The B-plane and the axis of rotations
- Making swing actions based on TrackMan data

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Ball flight and clubface orientation

The orientation of the clubface is very important to control at impact, as it affects the D-plane and values given by TrackMan such as the ball starting direction sideways (**launch direction**) and vertically (**launch angle**), the **smash factor** and resulting **ball speed**, **spin axis** orientation and **spin rate**

This means that if you want to start the ball more to the left or right, or more upwards or downwards, or align the clubface angle in relation to the club head path to change the ball speed, spin rate or spin axis orientation, you need to understand what to change in the swing.

The three axis of rotation

We can change the clubface orientation and position in three dimensions (height, width and depth). I here assume that the player wants to hit the ball at the center of the clubface for all shots. This means that the club head can rotate around three "imaginary axis" going through the sweet spot to ensure a centered impact (Figure 1); These are the

- Vertical axis (upwards/downwards along gravity)
- Lateral axis (left/right of target axis)
- Target axis (toward/away in relation to target).

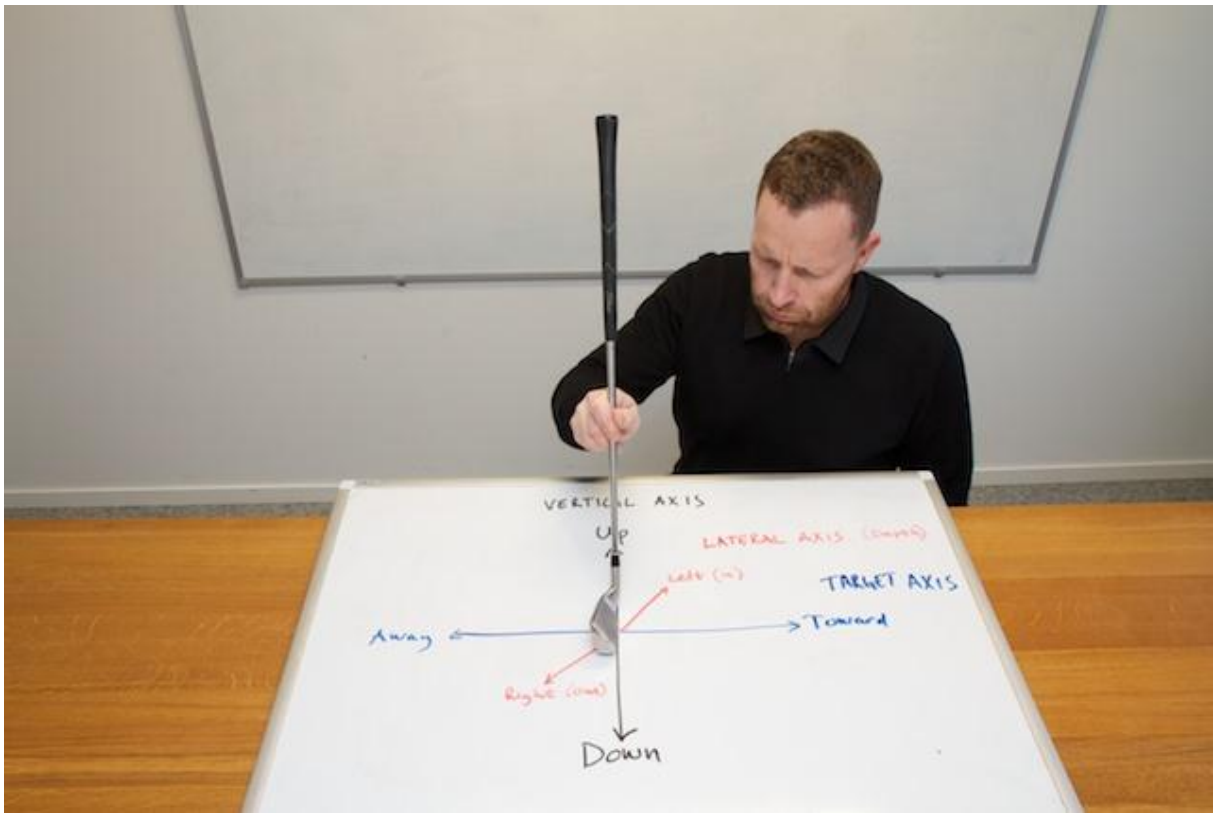

Figure 1. The three axis of rotation

The B-plane

A player can only control the clubface through the area where he grips the club. By changing the orientation of the butt at impact, the clubface orientation is changed and therefore the resulting ball flight.

