Understanding your TrackMan™ Analysis data
nonstopGOLF – Bill Dreger, CPGA Professional

The ultimate objective of golf is to make the ball behave the way we want it to. Changes to ball behaviour can be effected in two ways: the golfer can adjust his/her swing (skill development); or the golfer can adjust his/her equipment (club fitting). While an overall improvement strategy often incorporates both, swing analysis focuses primarily on identifying opportunities for skill development while considering club fitting principles in a general sense.

TrackMan data can be split broadly into two categories: Club Delivery and Ball Behaviour. Club delivery data forms the main area of focus for swing analysis. Ultimately, physical change to these data is the responsibility of the golfer. Equipment adjustments will have a relatively minor impact in these areas.

Club Delivery

1) **Club Speed:** The speed of the centre of the clubface at first contact with the ball. Club speed is the root source of distance; each MPH of club speed represents a potential 2.5 yards of carry distance. As a rule of thumb, club speed increases by about 2mph from one club to the next longer one.

<table>
<thead>
<tr>
<th>AVERAGE CLUB SPEEDS</th>
<th>Driver</th>
<th>6 iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGA TOUR</td>
<td>112mph</td>
<td>92mph</td>
</tr>
<tr>
<td>LPGA TOUR</td>
<td>94mph</td>
<td>78mph</td>
</tr>
</tbody>
</table>

How can you increase your club speed? Faster club speeds are a product of a well-timed weight transfer, arm swing and body rotation. A solid foundation with good posture and *dynamic* balance is essential; adding speed at the expense of these is never effective in the long run. Keep in mind, balance is an *activity*, not a position.

What about a longer driver shaft? Yes, all else being equal, a longer shaft will create a higher club speed. However, centered contact is an important key to maximizing distance - and using a longer shaft often results in less centered contact. This affects accuracy and also results in lower ball speeds, which in turn equates to less distance. If increased distance *and* accuracy is the goal, most golfers would do well to focus on staying balanced throughout the swing and play with a driver length that helps them make consistent centered contact. That might mean using a driver that is *shorter* than many of the “standard” offerings on golf shop racks. Interestingly, a typical “stock” driver is 45 to 46 inches in length, while the PGA Tour average is about 44.5 inches.

2) ** Swing Direction:** The orientation of the clubface, in relation to the target line, at the lowest point of the swing. This differs from “club path” in that club path is measured at point of impact.

Swing direction has important implications when it comes to aiming and alignment. It might seem logical to think that a swing direction of 0° would represent an “ideal” goal. This is not necessarily the case; to begin to understand why, we must introduce two additional elements to the mix: **Swing Plane** and **Angle of Attack**.
Swing Plane and Angle of Attack are often mistakenly interpreted as being one and the same. They are not - and it’s important to understand the difference between the two.

3) **Swing Plane (SP):** The angle made between the ground and the plane of club head trajectory at the bottom of the swing arc, as viewed from a “down the line” perspective. Generally described as “flat” (lower values) or “steep” (higher values). Sometimes referred to as “Vertical Swing Plane (VSP).

4) **Angle of Attack (AoA):** AoA represents the vertical (up/down) angle at which the club head is moving at impact, as viewed from a “face-on” perspective.

“Aiming your swing”. If a golfer had a swing plane of 90*, the angle of attack would have no effect on his aim. However, a swing with a 90* SP is a virtual impossibility. A golf swing takes place on an inclined plane that ranges from about 45*(driver) to about 65* (short irons), depending on the club. Swing direction is essentially the measurement of the lowest point – the base - of that plane.

If the AoA is downward, impact will occur before the lowest point of the swing; in that case, the club's vertical movement on the inclined swing plane will be downward and outward at impact. The base of the swing plane (aim) must be adjusted to neutralize the “out in the down” (to the left for a right-handed golfer). If the AoA is upward, impact will occur after the low point - therefore the golfer’s aim must be adjusted to account for the “in in the up” (to the right for a right-handed golfer).

<table>
<thead>
<tr>
<th>AVG AoA</th>
<th>Driver</th>
<th>6 iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGA TOUR</td>
<td>-1.3*</td>
<td>-4.1*</td>
</tr>
<tr>
<td>LPGA TOUR</td>
<td>+3*</td>
<td>-2.3*</td>
</tr>
</tbody>
</table>

Based on a growing body of evidence, it is becoming clear that maximizing driver distance calls for a positive angle of attack. However, PGA Tour players, on average, are hitting their drivers with a slightly negative attack angle (-1.3*), while the LPGA Tour average is +3*. This may be because PGA professionals, given their ability to generate such high club speeds, can afford to trade some distance in exchange for accuracy and consistency. This may also represent a reluctance to change something that has obviously worked well over the years. However, a gradual shift is underway and more and more of the top pros are embracing this “new paradigm”.

As a rough guideline, the measured value for swing plane with irons should line up closely with the static lie angle of the club, to ensure that the club is soling properly at impact and not adversely affecting the starting direction of the shots. A typical 6-iron lie angle is in the range of 62*.

