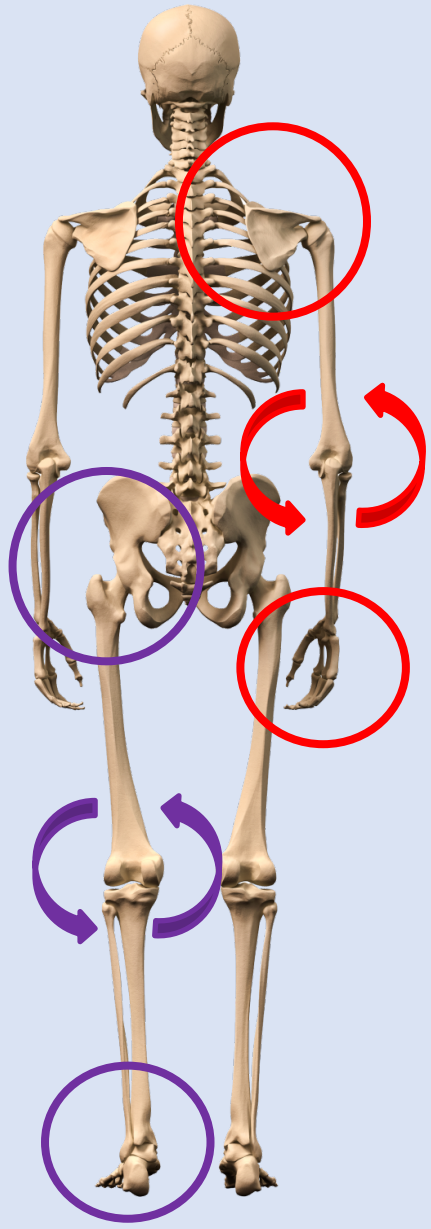
Coordinative Structures

- “A self-organized, softly assembled set of components that can play different roles under different constraints” – Nikolai Bernstein

- Three global body regions
  - Midline – Upper Limb – Lower limb

- Upper limb & upper midline
  - Hand/wrist lower arm upper arm scapula rib cage head/neck

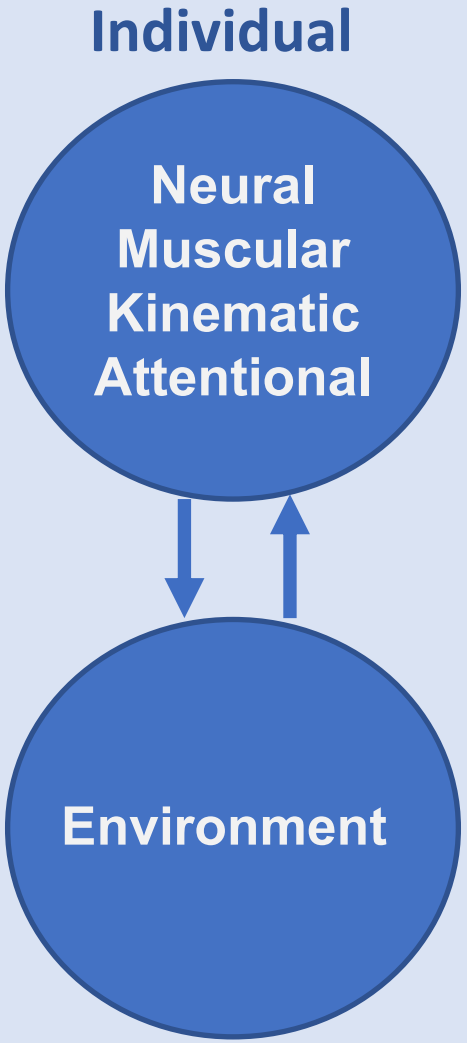
- Lower limb & lower midline
  - Foot/ankle > lower leg > upper leg > pelvis > rib cage/spine



Developing a Robust Coordinative Structure

- Local features
  - **Neural**
  - Muscular
  - Joint
  - Attentional

- How does the nervous system interact with the coordinative structure to manage load?
  - Conscious vs subconscious control dynamics



