



BIOMECHANICS

What is Biomechanics?

- The study of human movement and the forces acting upon it both internal and external, during motion and when stationary.
- It is important to study because it helps to identify the best techniques to perform an action



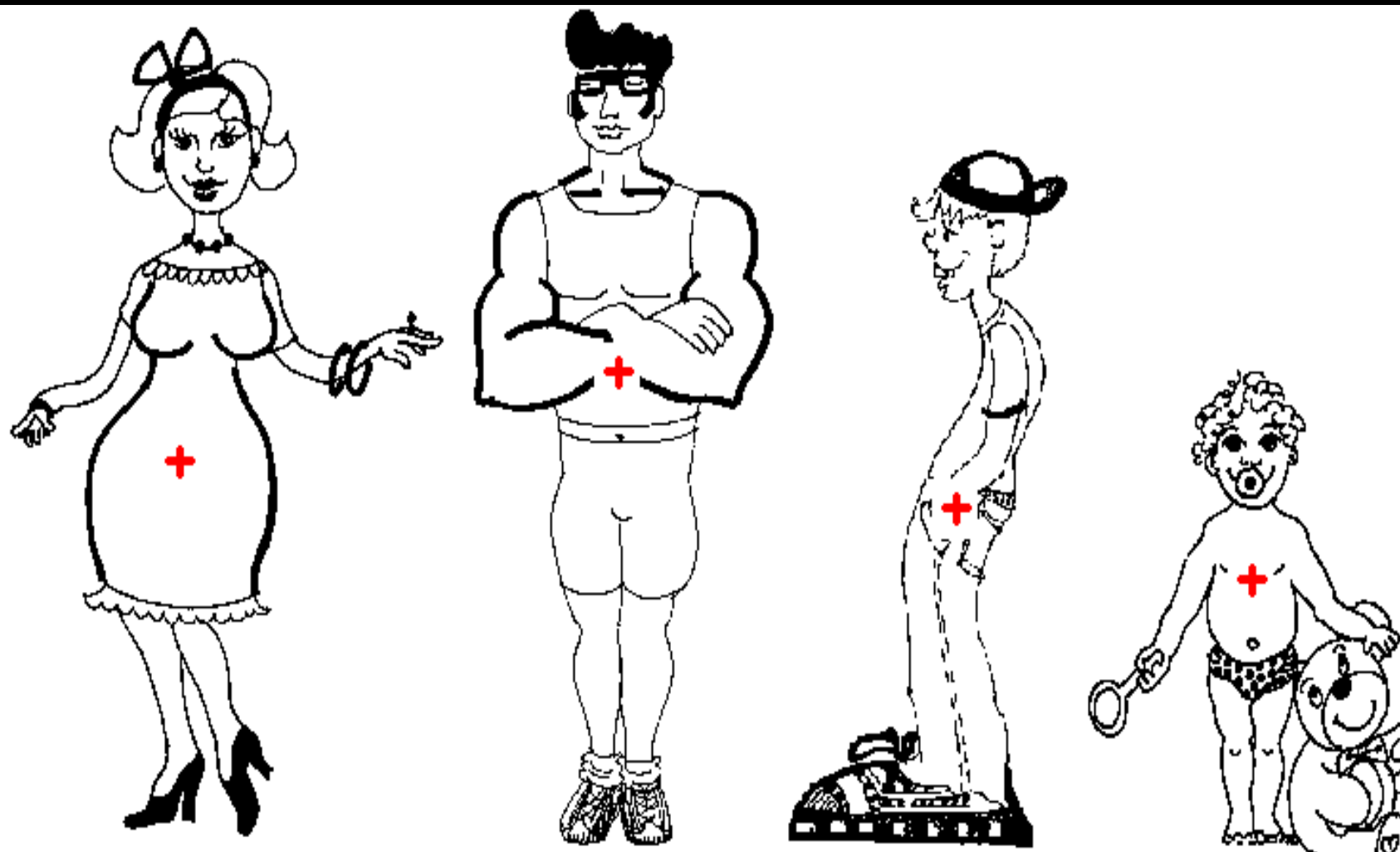
- It allows a skill to be broken down into its sub skills.





Centre of Gravity (COG)

- This is 'the point at which all parts of an object are equally balanced'
 - For a normal human being standing in the anatomical position the centre of gravity lies around their belly button.
 - Your centre of gravity changes depending on what position the body is in, sometimes it can be outside of the body
 - Refer back to previous slide and identify the COG
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Význam celkového těžiště těla: myšlený bod, do nějž umísťujeme tíhovou sílu. Je důležitý zejména tam, kde zjednodušujeme mechanickou analýzu pohybu na pohyb hmotného bodu. V tzv. základním anatomickém postoji (stoj spatný, paže podél těla, dlaně vpřed) se celkové těžiště těla nachází přibližně ve výši 2. křížového obratle, u žen je to asi o 1 – 2 % níže než u mužů (rozdílné rozměry pánve). V průběhu ontogenetického vývoje (do dospělosti) se těžiště posouvá níže (kojenci a batolata = větší hlava v porovnání s trupem a končetinami)

Line of Gravity (LOG)

