

**Triathlon
CANADA**



SWIMMING BIOMECHANICS



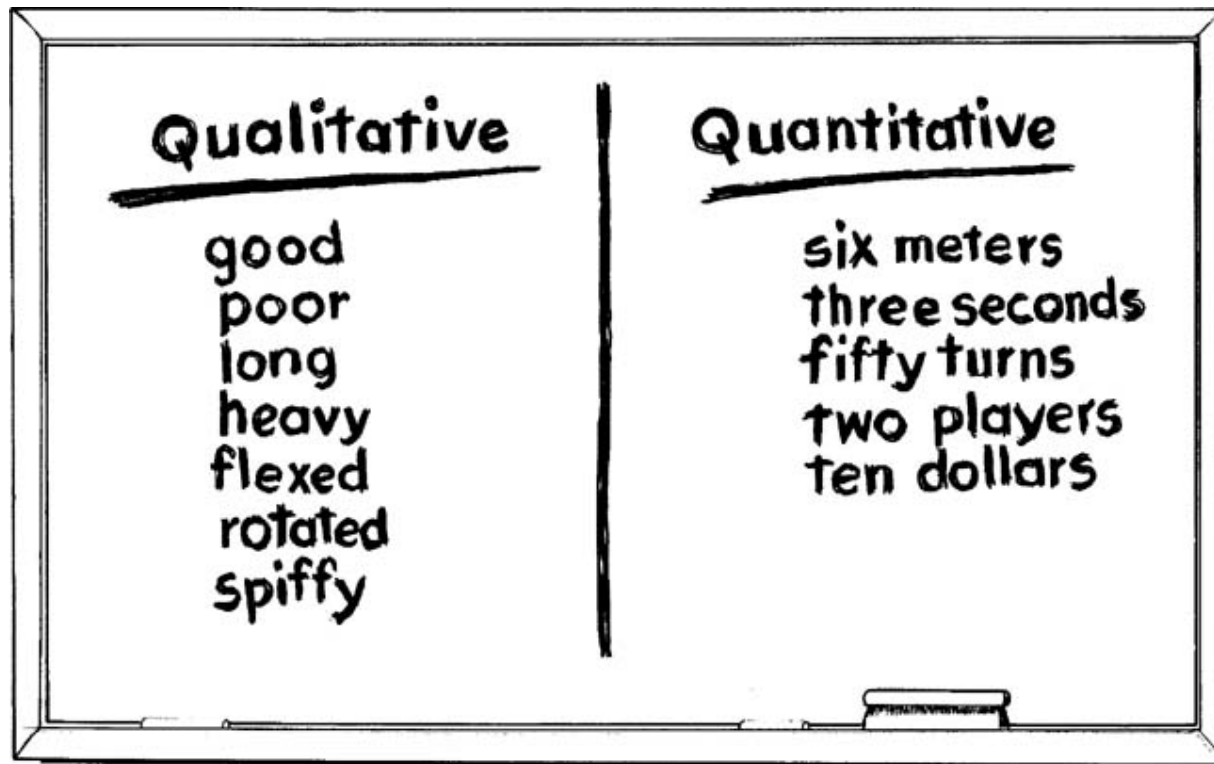
WHAT IS SWIM TECHNIQUE?

Why can two people look different when swimming but go the same speed?

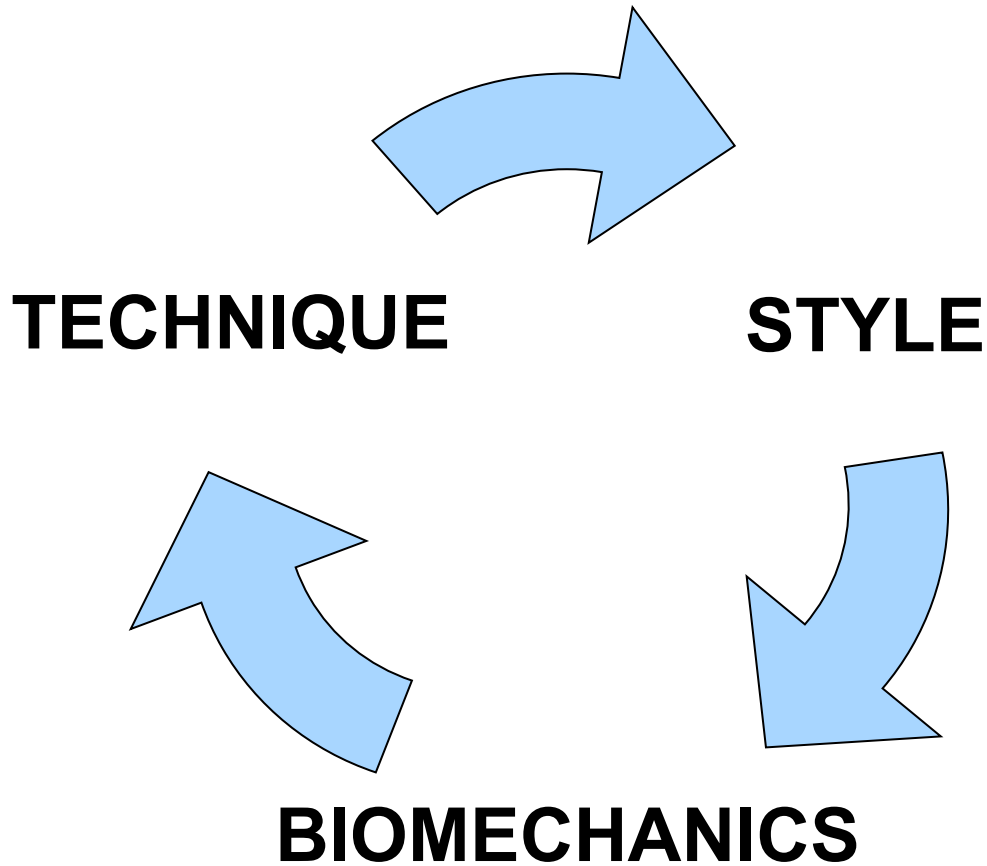
Why do some coaches emphasize one part of the stroke and other coaches other parts?

