

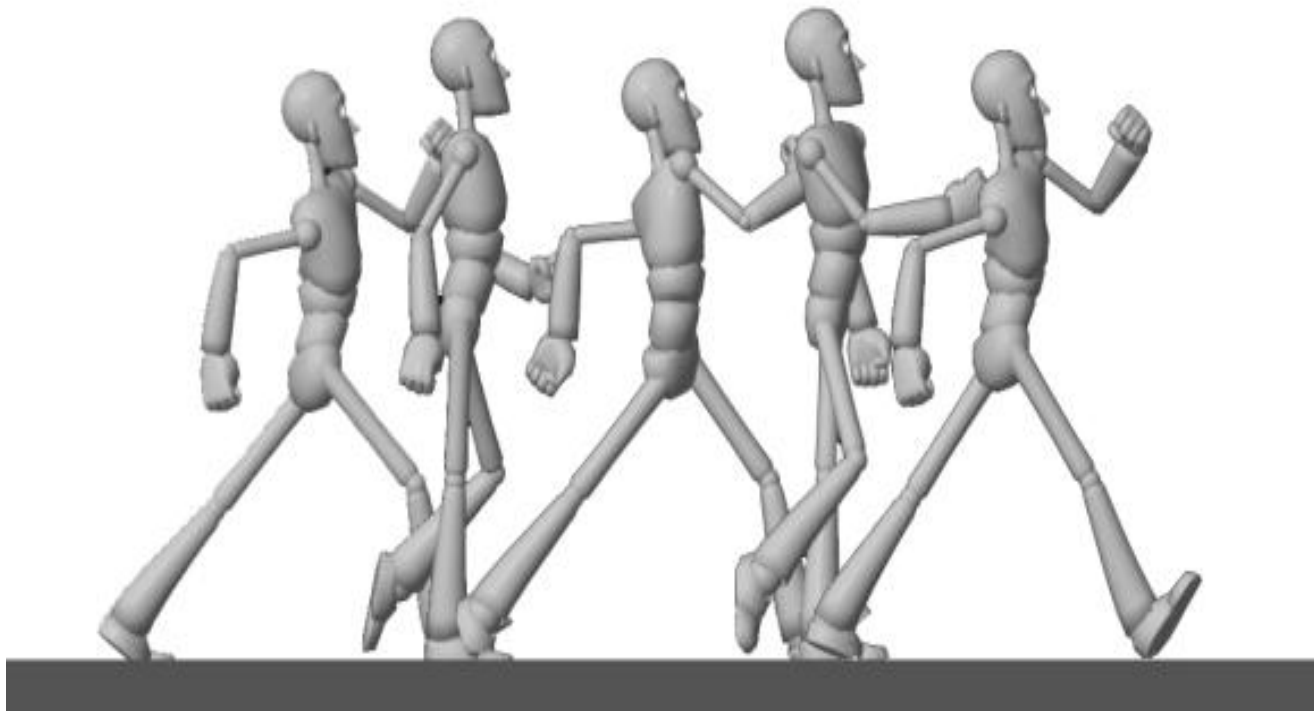
# Introduction to Walks



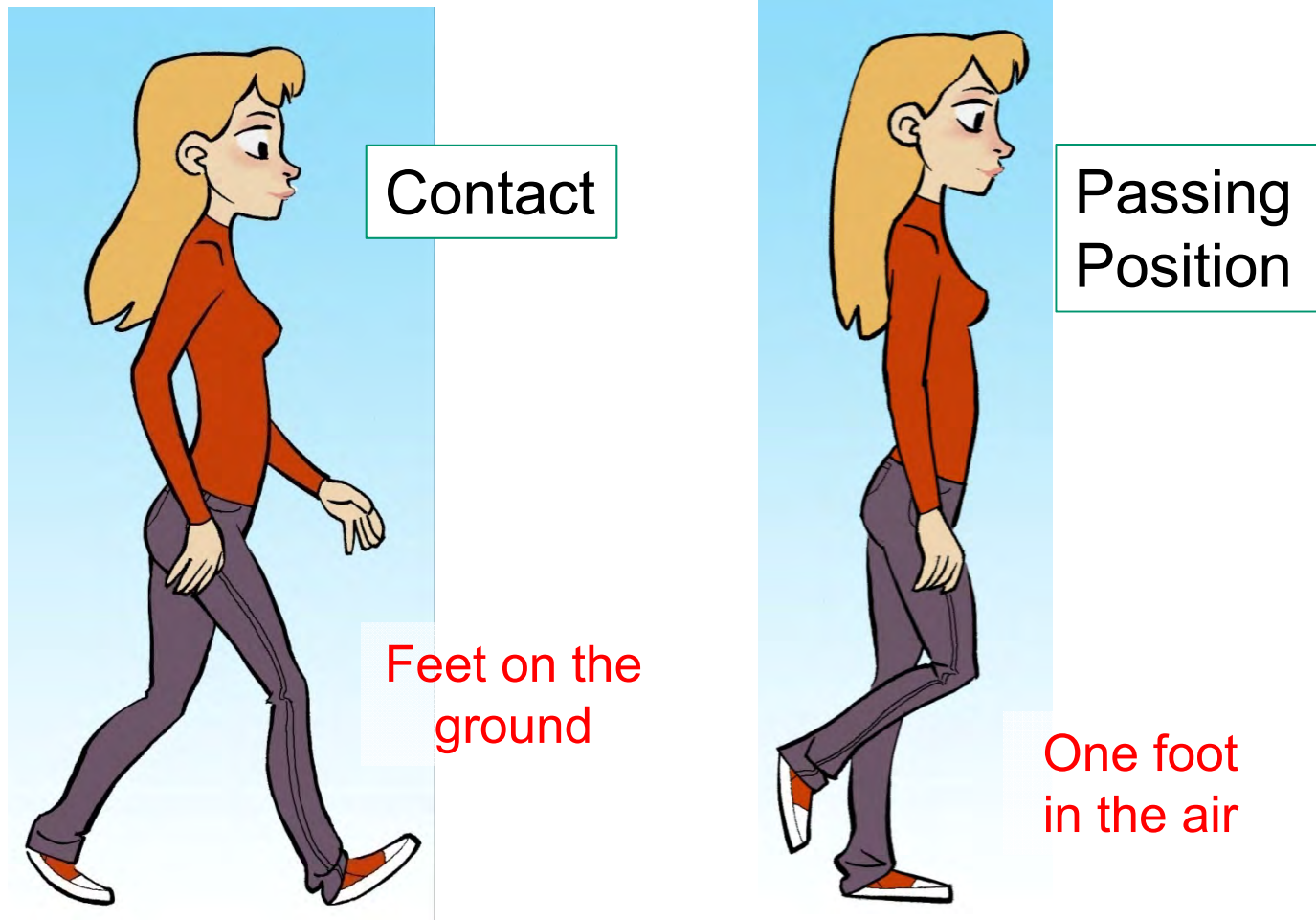
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# Characters in Motion - Walks

Walks are great for studying character motion since walking features all the basic elements of mechanics while including variety and personality.



