The following "Stroke Concepts"(Freestyle;Breaststroke;Butterfly; and Backstroke, are abbreviated and mostly taken from articles by Professor Boomer, University of Rochester, who is a biomechanics specialist.

Freestyle (Basic body positioning)

A study published in the *Journal of Swimming Research,* concluded with the following statement:

The production of force is important; however, resistance increases at a much greater rate than changes in speed due to propulsive forces. Thus, it is advocated that swimming actions first should be orientated to minimizing resistance, and second, to developing propulsion, as long as positions for minimal resistance are maintained.

It seems essential that the swimmer must understand the various forms of resistance when practising the physical mechanics of the stroke. It must be borne in mind that resistance in water increases as the square of the velocity; and when swimming movements are exaggerated up, down or laterally it will compound the resistance dramatically and cube the energy expenditure.

In every swimming movement you have to consider body position and balance, resistance and propulsion. When a swimmer creates waves or wakes, the energy of both originate with the swimmer and this is often wasted energy and increased resistance.

Balance and Technique

If a swimmer takes a full breath and lies still in the water, arms at sides, the lower body will sink to from 15 to 90 degrees, depending on body composition and whether female or male.

By placing the arms forward, the balance is changed and the centre of mass moves towards the centre of air, the chest/lung area.

Strokes should be designed to effectively control the position of the centre of mass, positioning it as close as possible to the centre of air. In this position the body is much more stable and energy can now be used for forward motion and not balanced by kicking or pulling. Although we are talking about freestyle; balance and form/streamlining apply in all strokes.

Having the arms 'out front' in freestyle can be explained by the following: View a freestyler from the side; draw a circle, the centre of which is at the shoulder. Break the circle into four quadrants, with the water surface as the dividing line between the top two and the bottom two. To establish the best profile, both arms should be in the lower front quadrant in each stroke cycle.

Think of the movement of pulling as being done by the action of the twisting hip and body core on the arm, which is anchoring the weight of the pull. The resultant movement will turn the body on to the side for a streamlined position and a more effective pull and push back, allowing the body to slide on the other side for maximum speed and distance. (see "Twist and Slide") continued:

Remember:

- The body spends as much time as possible on its side (45 degrees) because that is where the resistance is least and the anatomical position aids the pull.

- Your head must remain on the end of your spine! Prof Boomer's advice in all strokes except backstroke, which means that you don't lift your head but keep it in line with your spine.
- Your kick must be used for whatever propulsion you need or can get, and not for correcting bad balance or stroke faults.

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