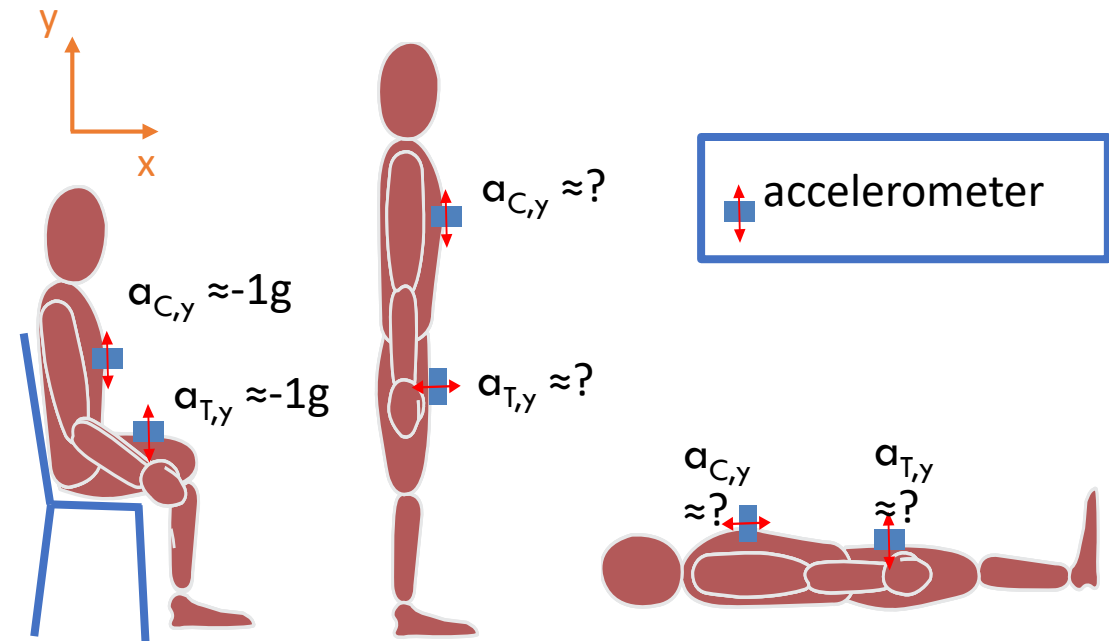


Arm elevation

Two uniaxial accelerometers are fixed on the chest (a_C) and thigh (a_T). Both measure approximatively $-1g$ when a subject is in sitting posture. Which statements correctly describe accelerometer readings in other postures? (multiple choices)

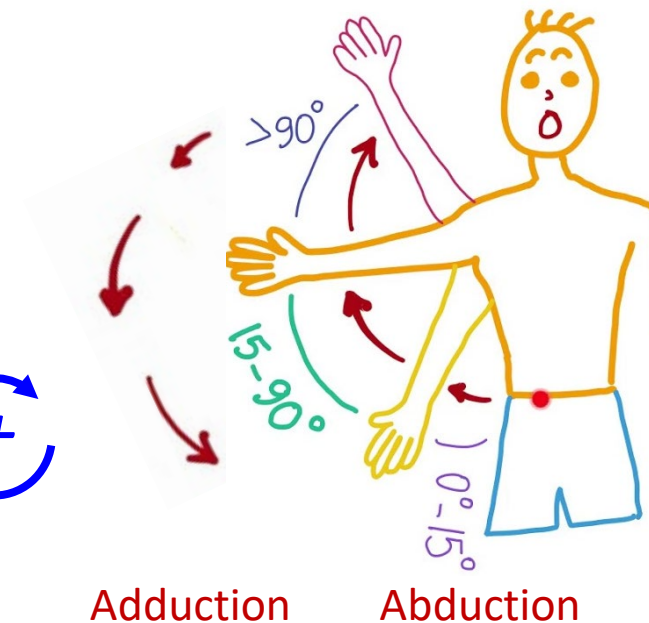
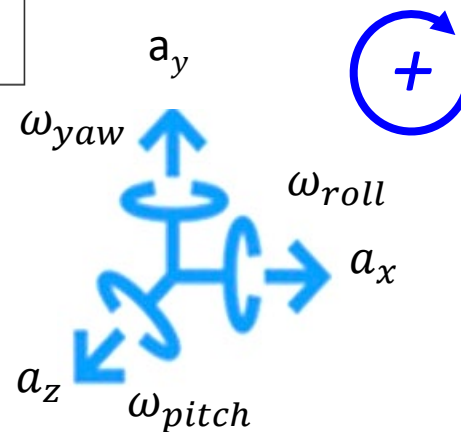
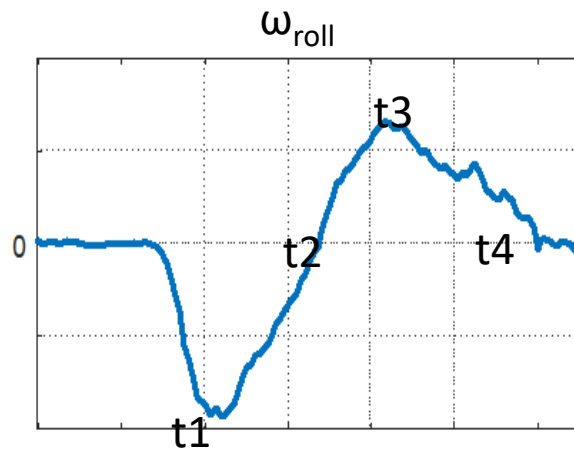
- A. $a_C \sim -1g$, $a_T \sim 0g$ in standing posture
- B. $a_C \sim 0g$, $a_T \sim 0g$ in supine position
- C. $a_C \sim 0g$, $a_T \sim 0g$ in standing posture
- D. $a_C \sim 0g$, $a_T \sim -1g$ in supine position