- This is the vertical line that passes through the COG to the ground
- The LOG is important when determining the stability of an object
- If the LOG falls within an objects BOS, the object is relatively stable
- If the LOG falls outside the objects BOS, the object is relatively unstable.
- Glue in picture demonstrating LOG



Base of Support (BOS)

- An objects BOS is the points of contact with the ground and the area in between them.
 - The larger the BOS the more stable an object will be.
 - Demonstrations
 - Hand out picture.
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Line of Gravity, Base of Support and Physical Activity

- The LOG must go outside the BOS to initiate or continue movement.
 - The direction the LOG moves in will be the direction that the object will move in.
 - E.g. Forward roll or stepping in touch, league or rugby.
 - Activity gb page 112
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Force

- Force is the basis of all movements
 - It is a push or a pull
 - All sporting activities have forces acting upon the athlete
 - The main force acting upon your body is Gravity
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Stability

- Stability is vital to all movements.
 - It is the 'ability of an object to remain balanced'
 - This is extremely important in sport and physical activity, as the more stable you are the easier it is to perform skills to a high level.
 - Stability is improved through
 - Widening the base of support
 - Lowering the centre of gravity
 - Keeping the line of gravity within the base of support.
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4 Key Principles for Stability

- 1. The *closer* the line of gravity to the centre of the base of support, the *greater* the probabilities of maintaining balance.



- 2. The *broader* the base of support, the *greater* the probabilities of maintaining balance.



- 3. The probability of maintaining balance is *increased when* the centre of gravity is *lowered* in relation to the base of support.



- 4. The *further* one body part moves away from the line of gravity, the chance of maintaining balance *decreases* unless another body part moves to compensate for it.

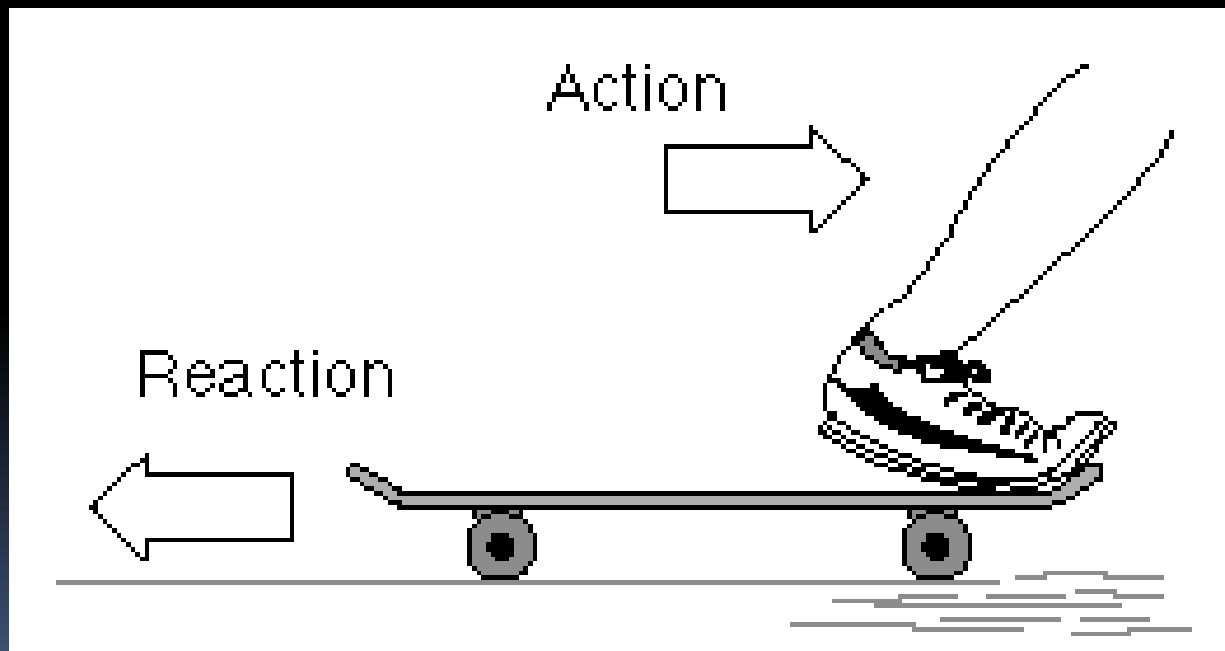


Newton's Laws

- Newton's 1st Law
 - "a body continues in its state of rest or uniform motion unless an unbalanced force acts upon it"
- Newton's 2nd Law
 - "the acceleration of an object is directly proportional to the force causing it, is in the same direction as the force and is proportional to the mass of the object"

Newton's 3rd Law

- “for every action there is an equal and opposite reaction”





Force Summation

- To give an object momentum in activities such as throwing, kicking or striking an object, the amount of momentum given to the object is determined by 'the sum of all forces generated by each body part' (force summation)
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- To gain maximum momentum, the force needs to be generated by,
 - Using as many segments of the body as possible
 - In the correct sequence, using large muscles first then smaller ones
 - With the correct timing
 - Through the greatest range of motion.



Friction

- Friction is a force that occurs when two surfaces come into contact
 - In sport friction can help or hinder performance.
 - The amount of friction that occurs depends on
 - The type of surfaces interacting with each other
 - The amount of force pressing the surfaces together
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