Finding the optimal trajectory for your driver

One of the more discussed topics involving Clubfitting is about what launch angle is best for any given golfer. With the increased awareness in golf periodicals and television coverage, plus the recent advent and access to affordable, portable launch monitors, launch angle is getting much deserved press. If you are serious about your game (and without any alterations to your swing) changes to your equipment can add distance off of the tee.

One of the keys to added distance is finding the proper launch angle or the trajectory the ball comes off the club face relative to the ground line. To provide an understanding, let us first look at a simple example. Whether it is a kid playing with a hose, a pirate who had a cannon or an AIS shot putter, they are all looking at the proper launch angle to send the projectile the furthest.

We learned in school that the proper angle to maximize carry is when the projectile is sent off at a 45º angle (regardless of initial velocity) to account for gravity. The reason that this is a simple example is because there are no outside forces that factor into the equation.

The launch angle of a golf club is much more complex as you have the added component of the golf ball and the lift that is created by the initial ball velocity and dimple pattern of the golf ball. Because of the lift created by the golf ball, the initial ball velocity should be much lower than 45º. To provide an example, the touring professionals are normally looking to launch the ball between 11-14º, while golfers with much reduced swing speed should launch the ball possibly much higher. (Note: The loft of a golf club does not denote the launch angle the ball will come off the face).

In order to find out exactly what angle you are currently at, you need to get measured by a launch monitor, which is a sophisticated device that measures the initial flight conditions of a golf ball. The three most important measurements obtained by the launch monitor are ball

speed, launch angle and spin rate. The launch monitor will also have an algorithm to input these variables to compute approximately how far and in what direction the ball will go. As technology has improved, launch monitors are becoming more affordable and can be found in select local retailers and clubmaking shops.

There are several factors that control launch angle:

- Tee Height / Impact position on the face
- Human Factor: The ability of golfer to swing the club efficiently
- Loft
- Center of gravity
- Golf ball
- Shaft

The first factor is often overlooked but may have the biggest influence that can make big changes to trajectory. If you don't agree, trying hitting a golf ball with you driver off of the ground or try to hit a ball standing on a 6" tee. As drivers have become much larger in volume, tee heights should increase proportionally to allow for the proper position to hit the ball on the face (typically in the geographic center of the face or just slightly higher).

Hitting low on the face (in the case with the ball teed too low) or whether the ball is hit ½" out on the toe, three-quarters of an inch in the heel or on the crown of the club, all influence initial ball velocity, direction and trajectory. An impact label can be placed on the face to help you determine the proper tee height for your current driver.

The Human Factor or the ability of the golfer to hit the ball efficiently is also extremely important. This includes ball position and stance. Wielding a club that is too long, too short, too heavy or too light affects one's ability to return the head to square. If a golfer has a hard time repeating their swing and making any solid contact with the ball, then a launch monitor and any results from the data will be worthless.

The position the ball is teed from, either back or forward in their stance will have a dramatic influence on angle of attack and ultimately effective loft at impact and spin rates. Long driver competitors spend much time honing their swing, even with extremely low lofted drivers (as low as 4º) by teeing the ball very high and positioning the ball well in front of their front foot. By swinging upward toward the ball, this creates a high launch angle and the low loft reduces the ball's spin rate. However, most golfers will struggle hitting the ball solidly and in the right direction by putting the ball in this location. This may require experimenting with ball position yourself or seeking the assistance of a local PGA instructor.

If you want to increase your distance (plus probably greater accuracy), then you very well may want to try a higher lofted driver. Consider this, even on the PGA Tour, the average driver loft is somewhere between 9 and 9.5º. A lot of amateurs can learn a good lesson from this as these are the most skilled golfers in the world and they found that by adding nearly 1.5º to their drivers since 2000, that they can hit the ball further, and in some cases, much farther. Remember too, increase loft creates more backspin and negates some side-to-side motion the ball will go on miss-hit shots resulting into straighter shots.

Part of the reason for switching to a higher lofted driver is the change of the modern-day golf ball as it has forced club designers and clubfitters to change as well. The golf ball today has a solid-core with a softer compression that comes off the face of a driver with reduced spin.

