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Ergonomics and Pain

Marissa Marchioni, OTD, OTR/L, CEAS

- Presenter Disclosure: Financial: Marissa Marchioni has received an honorarium for presenting this course. Non-financial: Marissa Marchioni has no relevant non-financial relationships to disclose.

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Learning Outcomes

Participants will be able to identify ergonomic principles and guidelines

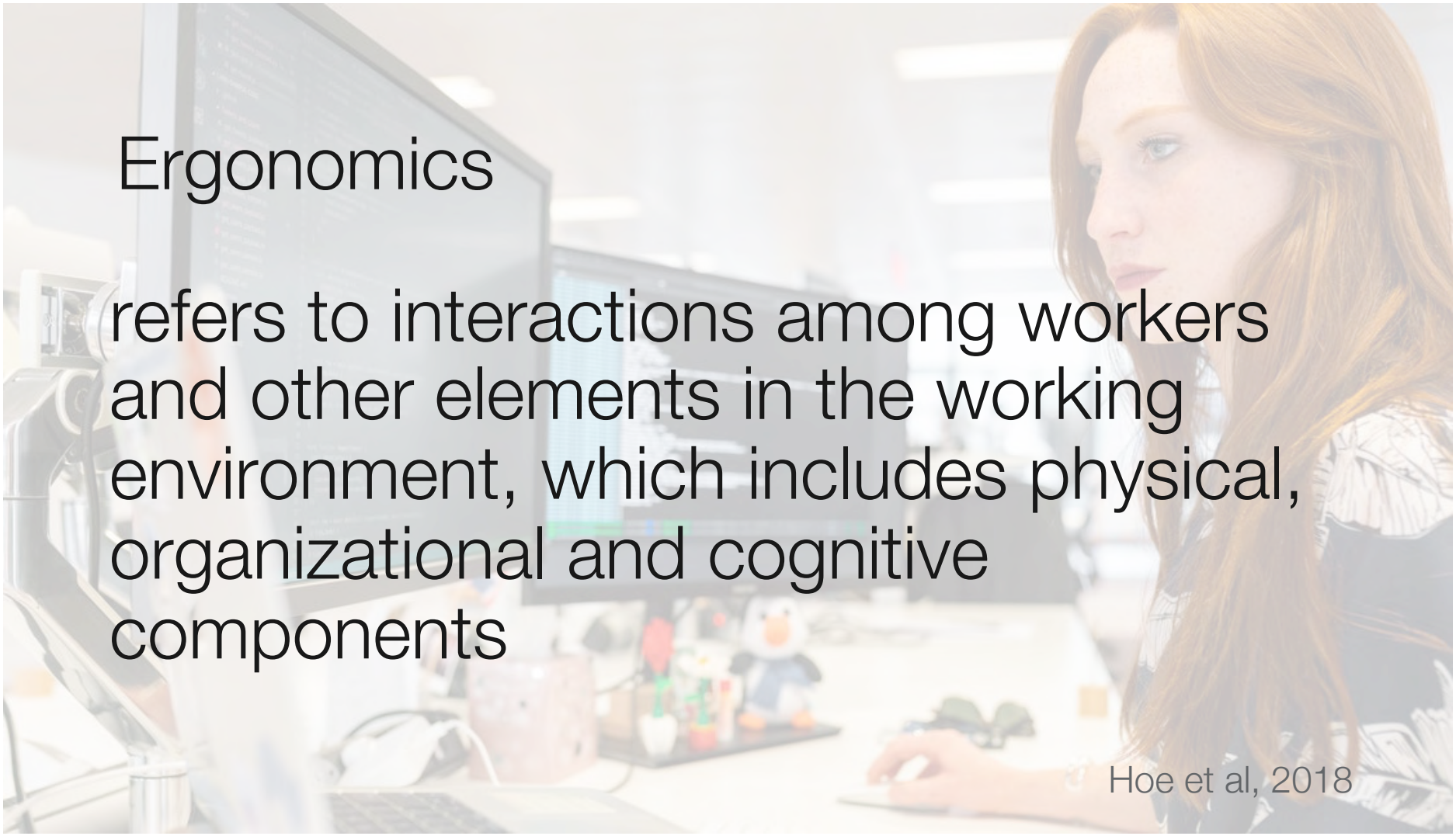
Participants will be able to recognize the importance of addressing ergonomics to reduce risk of pain

Participants will be able to list strategies for addressing ergonomics with clients

Photo by Kristin Hardwick from StockSnap

Outline

- Introduction
- Models of Intervention
- Ergonomic Risk Factors
- Environmental Factors
- Neutral Alignment
- Application
- Summary, Q & A