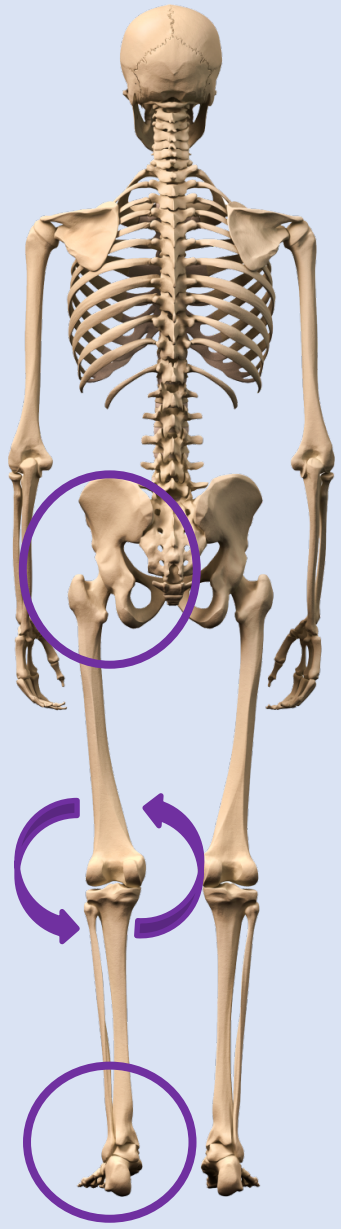
Case Insight

- Client with left side low back pain. Gradually developed over the past few months. Worse during activity and better with rest. Past hx includes left ankle sprains (3)

- What sticks out?
  - Worse after activity
  - Ankle sprains

- How might their current experience and injury history disrupt the behaviour and control gradient across the coordinative structure?

- What kind of strategies might we employ to restore a robust CS?
  - Restore dissociation capacity proximally
  - Restore isometric behaviour distally



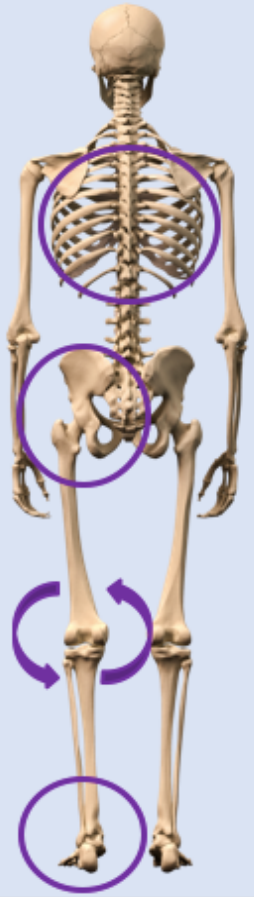
Joint Features

- How does our system learn to control all the individual joint segments when moving the entire coordinative structure?

- Freezing → Freeing → Exploiting reactive properties

- **Freezing**
  - A reduction in the degrees of freedom occurs in two general ways
  1. A “locking” of joint movement potential (co-contraction)
  2. Joint segments move in the *SAME* direction

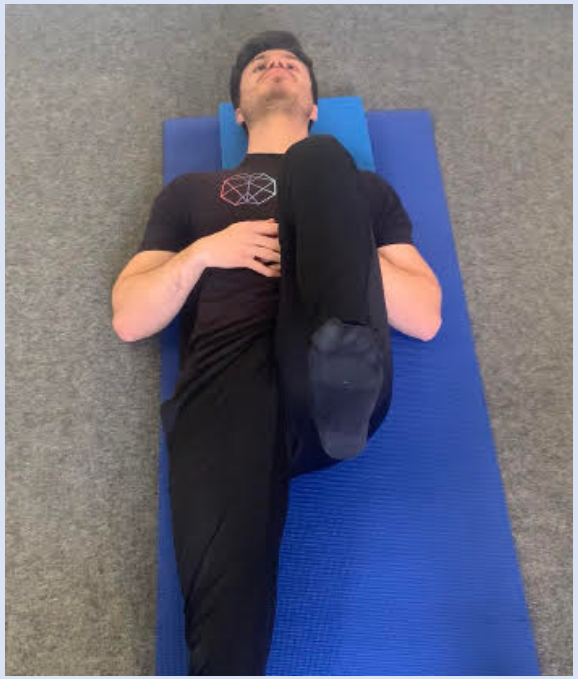
- **Freeing**
  - Joint segments moving in *OPPOSITE* directions
  - Presents more of a control challenge, but represents robust load sharing



