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Man and Robot in the Warehouse

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i-BOTICS

ERGONOMICS

HUMAN ROBOT INTERACTION

WEARABLE ROBOTS

COGNITIVE SUPPORT SYSTEMS

PROCESS ANALYSIS → TASK ALLOCATION → DESIGN → EVALUATION

Robotization and Work

47% of our jobs can be taken over by robots or ict…. (Frey & Osborne, 2014)

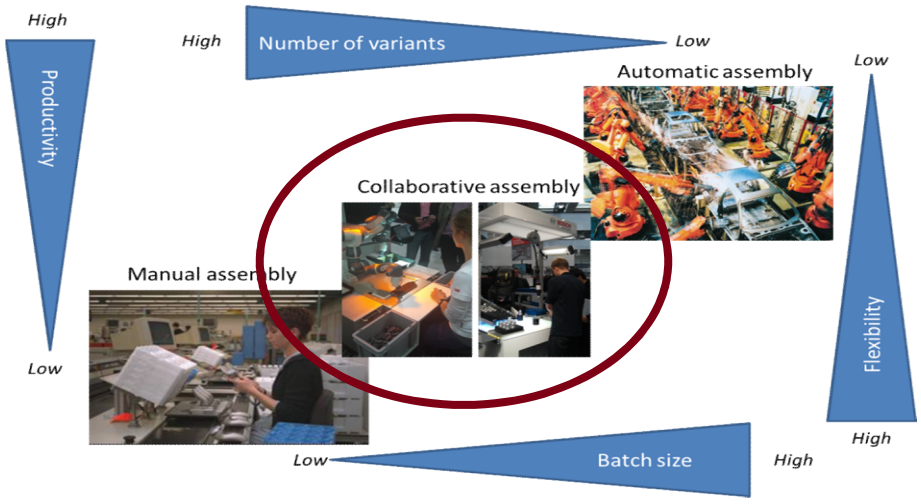
WRR (2015):

- Loss of jobs << 47%
- Much more jobs change
- Human Robot Collaboration

SER (2016):

- Dichotomy in society
- New skills and learning

Human Robot Collaboration in Manufacturing



Needs for Human-Robot Collaboration

- Capacities are complementary:
  - robots for high force, speed, high precision, minimize error
  - humans for flexibility in high variation or uncertainty
- Complex operations: much simultaneous activities too complicated to automated, too complex for humans to perform (‘need for third hand’)
- Robot to perform the task; human to guide or learn the robot, to monitor and to act in case of error

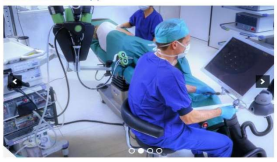
EFFECTS ON WORK LOAD

Effects on work load are highly variable

- physical load
- cognitive load
- job satisfaction

hard facts are lacking (still)

Advanced Endoscopy



TKI DINALOG CALL FOR RESEARCH (deadline June 1)

4. Human Capital Agenda

Robotica is niet meer weg te denken van de logistieke werkvloer. Automatic Guided Vehicles kunnen worden ingezet in magazijnen - samen met medewerkers of volledig autonoom. Flexibele robots worden ingezet in interne logistieke processen zoals order-picking, sorteren, verpakken en palletisering. Naast bedrijfsimpact heeft de inzet van robots ook impact op het functioneren van de logistiek medewerker en moeten wellicht andere vaardigheden aangeleerd worden voor het efficiënt uitvoeren van de processen in samenwerking met robots. Er is behoefte aan praktische experimenten die de inzetbaarheid en implicaties van robotica op de werkvloer voor de operatie en haar medewerkers onderzoekt."

https://www.dinalog.nl/wp-content/uploads/2017/03/TKI-2017-call-for-proposals-FINAL-VERSION-27-02-2017.pdf

Flexible or Collaborative Robot

- What are realistic and cost-effective levels of human-robot collaboration?
- How to organize the work optimally to benefit from humans and robots?
  Is there an allternative for the approach to automate as much as possible and minimize the amount of human interaction?
- What hard and soft skills are needed and how should people be trained?

Automated Guided Vehicles


Robotic Mobile Fulfillment Stations (Amazon Robotics)


Pick Supprt AGVs (Locus Robotics)

Different control and picking strategies: AGV follows the picker automatically or AGV goes to pick location and wait for (De Koster et al. 2017)

- What is the optimal strategy dependent on lay out, storage and order profile in order to achieve best performance and working conditions (job satisfaction, motivation, fatigue, safety)

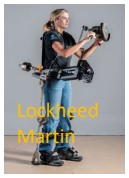
Wearable Robots or Exoskeletons


Hyundai


Cyberdyne


Panasonic


Noonee


Lockheed Martin


RoboMate

Exoskeleton is

- wearable structure
- enhance the power of a person
- human is in charge

Exoskeletons may help us where:

- human flexibility is required
- human lack mechanical power
- mobility is required
- ‘standard ergonomics’ does not work

Exoskeletons: state-of-the art

Passive systems

- light-weight, relatively cheap and simple in its use
- commercially available and entering the market
- effective in static trunk bending,
- limited in its application and support

Bosch et al. Applied Ergonomics 54 (2016) 212-217

Active Exoskeletons

- relatively heavy, bulky, not simple to use
- further away from market application
- potentially high adaptability and more powerful

De Looze et al. Ergonomics 5, 2016, 671–681