



A SCIENTIFIC APPROACH

Visit any driving range and watch the wide variety of swings on view and it is easy to see that each player has his or her own unique movement. Size, weight, strength, flexibility, past or present injuries, all contribute to the way in which an individual uses their body to produce a movement which is designed to swing the golf club at speed in order to transfer energy into a stationary object, namely the golf ball, and propel it in the desired direction.

Technique therefore can never be standardized with models only being seen as a desirable pattern which, may or may not, be suitable to a player. In my role as a coach I have seen literally thousands of different movements, each with idiosyncrasies, some of which make the swing work well and others which inhibit the player. In all cases the principles which I am about to define and explain are laws that affect the human body and the manner in which the club returns to meet the ball.

FORCE

“An influence tending to change the motion of a body or to produce motion or stress in a stationary body”.

(Oxford English Dictionary 10th edition Oxford University Press 2002)

There are different types of force that are inherent to the process of striking a golf ball and causing it to fly. There is a Force, which is produced by a player's muscles in order to generate and then deliver speed into the movement of the club.

It is common that in certain cases physically strong individuals may not hit the ball as far as some physically weaker players. The reason why this situation exists is that physical strength in isolation has little to do with the Force that can be generated and delivered to the club by any individual. The formula for Force is as follows:

Force = Mass x Acceleration



Imagine that we went to the World's Strongest Man contest and viewed all eight competitors, clearly all these men would be physically very strong, but could they all hit the golf ball great distances? Certainly they would be able to move the club mass easily but the acceleration generated through the muscles may be slow, where as a physically weaker person may not be able to move the mass as easily but may gain as a result of faster acceleration. The ideal situation is when a physically strong individual is able to generate and deliver fast acceleration.

There is a Force that is applied to the ball from a moving club. When a Force is applied to an object it will either:

- Change the speed of the object
- Change the direction of movement of an object
- Change the size or shape of an object

So when the club head is swinging and makes contact with the ball, assuming that a suitable angle of attack is applied, the ball will change shape, accelerate from the ground or tee and initially take on the same direction that the club head was traveling on at the point of impact.

There is a Force that causes the ball to reduce its speed and drop from its flight.

There is little within the limits of the rules of Golf that one can do about the effect of gravity on the golf ball. The effect of altitude however may have a minor effect on "hang time", with the ball having the potential to remain in the air longer at higher altitudes as a result less air resistance. In order to maintain a stationary position there must be a balance of Forces, take the example of the Force of Gravity, this pulls downwards which causes a reaction Force which, is that of the surface pushing back up while any horizontal Forces present must be opposite and equal. Whenever pulling, pushing, lifting, bending, twisting, stretching or squeezing a Force is being exerted.



POWER IN THE GOLF SWING

Some Players have lots of available power while others seem to struggle to hit the ball from even the shortest rough. Some physical factors that will help you to understand the real meaning of power follow along with an overview of the importance of maintaining an efficient centre of gravity

Power is described by Paul Chek¹ as, “A term that is used to describe force with respect to time.” This is not strictly true but perhaps is a way in which the layman can understand the concept of power. It may be thought of as the rate of doing work that is measured in either Watts or Horse Power. Chek also states, “To apply the principle of power to golf, consider how fast the club head is moving at impact, the faster that the club head is moving, then the more powerful the golfer.¹”

Power is not the same thing as Force, for example a powerful machine is not necessarily a machine that can exert or apply a strong Force, it can however transfer a lot of Force or Energy in a short space of time. We often hear sports commentators say that so and so has “explosive power”, sprinters need it, gymnasts need and so to do golfers. Imagine that we had identical twins with identical swings, (not too likely but we are using our imagination aren't we?) Now assume that we stop them both at the top of the swing, they have exactly the same distance to cover in order to strike the ball and they are swinging the same club in terms of design, weight, length and flex, then the amount of work to be done is the same. If one of the twins were to return the club to the ball earlier than the other then there would be a difference in Power.