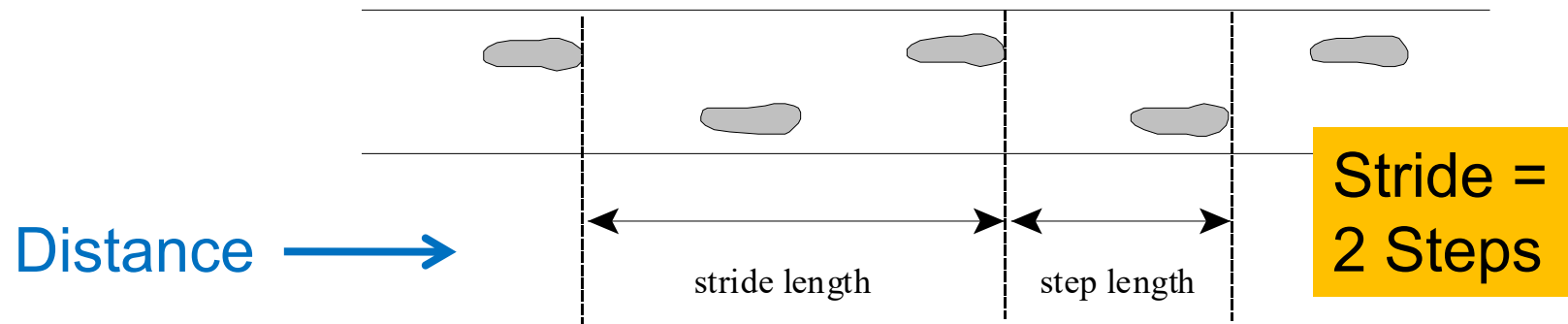
# Contact & Passing Position



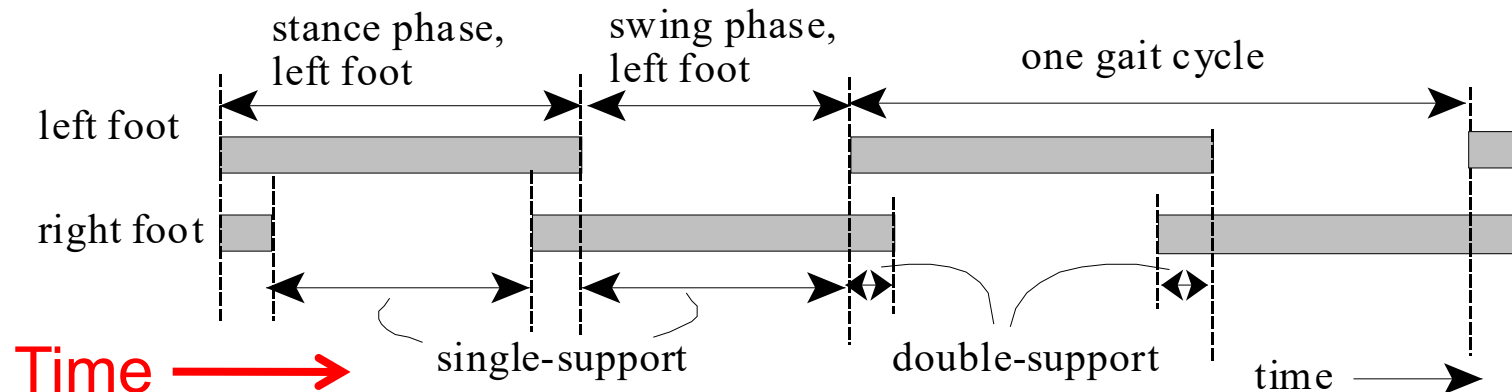
Concentrate on these two key poses, the contact and the passing position.

# Step, Stride, Gait

Step and stride length indicate spacing for the feet.



Gait indicates the timing of the motion for each foot.



# Timing of a Walk

Strobe photo  