Ergonomics

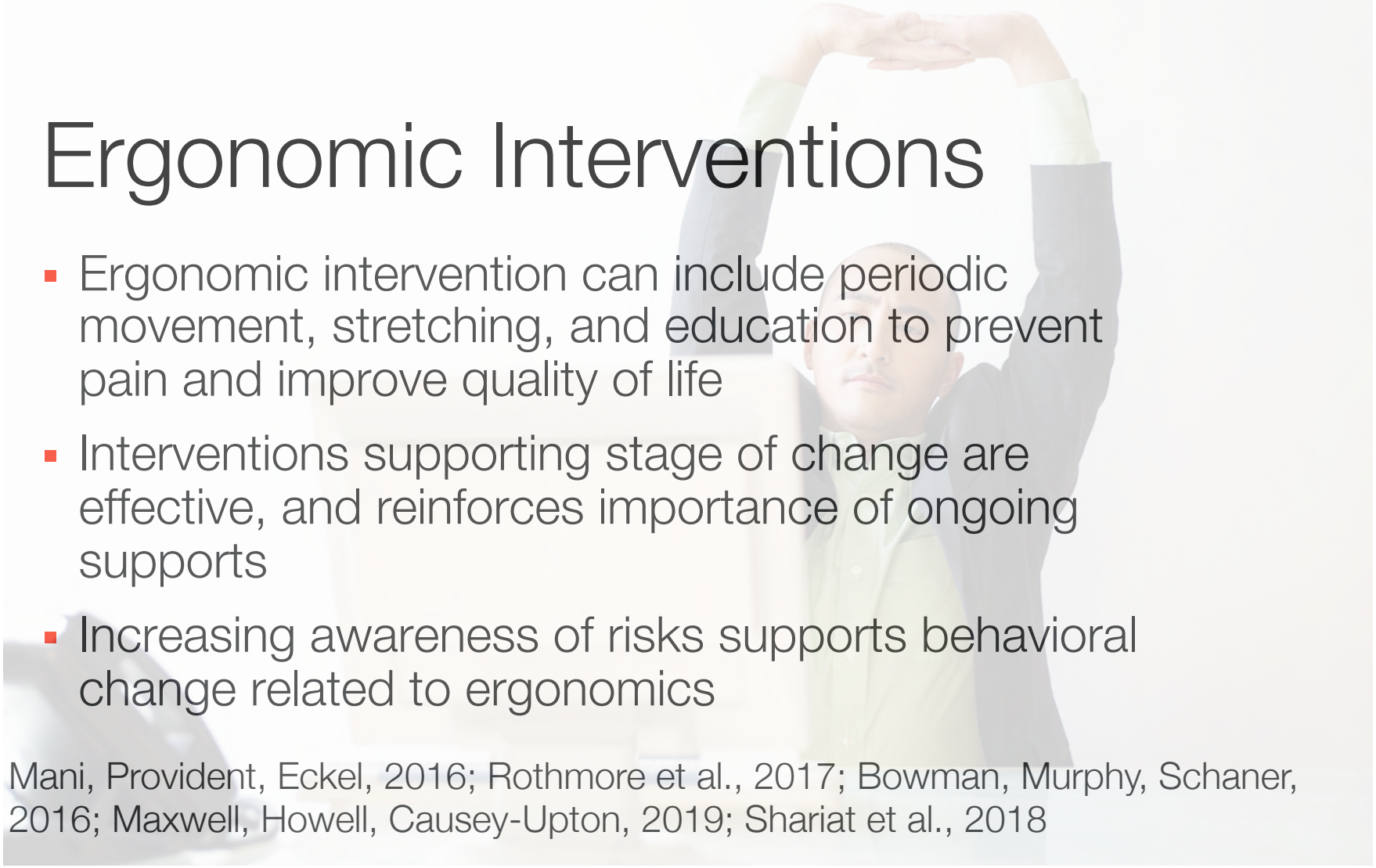
refers to interactions among workers and other elements in the working environment, which includes physical, organizational and cognitive components

Hoe et al, 2018

Ergonomics and Pain

- Ergonomic intervention results in decreased pain at the neck, shoulder, upper back, and wrist/hand
- Subjects with chronic low back pain tend to show a more static sitting behavior
- Workstation conditions including chair height, arm and back rest contribute to pain
- Ergonomic interventions result in decreased pain and sick days

Verhagen et al, 2013; Rodrigues,Leite, Lelis, Chaves, 2017; Bontrup et al, 2019; Lee Barros, de Castro, 2020

