

# Novel Teaching Techniques

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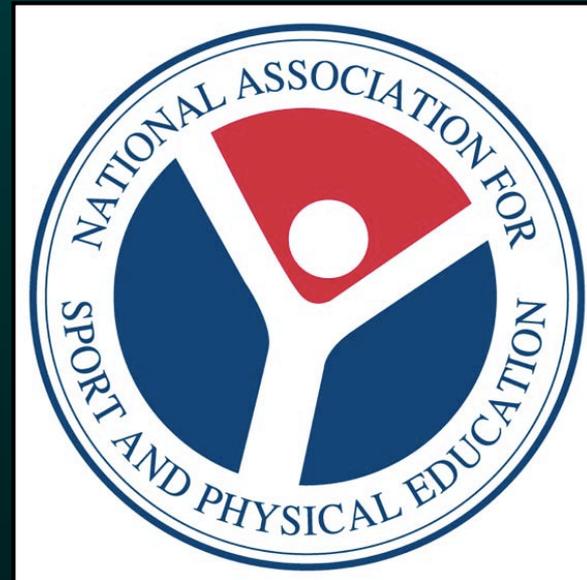
NASPE Preconference Symposium  
on Teaching Biomechanics

ISBS 2010

Northern Michigan University

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# Novel?

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- Socrates had novel techniques
- Most teachers - including me - have adopted and adapted teaching techniques from others

# Guidelines for good teaching

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- Encourage contact and ways of learning between students and faculty
- Develop reciprocity and cooperation among students
- Encourage active learning

(Chickering & Gamson, 1987)

# Guidelines for good teaching

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- Give prompt feedback
- Emphasize time on task
- Communicate high expectations
- Respect diverse talents

(Chickering & Gamson, 1987)

# Good teachers...

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- Enthusiastic
- Knowledgeable
- Confident
- Patient
- Fair
- Flexible
- Organized
- Caring
- Respectful
- Funny
- Cooperative
- ....

# Pete's principles

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- Reinforce correct preconceptions
- Challenge faulty preconceptions
- Encourage play
- Stimulate curiosity
- Guide discovery
- Make it fun
- Make it personal

# Typical class structure

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- Lecture
- Lab
- Tutorial/problem solving

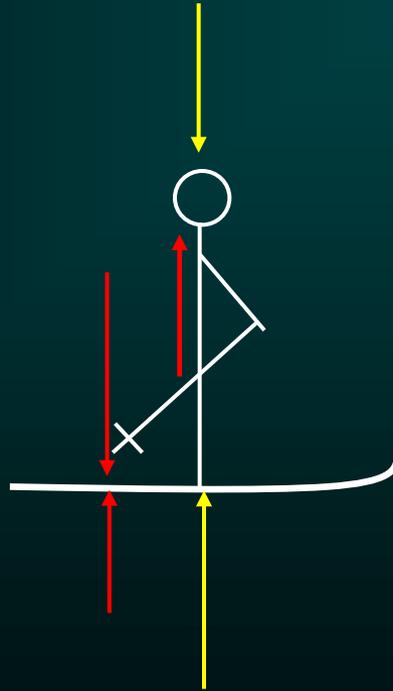
# Lecture

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- Story telling
- Demonstrations

# Story telling: static equilibrium

- Skiing with my sister and my nephew, Scott



# Story telling: $V = \omega r$

- My racquetball racquets



# Story telling: $V = \omega r$

- My racquetball racquets



# Story telling: $V = \omega r$

- My racquetball racquets



# Story telling: $V = \omega r$

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Story telling:  $a_r = \frac{v^2}{r}$

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- 2000 U.S. Olympic Trials:  
200 m finals



Story telling:  $a_r = \frac{v^2}{r}$

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- What was Brian Lewis thinking?