Is there any one correct technique?

HOW WE OBSERVE



WHICH COMES FIRST?



STYLE, TECHNIQUE AND BIOMECHANICS

Recognizes a style

Analyze the technique

Study the biomechanics

Adapt and create a new style

SPORT BIOMECHANICS

The application of mechanical principles to the study of human movement

- **Safe:** protection of injury
- **Effective:** maximization of the result
- **Efficient:** economy of energy expenditure

WHAT CAN BIOMECHANICS TELL US ABOUT SWIMMING?

What do you think...

BIOMECHANICS

Statics

Dynamics

Fluid mechanics

STATICS

The branch of mechanics that deals with systems in a constant state of equilibrium and the associated forces

What are examples of static systems in swimming?

DYNAMICS

The branch of mechanics that deals with motion and the associated forces

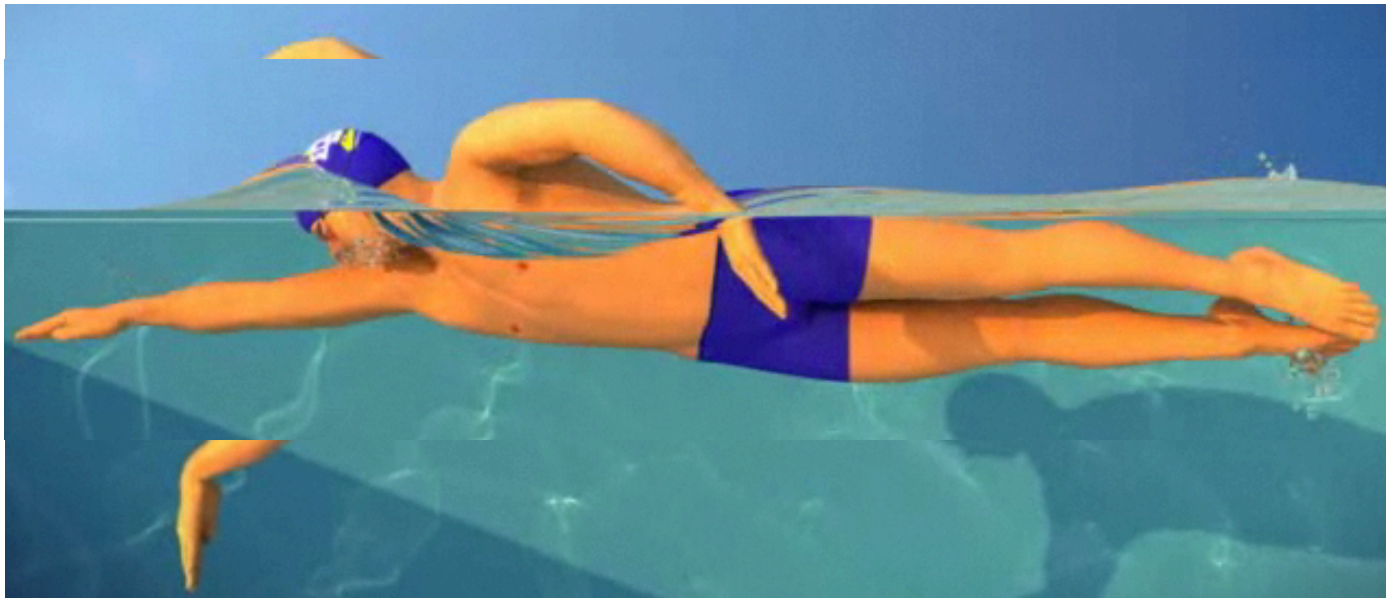
Newton's Three Laws of Motion

1. Things like to keep on doing what they are already doing.
2. Things like to keep moving in a straight line unless something forces them to change their direction.
3. For every action there is an equal and opposite reaction.

DYNAMICS IN SWIMMING

What are examples of dynamic systems in swimming?

WHAT FORCES ACT ON THE SWIMMER?



FLUID MECHANICS

Buoyancy: floating

Drag: slows you down

Lift: force acting perpendicular to movement

What are examples of fluid mechanics in swimming?

