BGN
Berufsgenossenschaft
Nahrungsmittel und Gastgewerbe

Exoskeletons at work

Overview and evaluation for Occupational health and safety

Digital manufacturing – online seminars (IFA + IVSS)

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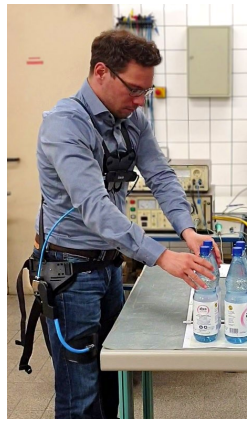
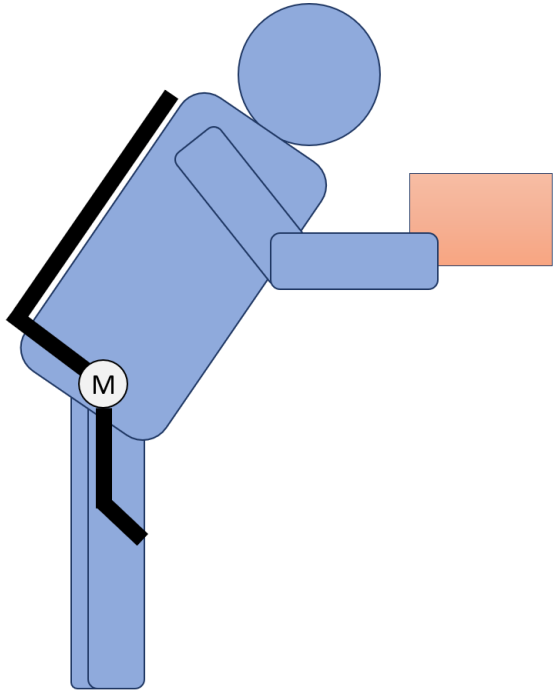
What you can expect today

- Exoskeletons overview
- Evaluation for Occupational health and safety
- Introducing exoskeletons sensibly

Exoskeletons



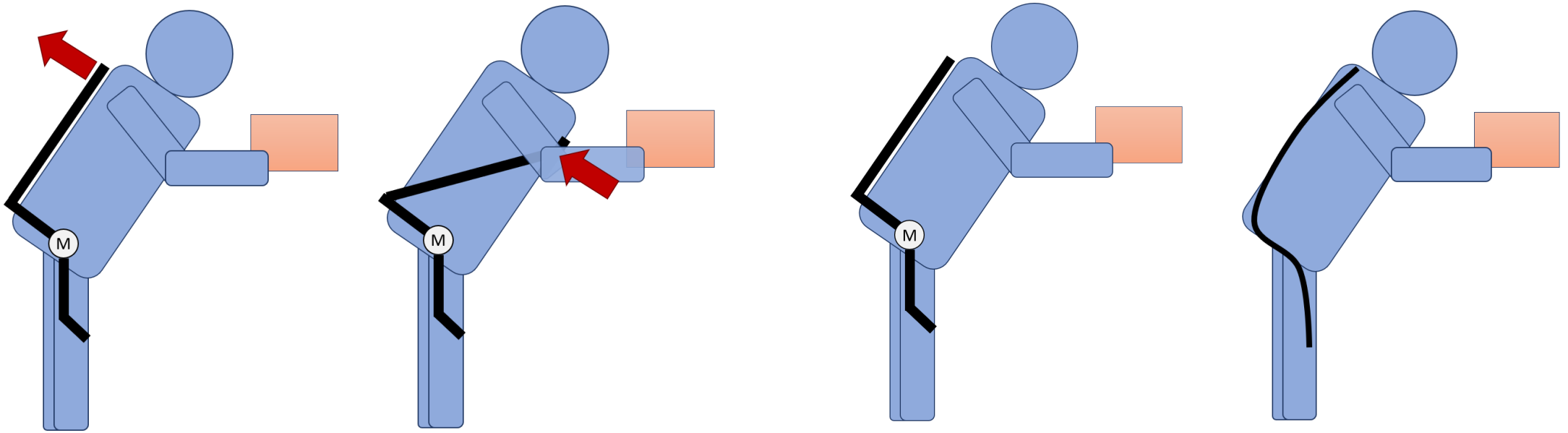
- **Exo** = outside, **Skelet**ós = Frame/scaffold
- … are technical systems worn on the body that act on the body through mechanical coupling.
- … are body-worn "robots" or machines that support or amplify the wearer's movements, for example by using servomotors to drive the exoskeleton's joints.
- Areas of application:
  Rehabilitation, prosthetics, military, prevention/ergonomics