Arm elevation

An inertial sensor (IMU) is fixed on the arm while a subject performs a maximum abduction angle and return to the initial position. Considering the profile of roll angular velocity (ω_{roll}), **at which time instant the accelerometer a_y indicates maximum of arm abduction (single choice)**

- A. t1
- B. t2
- C. t3
- D. t4





Walking detection

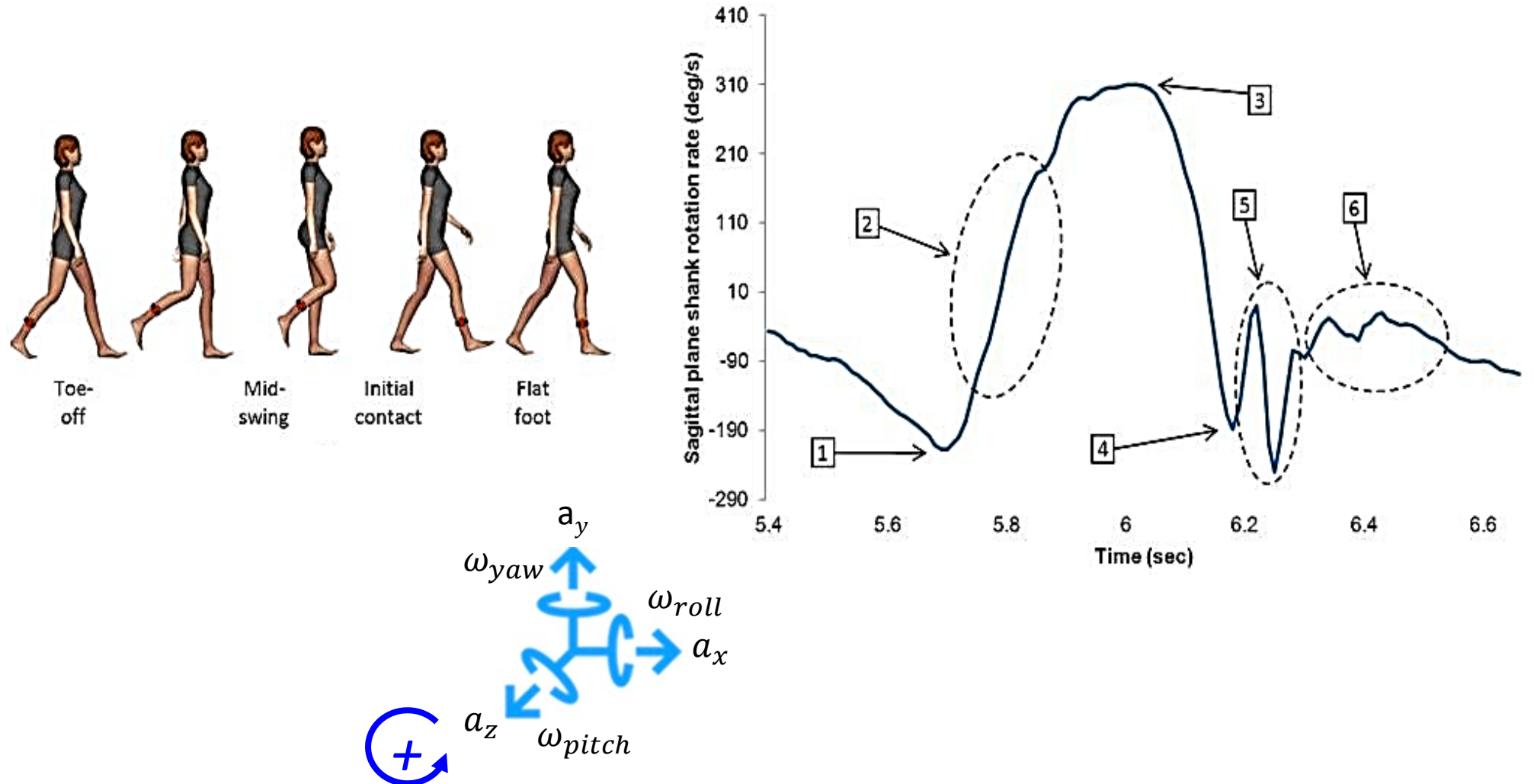
To detect walking activity, the most relevant information (useful for a detection algorithm) is provided by (multiple choices):