Proximal Dissociation

- Case insight:
  - Objective findings:
  - Limited left hip flexion – femur displays abduction & ER (freezing)
  - Limited left hip internal rotation

- Proximal dissociation capacity
  - Posterior pelvic tilt & femoral IR (freeing)
  - Distribute load through biarticular tissues

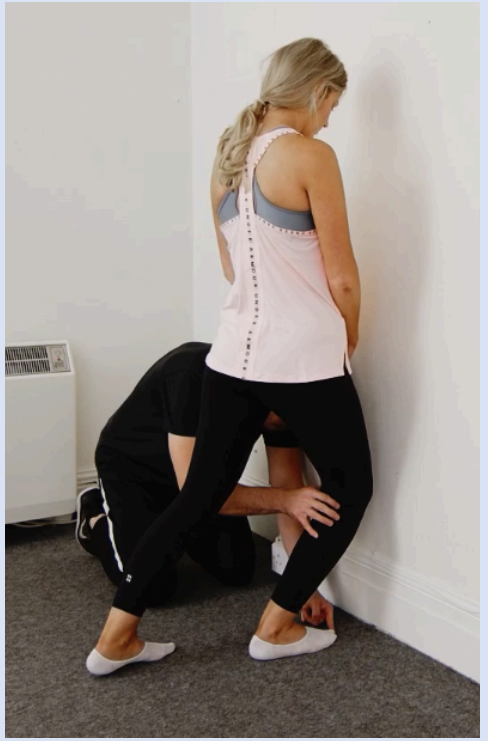


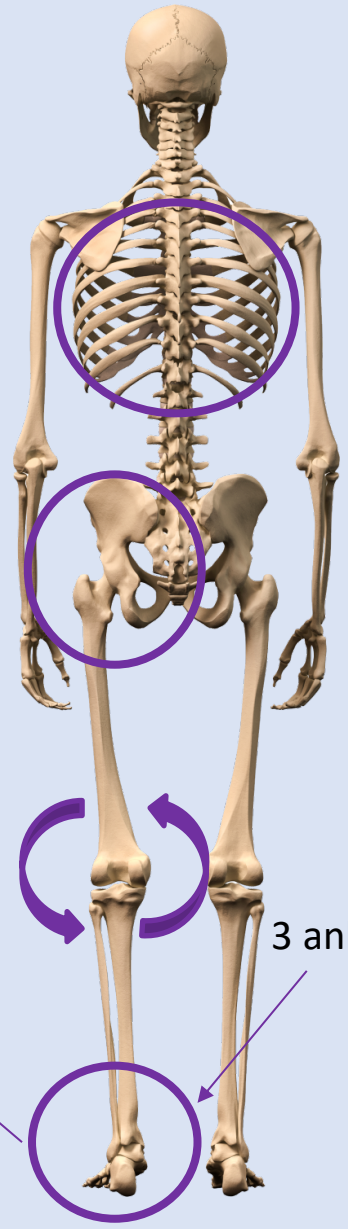
Dissociation Loading Strategy

- Intention:
  - Facilitate proximal dissociation
- Facilitate global IR distally
  - Tibial IR & femoral IR
- Facilitate contractile variability through biarticular tissues
  - Overcoming & yielding strategies
- Potential regressions
  - Freezing strategy between femur & pelvis
  - Facilitate contractile variability of proximal tissues first

Muscular Features

- Directions vs isolated muscles
  - Multi-joint movement is task and direction specific
- Monoarticular vs biarticular
  - Express different behaviours to manage load
- Proximal vs distal
  - Possess different architectural organization to manage load
- Contractile variability (overcoming vs yielding)
  - What strategies are we used to handle load?
  - Produce or decelerate forces?





3 ankle sprains

Dissociation → **Overcoming** → **Yielding** → **Coordinative**

Distal Isometric Strategies

- Local ankle assessment:
  - Left knee 2 inches from wall @10cm
  - Right knee to all @ 10cm

- Restoring distal isometric qualities
  - Stay specific with clients objective findings
  - Directional isometric with dorsiflexion bias

- Progressions:
  - Increase lever
  - Internal/external perturbations at the knee
  - Isometric → Isotonic distal contractions

Picture credit: Frans Bosch – Strength training and coordination

Less dissociation focus

Plantar flexion bias

Dorsiflexion bias