DRAG

Surface drag

- skin friction • smoothness • viscosity

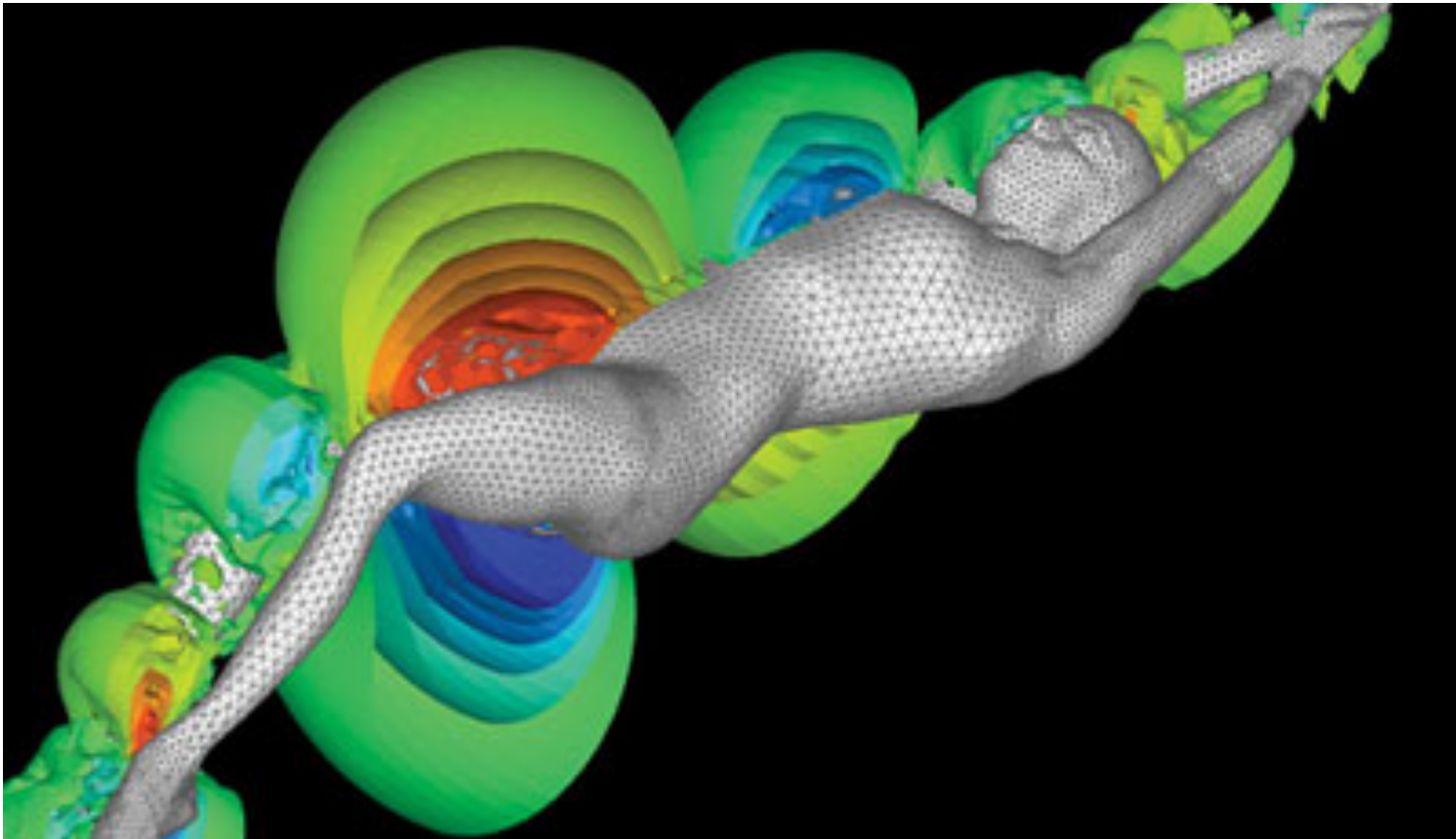
Form drag

- pressure differential • streamlining • turbulence

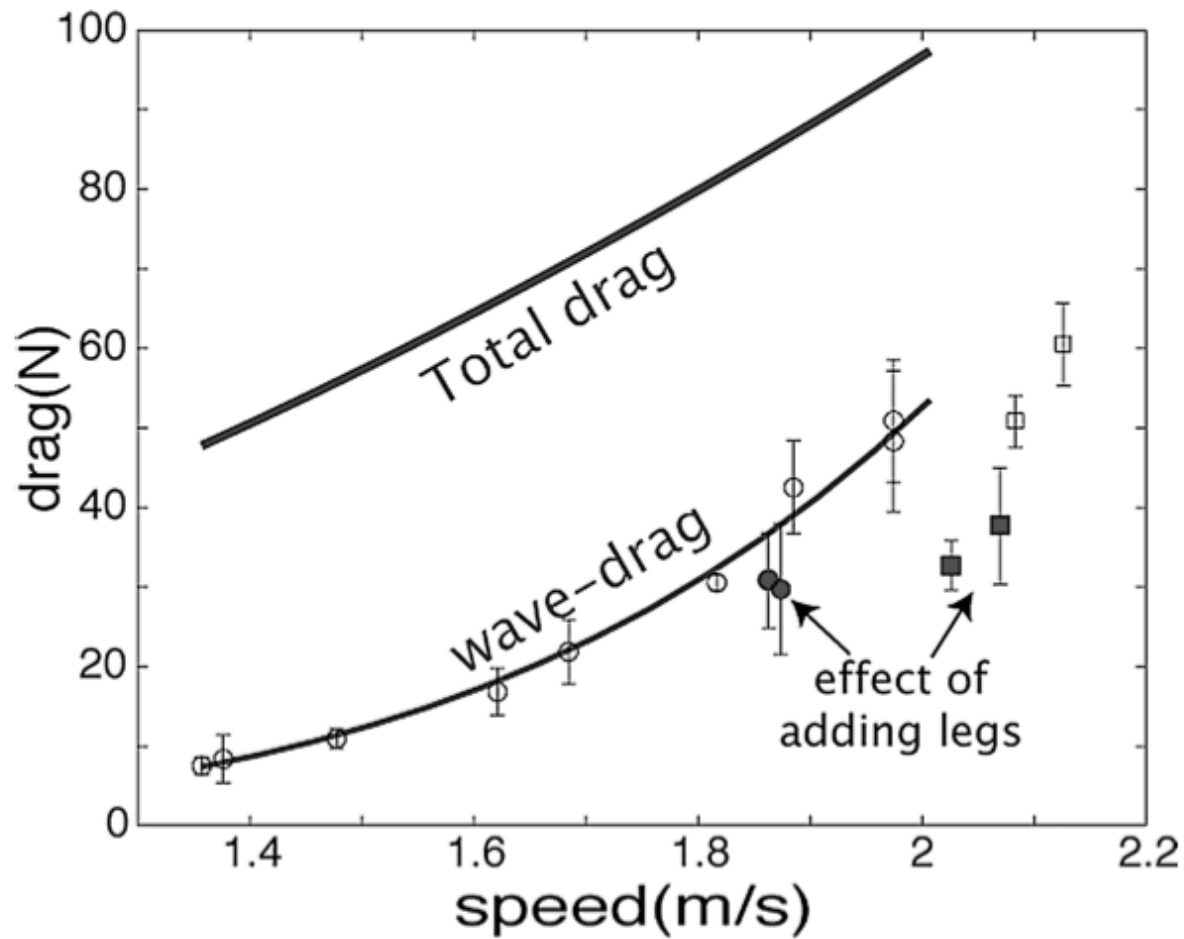
Wave drag

- creating waves
