

# Physics and Dance:

Using Dance Analogies to Teach Physics, and Vice Versa

Arthur Baum, Myers Park High School

# My Background: Physicist and Folk Dancer

- Physics Major
- High School Physics Teacher (AP, IB, Honors)
- Scottish Country Dancer
- Scottish Country Dance Teacher

How do my teaching interests align and intersect?





# Using Dance to Teach Physics

# Textbook Example: Grand Jeté

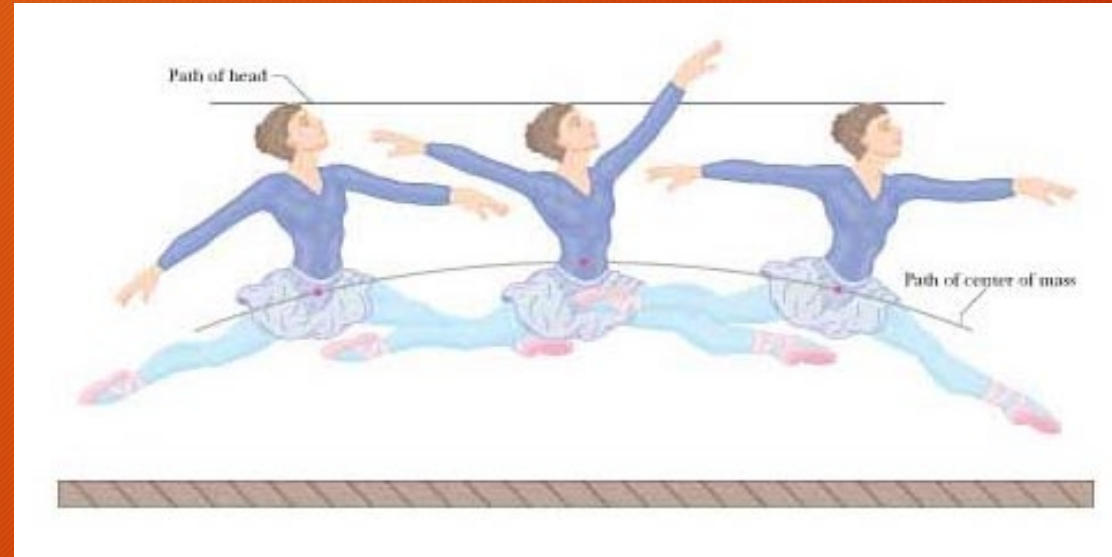


Fig. 9-6. Halliday Resnick & Walker 7<sup>th</sup> ed., adapted from *The Physics of Dance*, Kenneth Laws, Schirmer Books, 1984



# Using Dance in Physics Class

- Electric Circuits: Alternating and Direct Current
  - Open and closed circuits
  - Drift velocity
  - Presence of charge carriers throughout the circuit
- Sun and Moon Dance (Philip Sadler, Harvard-Smithsonian CFA)
  - Relative positions of sun and moon
  - Seasons and phases of the moon
  - Changes in sunrise, sunset, and lengths of day and night

# Teaching About Dance in Physics Class

- Newton's Laws, Force as an Interaction
  - Frame (waltz hold)
  - Strong arms (Scottish country dance turns and circles)
- Torque and the Waltz
  - “You push with both hands, you push with this one and pull with that one”
  - Balanced force at one point of contact, unbalanced at the other
  - Analogy to an electric motor