# Demonstrations

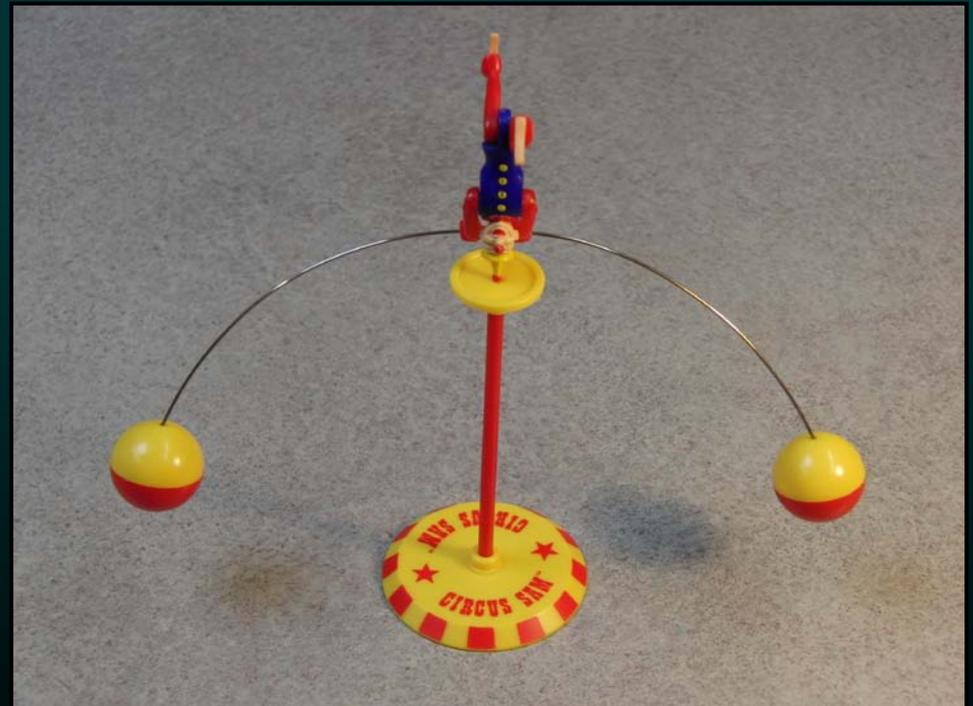
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- Describe the demonstration
- Ask students for predictions
- Discussion between students
- Discussion as a class
- Vote
- Perform demonstration
- Ask students what they saw
- Discussion -

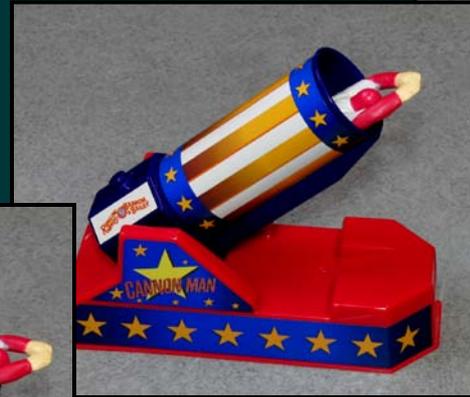
# Demonstrations

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- Toys
- Everyday objects
- Simple
- Complex



# Toys - Projectile motion



# Toys - Projectile motion

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# Toys - momentum

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- Newton's yo-yo



# Toys - COR

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- Deadly SuperBall<sub>TM</sub> trick



# Toys - COR

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- AstroBlaster™



# Toys - impulse-momentum

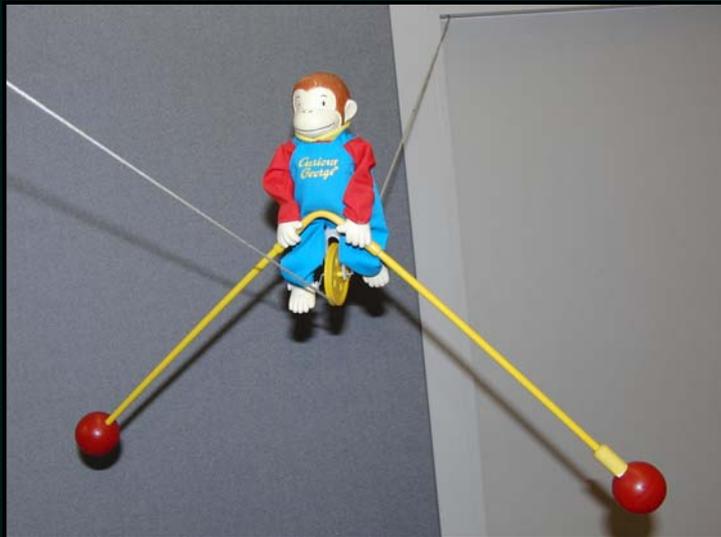
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- Toys that give