- When on the surface NOT 50+ cm below surface

PRESSURE

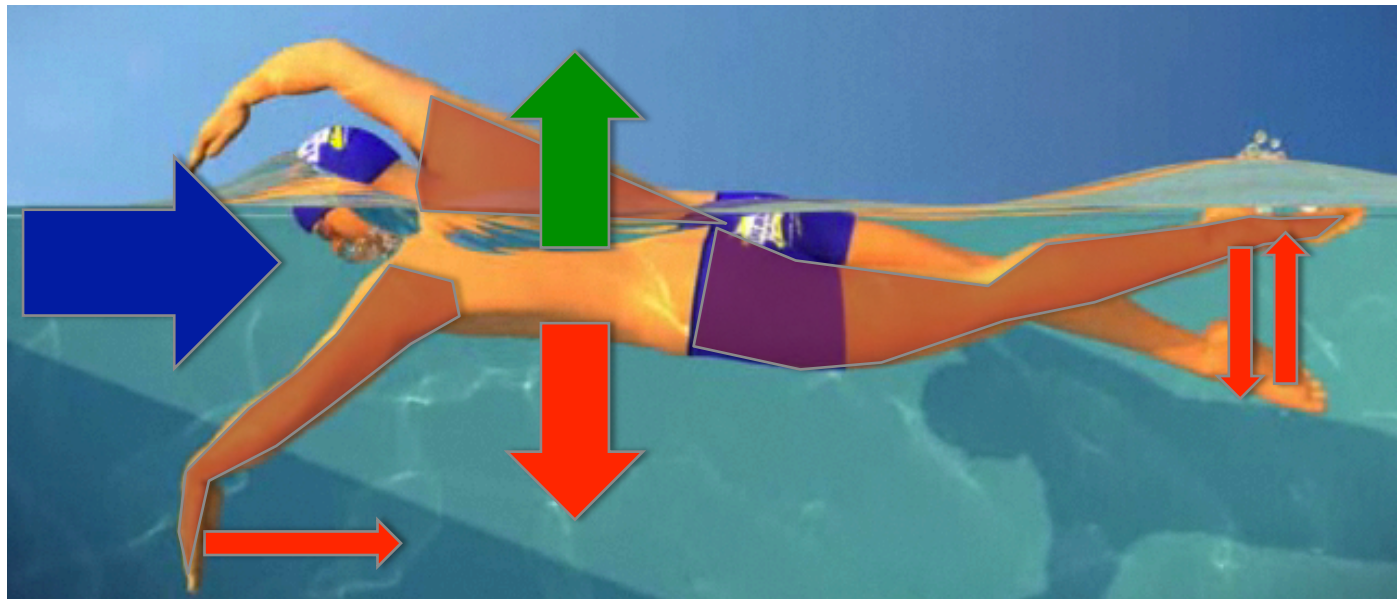


KICKING REDUCES DRAG

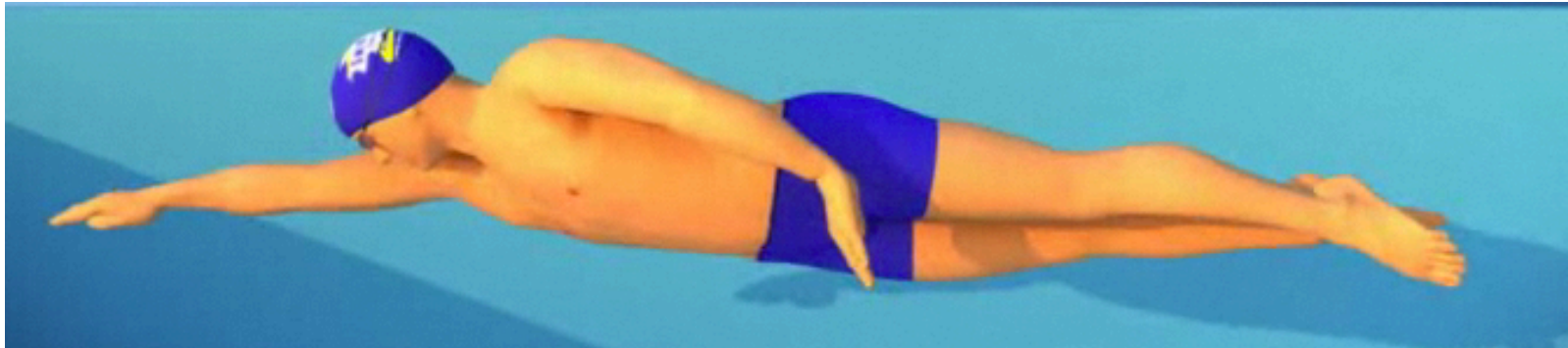


SWIMMER FORCES

- Muscles
- Gravity
- Buoyancy
- Hands
- Feet
- Water
- Waves...