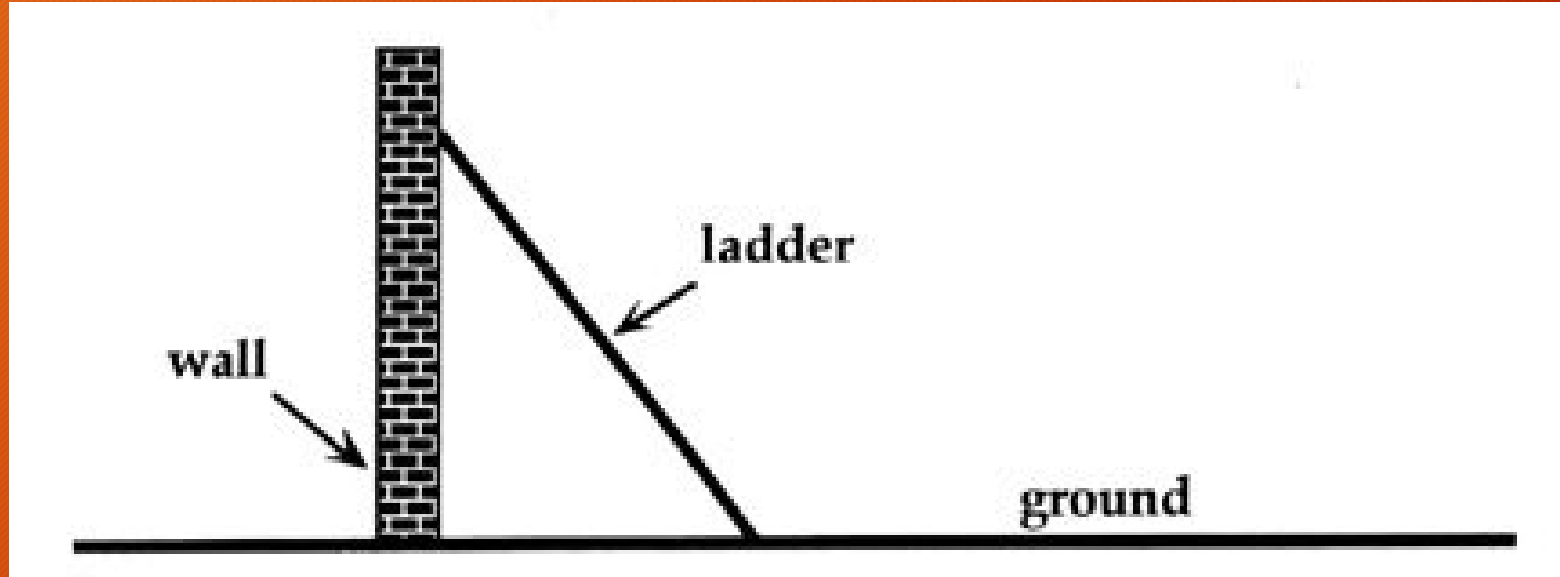
# Using Physics to Teach Dance

# Physics Analogies in Dance Class

- Right-hand rule (kids latch onto)
  - Immediately understand direction to face in dance class
  - More likely to remember and apply rule in physics class
- Centripetal force (turning partner with 1 or 2 hands)
  - Strong arms vs. “giving weight”
  - Instruction to pull slightly toward yourself (gets you around turns faster)
- Ladder problem (strathspey traveling step)
  - Lengthen your step by sitting into it



# Strathspey Traveling: Like a Ladder Problem



Physics Stack Exchange

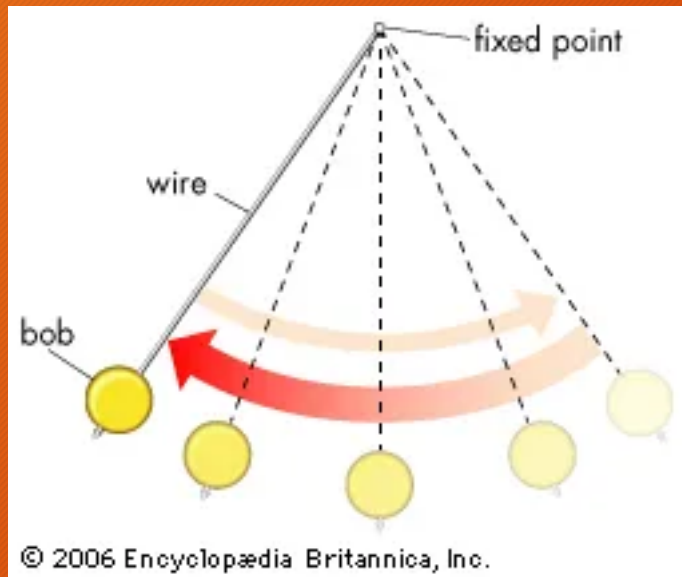
<https://physics.stackexchange.com/questions/415140/why-cant-a-ladder-sliding-down-a-wall-go-faster-than-light>

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- Ladder problem (strathspey traveling step)
  - Lengthen your step by sitting into it
- Move like the pendulum of a clock (strathspey setting step)
  - Lift and gracefully place your foot—not a flick!