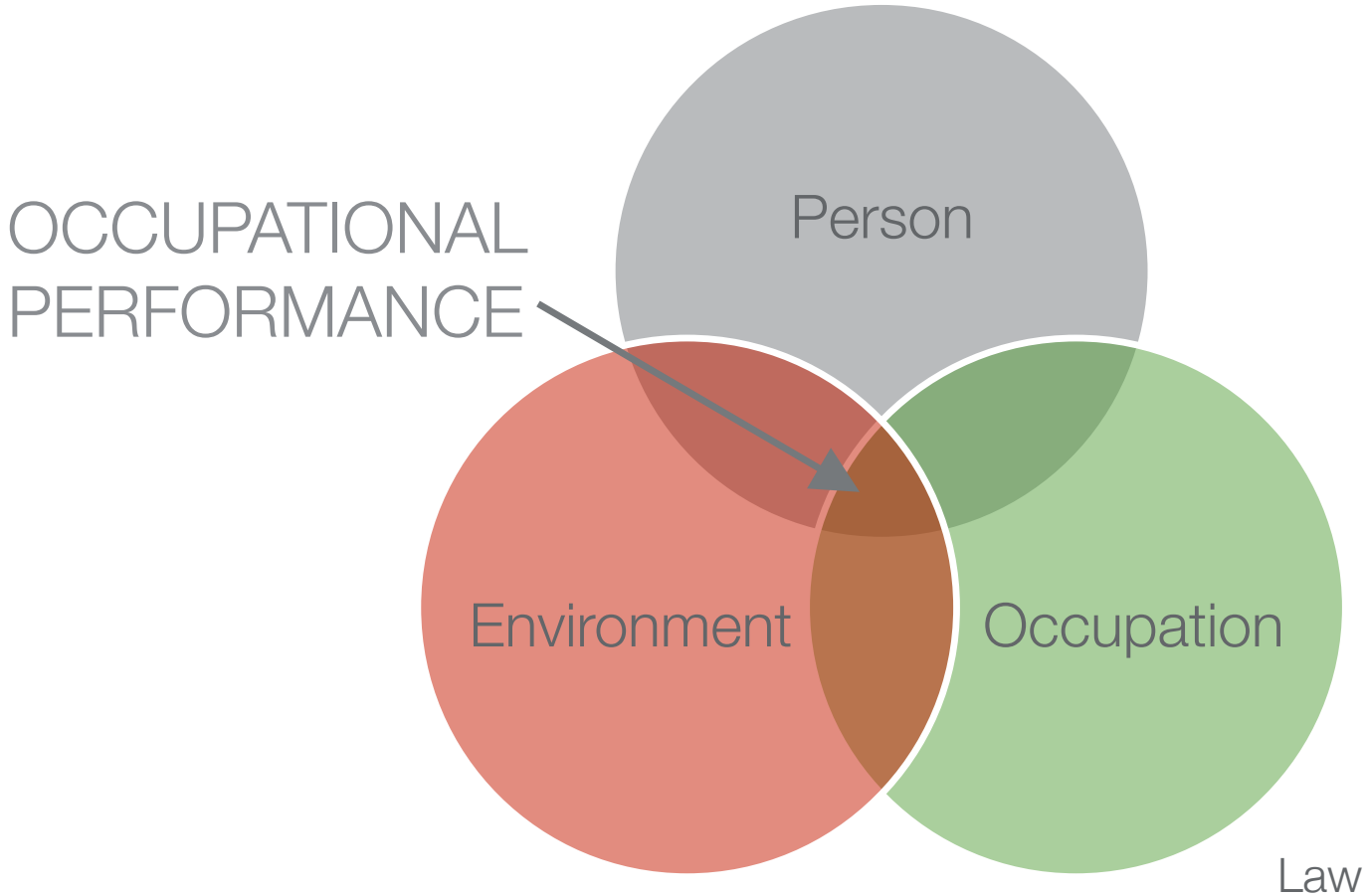


Ergonomic Interventions

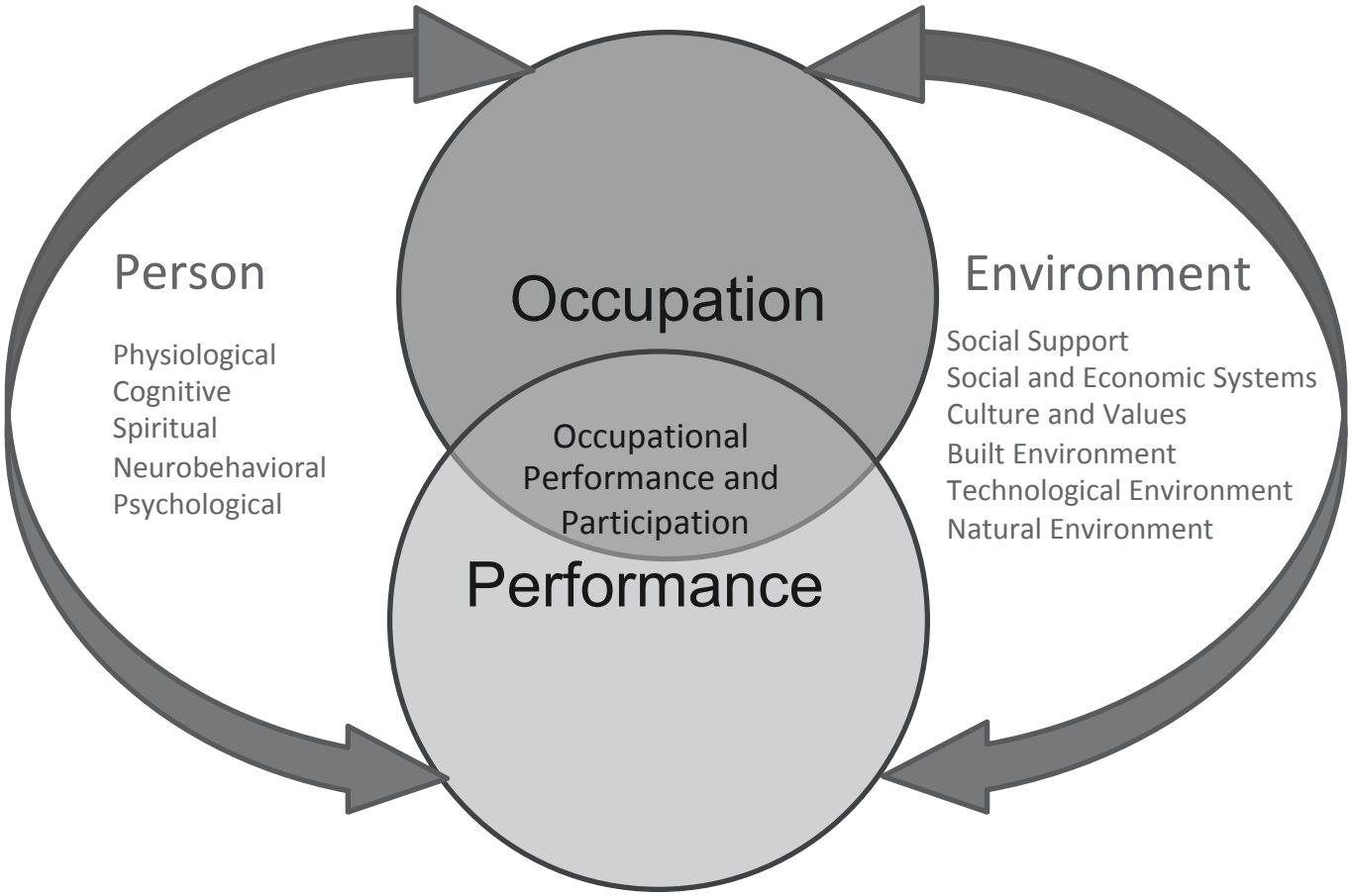
- Ergonomic intervention can include periodic movement, stretching, and education to prevent pain and improve quality of life
- Interventions supporting stage of change are effective, and reinforces importance of ongoing supports
- Increasing awareness of risks supports behavioral change related to ergonomics

Mani, Provident, Eckel, 2016; Rothmore et al., 2017; Bowman, Murphy, Schaner, 2016; Maxwell, Howell, Causey-Upton, 2019; Shariat et al., 2018

