

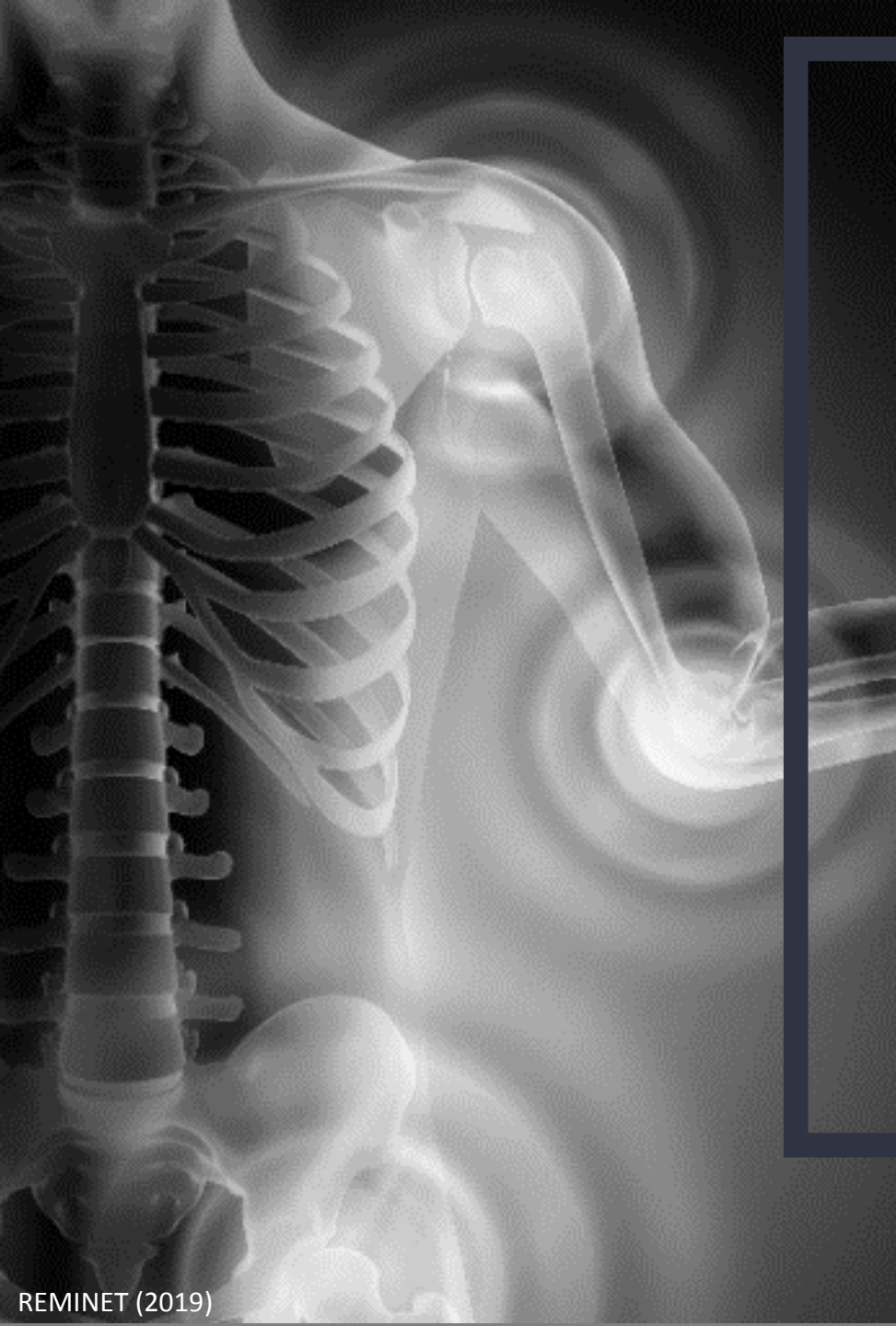


EXOSKELETON

The next step in
automation lifting &
ergonomic tools

OUTLINE

- Musculoskeletal disorders
- Industry 4.0
- Exoskeletons
- Overhead assembly operations
- Virtual implementation of exoskeletons
- Exoskeletons in the range of motion of workers



Musculoskeletal Disorders (MSDs)

Musculoskeletal Disorders are injuries and disorders that affect the human body's movement or musculoskeletal system (muscles, ligaments, bones, nerves or joints)

Why are MSDs important?