(5 flashes per second)

A normal walking gait ranges from a third to two-thirds of a second (8 to 16 frames) per step, with a half-second (12 frames) per step being about average.

A full stride (both right and left steps) is, on average, one second (24 frames) per cycle.

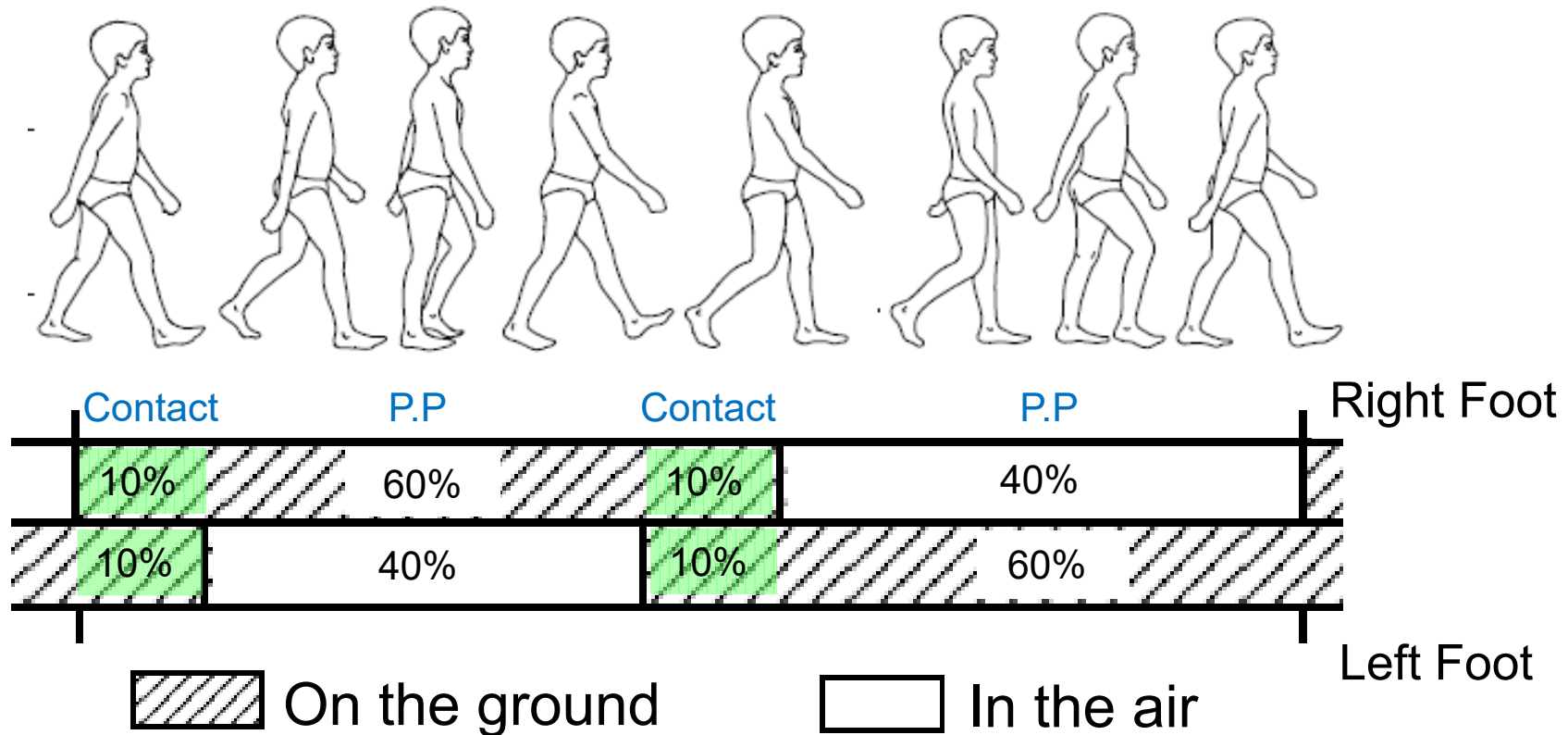
Parade march time is 120 beats per minute (one beat per step).