- A. Gyroscope on foot
- B. Accelerometer on foot
- C. Gyroscope on trunk (chest or lower back)
- D. Accelerometer on trunk (chest or lower back)

Gait phases identified by gyroscope on shank (pitch)

The interval/instant corresponding to the mid-swing phase based on pitch gyroscope data from the shank is: (single choice)

- A. 1
- B. 2
- C. 3
- D. 4

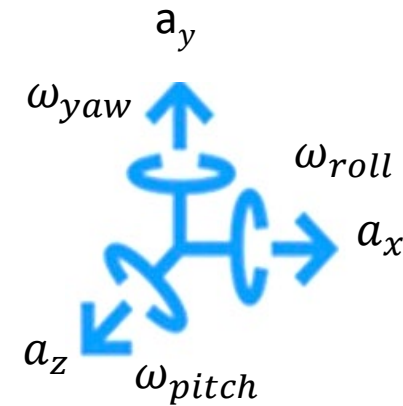


Activity detection

An inertial sensor placed on the chest records movements.

Which axes/signals allow detecting the sit-to-stand transition, performed as indicated in the figure?(multiple choices)

- A. a_y
- B. ω_{pitch}
- C. a_x
- D. ω_{roll}





Clinical evaluation

To evaluate walking symmetry improvement after leg fracture, **effective** sensor placements are: (multiple choices)

- A. 1 inertial sensor on lower back close to CoM
- B. 2 inertial sensors, one on each leg
- C. 1 inertial sensor on the fractured leg
- D. 2 inertial sensors, one on chest and one on the fractured leg



Piezoelectric sensors

A piezo ceramic with metalized surface A measures electrical quantities in direction 1 when a force (F) is applied in direction 1. When the two faces are court-circuited, the output is:

(Single Choices)

- A. $d_{11} \cdot F / \epsilon$
- B. $d_{11} \cdot F$
- C. $d_{11} \cdot F \cdot A$
- D. 0



Piezoelectric sensors

How does the cable length between a piezoelectric sensor and a voltage amplifier affect the system? (Single Choice)

- A. The cutoff frequency is higher when the cable is longer
- B. The cutoff frequency is independent of the cable length
- C. The sensitivity of the system is lower when the cable is longer
- D. The sensitivity is independent of cable length



Accelerometer sensors

Inclination (gravity component) of a segment can be measured during static position with a: (Multiple Choice)

- A: Capacitive accelerometer
- B: Resistive accelerometer
- C: Piezoelectric accelerometer
- D: none of the above answer