FORCES ON THE SWIMMER



Resistive forces

Skin Drag: between the you and the water

Form Drag: turbulence created by the you

Wave Drag: energy lost in creating waves

Environmental

Propulsive forces

Paddler forces: swim strokes, connection to core, etc.

Wind

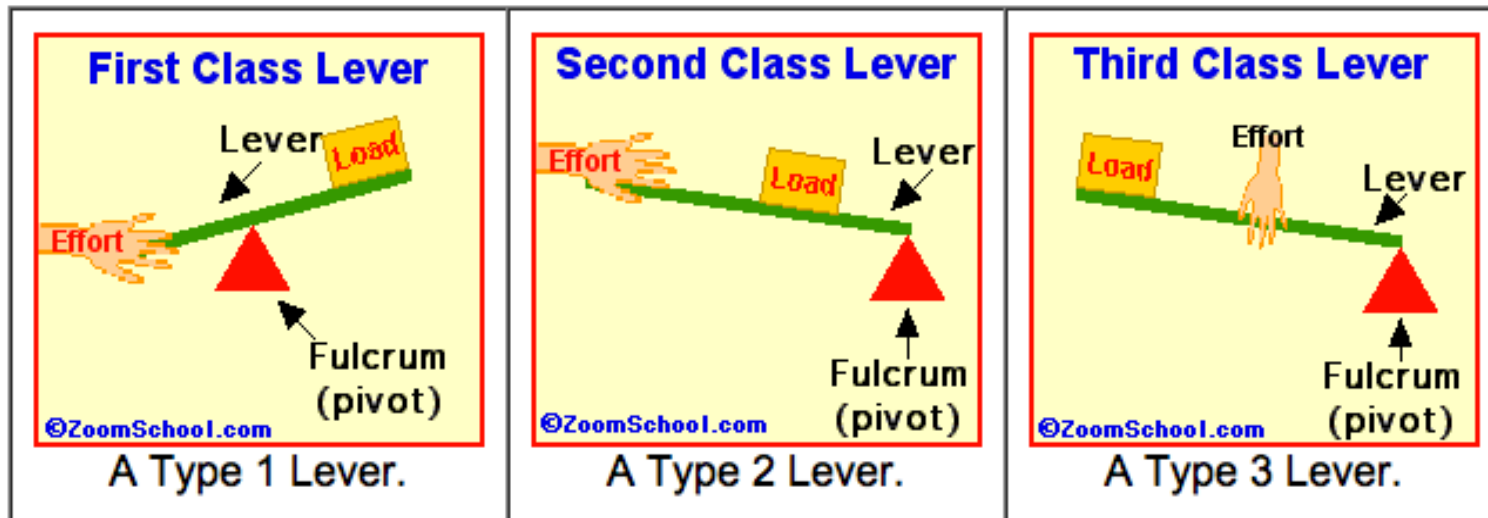
Waves

WHAT IS A LEVER?

A lever is a simple machine that makes work easier. A lever has three parts

1. A pivot point
2. An applied force, and
3. A resistive load

TYPES OF LEVERS



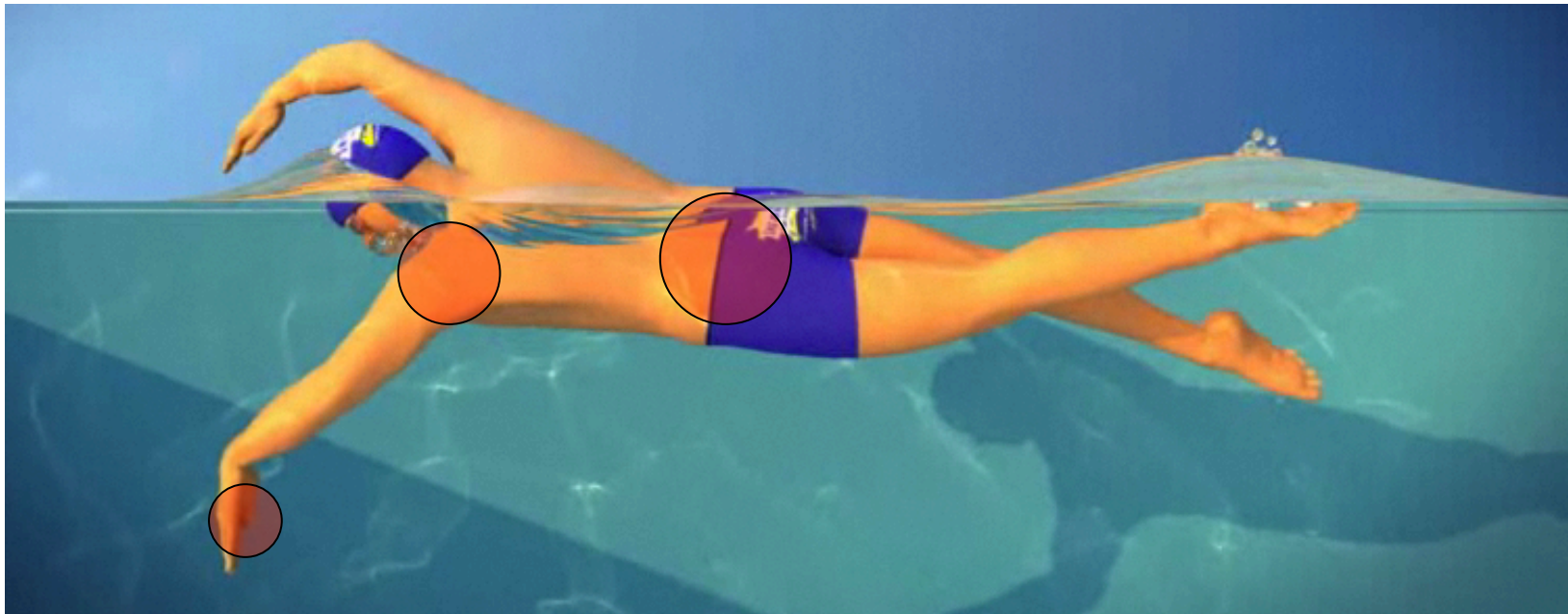
What types of levers are used in swimming?

