

Physics Reveals KEY to a Great Golf Swing

click

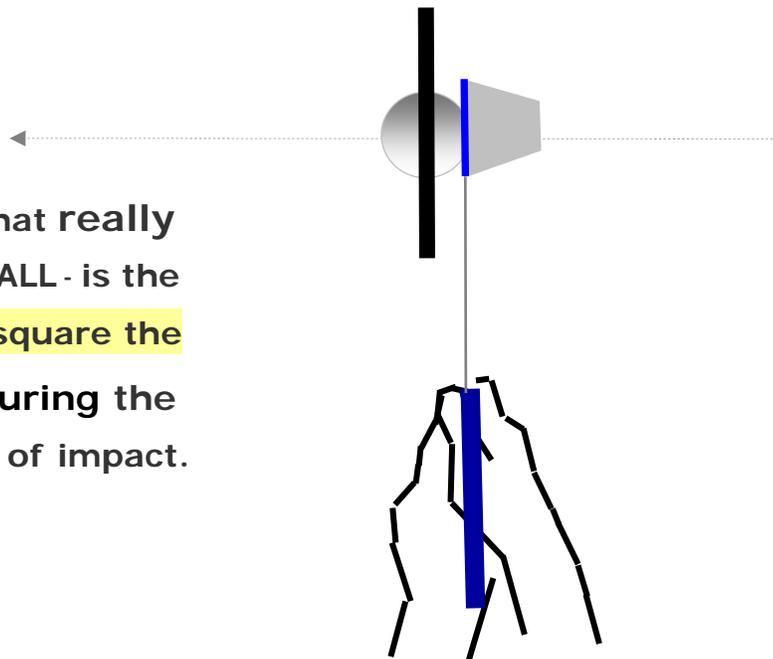
TIGER
Golf Swing
FRAME BY FRAME

click

PUJOS
Baseball Swing
FRAME BY FRAME

What happens when golf-loving researcher injures shoulder and can't play for three months? Rod White, a (measurement scientist) used this spare time off the course to undertake an analysis that revealed the foundation of an effective golf swing. As it turns out *it's all in the wrists.*

The only thing that really matters to the BALL - is the speed and **how square the Club Face is** during the precise moment of impact.



Physicists + engineers have studied the mechanics and physics of how **long does the golf club stay in contact with the golf ball at the moment of impact.** Almost all you need to know about their studies can be found in the following facts they observed: The face of golf club and golf ball are in contact for about

