

## **Involvement of Mechanical Principles & Forces in Swimming**

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### **Abstract**

Through this paper the researcher highlighted her rich experience as a swimmer while swimming different kind of water bodies whether rough seas, wild oceans, calm lake or the swimming pools. More & more she swam, more and more questions came to her mind, how and why of various stroke in different water bodies, impacts her movement in water and why every time it's a different experience with different water body. These questions forced her to reach a conclusion, its somewhere to do with mechanics and mechanical principles application and if we are able to understand right then it would help swimmers swim better through different water bodies.

It's not just what to do and why to do it in a certain way but it's important to know what not to do and why certain mechanical defects can be avoided to achieve economy in movement. Swimmers can take advantage and swim better.

At any given time a swimmer's forward speed is the result of two forces. One force is tending to hold him/ her back. This is resistance or drag, caused by the water where a swimmer has to push out of his way or pull along with it. The force which pushes the swimmer forward is called propulsion and it's created by his/ her leg and arms.

Through this paper the presenter highlights the importance of mechanics, mechanical principles of resistance & propulsion in swimming.

**KEYWORDS:** Swimming, Mechanics, Mechanical Principles, Resistance & Propulsion

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### **Introduction**

Ancient times swimming was a necessity & was considered as a life skill. Over several years swimming has transformed from art to science. This transformation has happened over the years with the help of research, sciences, advancement & technology and its application. The improvement in swimming is not ultimate refinement but it's an ongoing process.

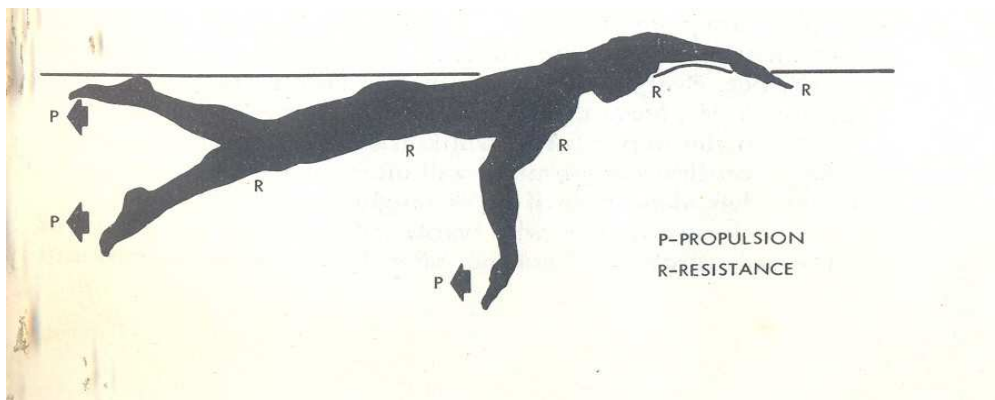
It's important to understand what impacts the movement in water and why every time it's a different experience with different water body. These questions forced us to reach a conclusion, its somewhere to do with mechanics and mechanical principles application. If we understood right then it would help us swim better through different water bodies & economy of movement will be achieved.

Knowledge of the mechanics involved in swimming strokes is based on certain mechanical principles which apply directly to swimming. Mostly the incorrect idea

concerning strokes mechanics result either from misunderstanding and improper application of these principles. One would say it's a complete disregard or lack of knowledge.

- It's not just what to do and why to do it in a certain way but it's important to know what not to do and why certain mechanical defects can be avoided.
- At any given time a swimmer's forward speed is the result of two forces.
  - **One force is tending to hold him/ her back.** This is resistance or drag, caused by the water where a swimmer has to push out of his way or pull along with it.
  - **The force which pushes the swimmer forward** is called propulsion and it's created by his/ her leg and arms.

## Propulsion & Resistance



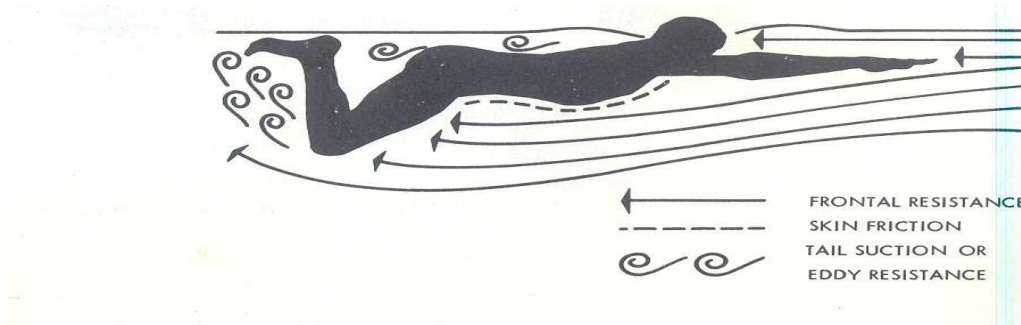
**A swimmer, in order to swim faster, must do one of the following:**