- Administrative, medical and worker compensation costs
- Loss of productivity and sickness absences

INDUSTRY 4.0

We are currently in the middle of the fourth industrial revolution.

Smart Factories.

The real and virtual world are growing together.

Human robot collaboration

It seeks to combine the best of humans and robots.

- Human flexibility
- Speed, Productivity and Continuity of robots



EXOSKELETONS

Wearable mechanical device that reinforce or restore the physical performance of the person

Depending of the power requirement:

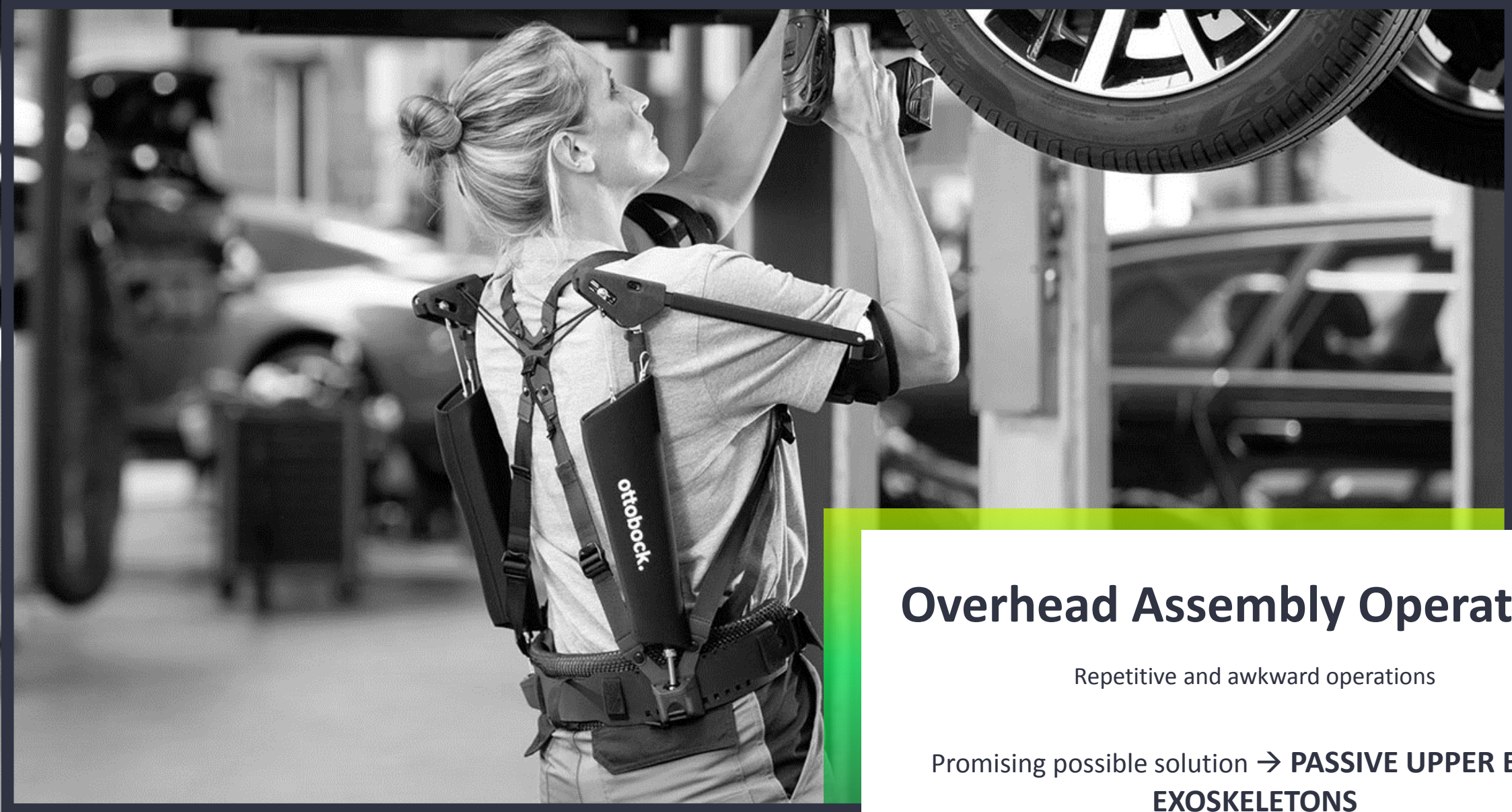
- Passive exoskeletons: It does not need any type of electrical power source.
- Active exoskeletons: It use some type of actuator.