# Toys - center of gravity

- Stability and balance



# Toys - center of gravity

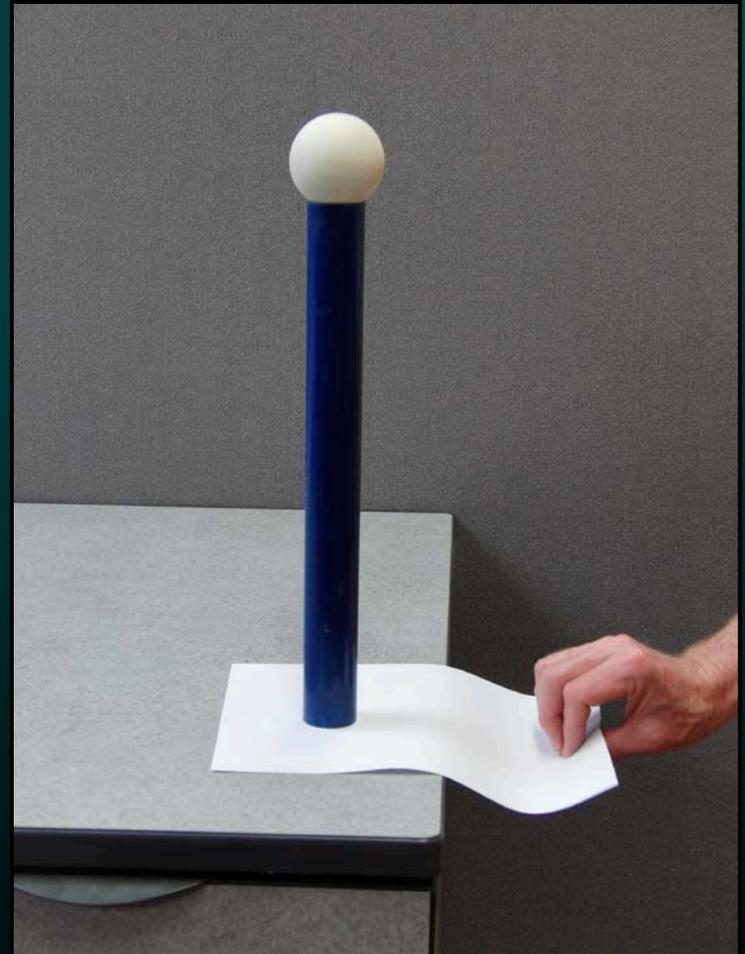
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- Unexpected movement



# Demonstrations - complex

- Tablecloth trick with pole, ball, and paper
- Friction, moment of inertia, impulse-momentum, torque...



# Demonstrations - complex

- Unbalanced barbell - will it fall straight - or will it rotate?



# Demonstrations - complex

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- Unbalanced barbell - will it fall straight - or will it rotate?