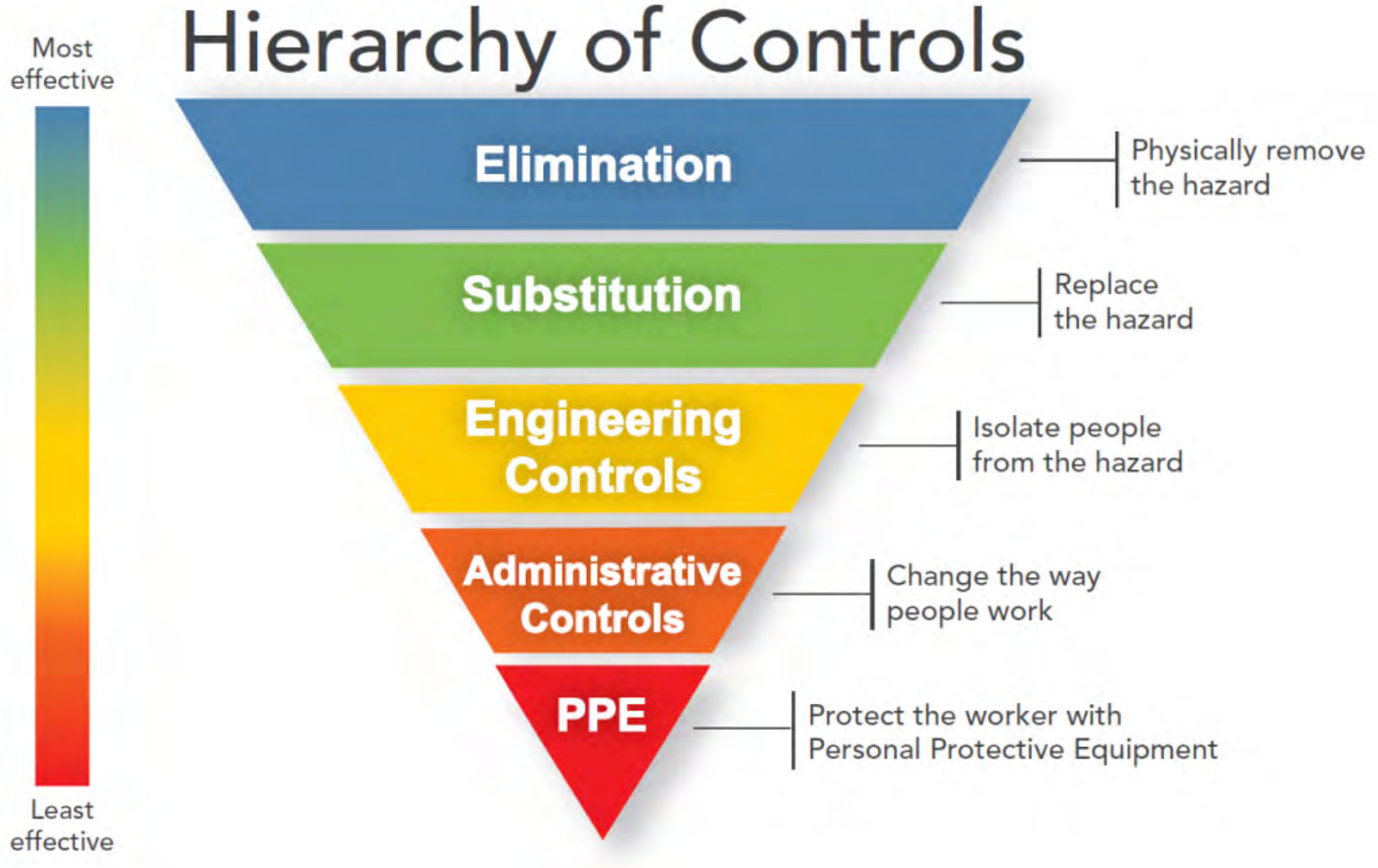
Models for Intervention



Law et al., 1996



Baum, Christiansen, & Bass, 2015


Hierarchy of Controls
Most effective
Least effective
Elimination
Physically remove the hazard
Substitution
Replace the hazard
Engineering Controls
Isolate people from the hazard
Administrative Controls
Change the way people work
PPE
Protect the worker with Personal Protective Equipment

Types of Controls

Source Control

Path Control

Receiver Control

Calloni, Musser, Castel, Mejdi, & Medeiros, 2019

Ergonomic Risk Factors

Awkward Posture

Any position where a body segment is angled outside the mid-point range of motion for that joint

AWKWARD POSTURE: RED FLAGS

Observe

- Any alignment out of neutral (coming up!)
- End of range joint positioning
- Tip: Position when they don't think you're looking

Contact Stress

Compression of soft tissue with any hard or sharp surface

CONTACT STRESS: RED FLAGS

- Look for:
  - Soft tissue on hard surfaces
  - Skin changes (e.g. blanching)
  - Load bearing through upper extremity, knees, abdomen, etc.
  - Soft tissue displacement
  - Using the hand as a hammer, knocking

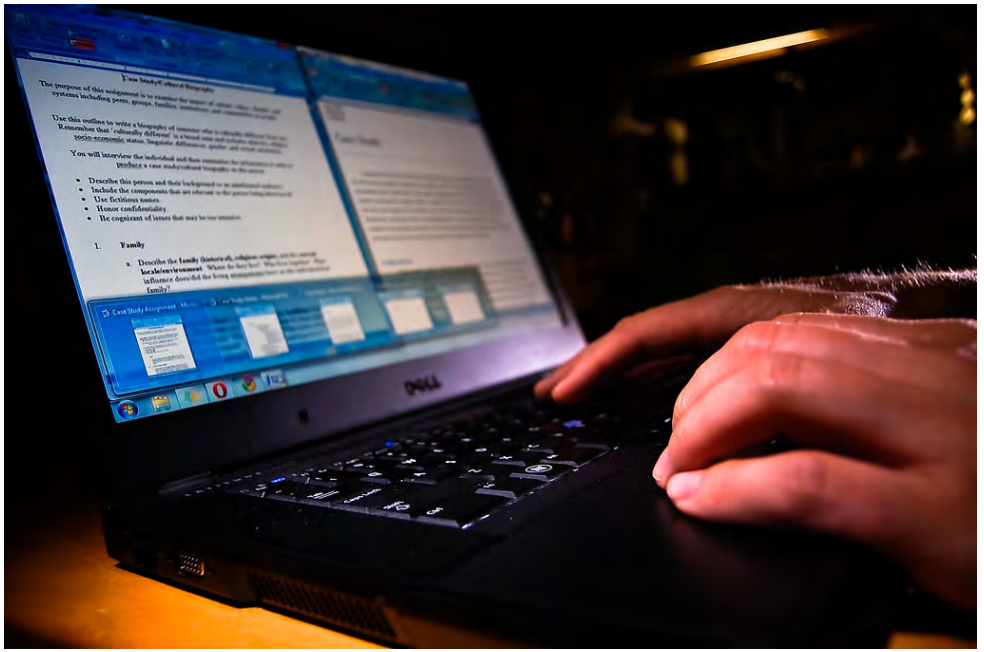


Repetition

Number of motions performed by a body segment; thresholds are body segment dependent and typically multiple repetitions per minute