Bachman (2019)

Depending of the body part support:

- Lower body exoskeleton: Lower extremities (legs)
- Upper body exoskeleton: Upper extremities (back, arms and shoulders)
- Full-body exoskeleton: Both lower and upper extremities.



Overhead Assembly Operations

Repetitive and awkward operations

Promising possible solution → **PASSIVE UPPER BODY EXOSKELETONS**

EKSOVEST



EksoBionics (USA)

Approx. 4.3 kg

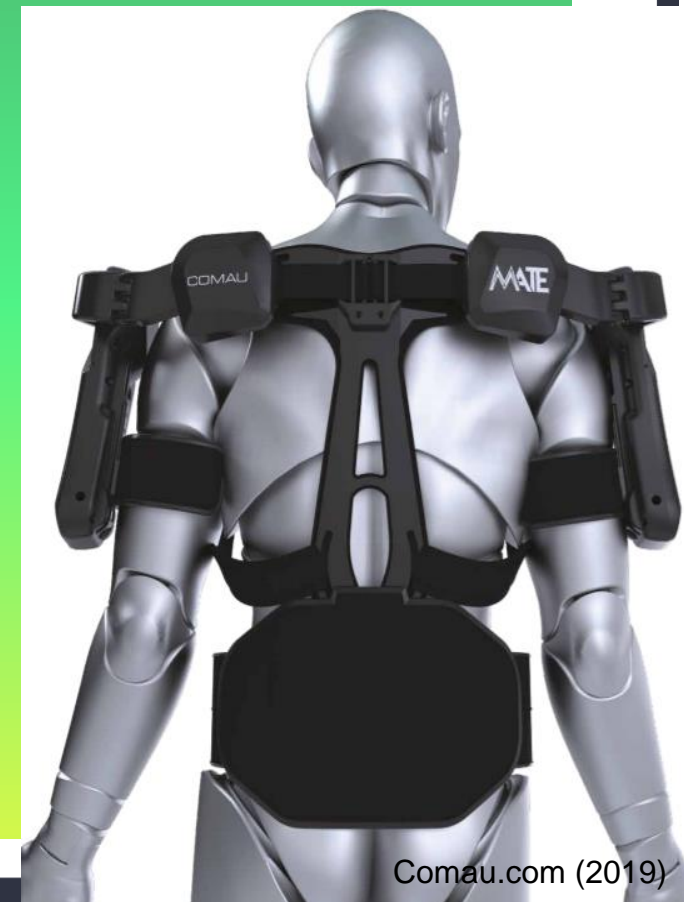
PAEXO



Ottobock (Germany)

Approx. 2 kg

MATE



Comau (Italy)

Approx. 4 kg



VIRTUAL IMPLEMENTATION OF EXOSKELETON

DIGITAL TWINS

Digital twins represent real objects or subjects with their data, functions, and communication capabilities in the digital world.

- Visualization and verification of results
- Optimization and simulation

Virtual model of EksoVest

Cad model of the exoskeleton EksoVest.

- Forces simulation.
- Parametrization



EVALUATION OF USING EXOSKELETONS IN THE RANGE OF MOTION OF WORKERS

EXPERIMENT

- Scenario: Testbed
- Subjects: Seventeen (Operators and students)
- Tasks:
 1. Drilling operation (tool from the side)
 2. Drilling operation (tool from the floor)
 3. Stretching and circular movements
- Material: Xsens (motion capture system)

RESULTS:

- 1. Paexo; 2. EksoVest; 3. Mate
- Improvements




QUESTIONS?


Thank you

Engadget.com (2019)

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