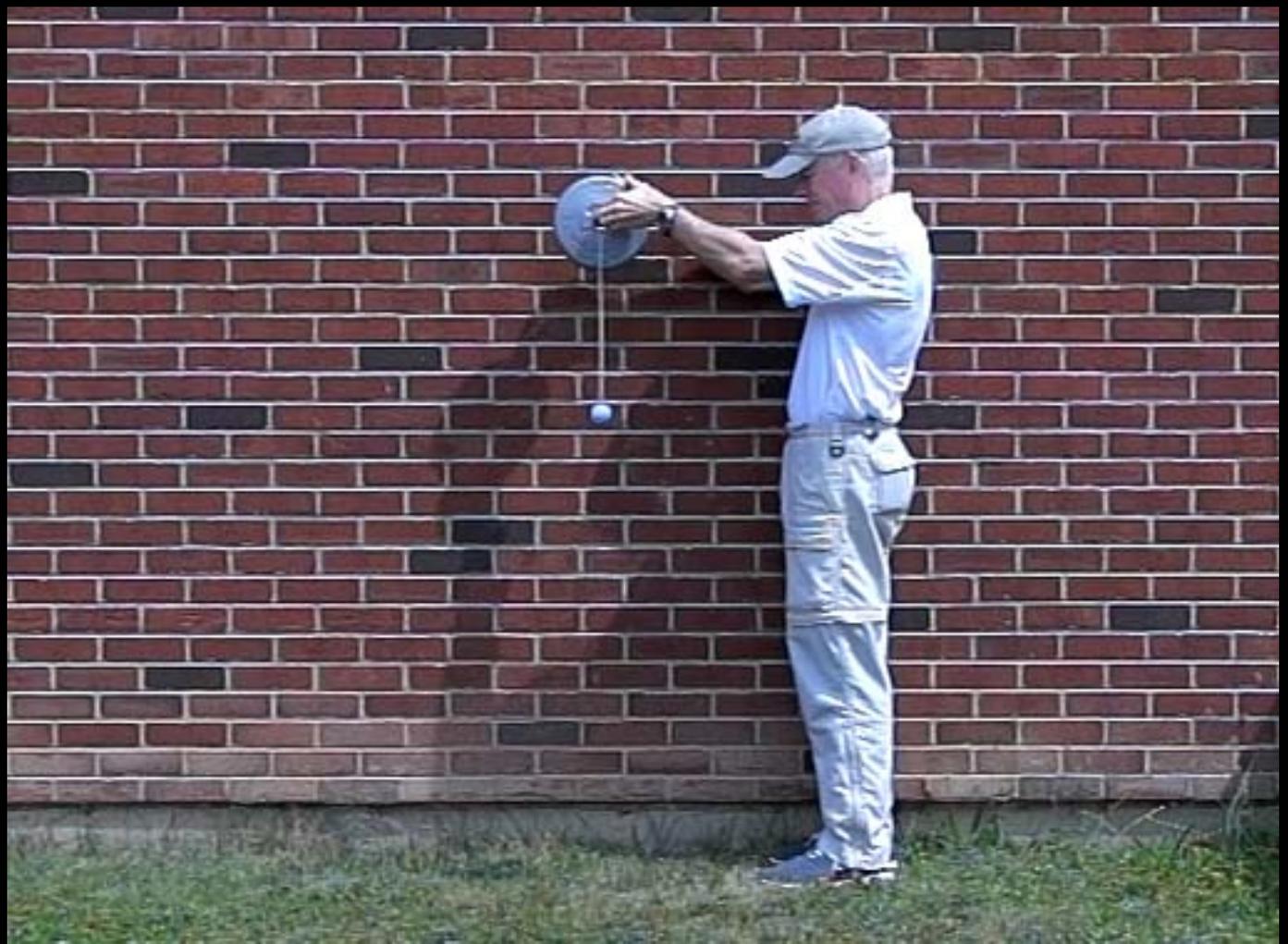
# Demonstrations - oops!

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- Some demos won't go as expected
- Use these as teaching moments



# Demonstrations - oops!



# Demonstrations - oops!



# Laboratory activities

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- Play - experiential
  - Qualitative
  - Discovery thru play
- Formal experiment
  - Pose hypothesis
  - Collect data
  - Quantify results
  - Reach conclusion

# Laboratory - play

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- Discuss concepts
- Play
- Discover
- Discuss

# Laboratory - play

- Angular momentum



# Laboratory - play

- Angular momentum



# Laboratory - play

- Impulse-momentum & water balloons



# Laboratory - formal

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- Discuss why - hypothesize
- Explain procedures
- Collect data
- Evaluate
- Discuss