So the formula for Power is:

In order to find the amount of “work done”, we must use the following formula:

$$\text{Power} = \frac{\text{Work done (joules)}}{\text{Time taken (seconds)}}$$

$$\text{Work done} = \text{Force} \times \text{Distance moved}$$



CENTRE OF GRAVITY

Centre of Gravity can also be called Centre of Mass, “If a Force pushes from behind a mass and is not directed exactly through the centre of Mass, then the Mass must rotate”². It is therefore vital that the Mass is pulled as the laws of physics dictate that when a “Mass is pulled it must align with and follow the force”, therefore a club is more stable during the swing when it is being pulled. Dave Peltz states that “as the golfer pulls the mass down towards the ball, they create a stable swing. The heavy club head follows the lightweight shaft in the direction of the golfer’s hands. If the golfer continues to Accelerate and consistently pulls the club head through impact, the club will continue to travel on a stable path”.⁵

During a swing the ability to maintain Centre of Gravity line over the player’s base of support is vital to the success a player will have in maintaining their optimal swing path and axis.³ The centre of gravity is the point through which the whole weight of an object seems to act. It was very common to hear the old Professionals state that good players were less than six feet tall, of course as the years have passed most players are now at least six feet tall with some as much as six feet and six inches tall! With the extra height that these players have, some huge advantages in terms of width of arc and angle of attack are found, but unfortunately they also have to work hard to maintain their balance due to their natural centre of gravity being positioned higher from the ground.



SPIN & SWERVE

When the ball takes off back spin is imparted and as the ball swerves through the air landing close to the hole we feel a sense of satisfaction of a well played shot.

Spin, "To move or cause to move through the air with a revolving motion"¹

Swerve, "Abruptly diverge or cause to diverge from a straight cause, a tendency to swerve imparted to the ball"¹

All shots that leave the ground have a degree of back spin imparted to the ball, the effect of striking the ball with a club causes the ball to compress for a short period of time, before the ball can regain its shape it climbs up the face of the club and back spin / lift is the result. The rules of golf clearly specify those clubs that conform to the limits imposed by the ruling body. During the last twenty years there have been two issues in particular that have caused disagreement between the R&A and the USGA, the first was the effect of grooves, the so called "square grooves controversy", and also that of the trampoline like effect of some new Driver faces. Both of these two issues have an effect on the amount of time that the ball is in contact with the club face.

The reaction of the ball during flight is produced by three main factors at impact.

- The position of club face at impact.
- The swing path of the club immediately prior to impact.
- The angle of attack at impact.

There are other factors which affect the golf ball's flight such as quality of contact, grass, dirt or water getting between the ball and the club. External factors such as wind, rain, type of grass and ball also have an effect on how the ball flies / swerves through the air. Even so the three points mentioned earlier can all be controlled by the player.



All shots have the club traveling through the impact zone, and most shots have an intended final target and almost all successful shots traveling for some time in the air: even some putts leave the ground for a short period. Secondly each factor will have an effect on the others. The position of the club face at impact will affect the way in which the ball moves during its flight, and in extreme cases may affect the initial flight path.

The path on which the club is swinging at impact has a major effect on the initial direction in which the ball takes off. The trajectory of the shot is affected by the swings angle of attack combined with the quality of contact made. A ball that moves to the right in the air has a clockwise rotation / spin imparted and a ball that moves to the left in the air has anti clockwise rotation / spin imparted. All shots are affected by draft and lift throughout the ball flight.

To conclude this section, an understanding of the previously mentioned bio-mechanical concepts are important if you wish to maximize your swing. Technique is simply one of several components that go into the makeup any given golfer. A technically perfect swing is of course desirable however any existing or past injuries will contribute to the way in which an individual moves their body in order to be able to swing the club. When we make a golf swing, a motor program is fired from the brain that instructs the muscles as to how to swing the club; for the most part the body will then attempt to produce a movement that is consistent with the laws of physics and the wants of the player.

Article written by Tony Bennett

Tel (351) 93 2524253

Email tony@bmycoach.org