

Increase your Productivity with these Ergonomic Principles

Presented by:

Rob Doucette

Jeff Hoyle



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BOSTONtec
□ **B** □ □ □
Ergonomic Workstations

 **MODEX**²⁰²⁰
GEORGIA WORLD CONGRESS CENTER
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Presenters



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Objectives

- **The Economics of Ergonomics**
- **Results of Washington State Department of Labor 250 Case Studies**
- **Principles to Consider when Designing an Industrial Workstation**
- **New Ergonomic Time and Motion Study**

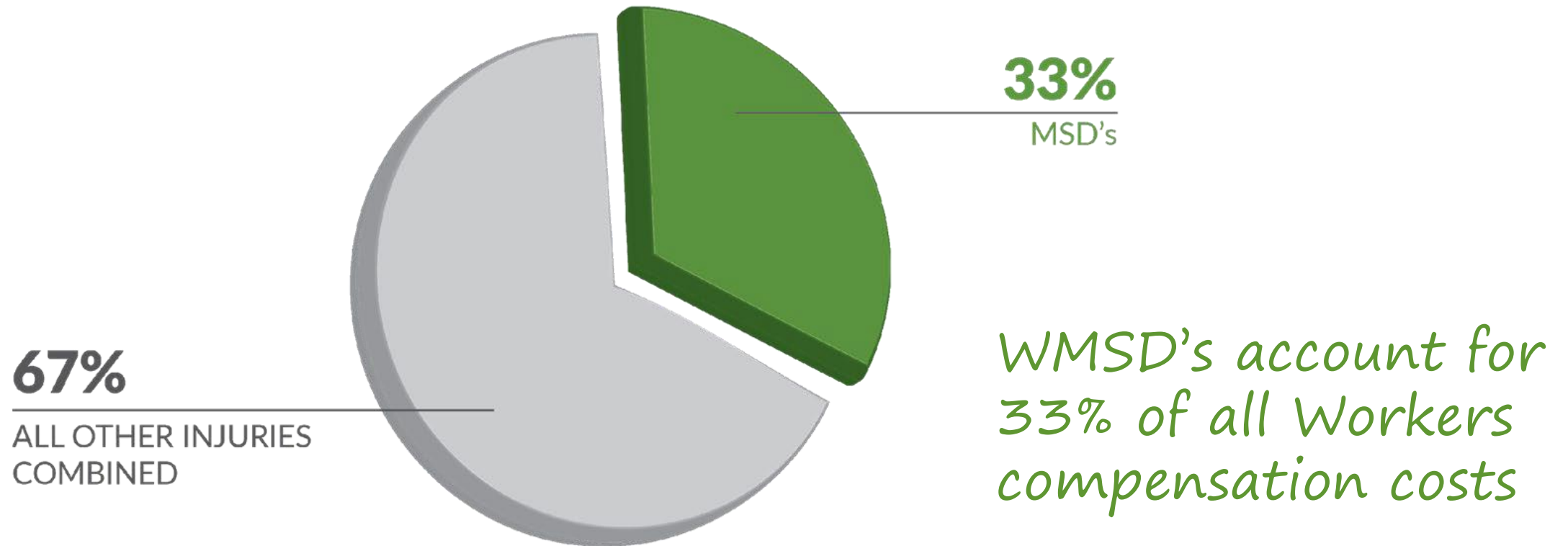
The Economics of Ergonomics



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Impact of Work-related Musculoskeletal Disorders (WMSDs)

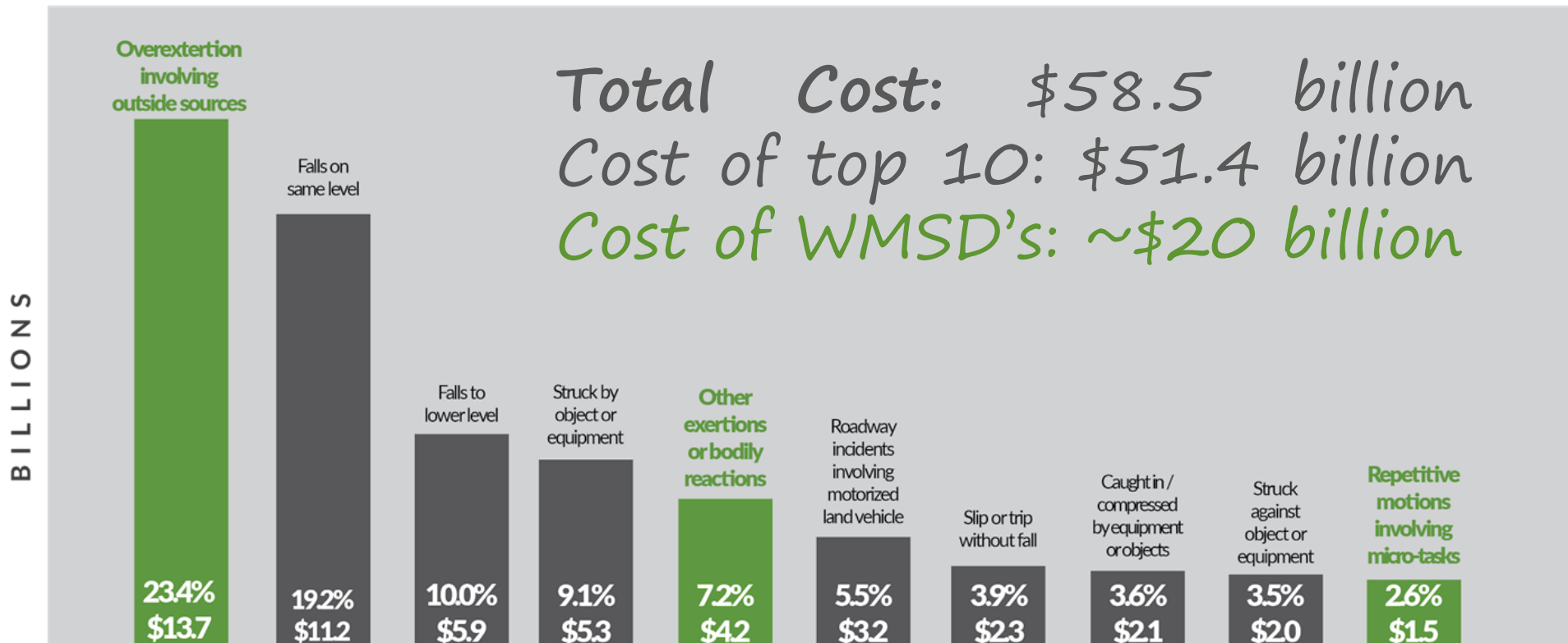
WMSD's are among the most frequently reported causes of lost or restricted work time.



Source: Bureau of Labor Statistics

Need for Ergonomics

Top 10 Causes and Direct Costs of the Most Disabling U.S. Workplace Injuries



Source: 2018 Liberty Mutual Workplace Safety Index

Costs of WMSD's

Indirect Cost of WMSD' are up to five times the direct costs

Direct Costs

*Workers comp, medical &
legal expenses*

Indirect Costs

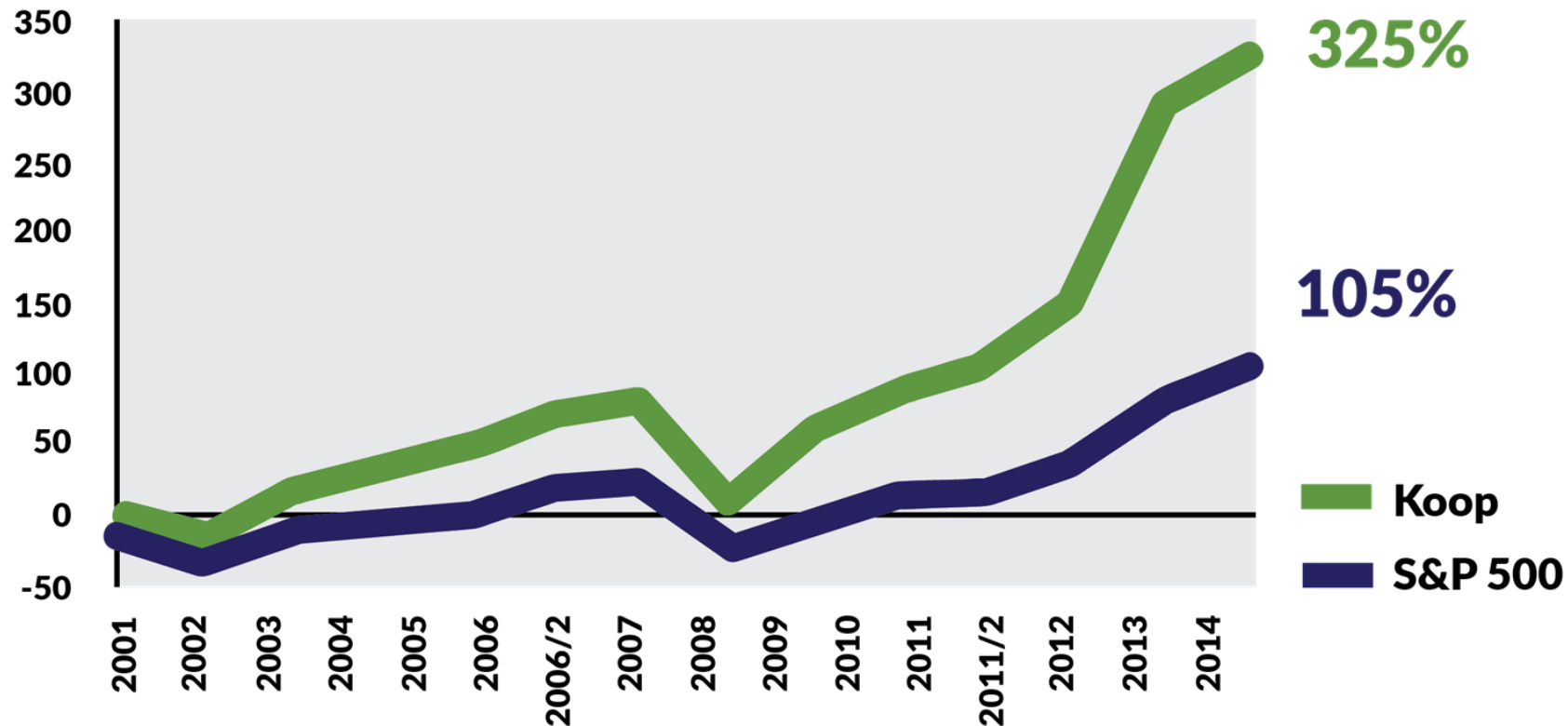
*Training replacement,
accident investigation, lost
productivity, lower employee
morale & turnover*