# Laboratory - formal

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- Newton's 2nd Law - bathroom scale

$$\Sigma F = ma$$

$$R - W = ma$$



# Laboratory - formal

- Simulated head impact - unpadded

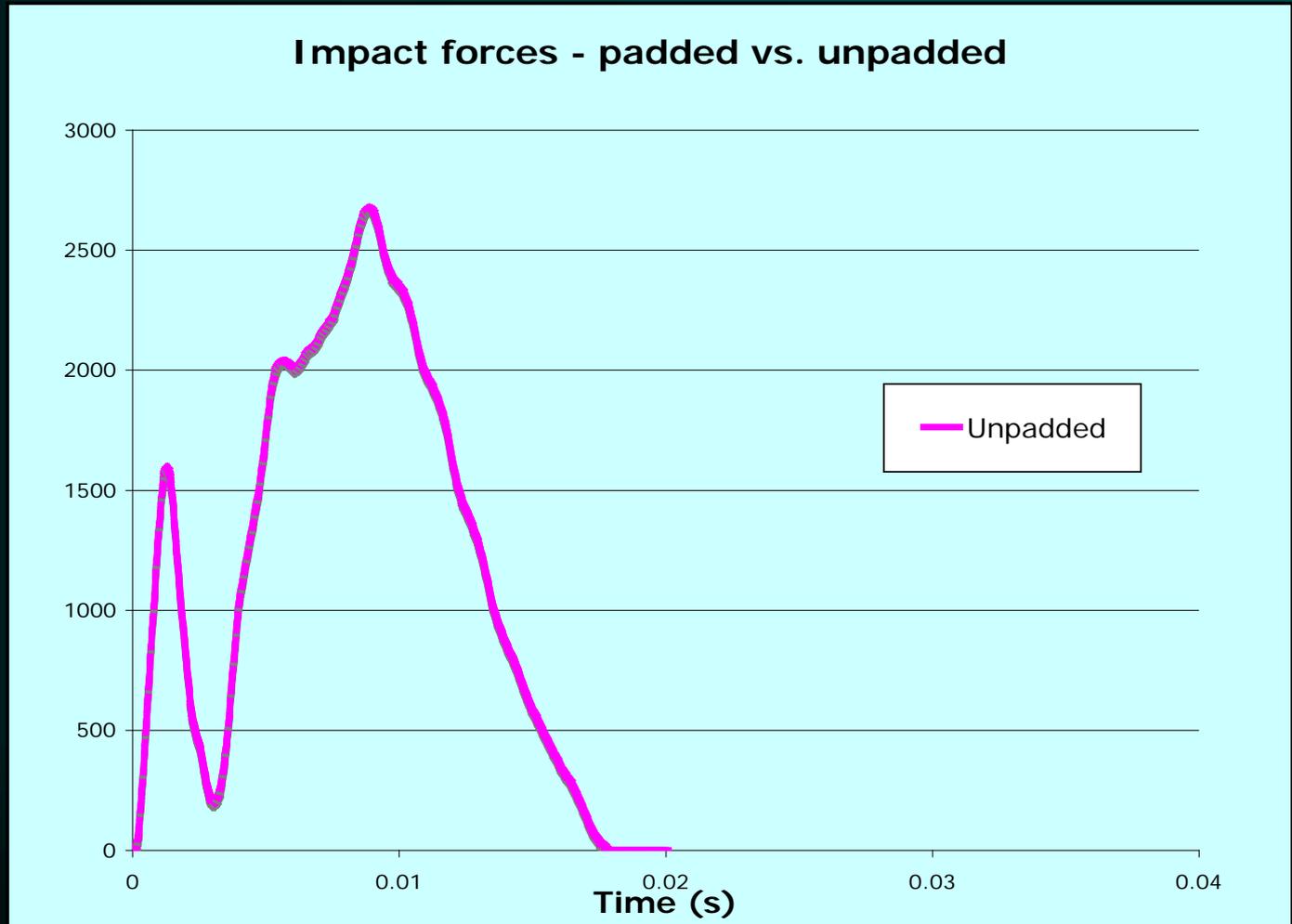


# Laboratory - formal

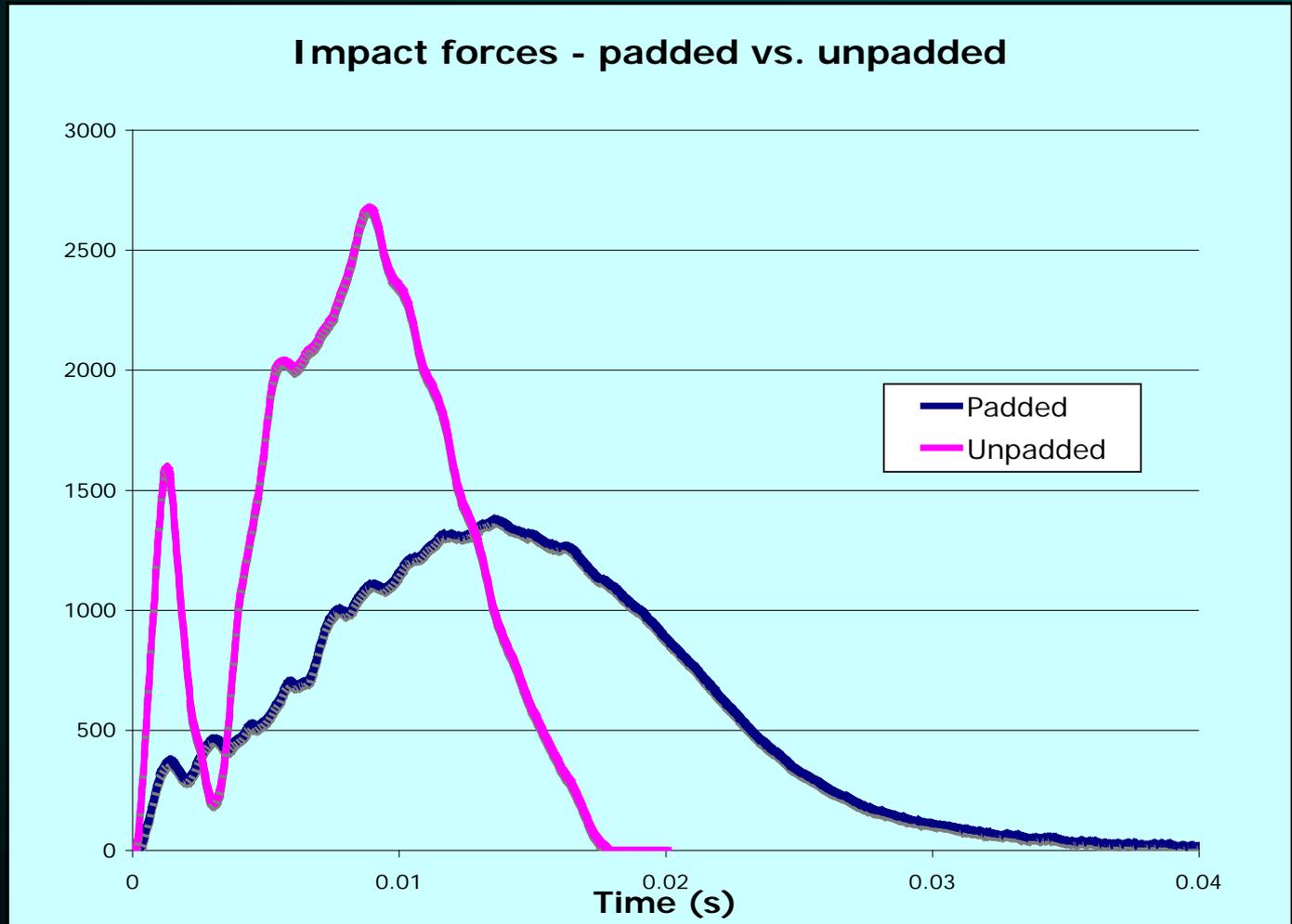
- Simulated head impact -padded



# Laboratory - formal



# Laboratory - formal



# Laboratory - formal

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- Running - Changes in step rate & step length as running speed changes
- Sprinting - Velocity changes through 100 m



# Laboratory - formal

- Sprinting with...  
...jumping stilts!



# Happy biomechanics

- Have fun!