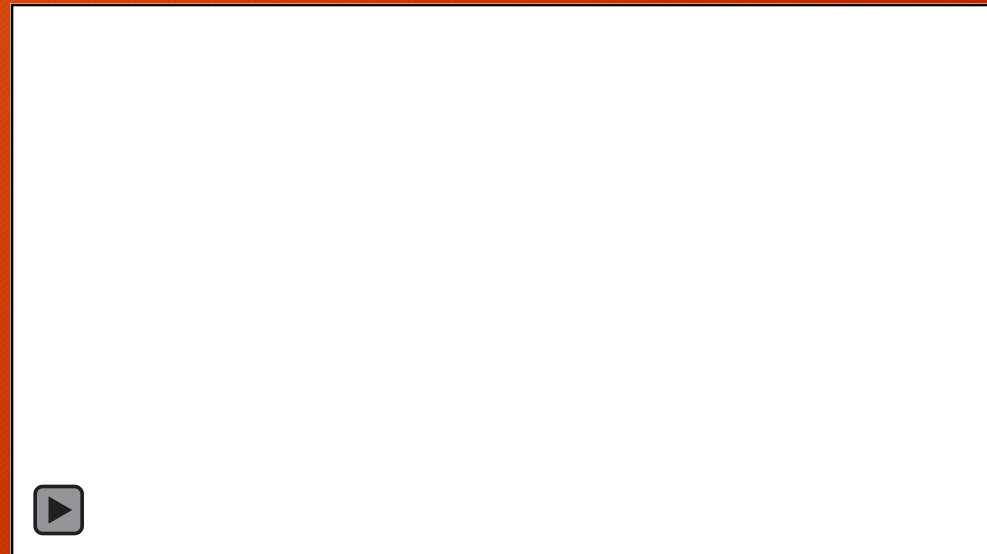


# Strathspey Setting: Like a Clock Pendulum



Encyclopedia Britannica

<https://www.britannica.com/technology/pendulum>



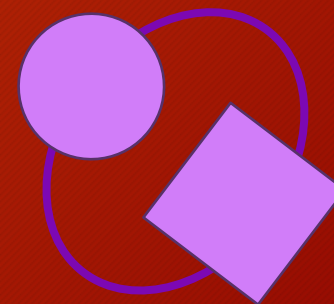
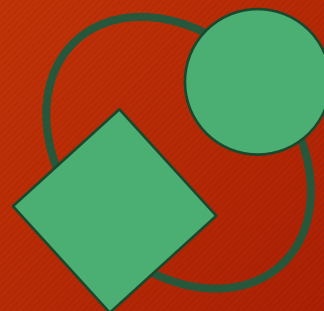
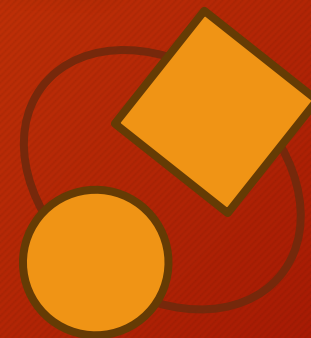
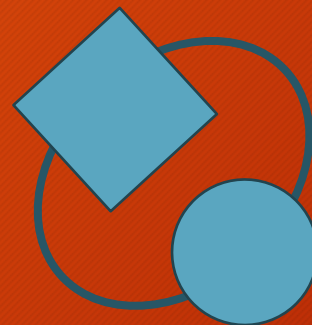
Royal Scottish Country Dance Society