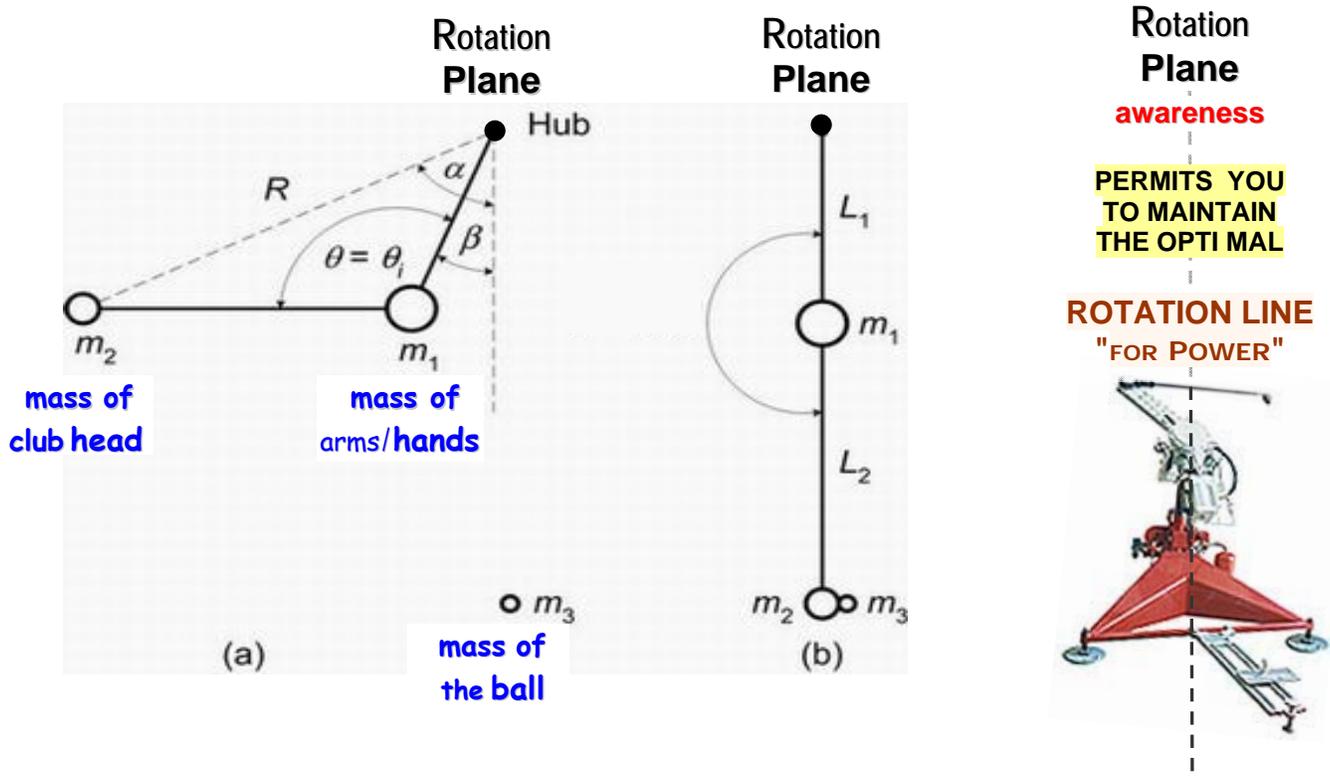
450 millionths of a second

$450 / 1,000,000 = 0.00045$

This short instantaneous contact also means that golfers who think they can shape their shots by twisting their wrists as they hit the ball, or any other "**tips**" that are a common staple in most golf magazines are **misguided in their hopes.**

Physics Reveals the Key to a Great Golf Swing

Rod White, technology company Industrial Research Ltd. in Lower Hutt, New Zealand, discovered that a **double pendulum model represents the swing reduced to its simplest elements** and best explains how to make a swing more efficient. The **double pendulum model** consists of one pendulum **tacked** onto the end of a second pendulum, where the **upper pendulum swings** the **lower pendulum** from a fixed pivot point. This simple double-pendulum model of the golf swing, shows key angles, lengths, and masses. For instance, m_1 =mass of arms/hands, m_2 =mass of club head, and m_3 =mass of ball. L_1 is the length of the arms/hands, and L_2 is the length of the golf club shaft. In addition, the double-pendulum model **reveals two critical points in the golf swing: (a) the moment** before the club head is released at top of golf swing, **(b) the moment** before the club head strikes the ball.



In golf, the equivalent components of upper pendulum is our **hands**, with our **arms** and **shoulders** acting as a fixed pivot and **Hub**. The equivalent components of lower pendulum is the **golf club** (club shaft and club head). Hence, **hands** (our upper pendulum) **swings golf club** (the lower pendulum).

"It is physically impossible, while in the process of swinging, to consciously think of the many details of the swing. You should think only of **sensing the feel** of what you are doing with the club head through the action of your **hands**."

SWING THE CLUBHEAD 1952 - Ernest Jones

Physics Reveals the Key to a Great Golf Swing

White's analysis is the *first* to consider **wrist-cock angle**. His model is also very simple in a Physics 101 kind of way, explaining the mechanics of the golf swing in terms of the club's changing moment of inertia. These two points distinguish his work from similar analyses by C.B. Daish, and late University of Nebraska physicist Theodore Jorgensen.

White shows the energy and momentum of the **hands-club system** are redistributed during the swing. As a direct result of the **uncocking** of **hands-wrists** that takes place before the club strikes the ball. As the **hands-wrists uncock** near the bottom of the swing, the **club-head** and **hands-wrists** are moving in different directions, which means the club pulls against the hands and slows them down.

The kinetic energy stored in our shoulders, arms, and **hands-wrists** is then transferred to the **club-head**. However, without proper **uncocking action**, most of this kinetic energy stays in our arms and shoulders, and the golf swing is inefficient. There are **two key points** in the swing where the **hands-wrists hinging action** is most critical: (1) at the top of the golf swing when the golfer is holding the club at a fixed wrist-cock angle and ready to release the swing; and (2) the instant before the **club-head** strikes the ball -when the golfer's **hands-wrists** and **golf-club** are lined up vertically.

Byron Nelson said that to get back to that **shaft-plane line at impact** he never put anything in his right pocket. He did not want anything interfering with his right arm through the hitting area. **"Great players return the club at impact to its original shaft-plane line set at address.** It makes you stay in your original spine angle through the strike **and not open your chest and hips** too fast, *and helps you focus on something specific in your forward swing.*" - **Byron Nelson**

The full range of motion of double pendulum model is described by two complicated equations. In fact, **White** says, they are too complicated to be of much help in a study of the golf swing. They obscure the basic mechanism by which the golf swing derives its efficiency. He simplifies the equations by removing the components that account for radial motion – motion away from the shoulders. By using these two snapshots, **White** breaks down the golf swing into a much more basic and manageable system.

There are several factors influencing the efficiency of a golf swing: the length of the club, the length of the player's arms, the mass of the club head, the **hands-wrists cock angle** - how far backward the wrists are bent during the swing, and finally whether the wrists actively twist during the swing, resulting in too much wrist torque.