Leave your ego at home and look at how far you hit your 3-wood off of the tee. If you hit it about the same distance as your driver that might give a general idea to the fact that a little extra loft may be helpful. Of course, too much loft could be just as detrimental as too little. With additional loft comes additional backspin. This creates too much energy that goes into the vertical component of velocity coming off of the face which could rob one of distance. So there is a narrow window as to what loft would maximize the launch condition for each golfer.

The center of gravity of the club also is a component of trajectory. We can understand as the center of gravity becomes lower in the club that the ball flight will increase. This is to allow the golfer now to hit the ball at or above the center of gravity of the clubhead. In addition, the further back the center of gravity can lie within the head, this too help increase the launch angle. By moving the weight further back also causes the ball to come off the face with reduced spin. Most designers try to move as much weight low and rearward as possible in their modern driver designs. This is the reason you see carbon crowns, or screws located in the rear of the head, or internal weighting positioned strategically within the head.

The golf ball is another component to trajectory and overall distance. If you don't agree, pick a brand new ball verses a range ball or one you dug out of your shag bag. This in itself can be a whole new article just devoted to the golf ball. This is one reason why operators of launch monitors might charge simply for a ball fitting. Just because a golf ball works better with your driver, doesn't necessarily it will be best for your scoring irons as far as obtaining the correct amount of distance, trajectory and spin. You may have to experiment a little with a sleeve or two of balls to find out. Most golfers already do this by purchasing a new model of ball or trying one they found out on the golf course. Remember, it is less expensive to change brands of balls than it is to change your driver.

Shafts also have an impact on trajectory and spin rates as well. The overall stiffness of the shaft (both longitudinal and torsion) affects the golfer's ability to square the ball at impact. Shafts that are too stiff or too flexible for the golfer's natural rhythm and timing will change the face angle and dynamic loft at impact. This falls under "Human Factor: the ability of golfer to swing the club efficiently". It is important first to fit the golfer to hit the ball relatively straight and solid, then fine tune the trajectory and spin rate to maximize performance.

It has been well documented that not all R-flex shafts are created alike. Shafts of the same weight and frequency could produce small differences in trajectory and spin rates. The bend profile (or stiffness distribution of the shaft) can alter ball flight. In general, a shaft possessing a stiffer tip will propel the ball at a lower launch angle (assuming it doesn't leave the face open at impact and have the opposite effect). Also, in general, a lower torque shaft will generally hit the ball with lower spin rate.

Composite (graphite) shafts allow the designer to independently change the tip stiffness from the torque more so than steel manufacturers are able with the geometry of the shaft. The shaft parameter combination that will produce the lowest launch and lowest spin rate would one that is very tip stiff and low in torque. This combination is usually much more expensive to manufacture and geared more toward those who have higher clubhead speeds and subsequently a greater ability to launch the ball higher. In contrast, slower swinging golfers would normally benefit from soft tip and higher torque shaft to help maximize launch angle and increased spin rate for greater distance. The cost to manufacture these types of shafts are usually the least expensive to make.

This leaves two other combinations; shafts with a softer tip / lower torque **or** stiffer tip / higher torque. Assuming the same weight and length installed in the same head, might create very similar launch conditions and flight pattern and might simply come down to where the golfer preferred the more one-piece feel of the stiffer tip / higher torque shaft over the livelier feel of the softer tipped shaft.

It might be very possible to match let's say match a 10º driver with a softer tip / higher torque shaft to increase the launch angle to the same as maybe that same head in a 12º version with a stiffer tip / lower torque shaft and achieve the same launch angle. However, it is important to remember that the higher loft will increase the back spin slightly.

For those who don’t have access to a launch monitor, try writing a log of what components have worked well in the past and those that have not. This includes any heads (loft, size, etc.), shafts (flex, torque, weight and bend profile), club length and golf balls. Once you have identified these parameters, it will be easier to select other components with similar qualities. There are endless possibilities to the combination of heads, shafts and balls that can help you increase distance from the tee and will be different for each and every golfer because of the uniqueness of the swing.