Exoskeletons in construction environments

During the course, you must work with an individual portfolio, where you write down the thoughts you have and the tasks you solve.

The portfolio must serve as documentation for what has been learned.

You will be assessed on participation and the portfolio.

Learning objectives

- You will be able to identify various general working postures and processes that can be advantageously carried out with Exoskeleton as an ergonomic tool.
- You can apply and remove Exoskeleton, as well as guide others in its use.
- You can use Exoskeleton in practice, by demonstrating lifting, twisting and similar movements in known work processes.
- You can explain how Exoskeletons can remedy wear and tear, muscle/skeleton problems and the like.

Introduction

Go to mentimeter.com and type in your thoughts.

SDG`s and Exoskeletons

How do Exo skeletons and the SDG`s fit?

- Organisations often use the SDG`s as a tool to define their social responsibility

Science direct

Assignment – 30 minutes

Go to SDG`s – UN

In pairs try reflects on which SDG can be connected to:

- Safety environment
- Exoskeletons
- Working in the construction industry

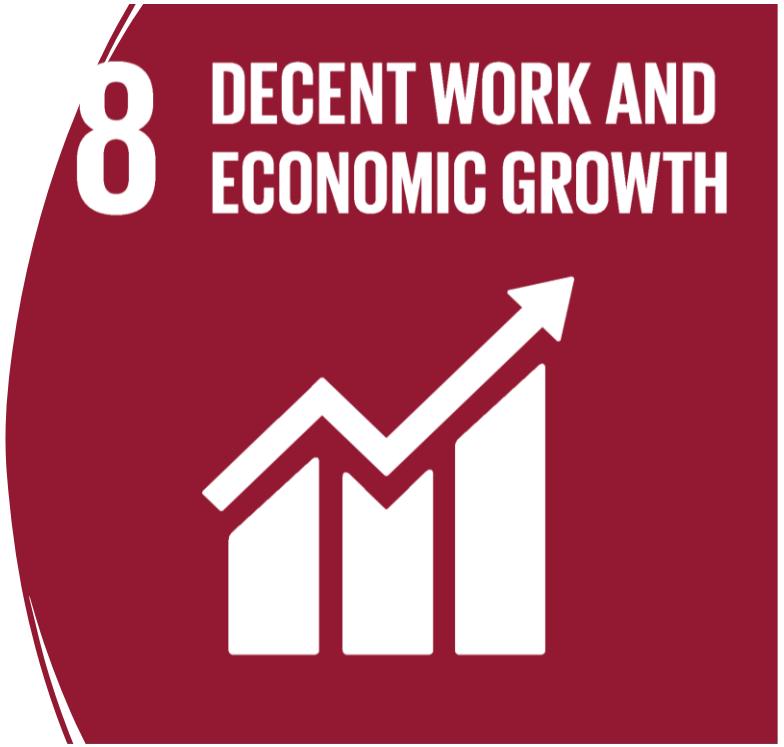
We will compare results and thoughts in the class.

Organisations vs. Work environment

- A dilemma = Not connecting SDG`s with work environment.

SDG 3

SDG 8



SDG 9

SDG 11

SDG 12

SDG 13

SDG 17

SDG 4

Practical assignment – 60 minutes

- In assigned groups, you are to work on the assigned stations in the workshop.
- You must work at the stations as you know it from your daily work. Film each other and talk about which muscles are affected.