SWIMMING LEVERS



Where do you think the levers and pivot points are in swimming?

PIVOTS IN SWIMMING



NOW IT GETS COMPLICATED...

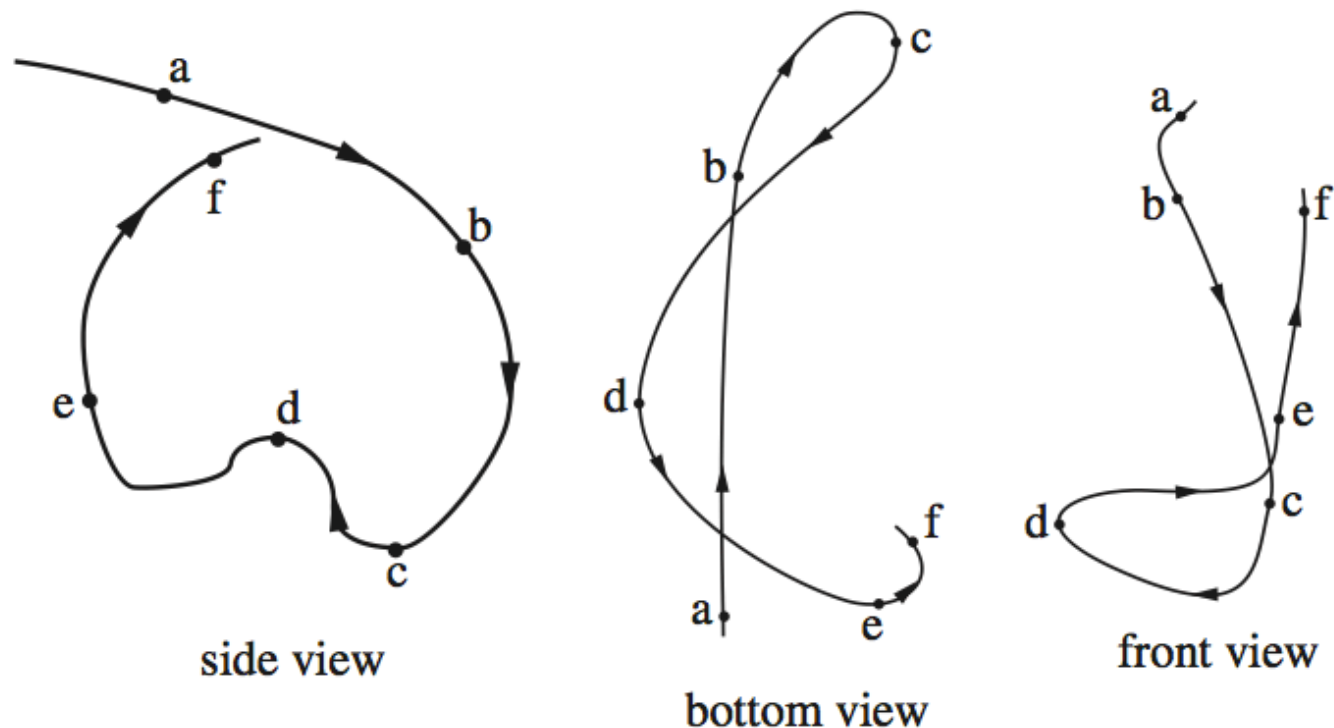


Figure 5: front crawl stroke pattern of the right hand in three dimensions (after Svec (55))
a-b: entry, b-c: entry scull, c-d: inward pull or insweep, d-e: outward pull, e-f: exit or upsweep.

MOVING PIVOT POINT!

