

Lever Systems



UNTAMED
EDUCATION

1.2.1 Movement analysis

Dorsi Flexion

Plantar Flexion

Levers

Load

Fulcrum

Effort

Lever Systems

Flexion

Adduction

Abduction

Extension

Rotation



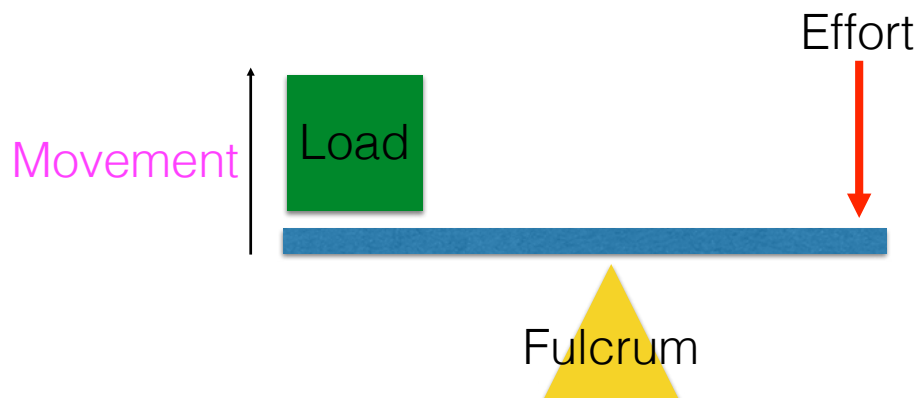
Lever Systems

1. Levers

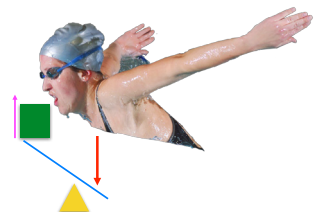
- ▶ Muscles and bones work together as a series of **levers** to create movement.
- ▶ A lever is a **rigid bar** that comprises three components:
- ▶ **Fulcrum** (the point at which the lever rotates)
- ▶ **Load** (the resistance applied to the lever system)
- ▶ **Effort** (the effort/muscle needed to move the lever system)
- ▶ The **classification of lever** depends on the **order** in which these **three components** are in relation to each other.

2. First class levers

- ▶ **First class levers** are organised in a see saw order to move the load.



- ▶ Examples of first class levers:
- ▶ **nodding the head** e.g. breathing in Swimming or heading in Football.

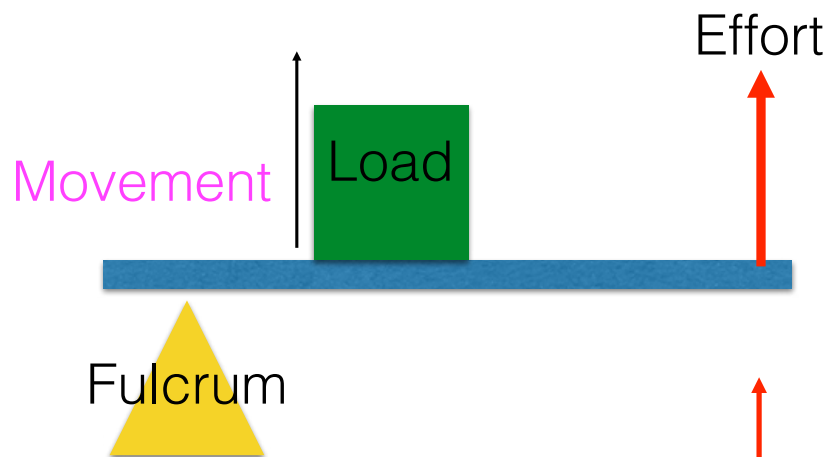




Lever Systems

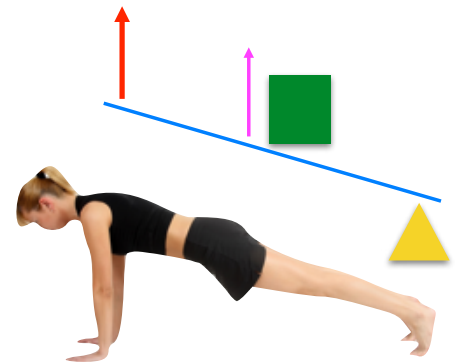
3. Second class levers

► **Second class levers** are organised in a wheelbarrow order to move the load.



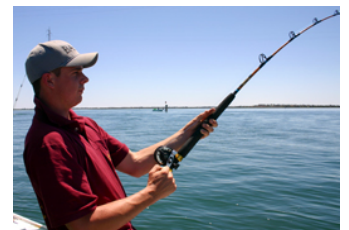
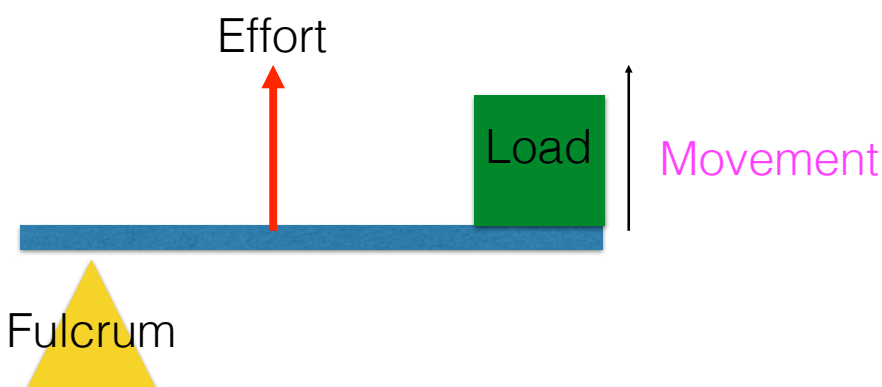
► Examples of second class levers:

► **press up**



4. Third class levers

► **Third class levers** are organised in a fishing rod order to move the load.