REPETITION: RED FLAGS

- Observe
  - Any prolonged or repeated movement
  - Similar movements
  - Time element (duration, frequency)



Force

Amount of effort needed to lift, carry, push, pull, or grip an object

FORCE: RED FLAGS

Observe

- Any explosive movement
  - Throwing, catching, whipping
- Any heavy work
  - Lifting, pushing, pulling, carrying

Vibration

From an external source transmitted to the whole body or body segment (e.g. arm, hand)

VIBRATION: RED FLAGS

- Observe:
  - Tissue changes (e.g. color, texture, temperature)
  - Numbness and tingling, sensory changes
  - Whole body or hand-arm vibration

Environmental Factors

Environmental Factors

Light

Sound

Air Quality

Texture

Temperature

World Health Organization, 2001

LIGHT

electromagnetic radiation that can be detected by the human eye…tool for perceiving the world and communicating within it

Stark, 2018

HOW DOES LIGHT IMPACT HEALTH

- Artificial light at night (ALAN) disruption of circadian rhythm and suppression of melatonin
- ALAN associated with cancer risk
- Impact on aging, metabolism, heart disease, diabetes, mood disorders, obesity
- Can trigger migraines and exacerbate sxs

Cho, Ryu, Lee, Kim, Lee & Choi, 2015; Navara, & Nelson, 2007; Digre, 2016

HOW DOES LIGHT IMPACT HEALTH?

- Non-melanoma squamous cell skin cancer
- UVA creates free radicals, creating risk of malignancy
- Primary source of vitamin D
- Increases serum beta-endorphin (e.g. depression, pain relief, relaxation)
- UVA causes cross-linking of collagen and wrinkling
- UVA can increase immune tolerance

Holick, 2016

NOISE

ANY DISTURBING OR UNWANTED SOUND

- Environmental components
- Personal components

Canadian Centre for Occupational Health and Safety, 2019C

WHY DOES NOISE MATTER?

- Changes to hearing including:
- Acoustic trauma
- Tinnitus
- Temporary hearing loss
- Permanent hearing loss
- Hyperacusia

Basner et al., 2014; Carroll et al., 2017; Canadian Centre for Occupational Health and Safety, 2019b

WHY DOES NOISE MATTER?

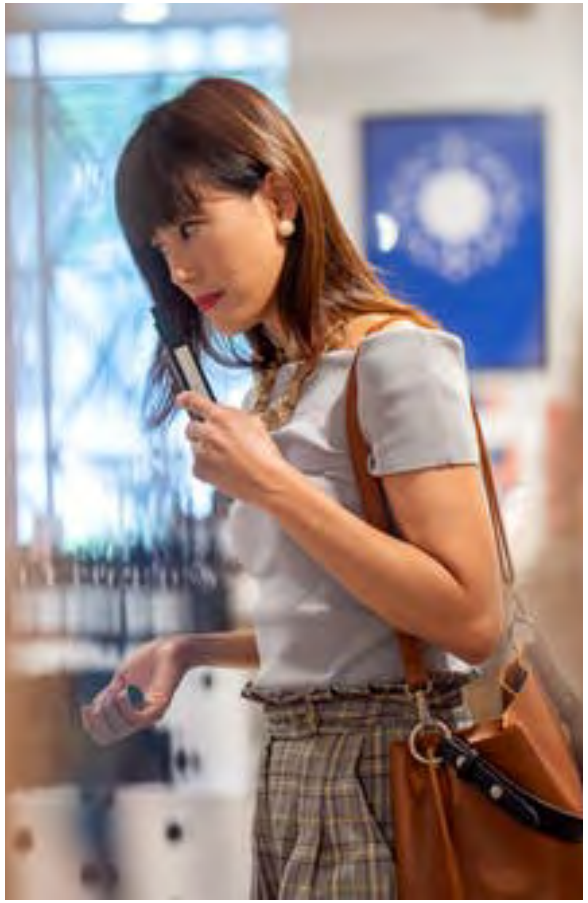
- Annoyance
- Cardiovascular disease
- Hypertension
- Sleep disturbance
- Myocardial infarction
- Stress
- Head pain

Canadian Centre for Occupational Health and Safety, 2019f; Laszlo, McRobie, Stansfeld, & Hansell, 2012; Martin, Todd, & Reece, 2005

AIR QUALITY

The temperature, humidity, ventilation, and chemical or biological contaminants of the air which influence respiration

(sometimes detectable with smell)



Brown, 2019

How Does Air Quality Impact Health?

- Productivity and learning
- Obesogenic nature of chemicals
- Asthma, lung cancer, respiratory conditions
- Chest pain
- Air + sickle cell+ acute pain

- Higher risk jobs:
  - Custodians
  - Professional drivers

Brown, 2019; Canadian Centre for Occupational Health and Safety, 2019a, Yallop et al, 2007

TEXTURE

The principles of an object including the feel, appearance, or consistency of a substance