One stride (two steps)

# Contact with the Ground

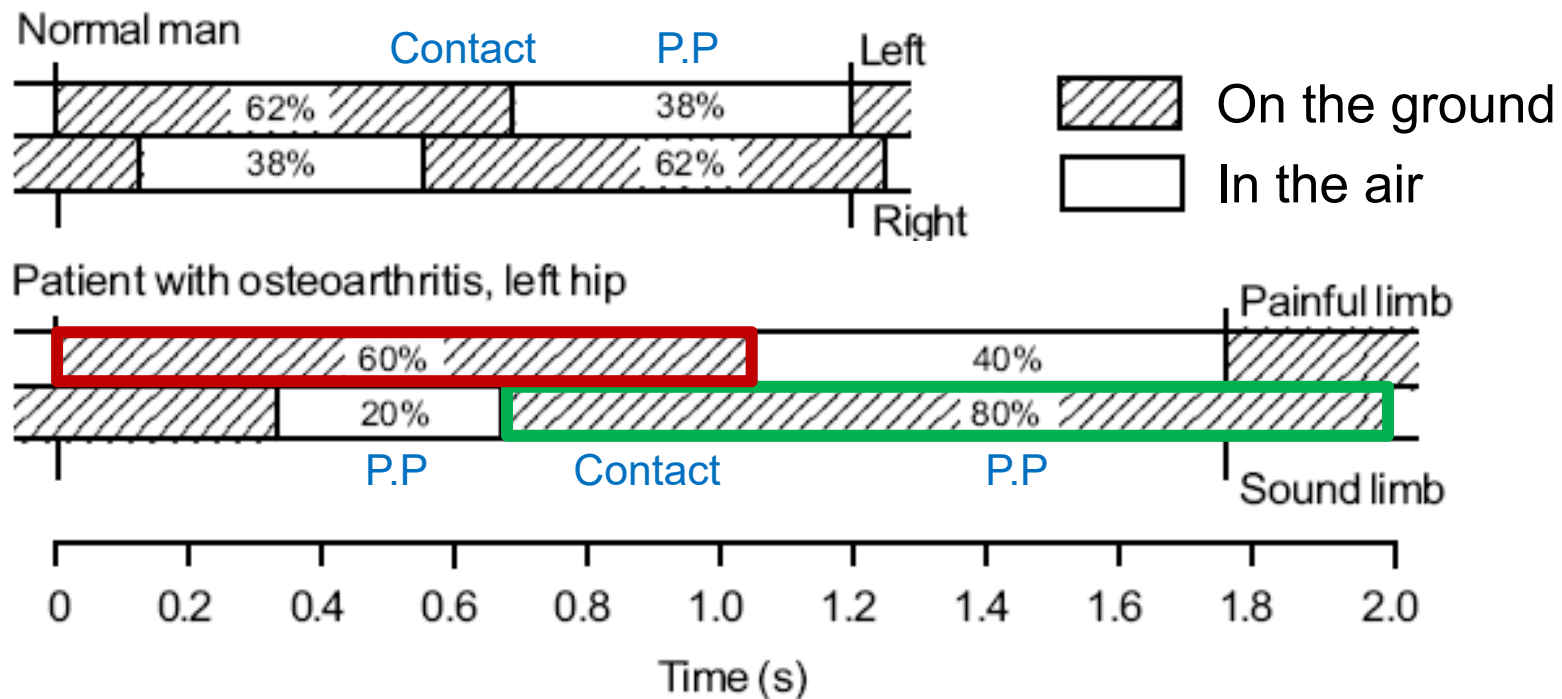
Each foot is on the ground about 60% of the time.  
About a 20% of the time both feet touch the ground.