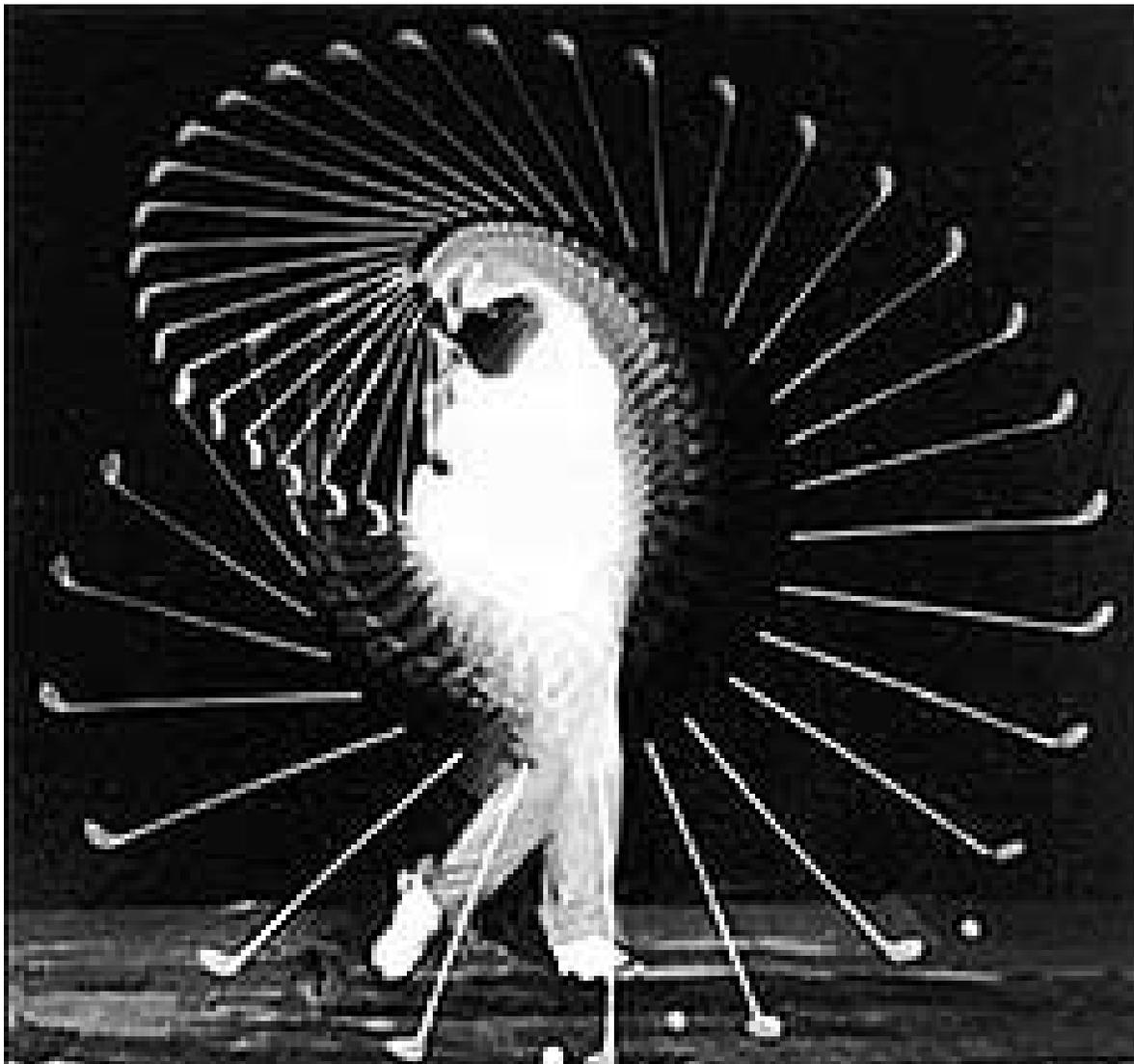
This model explains the extraordinary effectiveness of **hands-wrists hinging action** in gaining distance without having to do additional work. It also explains why a loss of distance occurs with the application of too much wrist twisting. These concepts are often counter-intuitive to most golfers. However, when the golfer directs his **primary motor feeling sensations** to his **hands-wrists hinging action**, he then becomes focused on the **primary make-or-break** factor in a good golf swing. Best of all, the golfer does not have to do any extra work to make this transfer of energy happen.

*"The biggest change to come in GOLF will be in the **mind**. I have not heard anything new about the golf swing - since I have been a pro. Golf courses are 50% better, equipment has improved beyond recognition, and physical fitness is way up. But we are really in our infancy in the mind. That is where golf will really take off. That is the next frontier"*

The Tutelman Site Other confirming research on **Applying Physics to Golf**

Most of the power in a golf swing comes from centrifugal force, generated by the muscles that rotate the body through the swing. So we need centrifugal force because:

- We know the bulk of the power comes from body rotation.
- We know that body rotation without wrist-uncock velocity gives a third less clubhead speed.
- In order for body rotation to generate wrist-uncock velocity, we need centrifugal force -- because the small muscles in the hands and forearms can't generate that much power.



Golf Questions Answered by a Physicist

[The Accelerating Golf Swing](#)