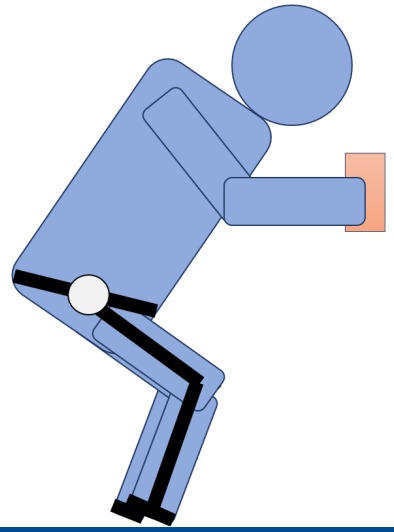
Exoskeletons – Differentiation

- **Drive type**
  Passive support or active support
  (gas pressure) springs/bands/... Servomotor drive/pneumatic
- **Targeted body region**
  Support for the legs, (lower) back or shoulders/arms
- **Shape**
  Shape close to or far from the body
- **Construction method**
  (e.g. use of hard or soft materials)
- **Biomechanical function**
  (e.g. generation of a tensile or compressive force)

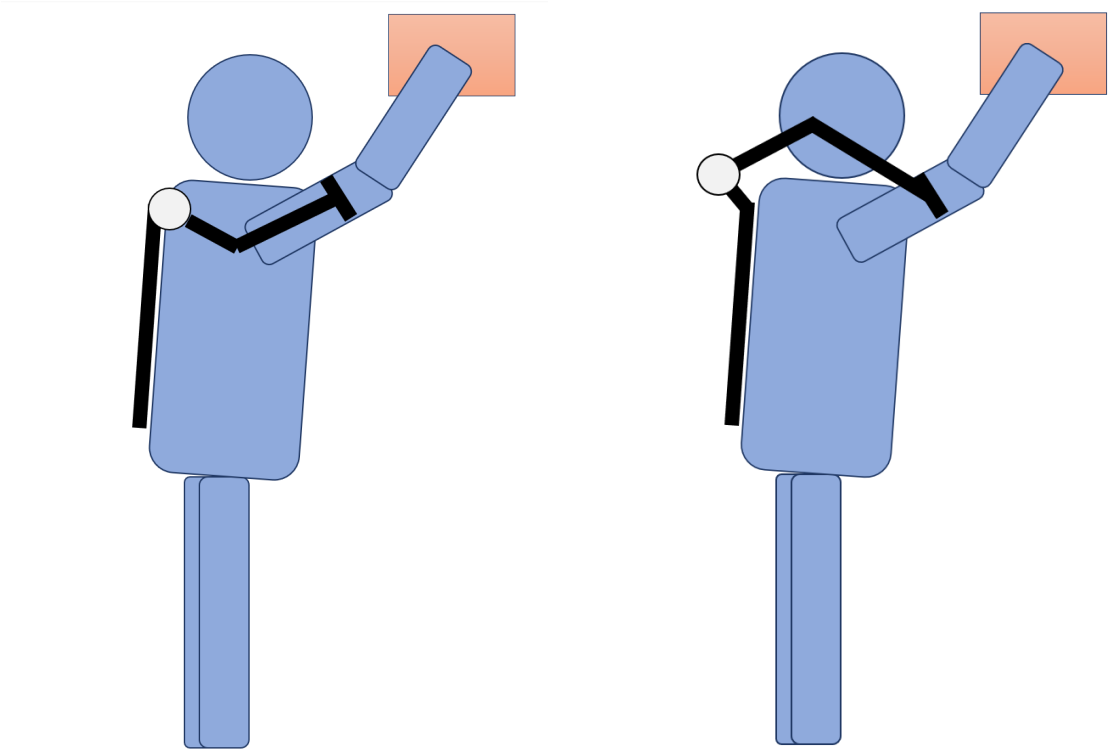
Exoskeletons for the back



Exoskeletons for the legs



Exoskeletons for the arms



Exoskeletons for hand and thumb

- Exoskeletons that strengthen the grip and support a prolonged grip
- Exoskeletons that support the thumb when repeatedly using it to in Assembly

Exoskeletons – Evaluation for Occupational health and safety

Exoskeletons … are personal measures

- Utilize technical measures
- Use organizational measures
- Personal measures

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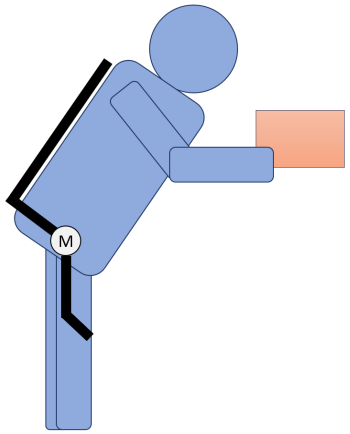
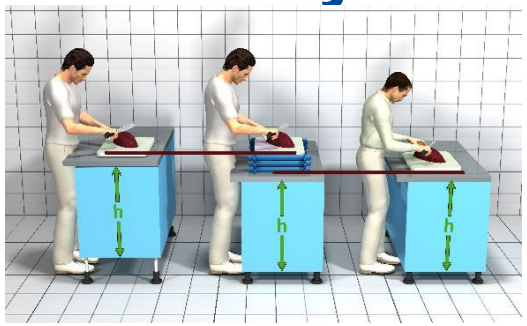