Time of dual contact decreases as walking speed increases.

# Walking with a Limp

With a limp, the gait changes significantly. The painful leg is still on the ground 60% of the time but walking slowly reduces the pressure on that leg, which is greatest at the contact pose.



# Walking Slower or Faster

To walk faster you naturally increase *both* your stride length and stride rate (cadence).

Walk	Stride length	Stride rate	Speed
Slow walk	3 feet	$\frac{2}{3}$ stride per second	2 feet per sec. ( $1\frac{1}{3}$ m.p.h.)
Fast walk	4 feet	1 stride per second	4 feet per sec. ( $2\frac{2}{3}$ m.p.h.)

At around 6-7 feet per second (4-5 m.p.h.) the gait pattern transitions into a run.



# Normal Walk



# Slow Walk



# Fast Walk



# Slow Walk Played Fast



# Step Length

When walking, why don't we take longer (or shorter) steps?

We naturally adjust our step length to minimize the energy output required to maintain our desired walking speed.



←→  
Step length

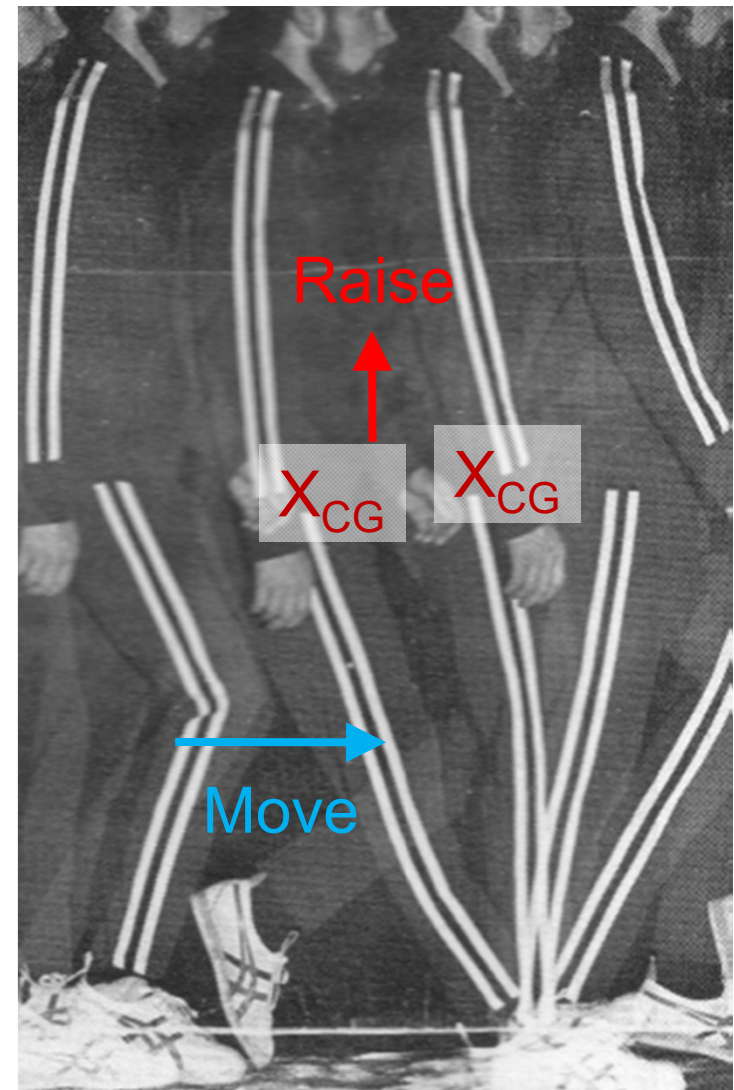


# Energy & Step Length

Energy is required to:

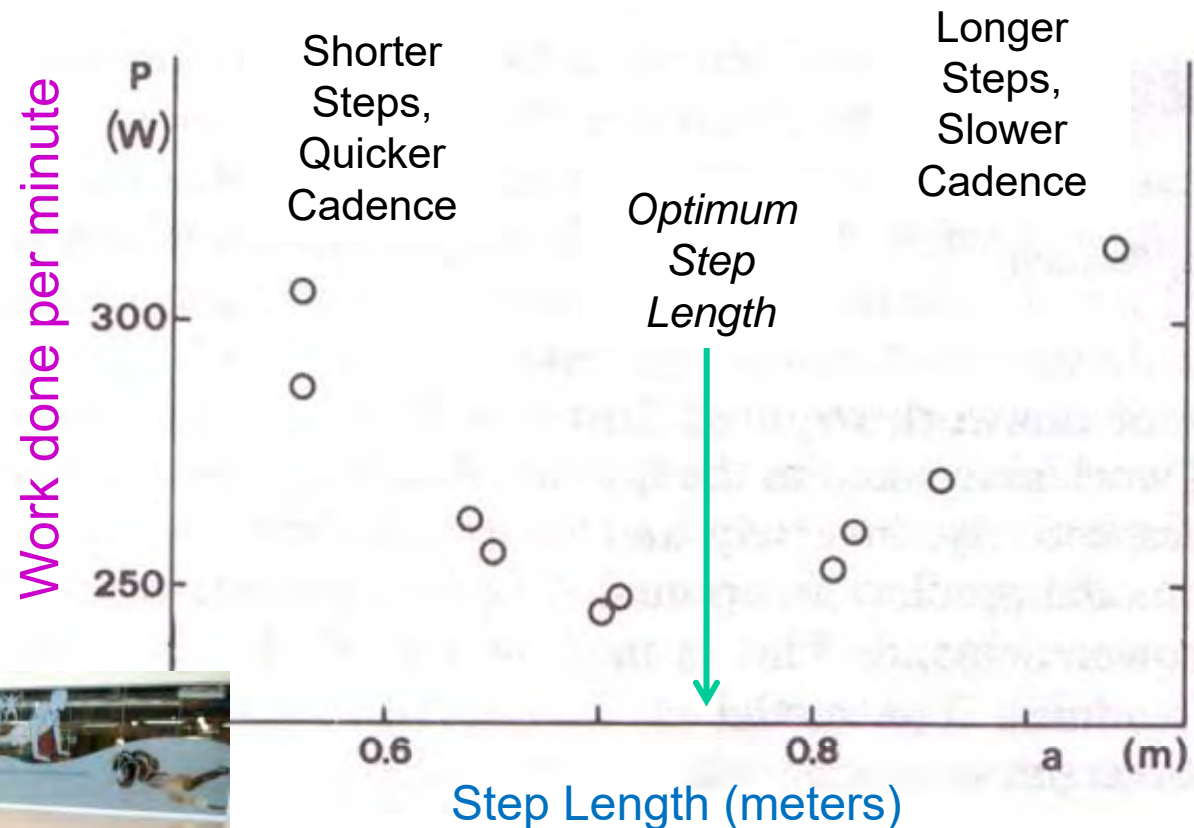
- Move the leg forward in the contact; longer steps take less energy.
- Raise the body in the passing position; longer steps take more energy.

Body finds the best balance.



# Optimum Step Length

Treadmill data of metabolic rate while walking at  $2\frac{1}{2}$  mph



The body adjusts the step length to minimize the total energy expended while maintaining desired speed.

# Summary

- Walking has two basic poses: *Contact*, with both feet on the ground and *Passing Position* with one leg moving under torso.
- Both feet are on the ground about 20% of the time for the cycle of one stride.
- To walk faster we tend to increase both step length and cadence.
- For a desired walking speed the body finds the step length that minimizes the required energy consumption.