Source: <https://www.osha.gov/safetypays/background.html>

Culture of Safety & Health

Tracking the Market Performance of Companies that Integrate a Culture of Health & Safety

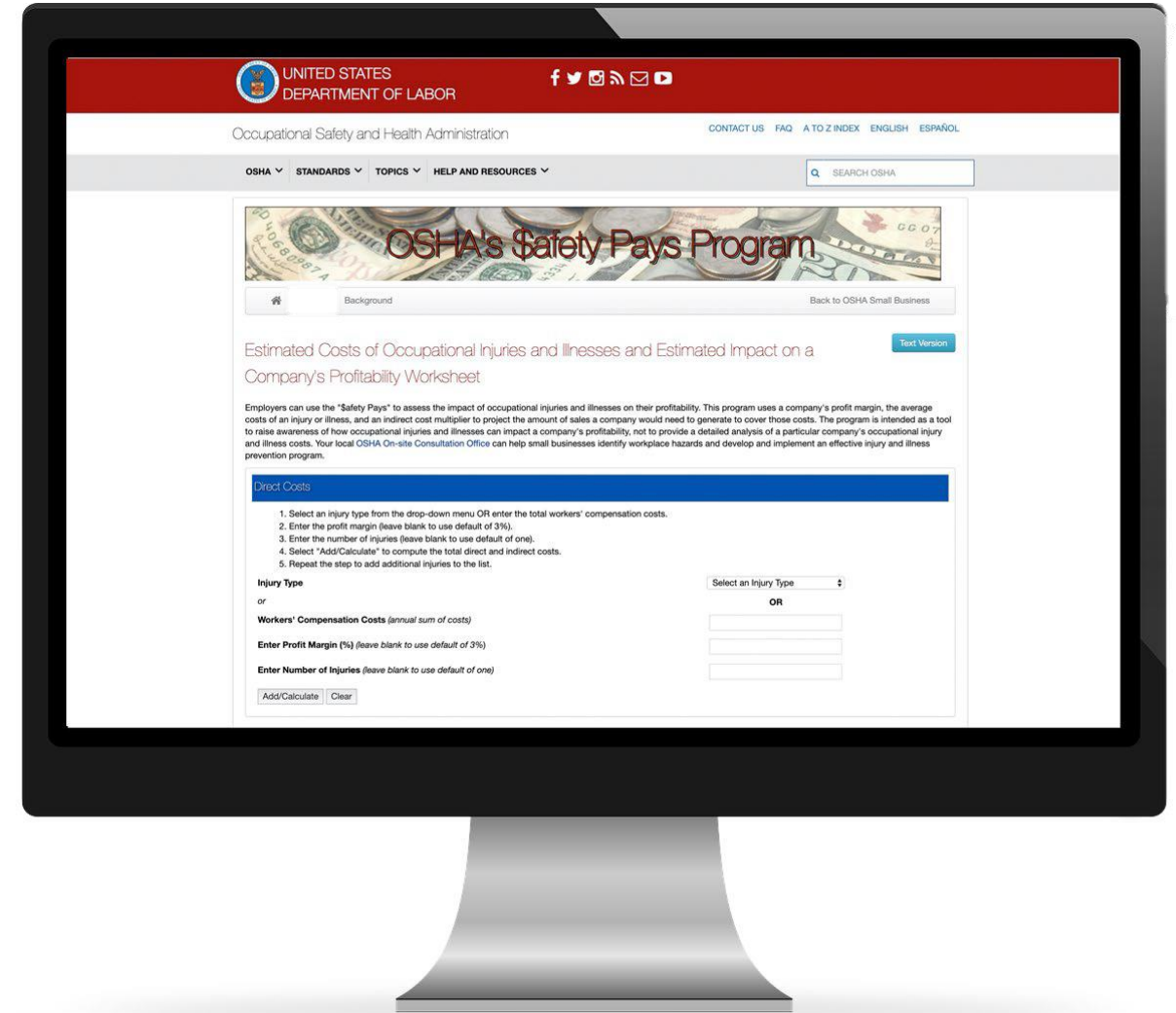


Source: Journal of Occupational & Environmental Medicine

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OSHA Calculator

*Calculate the
Impact of WMSD's
on Your Business*



Source: <https://www.osha.gov/safetypays/estimator.html>

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250 Case Studies

Washington State Department of Labor and Industries Reviewed Effect of Ergonomics

ERGONOMICS
Reduce Cost

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250 Case Studies

Washington State Department of Labor and Industries Reviewed Effect of Ergonomics

ERGONOMICS
Improve Productivity

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250 Case Studies

Washington State Department of Labor and Industries Reviewed Effect of Ergonomics

ERGONOMICS

Improve Accuracy & Quality

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250 Case Studies

Washington State Department of Labor and Industries Reviewed Effect of Ergonomics

ERGONOMICS

Improve Employee Engagement

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250 Case Studies

Washington State Department of Labor and Industries Reviewed Effect of Ergonomics

ERGONOMICS

Create a Better Safety Culture

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250 Case Studies

Washington State Department of Labor and Industries Reviewed Effect of Ergonomics

Metric	Number of Examples	Mean	Median	Range
WMSDs	90	59% ↓	56% ↓	8% - 100%
Lost workdays	78	75% ↓	80% ↓	3% - 100%
Workers' comp costs	52	68% ↓	70% ↓	15% - 100%
Productivity	61	25% ↑	20% ↑	-0.2% - 80%
Payback period	36	0.7 yrs.	0.4 yrs.	0.03-4.4 yrs.

Source: Washington State Department of Labor and Industries

250 Case Studies

Washington State Department of Labor and Industries Reviewed Effect of Ergonomics

Metric	Number of Examples	Mean	Median	Range
Quality (scrap/errors)	8	67% ↓	75% ↓	8% - 100%
Turnover	34	48% ↓	48% ↓	3% - 100%
Absenteeism	11	58% ↓	60% ↓	14% - 98%
Cost:Benefit ratio	6	1:45.5	1:10	1:2.5 - 1:140

Source: Washington State Department of Labor and Industries

Ergonomic Calculator

*Calculate Your
Ergonomic
Cost Benefits*

Washington State Department of Labor & Industries

Puget Sound Human Factors and Ergonomics Society

Number of employees in this job/dept./org.:

Average hourly salary for these employees: per hour

Number of WMSD claims for this job/ dept./ org. per year:

This past year:

Type	Back strain	Number	Typical costs: \$
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Total costs for year:			\$ -

The year before:

Type	Back strain	Number	Typical costs: \$
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Total costs for year:			\$ -

2 years before:

Type	Back strain	Number	Typical costs: \$
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Type	Back strain	Number	\$ -
Total costs for year:			\$ -