Exoskeletons – Evaluation for Occupational health and safety



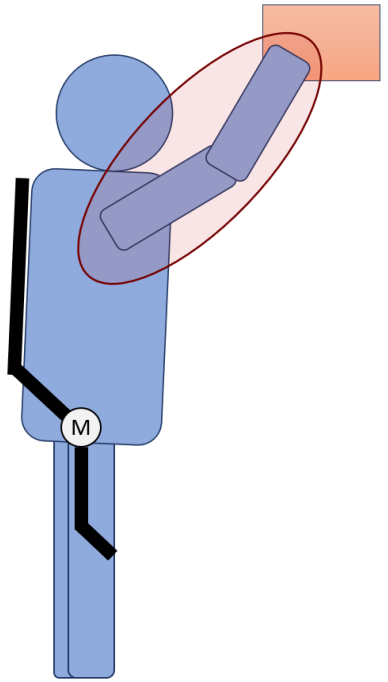
Exoskeletons … are particularly interesting for non-stationary workplaces

- Working at varying locations,
  beverage delivery, branch delivery, ...

Exoskeletons – Evaluation for Occupational health and safety

Exoskeletons … usually only relieve one region of the body and only partial movements

- Construction method determines the supported region
- Exoskeletons only provide partial support (support hysteresis)
  Maximum effect often only in certain areas of movement
- In reality, combinations of movements always occur
- Support effect depends on the user and the load



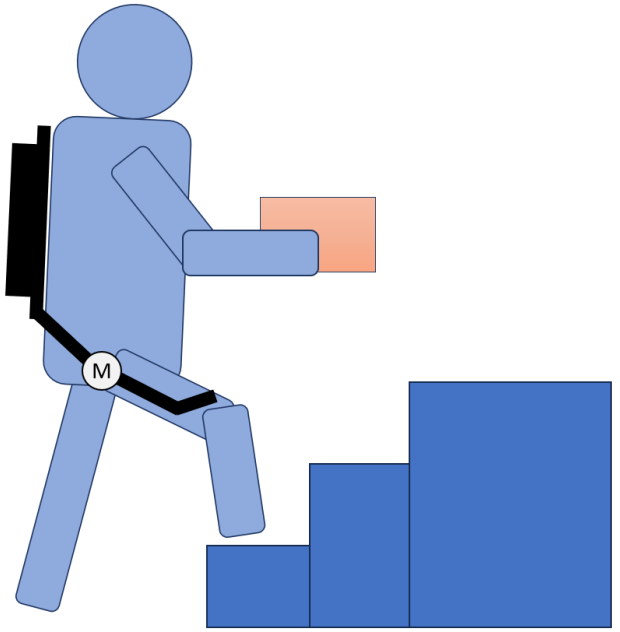
Exoskeletons – Evaluation for Occupational health and safety

Exoskeletons … can be a hindrance to unsupported activities

- Exoskeletons must not interfere with secondary activities

Effective factors:

- Weight
- Movement restrictions Walking/Climbing stairs
- Pressure points/support points (sweating)
- Space requirements, getting stuck, tripping and falling hazards
- Logistics effort (storage, loading, cleaning)