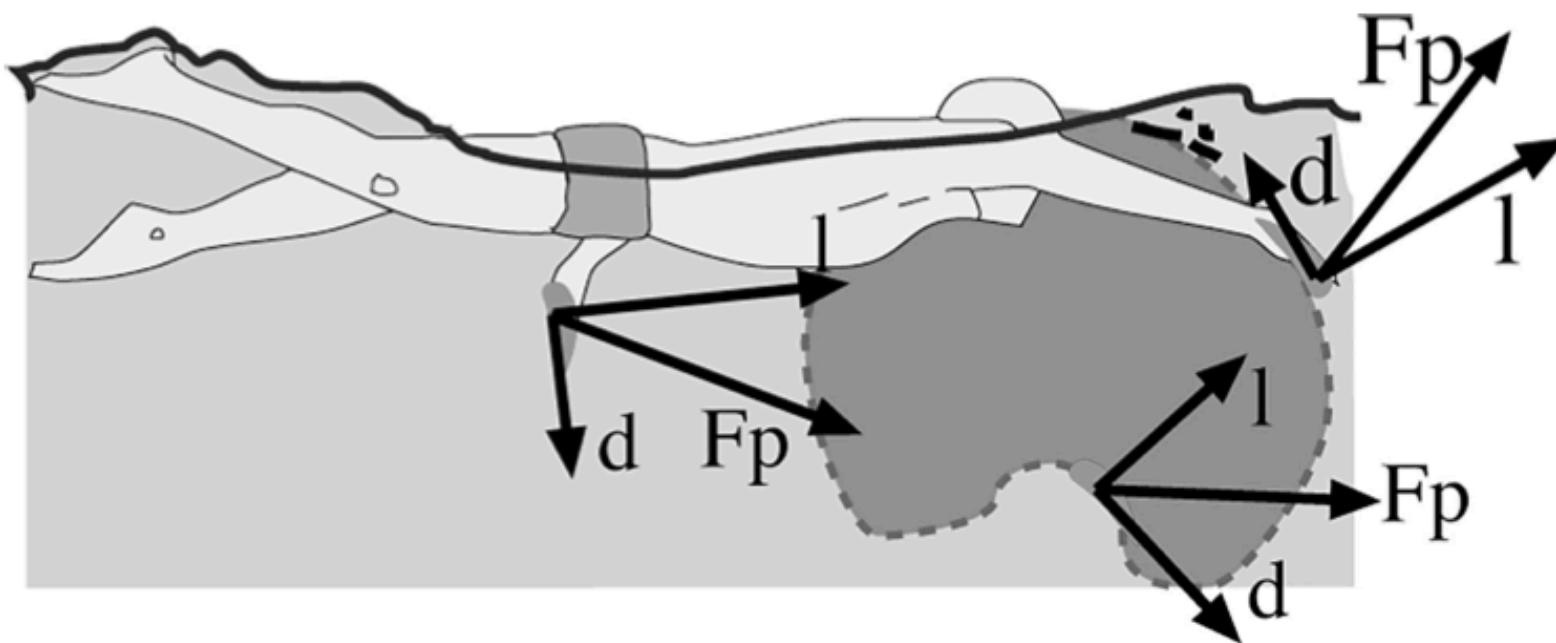


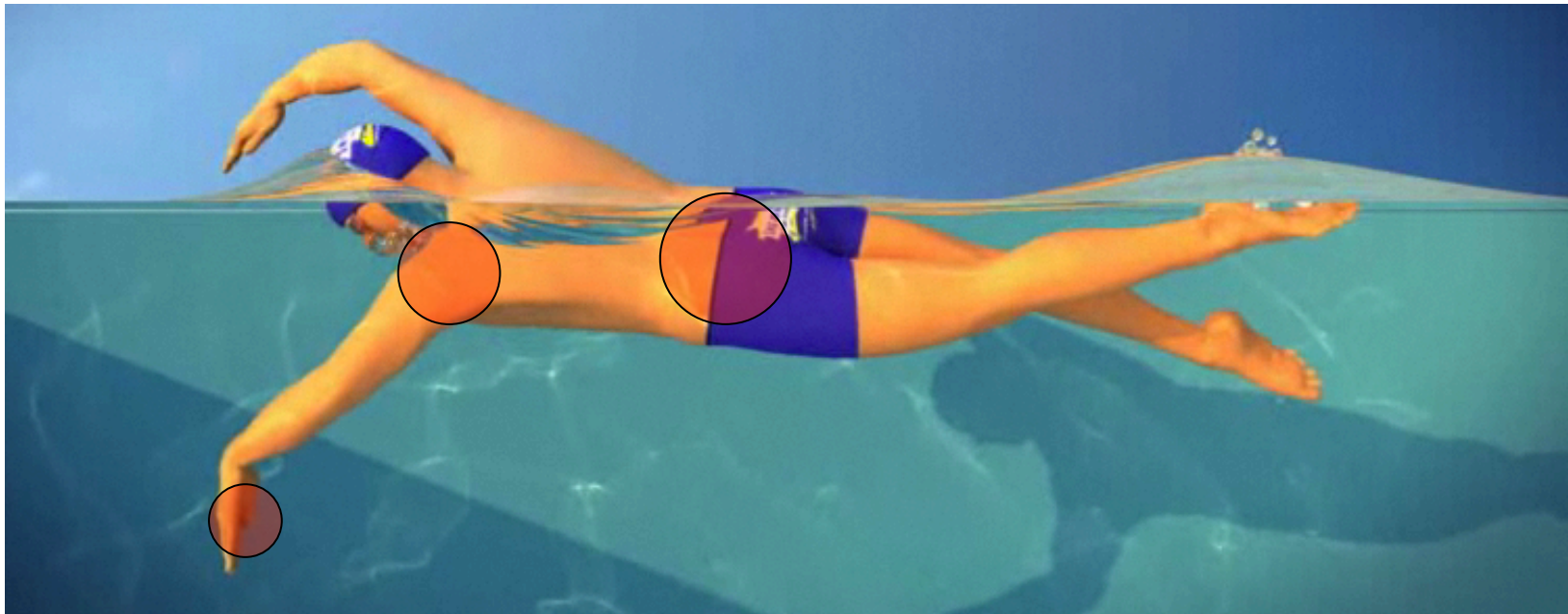
Figure 3. Side view of the hand trajectory during the pull. The angle of attack is continuously adapted to direct the propulsive force F_p forward.