Which interacts with soft tissues

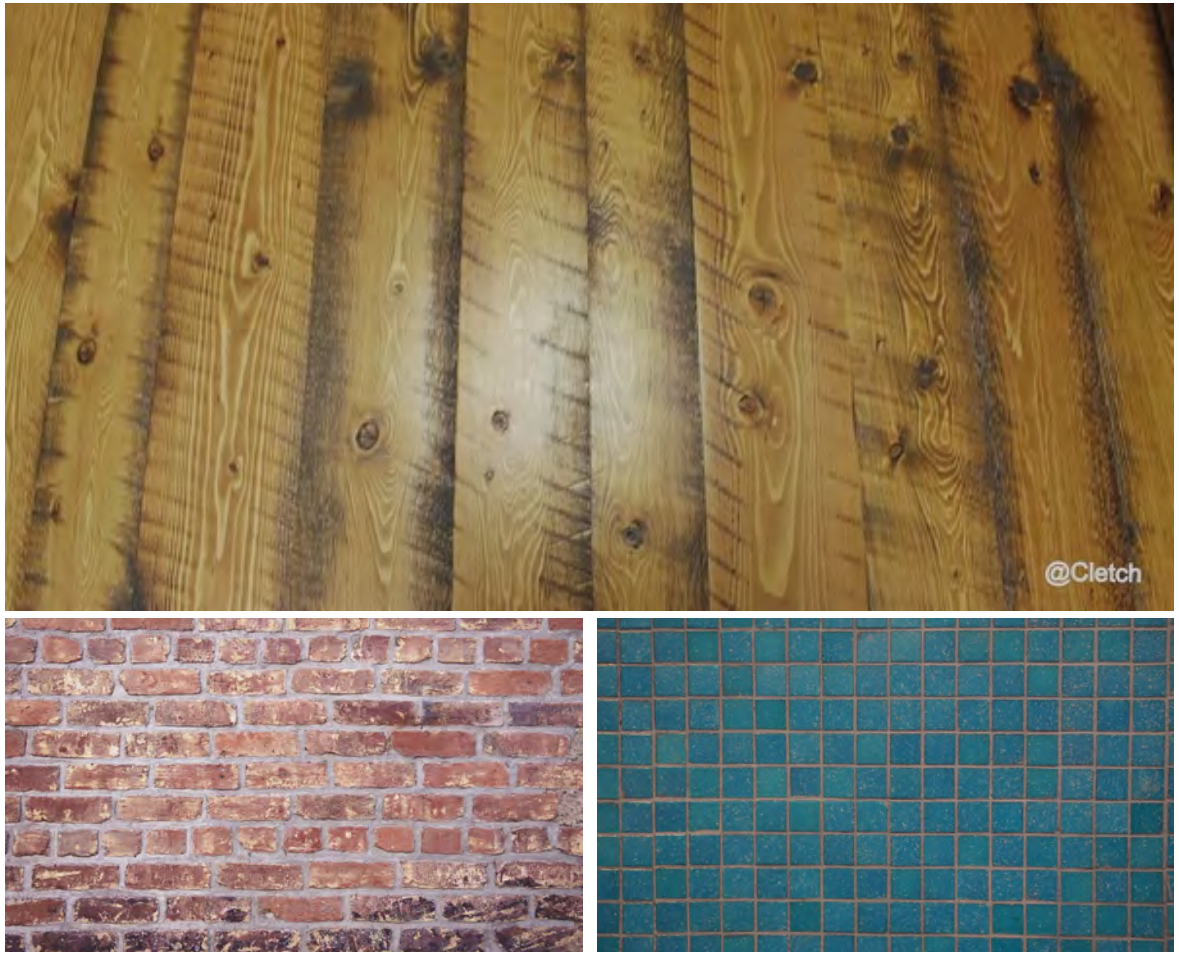


Photo by Lazy_camera_girl on Unsplash

Reddy et al., 2012

WHY DOES TEXTURE MATTER?

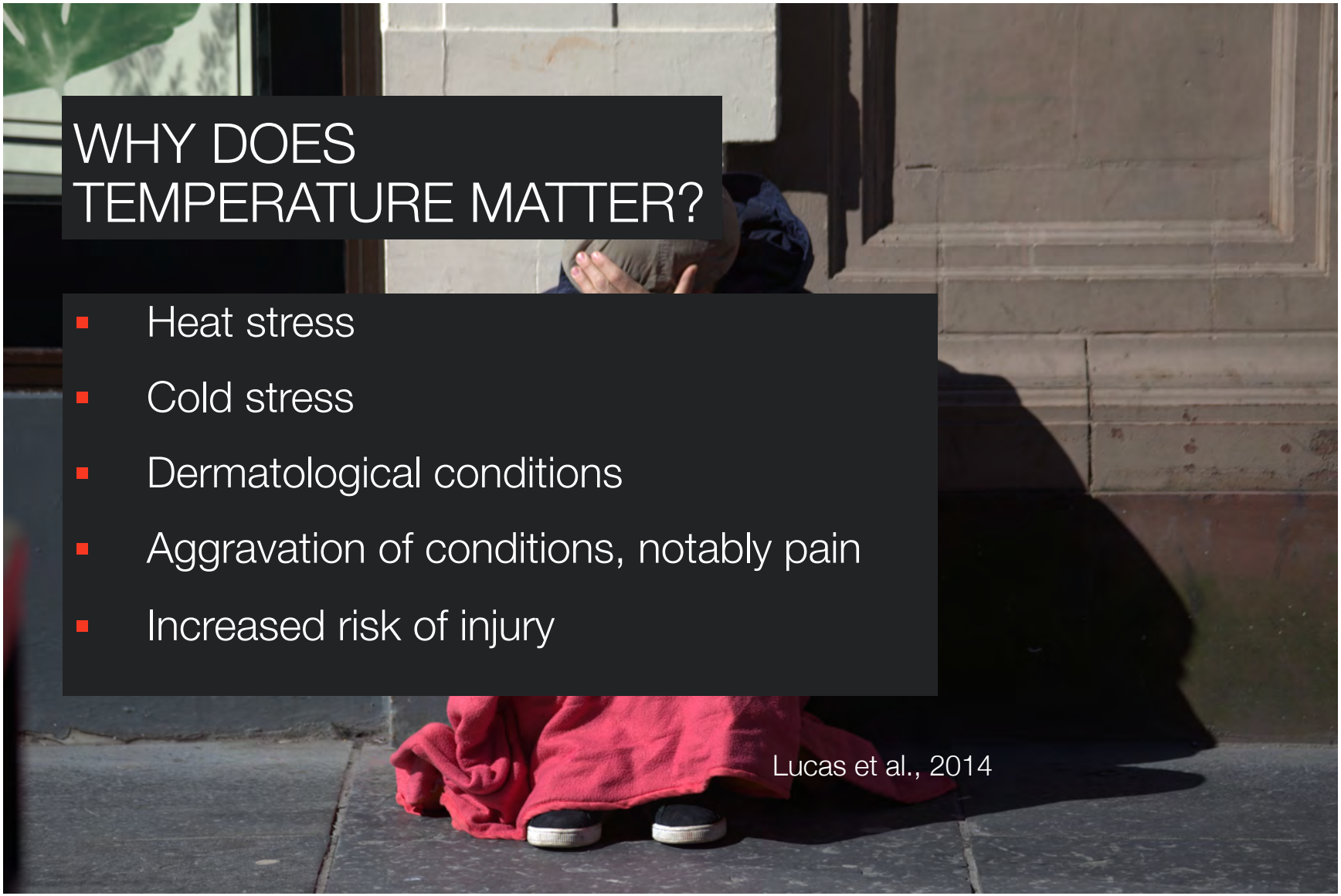
- slips, trips, falls
- musculoskeletal injury and pain
- fatigue
- pressure ulcers or rashes
- hand arm vibration exposure
- carpal tunnel syndrome