- 1- Decrease Resistance
- 2- Increase Propulsion
- 3- Use the combination of these two

**The study of fluid mechanics is complex and involves many concepts. We are primarily talking about resistance & propulsion.**

There are three types of water resistances:

- 1- Frontal or Head- on resistance.
- 2- Skin Friction
- 3- Tail Suction

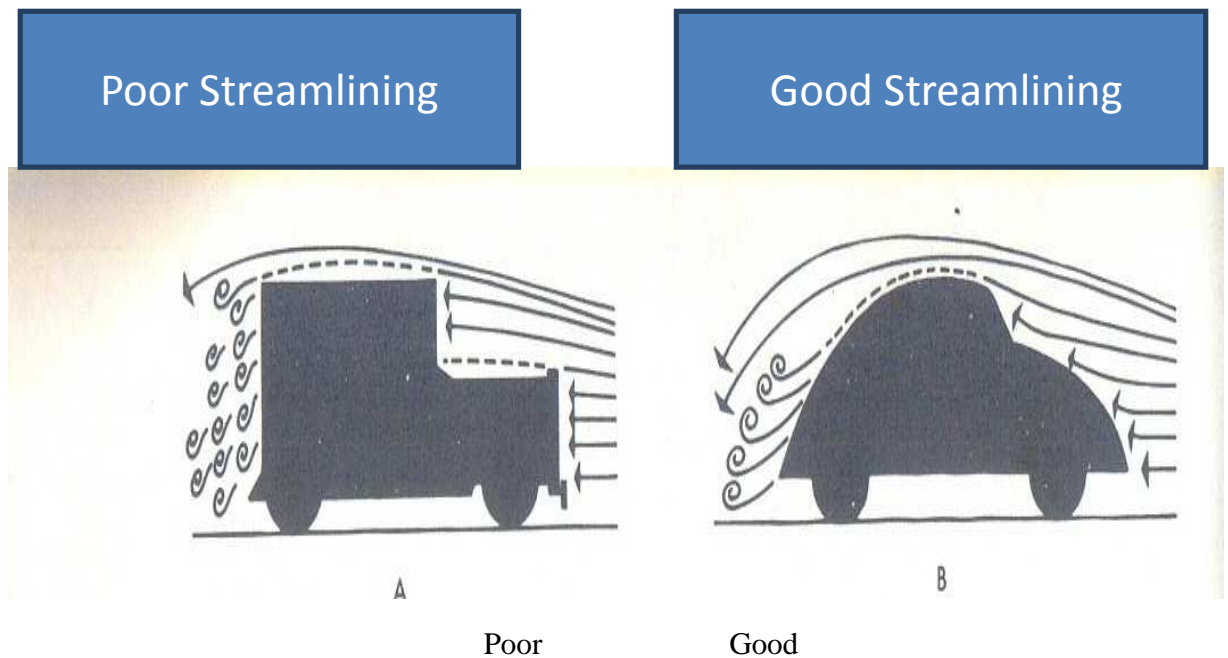


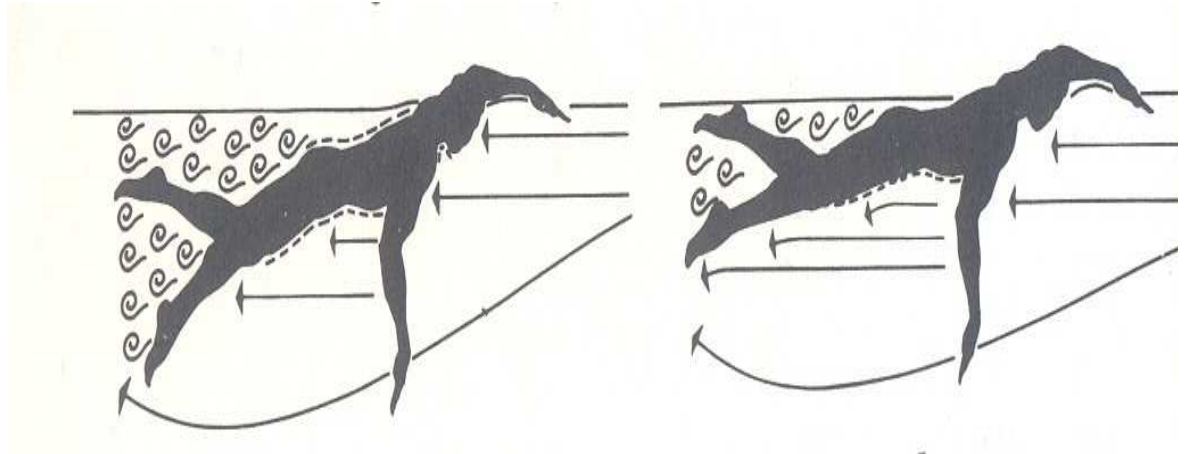
**Frontal resistance** is the resistance to forward progress that is created by the water immediately in front of the swimmer or any part of his body.