SWIMMERS USE LEVERS

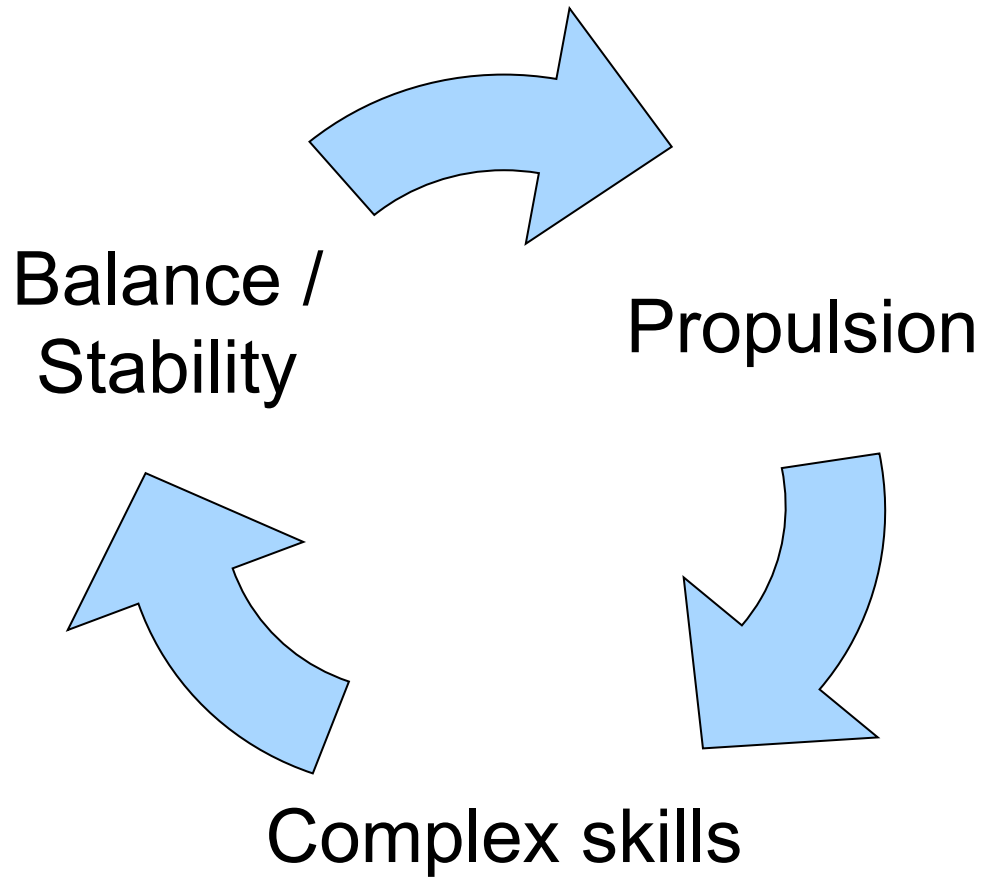
Where the fulcrum is located depends on two things;

1. Frame of reference (hand, shoulder, hips or ground)
2. Swimming technique and style

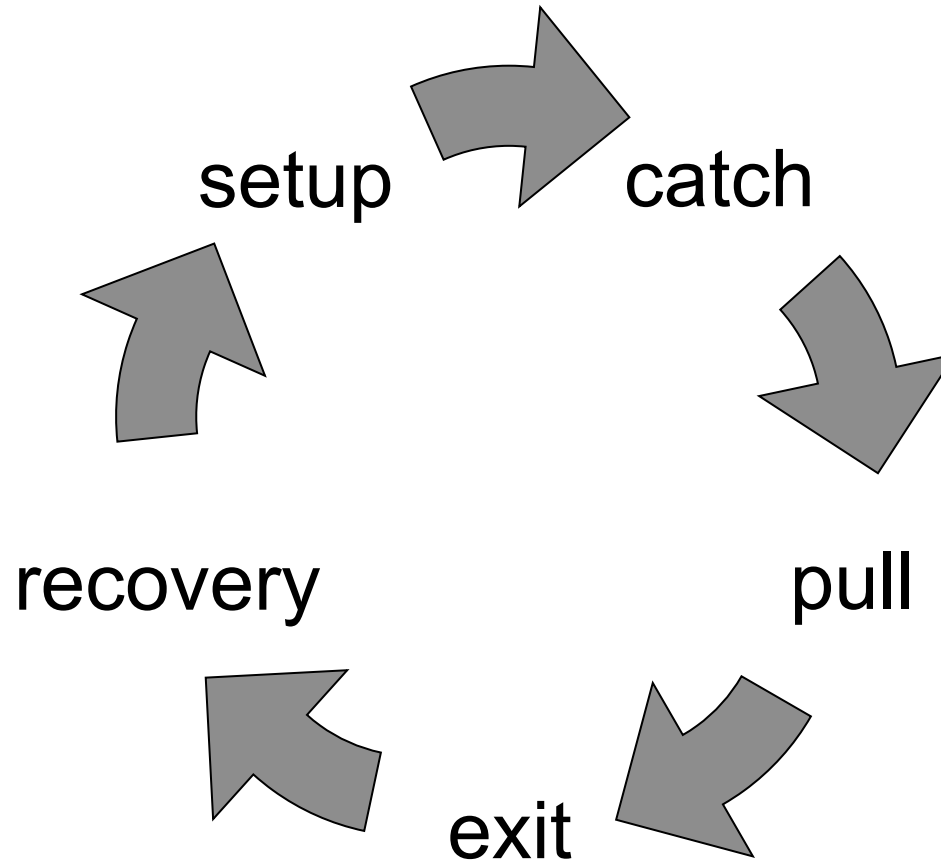
ONCE MORE...



THREE KEY ELEMENTS



FIVE PHASES OF THE STROKE



TECHNIQUE

The common elements of every stroke

- Recovery
- Set-up / Entry
- Catch
- Pull
- Exit

FIRST...

CAUSE & EFFECT

The five phases of the stroke have direct impact on the three key elements

You must learn to identify errors in each key element and find a solution in the phases

CAUSE & EFFECT

Exit affects recovery

Setup affects entry

Entry affects catch

Catch affects pull

Pull affects exit

Left side affects right | Right side affects left

STYLE

Individual, team, coach, club, country, time-

- all contribute to the interpretation of the biomechanics of swimming technique