Passive and active exoskeletons

Passive Exoskeletons

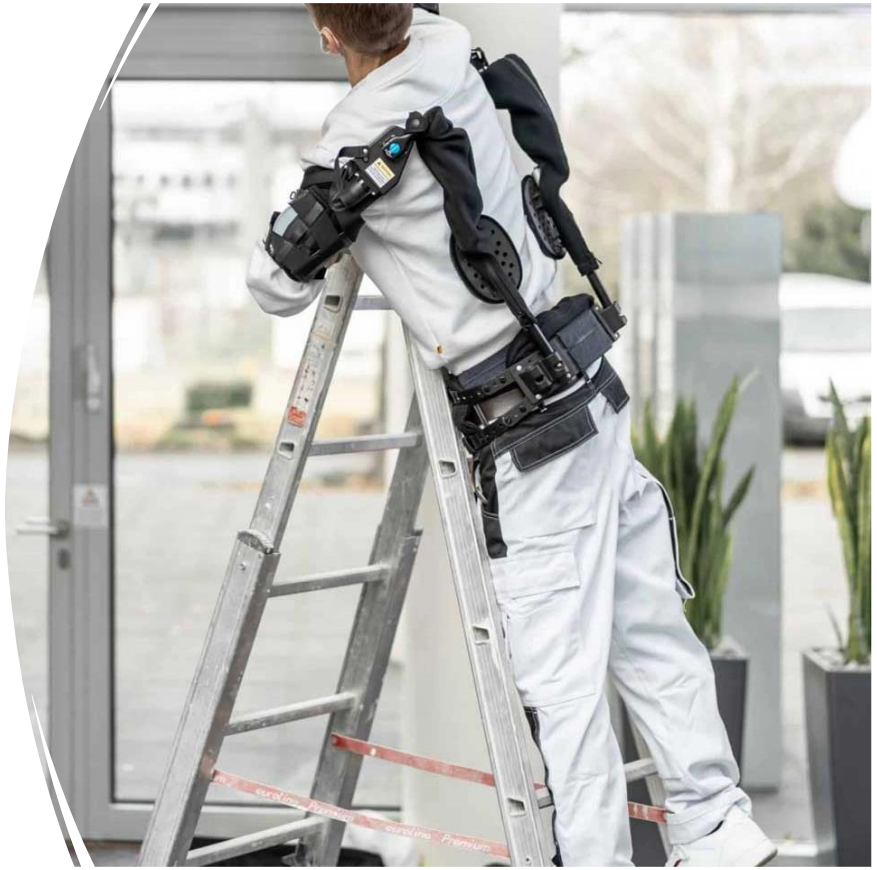
- Definition: Passive exoskeletons rely on springs, rigid frames, or other mechanical elements to provide support and assistance. They do not require external power sources.
- Effects of a passive exoskeleton

- Guardian by Ekso Bionics
- HAL (Hybrid Assistive Limb) by ReWalk Robotics
- Lokomat by Hocoma

Active Exoskeletons

- Active exoskeletons make use of motors or hydraulic systems that generate force to assist or augment the user's movements.

- EksoWorks by Ekso Bionics
- Levitate 1000 by Levitate Technologies
- BAER by SuitX



- number of injuries have increased by 10%.
- More specific:
- knees (+74%)
- back (+56%)
- elbows (+54%)
- shoulders (+53 %)
- Bygtek - Article

Skadestype	2018	2019	2020	2021	2022	2023	Total
010 Sår og overfladiske skader	7.410	7.390	7.075	7.850	8.150	4.745	42.610
020 Knoglebrud	4.625	4.615	4.475	4.975	5.425	3.190	27.305
030 Ledskred, forstuvninger og forstrækninger (overbelastning)	**18.235**	**18.090**	**17.310**	**18.960**	**19.235**	**11.330**	**103.160**
031 Ledskred (fx skulder der er gået af led)	980	1.000	925	1.095	1.180	715	**5.895**
032 Forstuvninger og forstrækninger (inkl. overrivning af muskler, sener/nerver, brok)	9.535	9.570	9.370	9.995	10.090	5.900	**54.465**
039 Andre former for ledskred, forstuvninger og forstrækninger	7.720	7.515	7.015	7.870	7.965	4.715	**42.800**

