Ergonomics/Manual Materials Handling  
Course number: EOS 011

Ergonomics derives from two Greek words: ergon, meaning work, and nomoi, meaning natural laws. Combined they create a word that means the science of work and a person’s relationship to that work.

In application ergonomics is a discipline focused on making products and tasks comfortable and efficient for the user.

Ergonomics is sometimes defined as the science of fitting the work to the user instead of forcing the user to fit the work. However this is more a primary ergonomic principle rather than a definition.

Also Known As: Human Factors, Human Engineering, Human Factors Engineering

Five aspects of ergonomics

There are five aspects of ergonomics: safety, comfort, ease of use, productivity/performance, and aesthetics. Based on these aspects of ergonomics, examples are given of how products or systems could benefit from redesign based on ergonomic principles.

1. Safety - Medicine bottles: The print on them could be larger so that a sick person who may have impaired vision (due to sinuses, etc.) can more easily see the dosages and label. Ergonomics could design the print style, color and size for optimal viewing.

2. Comfort - Alarm clock display: Some displays are harshly bright, drawing one’s eye to the light when surroundings are dark. Ergonomic principles could redesign this based on contrast principles.

3. Ease of use - Street Signs: In a strange area, many times it is difficult to spot street signs. This could be addressed with the principles of visual detection in ergonomics.

4. Productivity/performance - HD TV: The sound on HD TV is much lower than regular TV. So when you switch from HD to regular, the volume increases dramatically. Ergonomics recognizes that this difference in decibel level creates a difference in loudness and hurts human ears and
this could be solved by evening out the decibel levels. Voicemail instructions: It takes too long to have to listen to all of the obvious instructions. Ergonomics could address this by providing more options to the user, enabling them to easily and quickly skip the instructions.

5. Aesthetics - Signs in the workplace: Signage should be made consistent throughout the workplace to not only be aesthetically pleasing, but also so that information is easily accessible for all signs

Physical ergonomics is important in the medical field, particularly to those diagnosed with physiological ailments or disorders such as arthritis (both chronic and temporary) or carpal tunnel syndrome. Pressure that is insignificant or imperceptible to those unaffected by these disorders may be very painful, or render a device unusable, for those who are. Many ergonomically designed products are also used or recommended to treat or prevent such disorders, and to treat pressure-related chronic pain.

**What is a Repetitive Motion Injury and Carpal Tunnel Syndrome?**

Tens of thousands of injuries each year are caused by repetitive motions. There are different ways injuries can happen, but they all result from stress or strain imposed on some part of the body from a task’s repetitive nature. This includes typing, computer mouse use and recurring motions such as twisting, turning and grasping.

Repetitive Motion Injuries can be quite painful and become progressively worse without treatment, possibly resulting in complete loss of function in the affected area. Tingling, numbness, or pain in the affected area, and loss of flexibility or strength are common symptoms. Hands, fingers, wrists, elbows, shoulders and backs are the most common areas affected.

Tendons connect the muscles to the bones. If movement is repeated too often without rest, the tendons surrounding the muscles can become inflamed and blood flow becomes restricted. When tendons become inflamed, they can press against nerves often resulting in numbness and tingling.

**What Is Carpal Tunnel Syndrome?**

Carpal Tunnel Syndrome is one of the most common disorders among the repetitive motion injuries. The Carpal Tunnel, at the base of the palm, is a snug canal through which tendons and nerves pass on their way through the wrist from the forearm to the hand and fingers. The nerve that passes through this narrow tunnel to reach the hand is called the median nerve. The Median nerve runs the length of the arm providing motor function to the hand and feeling to the thumb.
side of the hand including the first three fingers and thumb. If swelling and inflammation from overuse occurs, everything becomes compressed and the median nerve in the carpal tunnel becomes constricted or "pinched". The result is a decrease in nerve transmission to the hand causing numbness and weakness.