<https://www.youtube.com/TheRSCDS>

# Polka, Teacups, and the Right-hand Rule

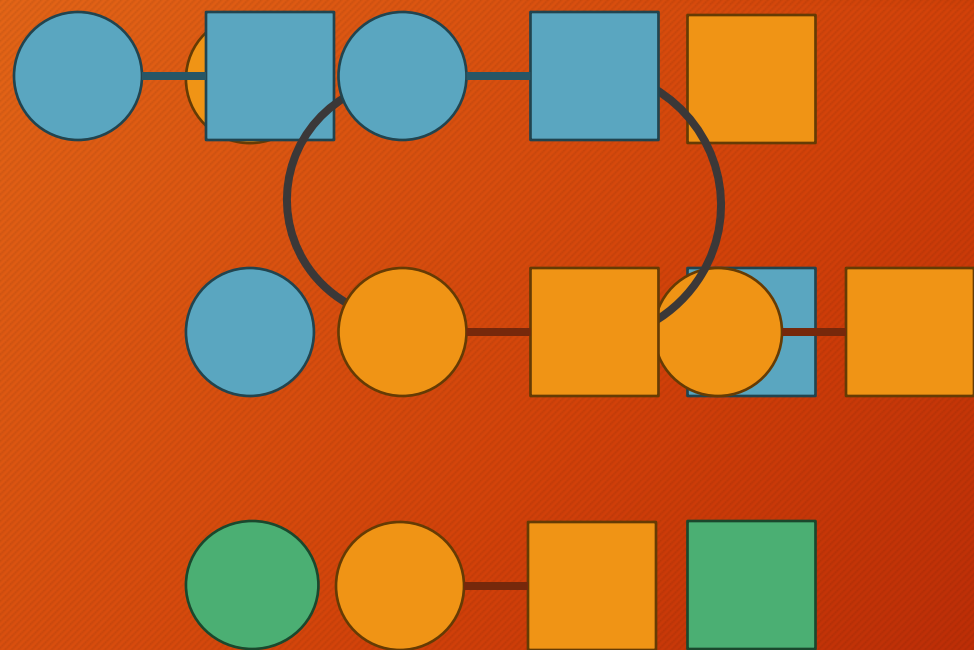


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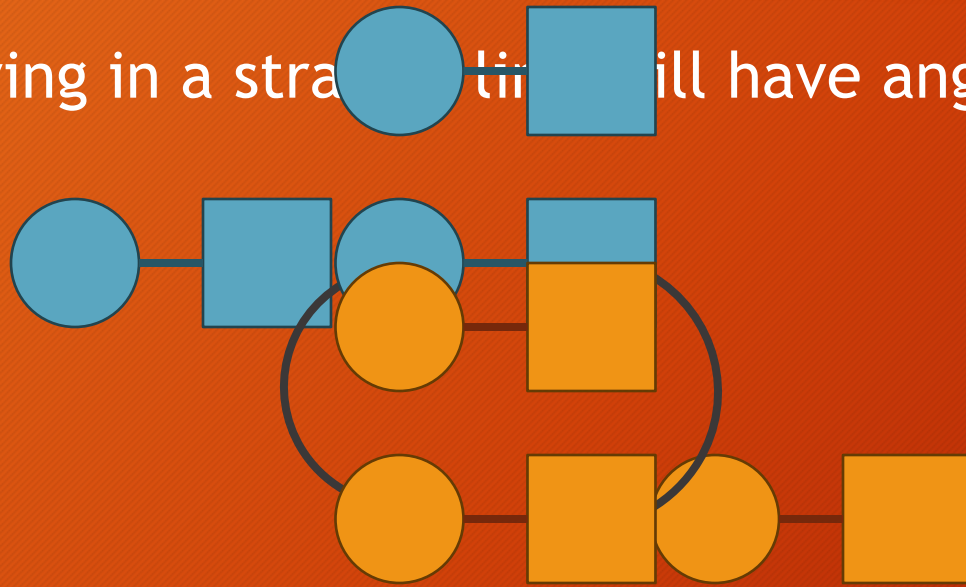


# The Queen City Salute



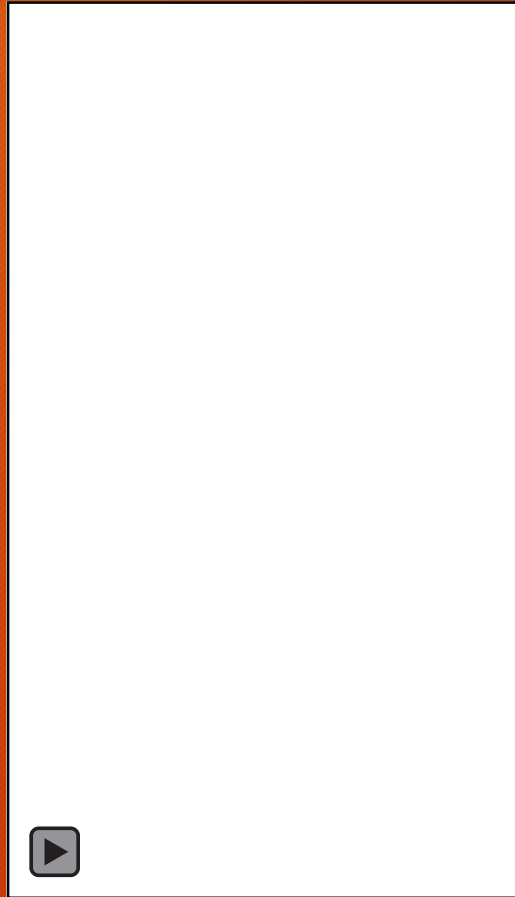
# The Queen City Salute

- Objects moving in a straight line will have angular momentum





# Just for fun: St. Andrews SCD Summer School



# Ghost Particles: A Neutrino Dance

<https://my.strathspey.org/dd/dancevideo/10932/>

