HOW AMPLITUDE TIES INTO STROKE MECHANICS

BY JAN PRINS

If you want to swim as fast as possible, reduce the amplitude of movement while increasing its frequency.

(Photo by Michael Aron)

ABOVE » *An ideal dolphin kick is one that combines a high frequency and optimum amplitude. A swimmer shouldn't increase the size or amplitude of the kick to generate more speed.*

biomechanics

When it comes to human motion, we must understand that if we want to move *forward*, we need to exert muscular forces that move our limbs *backward*. However, we rarely have the luxury of exerting these forces directly backward in order to move forward.

Most often, the line of action of the exerted force takes place at an angle, with only a portion of the force made available for actual propulsion forward.

Usually, the forces we exert are said to be "resolved" into horizontal and vertical components. A good example of this is seen when tracking a swimmer's trajectory off the blocks: we would like to maximize the horizontal component of the leg extensor force, but in order to enter the water cleanly, some vertical component has to be included.

HOW DOES THIS RELATE TO AMPLITUDE?

First, let's describe how amplitude is defined. When scientists think of amplitude, they see a repeating "wave-like" pattern of motion that is observed in virtually all areas of the physical world **(Figure 1)**.

Amplitude is defined as the vertical displacement—either upward or downward—from the baseline.

Sound familiar?

As it turns out, tracking these vertical displacements during human activity is a vital part of motion analysis. As we are only too aware, most rhythmic activities—such as walking, running and swimming—are a combination of sustained application of muscular forces that produce horizontal and vertical movements. For the most part, minimizing the vertical components in these activities will produce more efficient forward propulsion.

An excellent example of this is seen when observing the rise and fall of the hips in runners. Watch casual joggers and less experienced runners, and you will notice perceptible upward and downward movements of the torso. In contrast, watch elite runners in a 5K or 10K race, and you will get the impression that these athletes' hips are virtually floating in a horizontal plane as they move around the track!

APPLYING AMPLITUDE TO SWIMMING

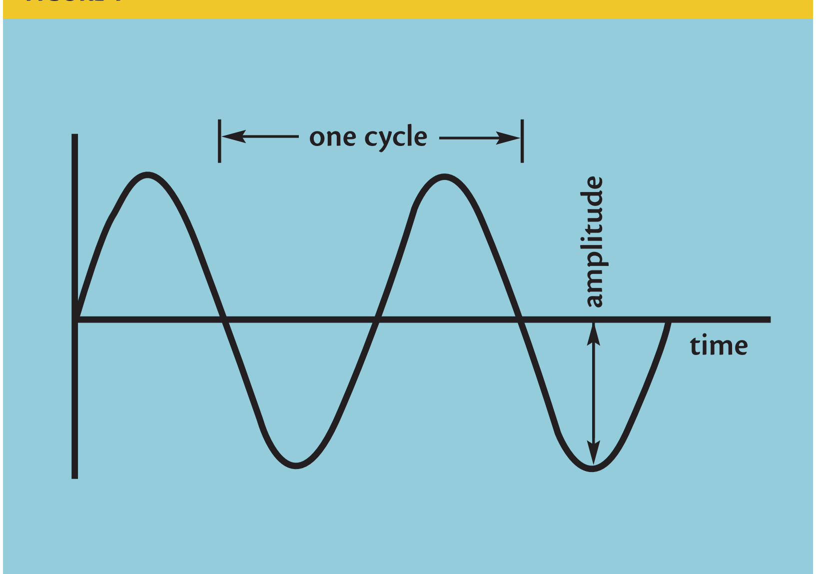
Swimming, of course, is probably the premier activity in which amplitude and rhythmic movements play an integral role. There are numerous examples that show how amplitude can affect performance.

Let's start with the dolphin kick. An ideal kick is one that combines a high frequency (i.e., the rate of undulation) and optimal amplitude.

Since it takes longer to travel over a path with greater amplitude, a swimmer shouldn't increase the size or amplitude of the kick to generate more speed. There are two reasons for this: first, it consumes too much energy, and more importantly, it will take longer for the feet to rise and fall because they will have to travel a longer distance.

If you want to swim from Point A to Point B as fast as possible, reduce the amplitude of movement while increasing its frequency. ❖

FIGURE 1



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