Average annual WMSD claim costs: \$ -

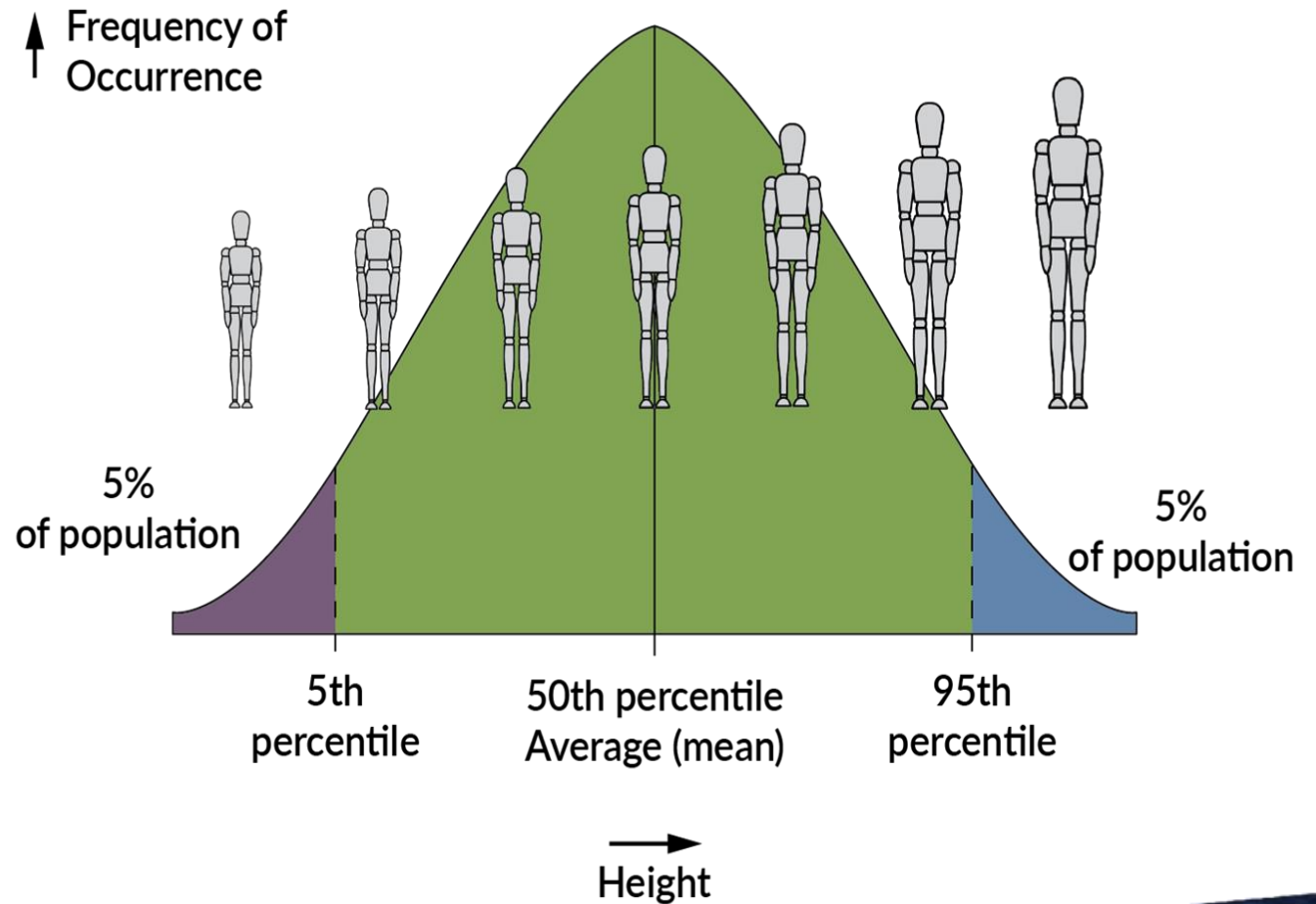
Estimated annual indirect costs: \$ -

Source: <https://pshfes.org/cost-calculator>

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Workforce Diversity

*Challenges to
workstation set-up
and design.*



Ergonomic Principles

- **Optimize Position**
- **Eliminate Extreme Movements**
- **Minimize Forces & Repetition**
- **Order & Color Coding**
- **Optimize Lighting**

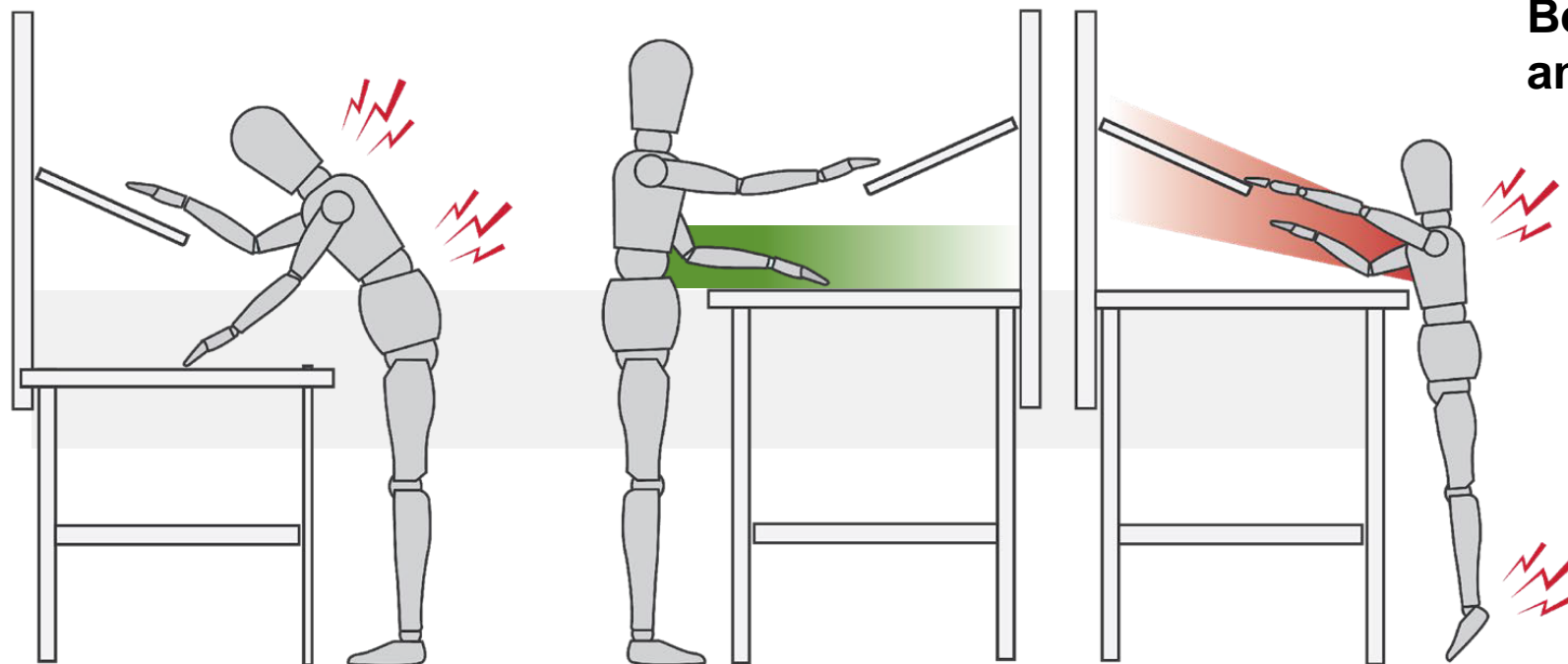


Optimize Position

Challenge:

Multi-Operator processes

Varying heights

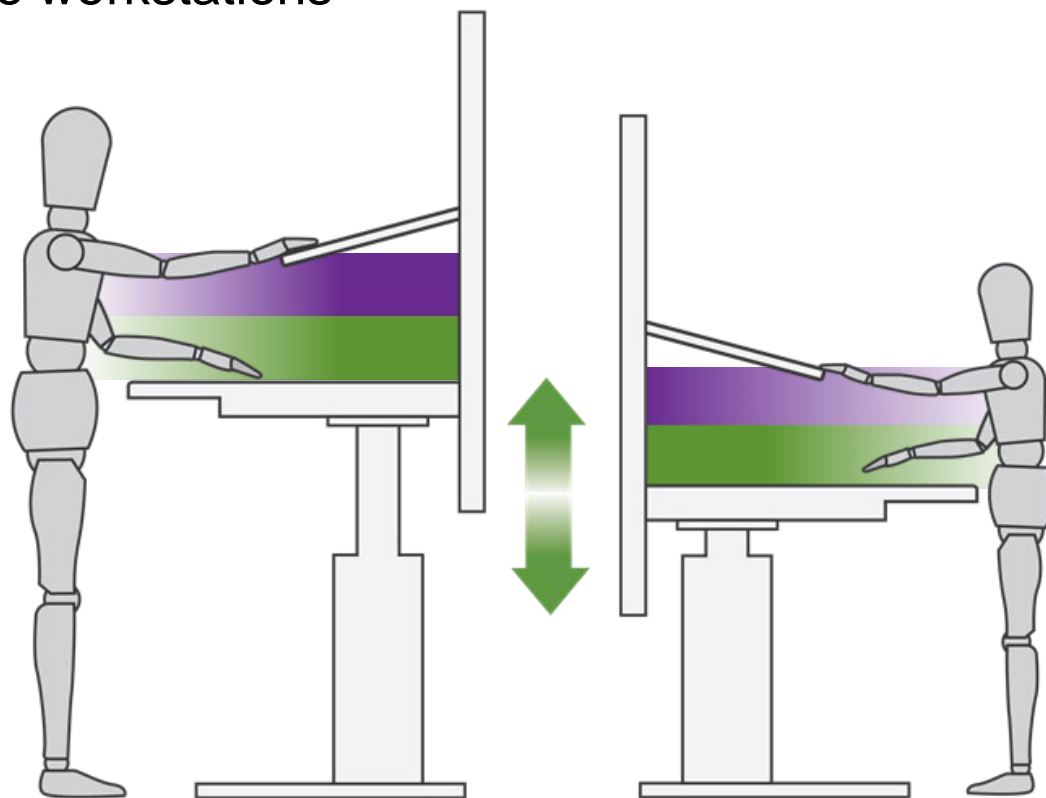


Danger Zone
Bending, stretching,
and/or reaching

Optimize Position

Solution:

Height-adjustable workstations



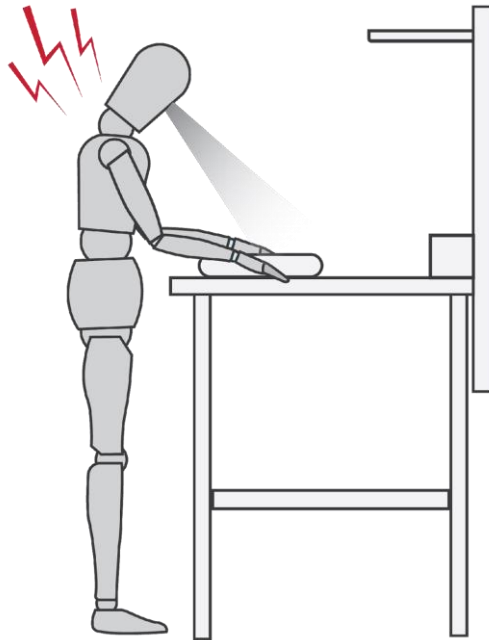
Neutral Position

**Most operators stay
in 1st and 2nd zone**

Optimize Position

Challenge:

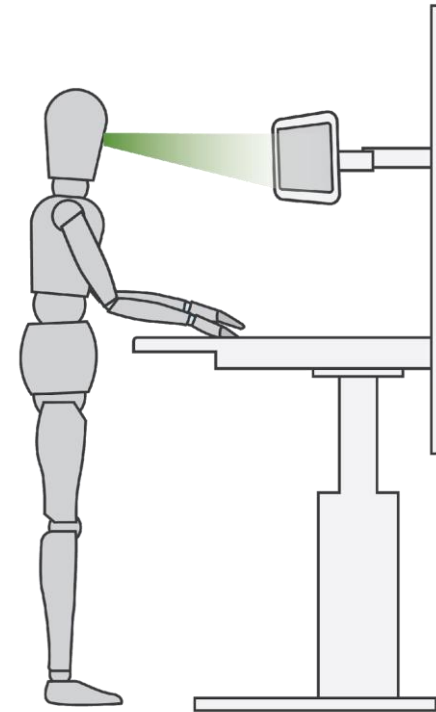
Position of work instructions or other documentation



Danger Zone
Neck bending

Solution:

Use monitor arms to position screens in correct height



Neutral Position
For body and neck

Optimize Position

Accessories that help ensure an ergonomically sound position:



*Height-Adjustable
Arms*



Articulating Arms



Combined Arms

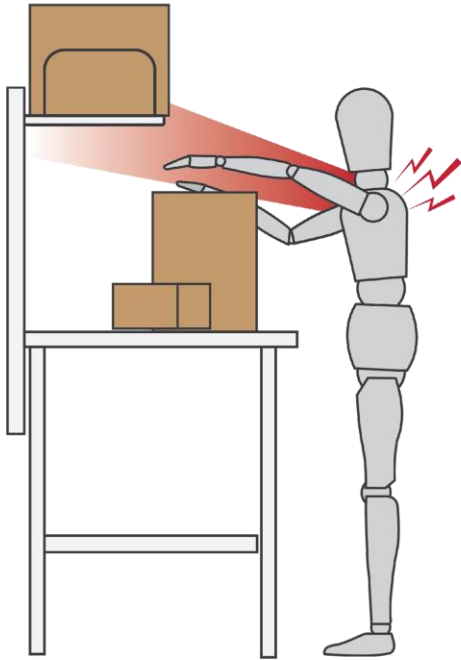


Keyboard Trays

Eliminate Extreme Movements

Challenge:

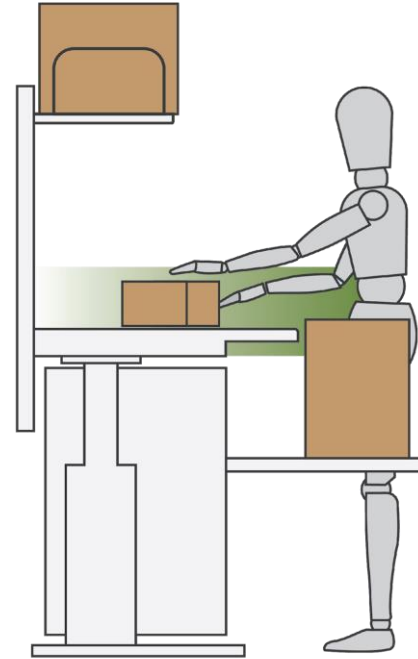
Box building and packaging of large boxes on work surface:



Danger Zone
Reaching
above the shoulder

Solution:

Under work surface shelving system:



Neutral Position
Keeping arms under
shoulder height

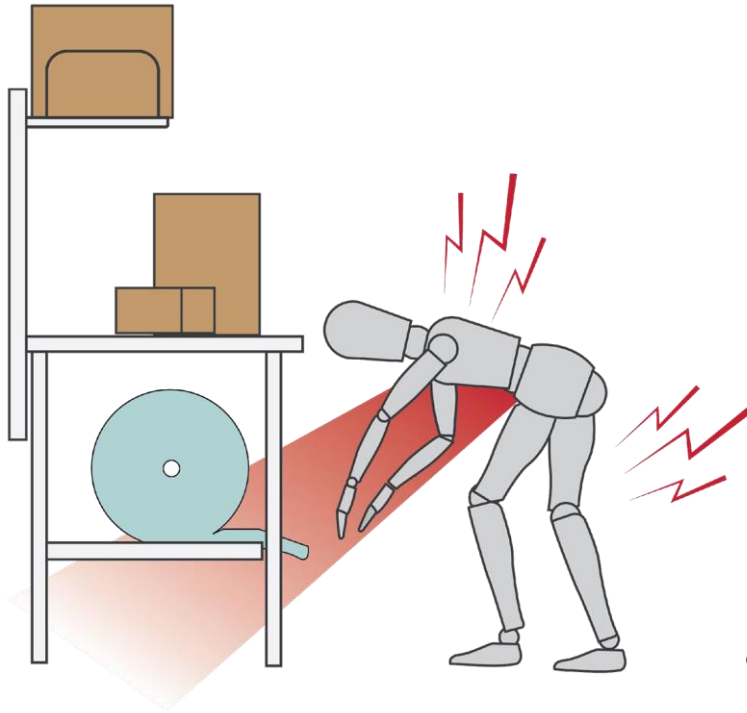
Eliminate Extreme Movements

Challenge:

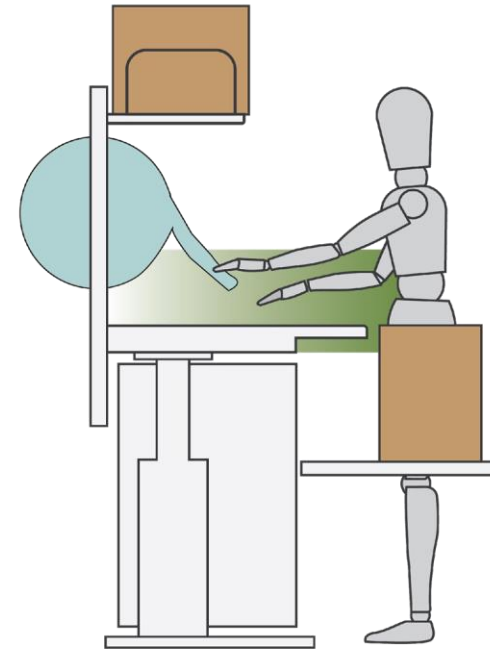
Store packing material under work surface

Solution:

Specialty holders / spools



Danger Zone
Bending hips
and waist



Neutral Position
Allows the body to
remain upright

Workstation Examples



Box Building Shelf

Spool Holders for Bubble-wrap



Corrugate Storage Cart



Label Trough

Printer Pull-out Shelves

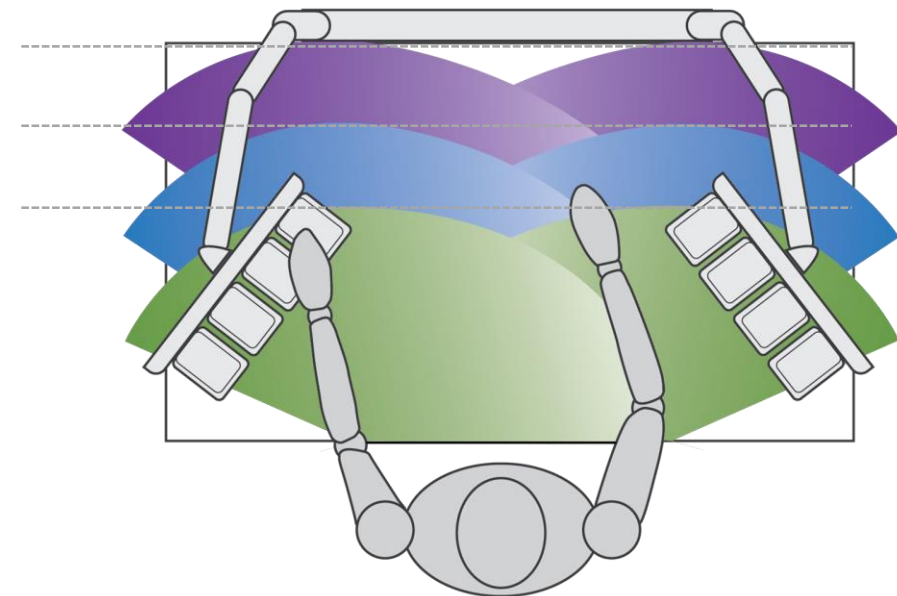
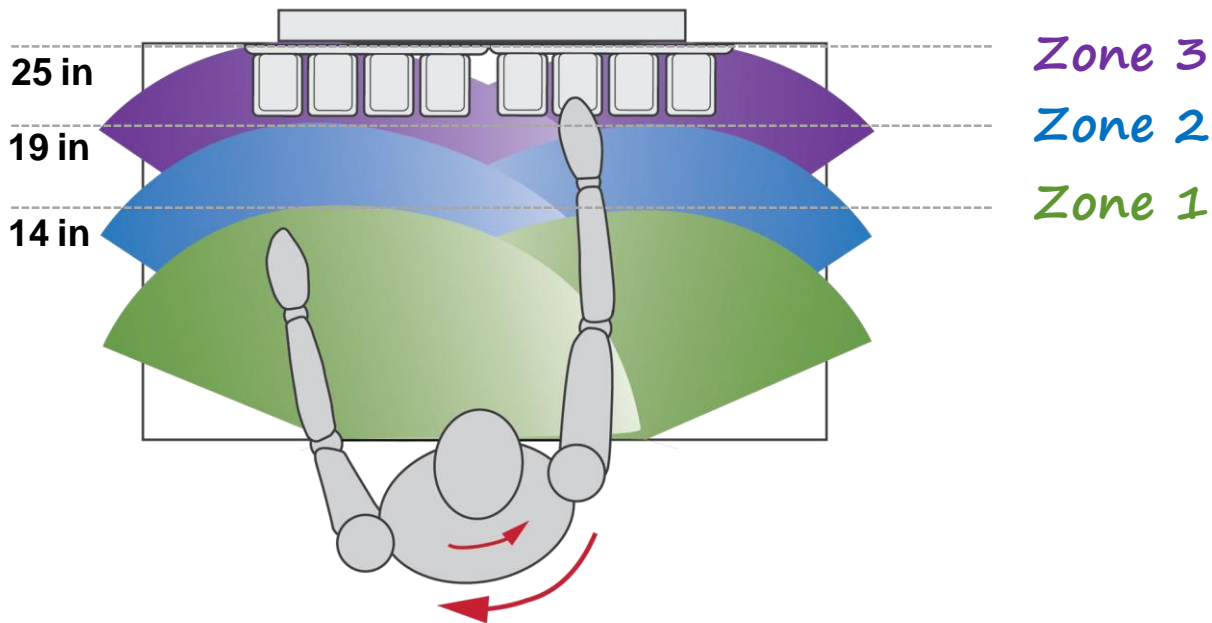
Minimize Repetitive Movements

Challenge:

Frequently used items for repetitive tasks placed at the rear of workstation forcing the operator to reach and twist to Reach **Zone 3**.

Solution:

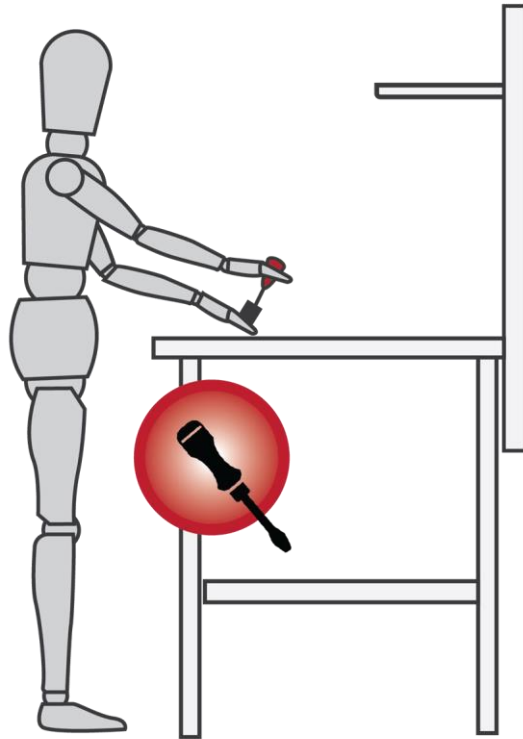
Arm and rail systems bring items into Reach **Zone 1**.



Minimize Forces and Repetitive Exertions

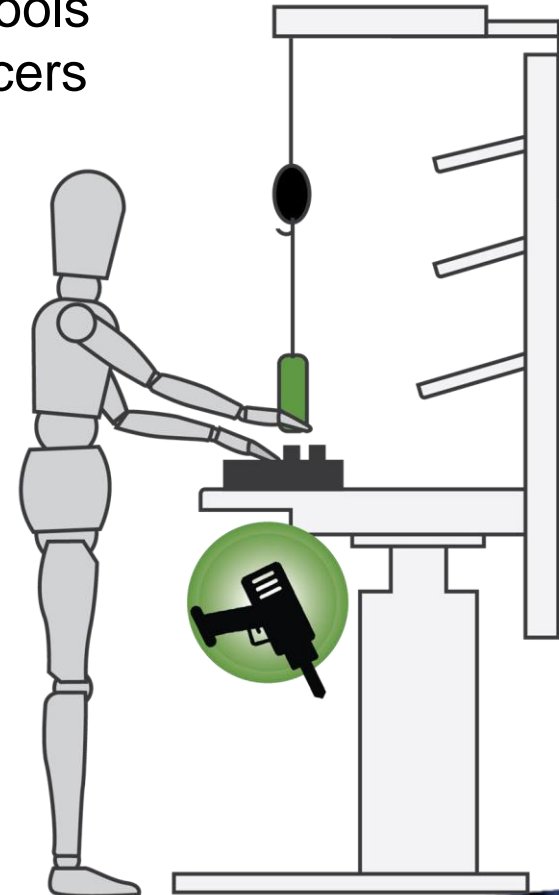
Challenge:

Repetitive motions
using manual tools w/o support



Solution:

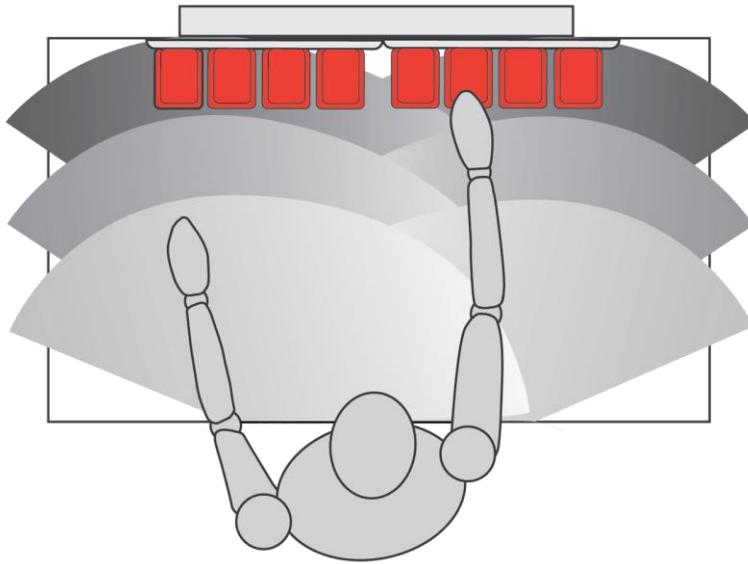
Powered tools
and balancers



Order and Color Coding

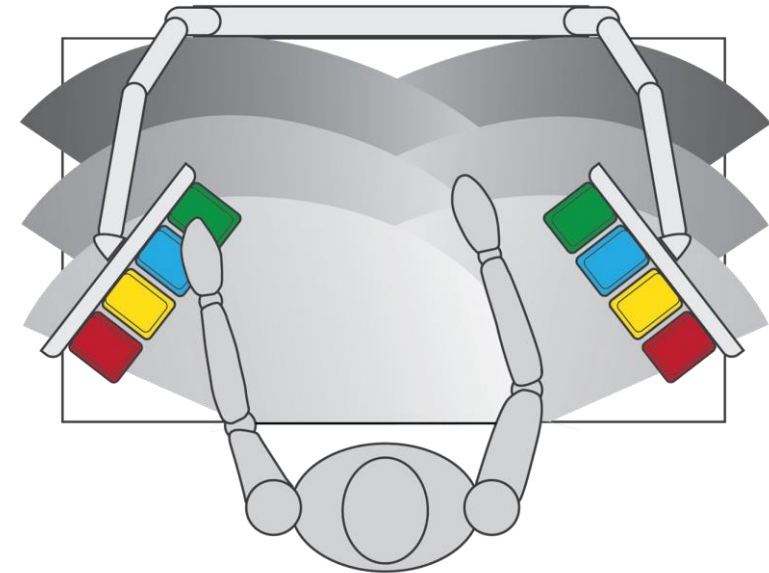
Challenge:

When variety of items is needed for work process, uniform color of bins challenges productivity and accuracy.



Solution:

Clear color coding and labeling.
Order top to bottom, left to right for sequencing.