► Examples of third class levers:

► **bicep curl** (effort is where the muscle attaches to the lever)

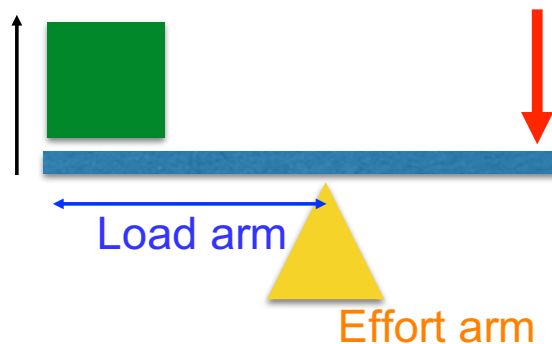


Lever Systems

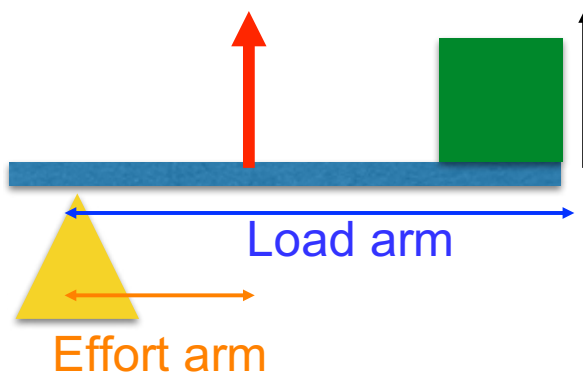
5. Mechanical advantage

- ▶ When a lever's **effort arm is longer than its load arm** then it is said to have **high** mechanical advantage.
- ▶ When a lever's **effort arm is shorter than the load arm** it is said to have **low** mechanical advantage.
- ▶ **Mechanical advantage = $\frac{\text{effort arm}}{\text{load arm}}$**

1. First class levers - High or low mechanical advantage



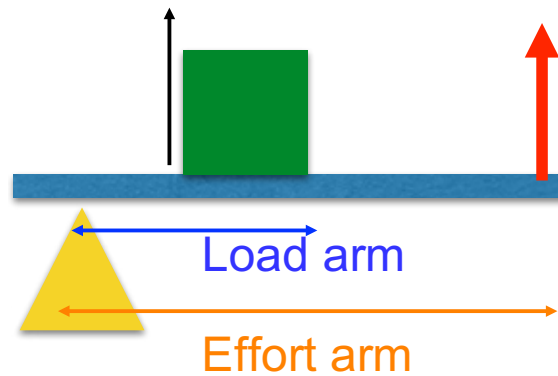
2. Third class levers - Low mechanical advantage





Lever Systems

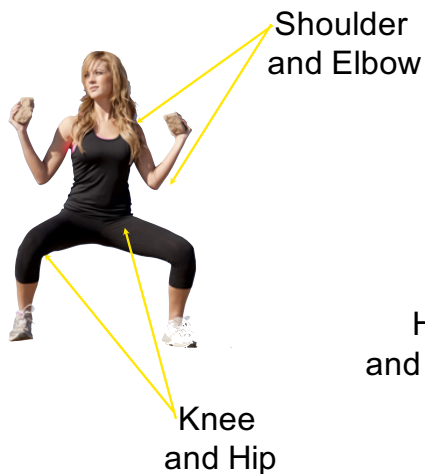
3. Second class levers - High mechanical advantage



6. Range of movement

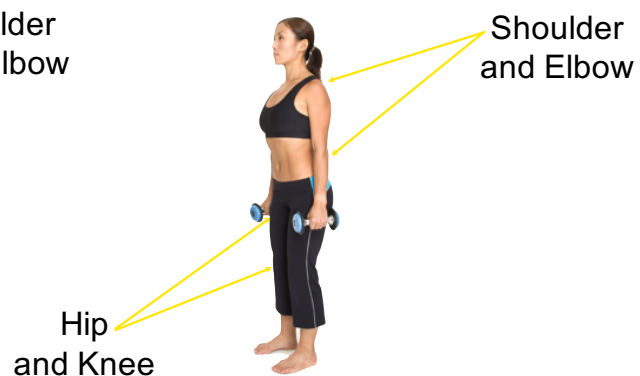
Flexion

Decrease the angle at the joint



Extension

Increase the angle at the joint





Lever Systems

Abduction

Move the limb away from the central axis



Adduction

Move the limb towards the central axis



Rotation

Movement around an axis/rotational movement



Neck



Shoulder



Hip

Plantar flexion

Movement at the ankle joint that points the toes



Dorsiflexion

Movement at the ankle joint that flexes the foot upwards



Lever Systems

7. Sporting examples



Tennis serve
involves rotation at
the shoulder



Dancing involves
adduction and
abduction at the
shoulder and hip



Weight lifting
involves dorsiflexion
at the ankle

Jumping involves
plantar flexion at the
ankle