Values for driver swings tend to be somewhat flatter than the static lie angle of the club. PGA Tour averages are 45 to 48*. This is due to the driver's longer shaft and the more “sweeping” swing motion associated with the driver swing. Because a driver is a low-lofted club, lie angle does not have a significant effect on starting direction.
5) **Club Path:** The horizontal angle at which the club is moving at impact. A positive value means the club is moving to the right (inside to out for a right-handed golfer); negative means the club is moving to the left (outside to in for a right-handed golfer).

6) **Face Angle:** Face angle is the primary determinant of the ball’s initial launch direction, represented by the orientation of the clubface in relation to the target line. A face angle that points to the right of the target line at impact will return positive values; a face angle that points to the left of the target is indicated by negative values.

Club Path and Face Angle can be discussed in tandem, as they go hand-in-hand to determine the initial launch direction and curvature of shots. These values are measured in relation to the “target line”, which is represented by the imaginary straight line directly between the ball and the target. A good objective for practice is to strive for zero values in both of these parameters - in the presence of square (centered) contact, “zero-zero” equals a shot that flies straight, without curvature. As discussed above, it is important to understand aiming the swing direction to account for VSP and AoA, so that those straight shots will be directed at the target. This is a sensory skill area; voice-enabling TrackMan to provide instant feedback for these two parameters is a highly effective and intuitive “bottom-line” training strategy.

The angle of the club face is primarily responsible for the initial launch direction of a given shot while the relationship between face and path dictates a given shot’s curvature. **Given centered contact,** if the club face points to the right of the club path, the resulting shot will curve to the right. If the club face points to the left of the club path, the shot will curve leftward. The greater the difference between club face and club path, the more pronounced the curvature. Shot curvature is also affected by impact location; see Face to Path below.

7) **Face to Path:** The difference between the face angle and the club path measurements.

To interpret this data, we must also consider the ball’s **spin axis.** Spin axis is the measurement of the axial tilt applied to the ball that causes it to spin one direction or the other. A ball tilted to the right will spin to the right; a ball tilted to the left will spin to the left.

**So what causes “axial tilt”?** Axial tilt is the result of divergence between club face and club path; and/or non-centered impact on the club face. By examining the difference between club face and club path, we can derive an “expected” spin axis. For a 6 iron, the expected spin axis would be about twice the difference between face angle and club path. For a driver, it’s about four times the difference. So, using an example of a right-handed 6 iron shot with a face to path measurement of +6*, the expected spin axis would be about +12* - the shot would curve about 8 yards to the right per 100 yards of flight. (each degree of axis tilt equals .7% curvature at 100 yards)

**What if the expected spin axis differs from the actual measured spin axis?** In such cases, the answer lies in the impact location on the club face. Heel contact will increase rightward axis tilt or decrease leftward axis tilt. Toe contact will have the opposite effect. If the actual spin axis in the example above was, say, +6* - this would indicate contact toward the toe. The bottom line? Hitting the ball just 1cm off-center (that’s about the width of 3 dimples) is enough to impact spin axis by 6*.
8) Loft – Static Loft, Dynamic Loft and Spin Loft

Strictly speaking, only dynamic loft is a “club delivery” data parameter, but it is worth discussing all three as they are all, predictably, interconnected.

Static loft is simply the loft of the club as it was designed.

Dynamic loft is the loft that is actually delivered to the ball at impact. It is influenced by forward or backward shaft lean and the bending of the shaft that occurs through impact. When dynamic loft is greater than the static loft of the club, the cause can often be traced to the golfer “flipping” the club with their hands through the downswing and impact. The result is a backward-leaning shaft at impact, which increases dynamic loft, diminishes quality of contact and affects distance and accuracy of the shot. Generally speaking, stronger players hit their irons with some degree of forward shaft lean, which reduces dynamic loft. The result is a more stable, “penetrating” ball flight.

Spin loft incorporates angle of attack into the equation. Dynamic Loft – AoA = Spin Loft. Spin loft is not “spin”; nor is it loft – it is simply one of the components that determine the amount of back spin that is imparted to a given shot. Spin loft is relative to the club’s static loft; in that context, lower spin loft is better – it indicates “solid”, less oblique contact.

It has long been held that increasing the downward angle of attack will increase the backspin of a shot. However, this is not the case, as any change in AoA is accompanied, almost degree for degree, by a change in dynamic loft. The relationship between the two does not change; therefore, spin loft is not affected by changing the angle of attack.

It is impractical to strive for an upward AoA with irons, but with the driver, an upward AoA is desirable. What if we could increase the AoA without affecting the dynamic loft? Consider the following equations:

<table>
<thead>
<tr>
<th>Dynamic Loft</th>
<th>(−) Angle of Attack</th>
<th>(=) Spin Loft</th>
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<tbody>
<tr>
<td>12°</td>
<td>−3°</td>
<td>15°</td>
</tr>
<tr>
<td>12°</td>
<td>+3°</td>
<td>9°</td>
</tr>
</tbody>
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The shot in the second example will launch higher and spin less – resulting in stronger, more stable flight – and significantly more distance. So how can we physically accomplish this? The answer: upward angle of attack with forward shaft lean at impact. Ready to dig deeper? Contact me and let’s get started!

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TrackMan Analysis Sessions are available at the Riverside Golf Academy - “Calgary’s Most Unique Indoor Golf Facility”
110 Point Mackay Cr NW