Redfern & Chaffin, 1995; Robinson & Lyon, 1994

Temperature

the measure of hotness or coldness of a substance on a definite scale

Encyclopaedia Britannica, 2019



WHY DOES TEMPERATURE MATTER?

- Heat stress
- Cold stress
- Dermatological conditions
- Aggravation of conditions, notably pain
- Increased risk of injury

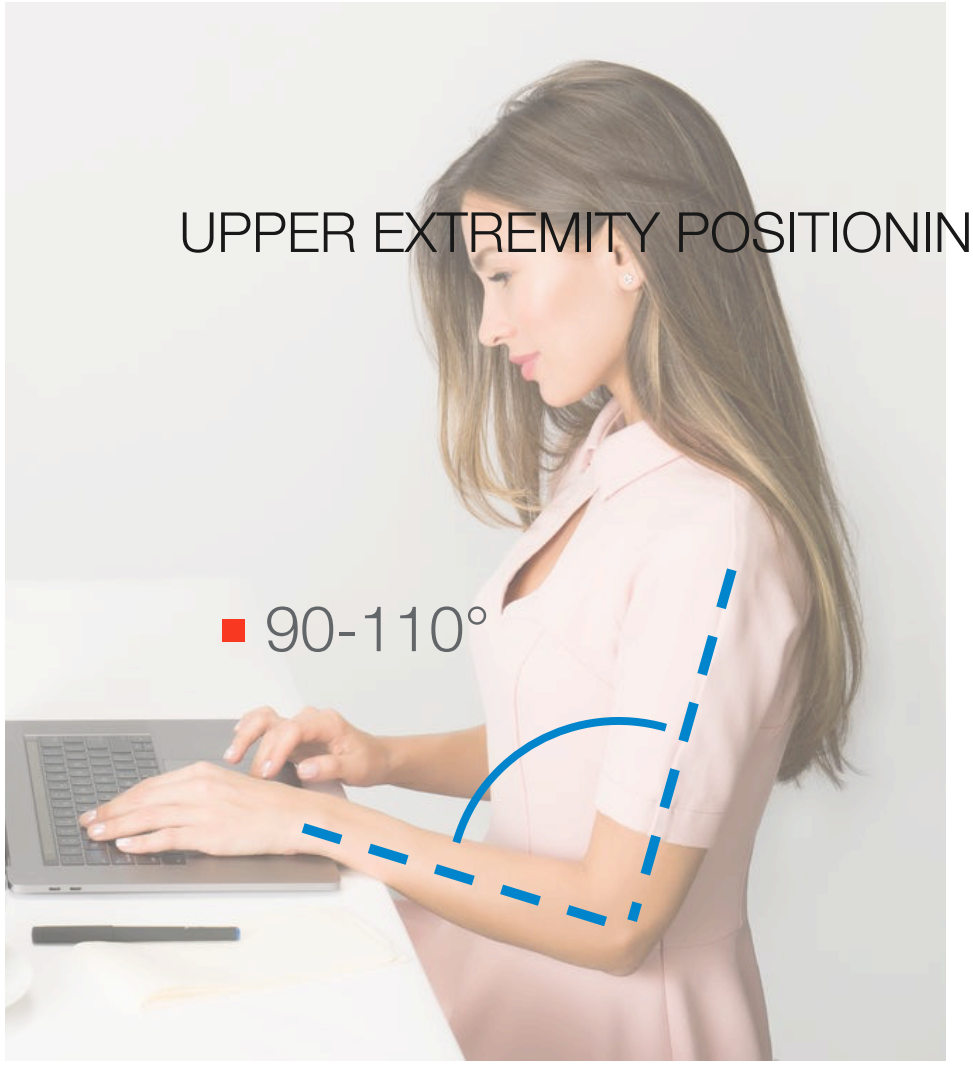
Lucas et al., 2014

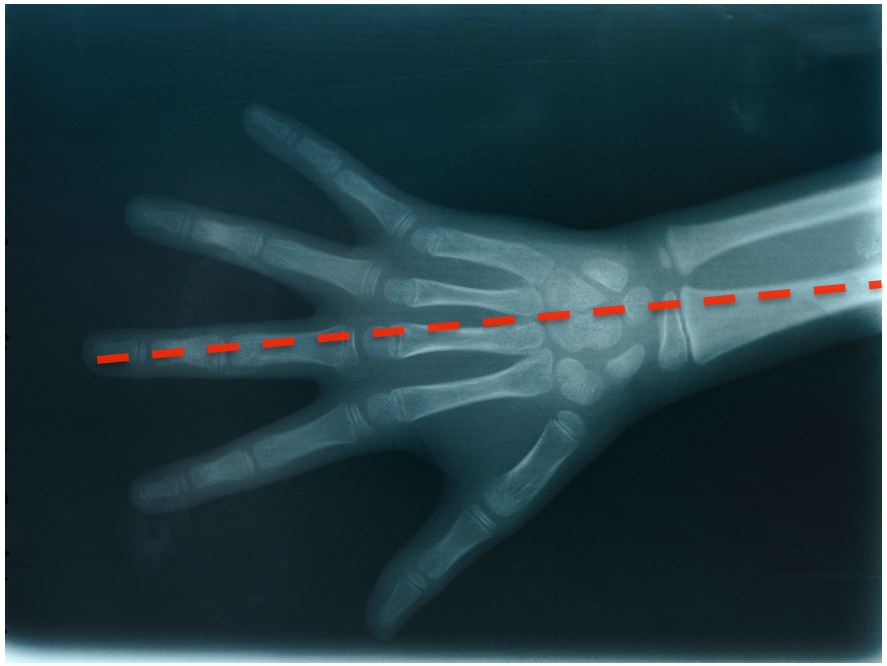
Neutral Positioning

Spine Positioning

"For every inch of forward head posture, it can increase the load by 10 lbs"

UPPER EXTREMITY POSITIONING





LOWER EXTREMITY POSITIONING

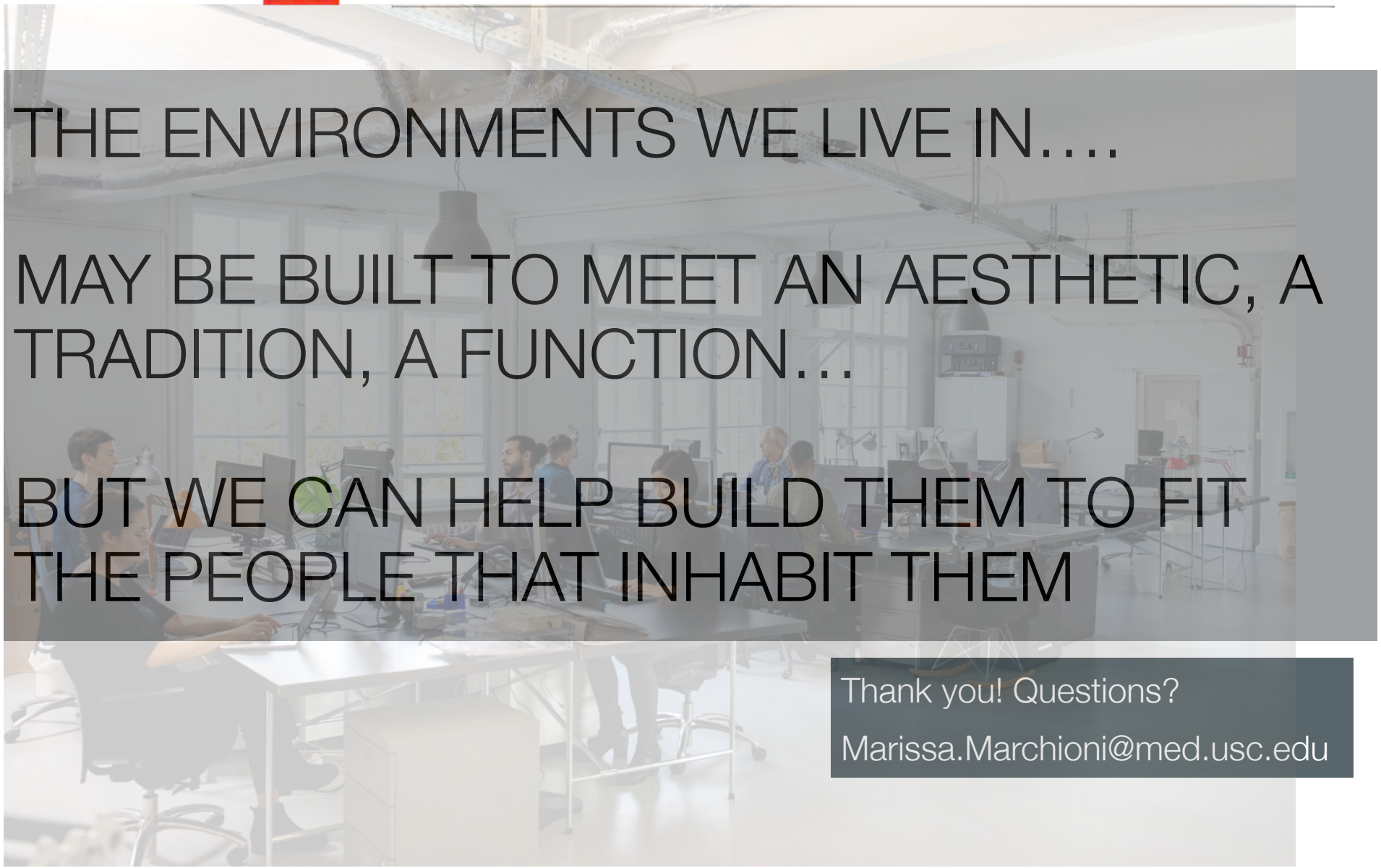
- Ankle
  - Look for extreme dorsiflexion or plantar flexion
- Knee
  - Look for locking or prolonged flexion
- Hip
  - Look for outside of 90 in seated, leaning

Application

CONSIDER:

- Ergonomic Risk Factors
  - Awkward posture
  - Repetition
  - Force
  - Vibration
  - Contact Stress
- Environmental Factors
  - Light
  - Noise
  - Air Quality
  - Texture
  - Temperature

What are the factors to consider in your own workspace?



THE ENVIRONMENTS WE LIVE IN….

MAY BE BUILT TO MEET AN AESTHETIC, A TRADITION, A FUNCTION…

BUT WE CAN HELP BUILD THEM TO FIT THE PEOPLE THAT INHABIT THEM

Thank you! Questions?

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Summary and Q&A

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