Perturbation direction reverses the effect of timing on peak center of mass speed

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How do individuals maintain stability following diverse perturbations?

magnitude, direction, and timing
We hypothesize that perturbations beginning earlier in stance phase (i.e. longest time until next heel contact) will be the most destabilizing regardless of perturbation direction.
Methods

- diverse perturbation set
  - magnitude
  - direction
  - timing

- stability

Vaughan & O’Malley (2005)
Methods

Diverse perturbation set
- Magnitude
- Direction
- Timing

Stability
- Peak ML CoM speed

\[ F_n = \frac{v^2}{gl} \]

Vaughan & O’Malley (2005)
Results

4 subjects
864 perturbations

Lateral Perturbation
(∼wider steps)

Medial Perturbation
(∼narrower steps)
Conclusions & Future Directions

• Multiple variables interact to affect biomechanical stability
• Understand the interaction of all three variables
• Evaluate more thorough balance metrics

• Drive therapy strategies and clinical outcomes
• Inform bio-inspired control strategies for bipedal robots
• Develop wearable robots to augment stability in impaired populations
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References