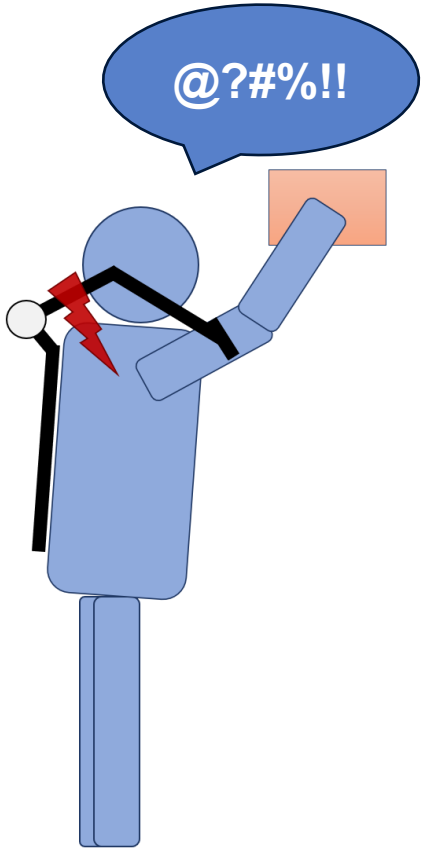


Exoskeletons – Evaluation for Occupational health and safety

Exoskeletons … can cause acceptance problems

- No acceptance = No use = No support

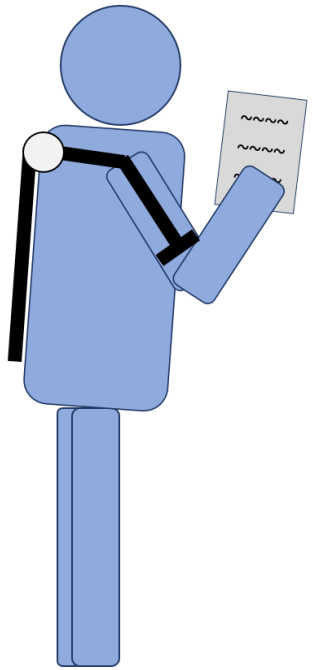
- Exaggerated expectations or waning euphoria?
- Support for only a few activities?
- Need for frequent dressing and undressing?
- Small "problems“ (pinching/rubbing/etc.)?
- Problems getting started (sore muscles)?
- Poor introduction of the exoskeleton (stigmatization)?



Exoskeletons – Evaluation for Occupational health and safety

Exoskeletons … must be included in the risk assessment

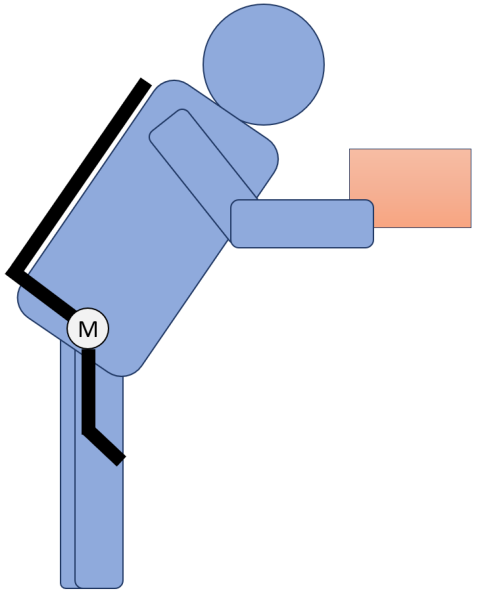
- Analyze work situation with regard to main and secondary activities
- Document: which activities are (not) supported by the exoskeleton
- Consider spatial parameters, environmental influences and danger zones
- Consider exceptional situations (fire alarm, medical emergency)
- Enable occupational medical support and preventive care
  Clarify how to deal with people with pre-existing conditions



Exoskeletons – Evaluation for Occupational health and safety

Exoskeletons … can have a relieving effect &
… generate positive feedback from employees

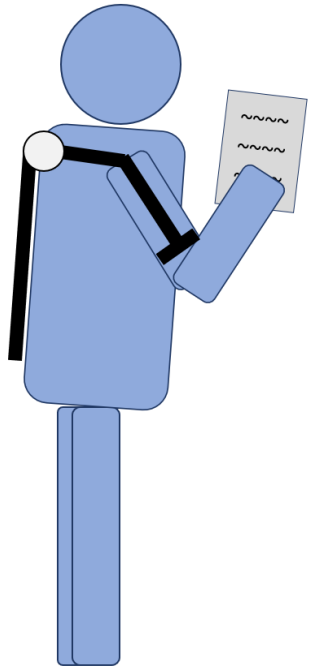
- Absorption and/or redirection of forces reduces premature fatigue and overstraining of particularly heavily stressed areas of the body
- Accompanying effects to improve posture are possible
- Motivation boost for employees, possibly fewer accidents
- An increase in performance through exoskeletons is not to be advocated!
- No risk of muscle atrophy when using an exoskeleton



Exoskeletons – Evaluation for Occupational health and safety

Exoskeletons … must be introduced to the workplace cautiously!

- Determine main load
- Getting employees excited about the project at an early stage and reducing fears
- Try out different exoskeletons and carry out a test phase
- Human-centered approach: Recording and evaluating subjective feedback
- Start with less support and/or utilization time. + Involve occupational physicians



Summary

Exoskeletons ≠ All-purpose remedy

- Supplementary measure → Technical measures have priority
- Individual case analysis → Loads, postures, activity profile, space, hygienic factors,...
- Ergonomics must be implemented systematically

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Thank you for your attention.

Questions & Discussion

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