**Causes of Repetitive Motion Injuries and Carpal Tunnel Syndrome**

Repetitive Motion Injuries and Carpal Tunnel Syndrome develop slowly over time. They can be caused by:

- Long periods of steady hand movement doing tasks that are repeated over and over
- Holding the same position for a long time
- Working in an awkward position
- Forceful movements
- Not enough time to rest between repetitive tasks

**Am I at Risk?**

A sampling of the more common places where Carpal Tunnel Syndrome and Repetitive Motion Injuries occur include:

- Graphic Designers from typing and using the computer mouse
- Computer Illustrators
- Programmers
- Other computer users
- Musicians
- Dental Hygienists
- Cashiers
- Work that demands repeated grasping, turning and twisting
- Some sports such as rowing, golf and tennis

**What are the Symptoms?**

- Weakness in hands and fingers - dropping objects
- Numbness and tingling in hands and fingers
- Burning in hands and/or wrists
- Pain in wrist sometimes feeling stiff or sprained
- Pain radiating from neck to fingertips or from fingertips to your neck
- Shooting pains from your wrist or hand to your elbow
- Numbness, tingling and sometimes shoulder pain on waking from sleep

If you are experiencing some of these symptoms, don’t ignore them. Your doctor
can make a proper diagnosis whether Carpal Tunnel Syndrome or Repetitive Motion Strain is the cause. Early treatment is key in preventing further damage.

**Prevention and the Proper Workplace Set-up:**

Repetitive Motion Injuries and Carpal Tunnel Syndrome can be prevented through a proper workplace set-up. Once you make these adjustments to your office or work areas, even if you aren’t feeling symptoms, you’ll notice how much more natural and comfortable you’ll feel while working. You will become more productive and have more energy at the end of the day as your physical stress has been reduced.

**While at work:**

- Take short, frequent breaks from computer work. Suggested 10-15 minutes break away from the computer for every hour on the computer.
- Get up and move around whenever you feel any symptoms
- Pause periodically to do relaxation exercises
- Give input when your department is purchasing furniture and computer equipment

**Work station layout:**

These are guidelines to ergonomically set up your workstation. The best way to know what works for you is by paying attention to the way your body feels. Are you comfortable? Feel physical strain or pain? Remember, pain is the way your body tells you something is wrong.

**Computer set-up:**

- Adjust your monitor so that the top of the screen is eye level.
- It should be directly in front of you 1.5 – 2 feet from your eyes. Putting the monitor off to the side involves twisting and stress on the neck
- A document holder is recommended to hold papers while you work.
- Position your monitor to avoid glare through lighting and positioning from windows.

- The keyboard should be detached from the monitor preferably on an adjustable tray or stand and level with the floor.
• The keyboard height should allow your elbows to be at your sides, forearms parallel to the floor, and your wrists in a neutral position.
• The mouse needs to be as close as possible and located on the same level as the keyboard.
• Thick, soft wrist pads are recommended for proper wrist alignment.

**Desk arrangement:**

• Make sure your chair is the right height for you.
• It should have firm lumbar/lower back support.
• The edge of the seat should be rounded so it doesn't press on the backs of your thighs.
• Armrests are optional – if you have them, they should be padded.
• Your feet should be flat on the floor or on a footrest putting your thighs parallel to the floor, knees at a 90 degree angle.
• There needs to be enough room under your desk for your legs.
• Items on your desk need to be at the proper distance for reaching comfort and not crowded together.

**Manual Materials Handling:**

Proper lifting technique is important but planning is the key. Planning should place maximum emphasis on eliminating the need for manual lifting whenever and wherever possible. This may mean taking a critical look at where, why, and how the item or material is stored and where it is stacked. In many cases, proper planning may eliminate the need for repetitive movement of items or materials. When materials have to be physically lifted, and when you lift on a routine basis, proper planning would include attempts to mechanize the operation so that mechanical lift devices can be used to lift and transport the material. Another technique, and especially where mechanical devices are not feasible, is the use of a "lifting team." This concept does not necessarily completely eliminate the risk of an injury, but it does reduce the exposure somewhat, in that, the agency can ensure adequate training and has a better control on the who, what, where, and how lifting and moving is accomplished.