Musculoskeletal disorders in the EU

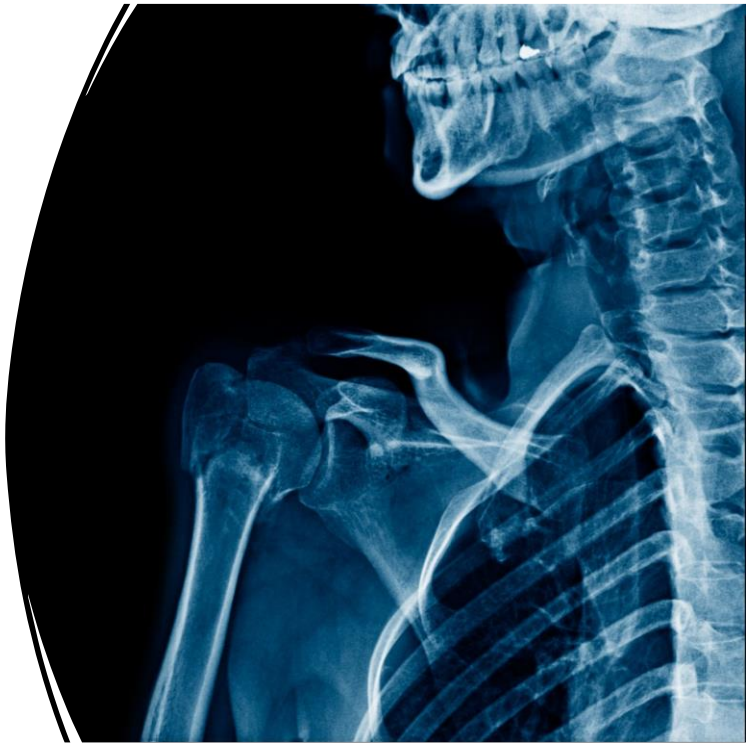
- 44 million workers in the EU are affected by workplace-related MSDs
- A study made by the Work foundation in Lancaster, UK show that MSDs are responsible for 40-50% of all work-health related issues.

- Economic impact of musculoskeletal disorders (MSDs) on work in Europe, 2015
- Royal danish academy - project Exskallerate

Musculoskeletal disorders (MSDs)

- Soft-tissue injuries caused by sudden or sustained exposure to repetitive motion, force, vibration, and awkward positions.
- Muscles, nerves, tendons, joints etc. are affected by the aforementioned exposures.

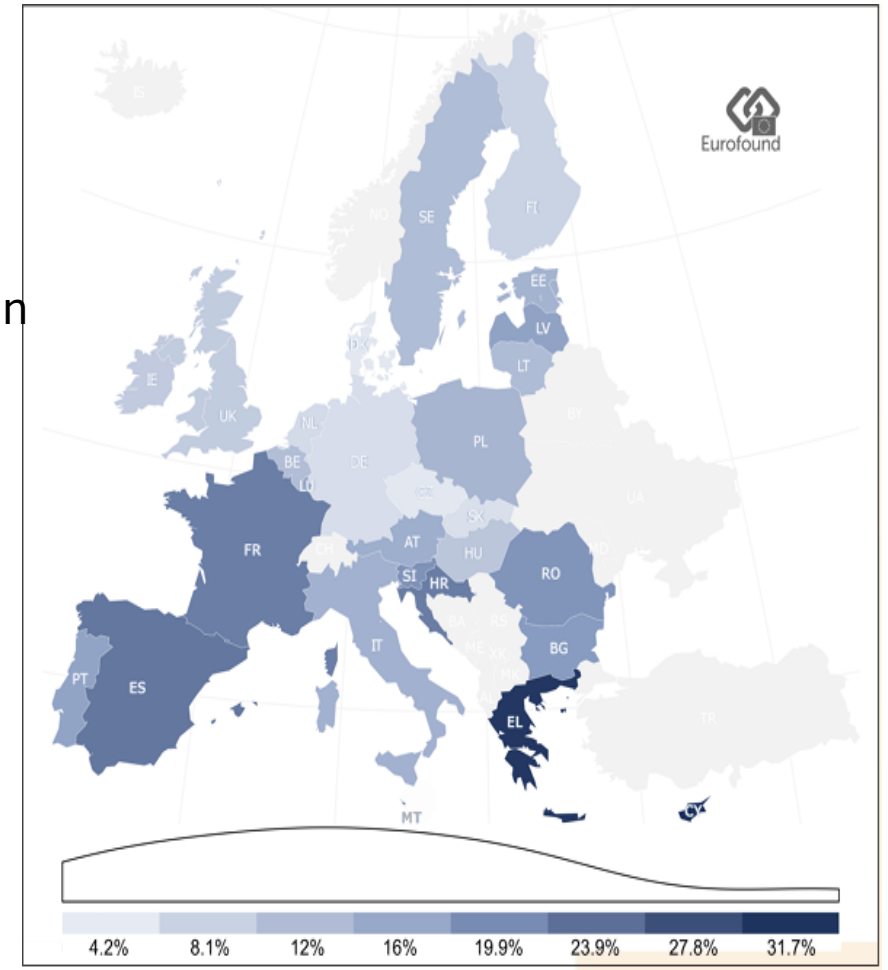
- CDC - Musculoskeletal Health Program



EU data

- Data show us that approximately 40 % of workers in Europe suffer from lower back pain or shoulder complaints.
- 63 % of workers perform repetitive tasks or frequently work (46 %) in potentially hazardous positions. Eurofound, 2012
- The annual costs arising from health-related issues due to these working conditions amount to about 2 % of the gross domestic product of the EU.