Workstation Example

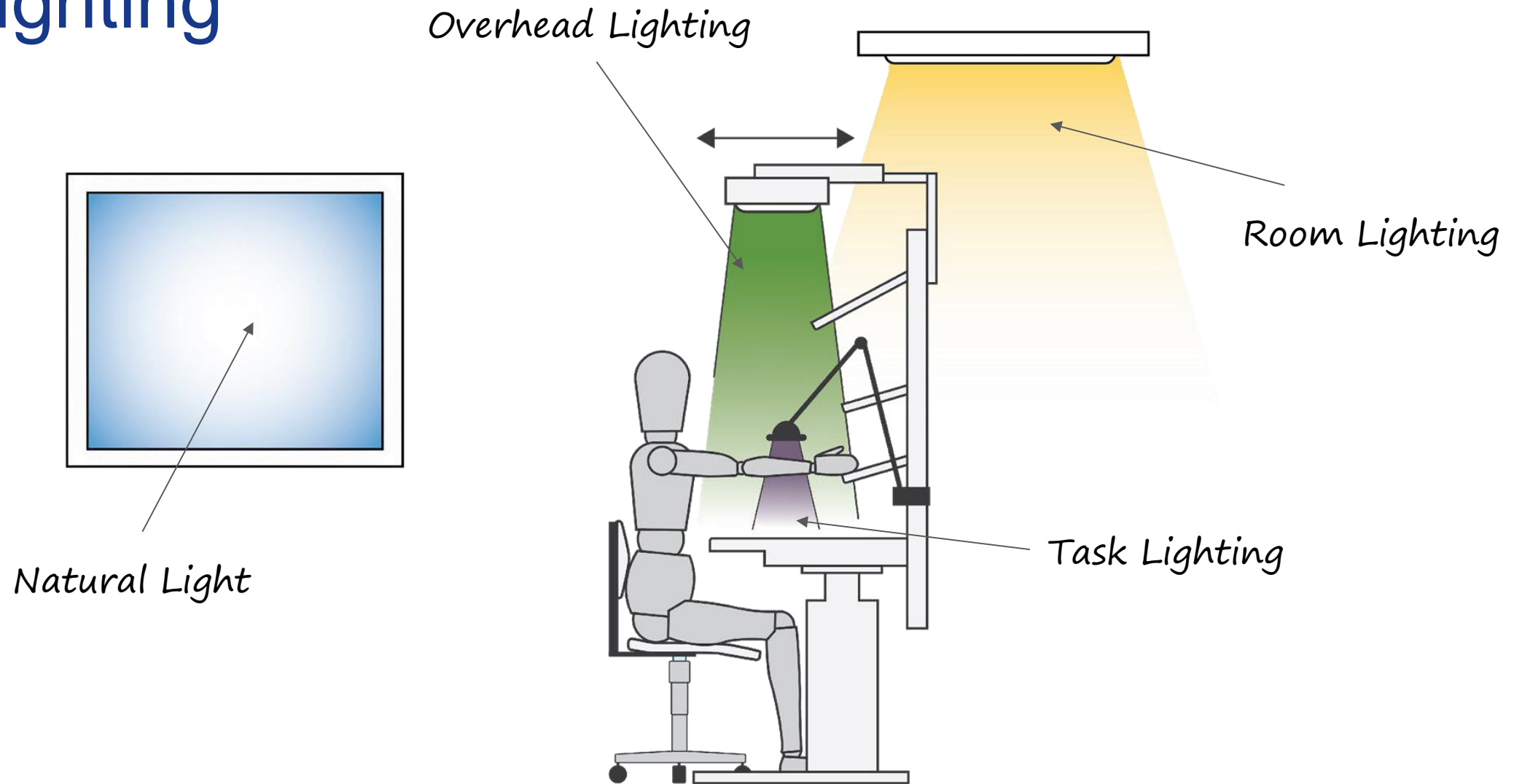
Tool Track with
Trolley and
Balancer

Bin Rail with
Color-coded Bins



Articulating Bin
Holder

Lighting

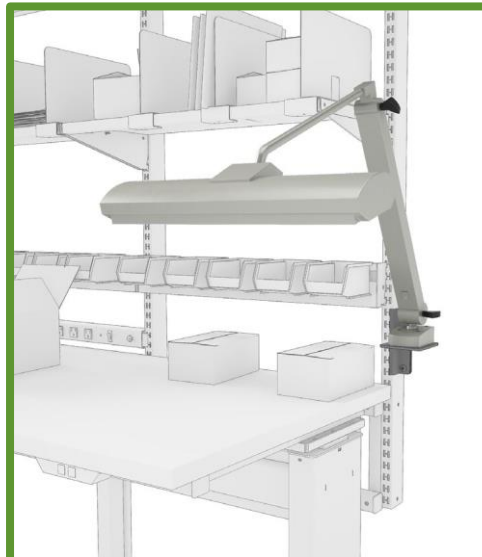


Lighting

Accessories that help provide ergonomically sound lighting:



LED Overhead Light



Task Light



LED Ring Magnifier



Max Magnifier

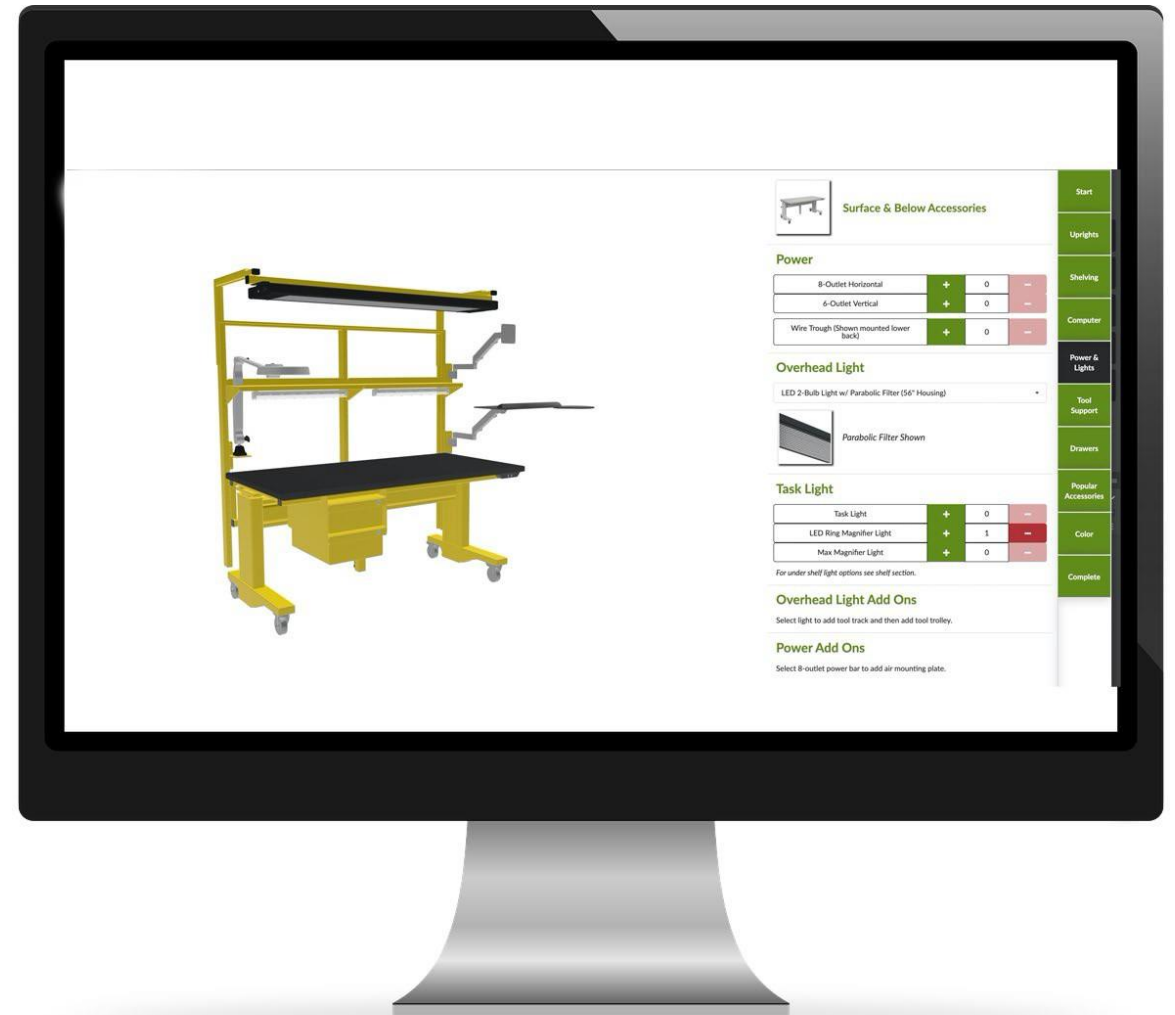
Workstation Example



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Online Configurator

Easy-to-use Online Configurators Help You Plan Ergonomic Details of Your Workstations