**Skin Friction**, caused by the resistance of the water immediately next to the body.

**The tail resistance** is caused by the water that is not able to fill in behind the poorly streamlined parts of the body, so that the body must pull along a certain number of water molecules.

In swimming traditionally the old school of thought has always advocated the streamline line position while swimming. To understand the advantage of streamline position study the figure below:





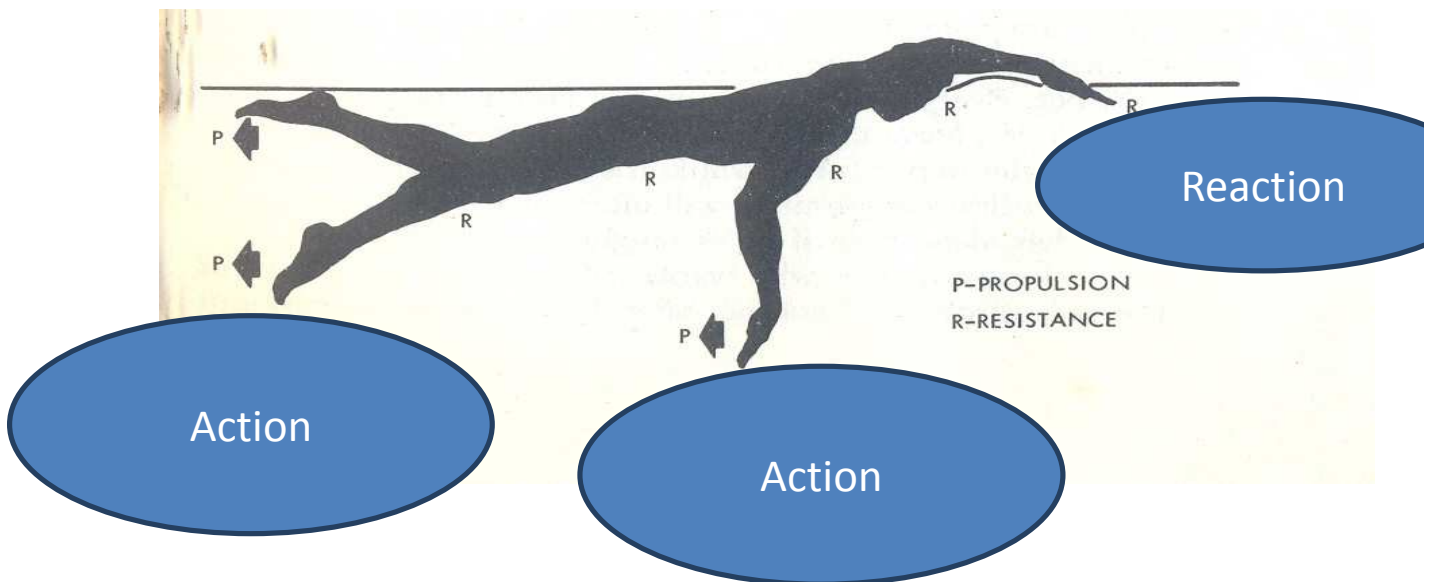
Streamlining

### Propulsion

Propulsion is the force that drives the swimmer forward and is created by the swimmer's arm and sometimes by his/ her leg. It is caused by the resistance of hands & feet as they push the water backward.

A principle that will be considered frequently in the mechanics of all the swimming strokes is the Newton's third law of motion, action & reaction law.

Every action has an equal and opposite reaction.



## Conclusion

Deep involvement of mechanical principles in swimming cannot be ruled out and both are co-related to each other. Knowledge of the mechanics involved in swimming strokes must be based on certain mechanical principles which apply directly to swimming.

The knowledge of mechanical principles & different forces acting on swimmers, we get to know what not to do and how certain mechanical defects can be avoided and maximum advantage can be taken.

It is advised to all swimmers & coaches to have knowledge of mechanics and mechanical principles so they know how to reduce resistance and how to achieve maximum propulsion.

Whatever swimming stroke one may choose to swim one cannot rule involvement of mechanics and mechanical principles is there and will always remain there. Only those will swim better & faster who take advantage of this knowledge.

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