

ESG 8.01 Sports Units Analysis Problem  
Replacement for TEAL Problem Set 1, Question 1  
September 8, 2006

Part 1)

In the Wednesday walking lab, we saw that people walk in a wave motion over time.

Given a person's mass, geometry (length, height...), proportions, and speed, how will these aspects combine to produce a wave of the form that represents the up and down motion of the person's nose while walking? Presume the person is walking on the surface of the planet Earth. Assume a solution of the form:

$$Y_{\text{nose}} = Y_{0\text{nose}} + Y_{\text{nose\_movement}} \sin(\omega t)$$

Take a best guess at what  $Y_{0\text{nose}}$  (the average height of the nose),  $T_{\text{nose\_movement}}$  (the maximum deviation from the average height), and  $\omega$  (the frequency of "noseoscillation") are in terms of the givens. A rough guess is appropriate; there is no need to account for all of the proportions of all the joints in the human body. If you are inclined to further refine your model, answer the question "where would you add the refinement" rather than adding the refinement itself.

Part 2)

Pretend that upright bipeds have been discovered on a planet on whose surface the acceleration of gravity is 10 times that of earth. Estimate how fast these creatures walk? What further information do you need to know to be more certain of your estimate? Take an educated guess at a formula for the speed of extraterrestrial bipeds.