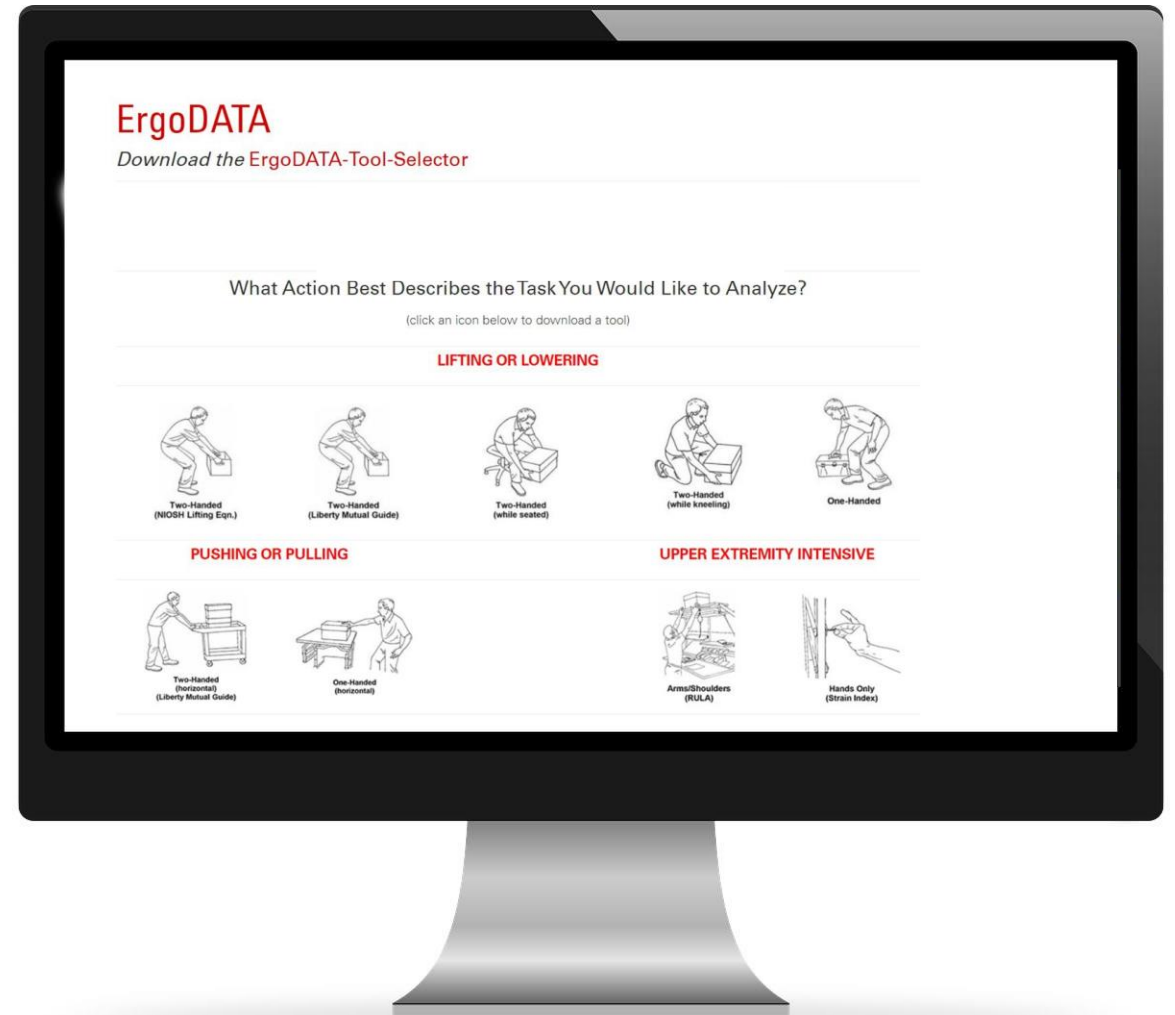


Source: <https://www.bostontec.com/design-workstation/>

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Task Analysis Tool

FREE, online suite of assessment tools designed to assist your company in providing the best analysis of your operations and tasks.



Source: https://www.ergocenter.ncsu.edu/resources_tools/ergodata/

New Ergonomics Time & Motion Study

The Ergonomic Center North Carolina State University

- Conducted in November - December 2019
- Ten subjects (5 M, 5 F), varied height, weight, BMI
- Typical assembly task: Cycle time <5 min
- Typical fulfillment task: Cycle time <3 min
- One workstation in traditional, fixed-height set-up
- One height-adjustable workstation following ergonomically sound principles

New Ergonomics Time & Motion Study

Objective Measures:

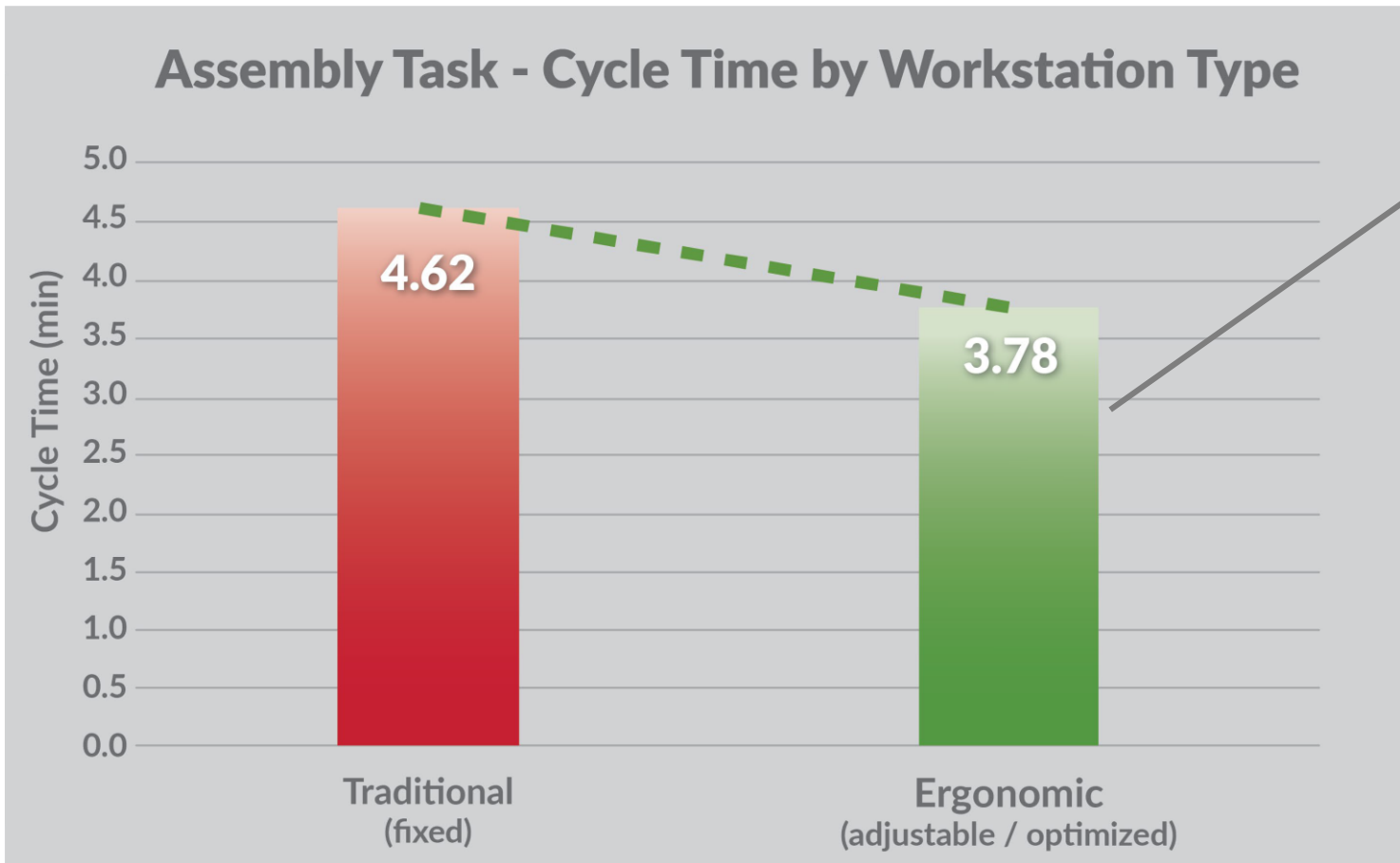
1. Productivity / time differences
2. Motion differences
 - a) Total No. of upper extremity motions
 - b) No. of upper extremity value-added motions
 - c) No. of upper extremity non-value-added motions
3. Ergonomic risk differences:
 - a) No. of reaches outside of acceptable reach zones
 - b) REBA or RULA scores - risk differences

New Ergonomics Time & Motion Study

Subjective measures:

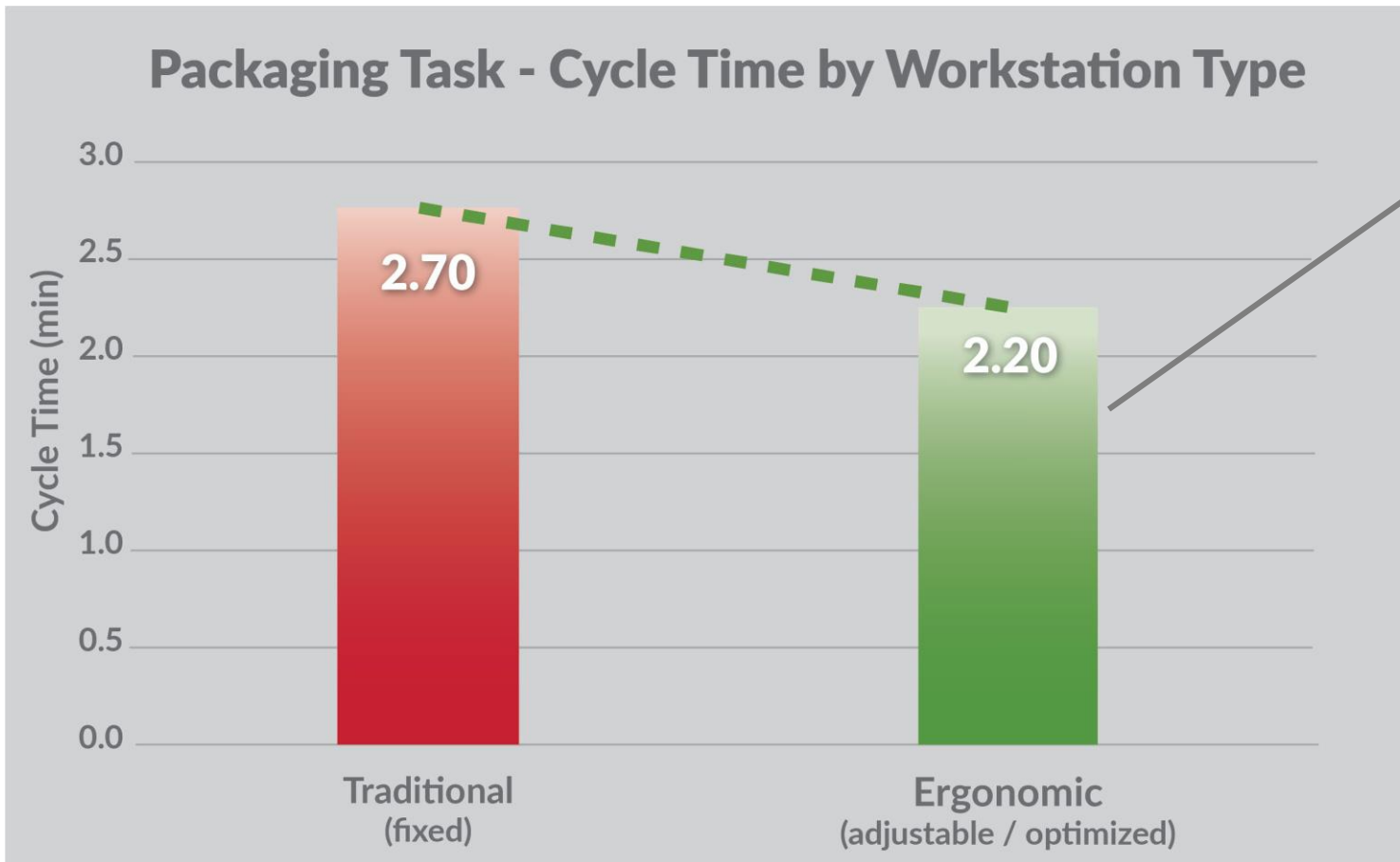
1. Performance preference (rank order workstation type)
2. Comfort preference (rank order workstation type)
3. Ease of use (System Usability Scale)
4. Participants open comments/feedback

Results: Productivity (Cycle Time)



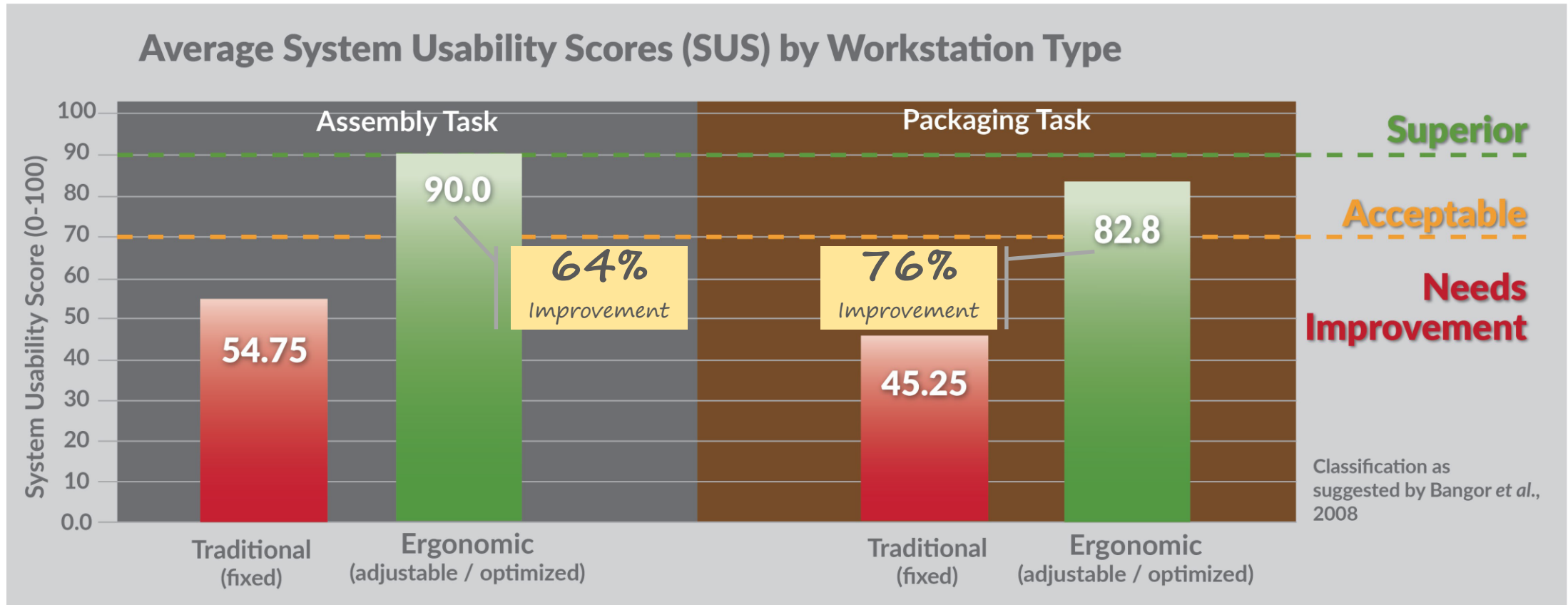
18%
Improvement

Results: Productivity (Cycle Time)

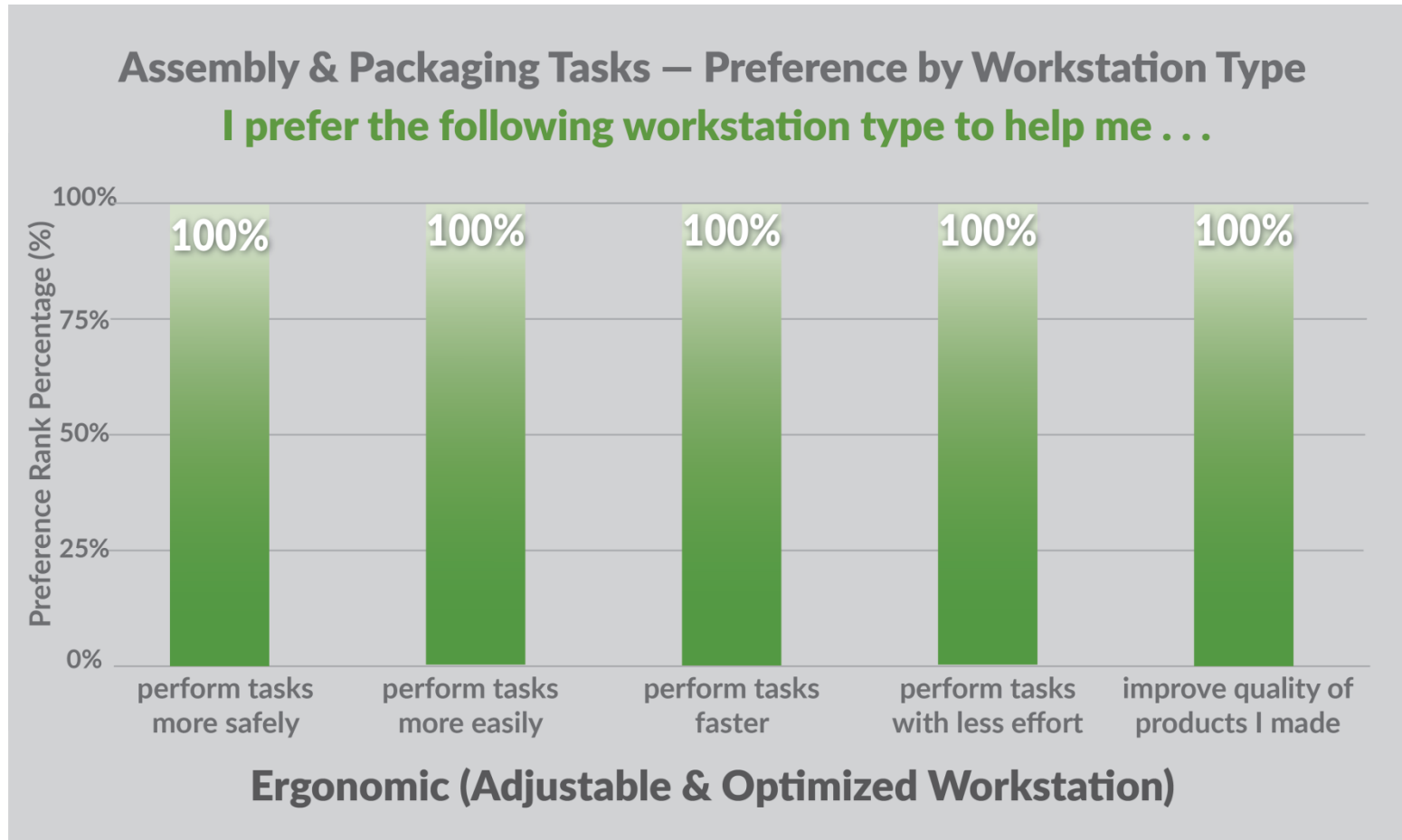


18.5%
Improvement

Results: Ease of Use (System Usability Scale)



Results: Performance Preference



Q & A

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Examples of Custom Workstations



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Examples of Custom Workstations



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Examples of Custom Workstations



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