**Proper Lifting Technique**

- Plan the lift, the route, etc., and size up the load;
- Ask for help, especially for heavy or bulky items;
- Keep your feet apart, comfortably staggered;
- Squat to lift, do not bend at the waist, and lift with you legs;
- Get a firm grip, and keep object close to the body;
- Lift objects carefully using the leg muscles, do not jerk the load;
- Keep your head up and look straight ahead while making the lift;
- When walking maintain a straight posture; and
• Lower slowly and smoothly in a squatting manner and do not twist your body.

The Use of Back Support Belts for Back Injury Prevention

The proliferation of back belts in the last decade and a half has gained the attention of several federal regulatory agencies in the recent past. Prior to their involvement, much of the research on back belts and their effectiveness in injury prevention was conducted by independent organizations, often market motivated. The usage of back belts is not forbidden and may, under certain controlled conditions with proper training, have some merits in injury prevention. However, OSHA, based on recent NIOSH research, does not recognize back belts as an effective engineering control to prevent back injuries and specifically discounts them as an item of personal protective equipment (PPE).

Ergonomic Exercises and Stretches to Prevent Injury:

Eye Exercises and Stretches

Eye Comfort Exercises

A. Blinking (produces tears to help moisten and lubricate the eyes)
B. Yawning (produces tears to help moisten and lubricate the eyes)
C. Expose eyes to natural light
Palming

A. while seated, brace elbows on the desk and close to the desk edge  
B. let weight fall forward  
C. cup hands over eyes  
D. close eyes  
E. inhale slowly through nose and hold for 4 seconds  
F. continue deep breathing for 15-30 seconds

Eye Movements

A. close eyes  
B. slowly and gently move eyes up to the ceiling, then slowly down to the floor  
C. repeat 3 times  
D. close eyes  
E. slowly and gently move eyes to the left, then slowly to the right  
F. repeat 3 times

Focus Change

A. hold one finger a few inches away from the eye  
B. focus on the finger  
C. slowly move the finger away  
D. focus far into the distance and then back to the finger  
E. slowly bring the finger back to within a few inches of the eye  
F. focus on something more than 8 feet away  
G. repeat 3 times

Musculoskeletal System Exercises and Stretches

Deep Breathing

A. while standing, or in an otherwise relaxed position  
B. place one hand on the abdomen and one on the chest  
C. inhale slowly through the nose  
D. hold for 4 seconds  
E. exhale slowly through the mouth  
F. repeat
**Cable Stretch**

A. while sitting with chin in, stomach in, shoulders relaxed, hands relaxed in lap, and feet flat on the floor, imagine a cable pulling the head upward
B. hold for 3 seconds and relax
C. repeat 3 times

**Sidebend: Neck Stretch**

A. tilt head to one side (ear towards shoulder)
B. hold for 15 seconds
C. relax
D. repeat 3 times on each side

**Diagonal Neck Stretch**

A. turn head slightly and then look down as if looking in your pocket
B. hold for 15 seconds
C. relax
D. repeat 3 times on each side

**Shoulder Shrug**

A. slowly bring shoulders up to the ears and hold for approx 3 seconds
B. rotate shoulders back and down
C. repeat 10 times

**Executive Stretch**

A. while sitting, lock hands behind head
B. bring elbows back as far as possible
C. inhale deeply while leaning back and stretching
D. hold for 20 seconds
E. exhale and relax
F. repeat 1 time

**Foot Rotation**

A. while sitting, slowly rotate each foot from the ankle
B. rotate 3 times in one direction, then 3 times in the opposite direction  
C. relax  
D. repeat 1 time  

**Hand Shake**  
A. while sitting, drop arms to the side  
B. shake hands downward gently  
C. repeat frequently  

**Hand Massage (Note: Perform very gently!)**  
A. massage the inside and outside of the hand using the thumb and fingers  
B. repeat frequently (including before beginning work)  

**Finger Massage (Note: Perform very gently!)**  
A. massage fingers of each hand individually, slowly, and gently  
B. move toward nail gently  
C. massage space between fingers  
D. perform daily  

**Wrist Stretch**  
A. hold arm straight out in front of you  
B. pull the hand backwards with the other hand, then pull downward  
C. hold for 20 seconds  
D. relax  
E. repeat 3 times each