- Bevan, 2015
- Zurada, 2012; Collins and O'Sullivan, 2015



Improved Safety

- Movie 2
- By offering stability and support, exoskeletons minimize the risk of accidents and work-related injuries, ensuring a safer working environment.

Single market economy - SME

Enhanced Productivity

- Exo skeletons enable effortlessly lift heavy loads, increasing efficiency and reducing project timelines.
- Increased productivity in repetitive tasks.

- eumonitor - September 2023

Introduction to the HAPO posture harness – PASSIVE exoskeleton

Introduktionsvideo

Brolægger

Video demonstrations – 120 min.

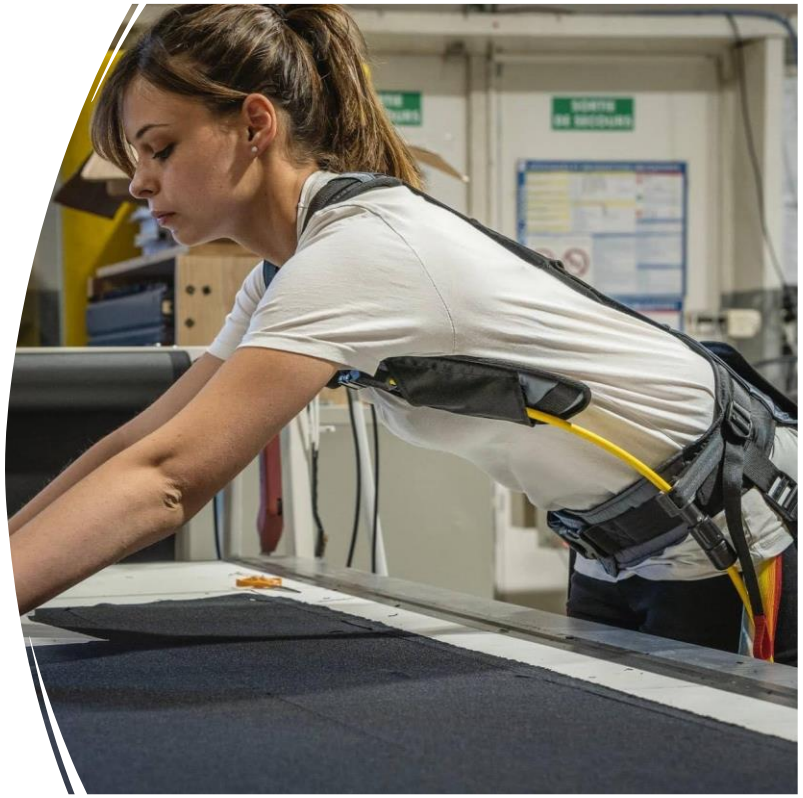
- Video 1 (6 min.) (The producer's own introductory film)
- Video 2 (7 min.) (The producer's own introductory film)
- Video 3 (2 min.) (The producer's own introductory film)
- Video 4 (8 min.) (The producer's own introductory film)
- Video 5(2 min.) (The producer's own introductory film)

- Watch the films and take notes during the video. Point out the benefits and disadvantages from the producers' demonstrations. Would they usable in your daily work?

- We will discuss your points in class.

HAPO Posture Harness

- Designet by ErgoSanté Technology the Hapo exoskeleton has the purpose to support the lower back and shoulders.



Hapo demonstration

Introduction to the Festool– ACTIVE exoskeleton

Festool ExoActive

www.festool.com

Festool campaign video

Future Developments and Trends in Exo Skeleton Technology

Challenges of Exoskeletons

Cost

Customization

Compatibility

Training

rootsanalysis.com/reports

Implementing exoskeletons in class

Practical assignment – 1 hour

- You must now return to your stations and work on the same tasks as before you knew about the exoskeletons.
- The task is the same. You must film each other again and in your individual portfolio.

Final assignment

- Log in to Socrative.com (The teacher will have to create at test beforehand. In the matrix you can read about the various learning tools suggested throughout this powerpoint).