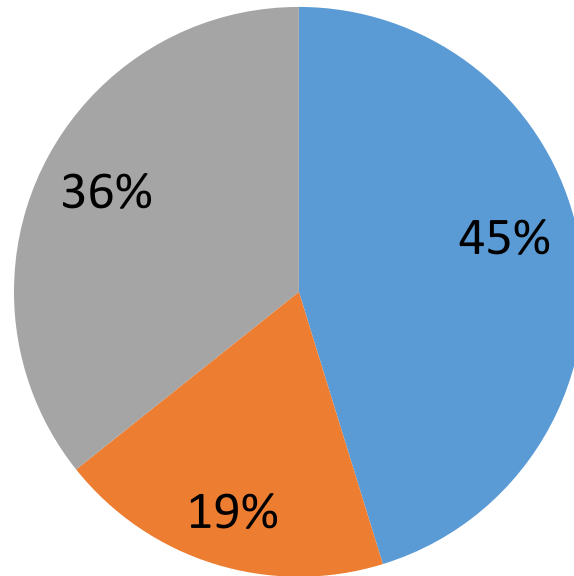
7 used in « coactivity »

- No fences around the robot



Results

- Interest for coactivity:



■ Expressed spontaneously (Phase1)

■ Suggested (Phase2)

■ No interest

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Improve flexibility (mobility and re-use)	6,1%

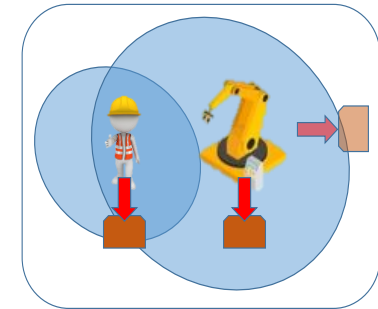
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⇒ Workspace sharing

⇒ Separate tasks

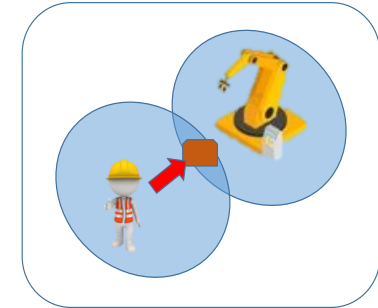
61 %



⇒ Indirect collaboration

⇒ Sequential tasks on the same part

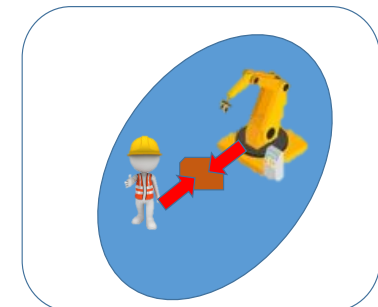
11 %



⇒ Direct collaboration

⇒ Simultaneous tasks on the same part

28 %

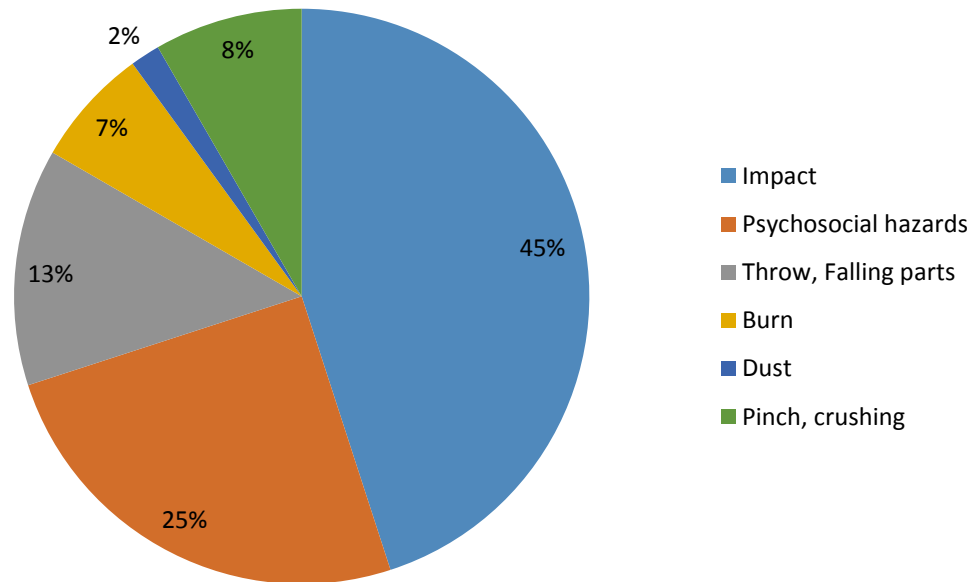


Results

> 64 % of the interviewed companies are interested in coactivity

→ 30 % of those companies do not intend to use coactivity

> Risk awareness (90,5 %)



> Non acceptance of limits (16%)

- Reduced speed not compliant with process cycle time
- Separation distances too large
- Risk of undesired robot stops
- Payload too low

Results

- > 64 % of the interviewed companies are interested in coactivity
- > Use of coactivity is not systematic
 - 30 % of those companies do not intend to use coactivity

	Average grade All companies	Average grade Companies that plan to use coactivity
Satisfaction without coactivity	6 / 10	4 / 10
Satisfaction with coactivity	7 / 10	8,5 / 10

Conclusion

- > 64 % of the interviewed companies are interested in coactivity
 - Improvements
 - > Productivity
 - > Flexibility
 - > Better working conditions
 - Nature of coactivity
 - > Workspace sharing
 - Risks and limits awareness
 - => Limited use of coactivity



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Thanks for your attention



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