The B-plane is the flat imaginary surface that the butt needs to move along to change the clubface orientation around one of the three axes (Figure 2). If the club head orientation is changed around several axes at once, then the B-plane becomes inclined. Two axes are needed to define each plane:

- Horizontal plane between the target axis and the lateral axis
- Lateral plane[1] (or frontal plane) between the lateral axis and the vertical axis
- Target plane (or sagittal plane) between the target axis and the vertical axis

[1] These plane names may be used to differentiate from the anatomical "body plane" nomenclature

Figure 2. The movement of the butt along the B-plane

Changing clubface and butt orientation

In TrackMan, you get calculated values of the **face angle** and **dynamic loft**. These values can be very helpful in order to set action based goals for the player. Following three points shows how the clubface orientation is changed as the butt position and orientation are changed.

1. Changing the face angle only

If you want to change the face angle only, then the club head should rotate around the vertical axis and the butt move parallel to the horizontal plane (Figure 3). This is commonly called opening or closing the clubface. A common misconception is that opening the clubface should increase the dynamic loft. The dynamic loft will remain constant when rotating the club head around the vertical axis.

Example:

Desired ball flight: Want to start the ball more to the right, getting a more positive **face angle** value in Trackman

Swing action: Rotate the club head clockwise around the vertical swing axis. The B-plane is then parallel to the horizontal plane. The butt should then move along that plane, keeping a constant height.

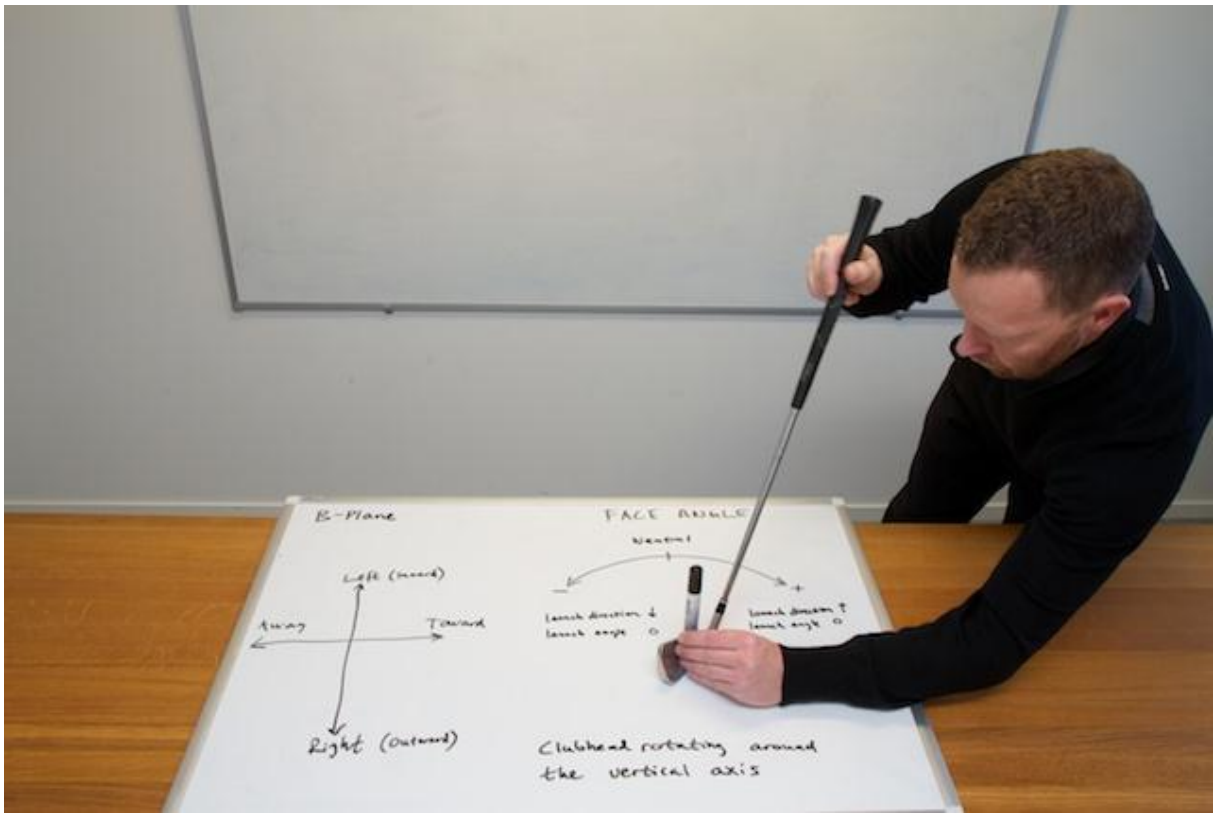

Figure 3. Rotating around the vertical axis

2. Changing the dynamic loft only

If you want to increase or decrease the dynamic loft only, then you should move the butt parallel to the target plane to rotate the club head around the lateral axis (Figure 4).

Example:

Desired effect: Increasing the launch angle, i.e. getting a more positive launch angle value in TrackMan.

Swing action: Rotate the club head around the lateral axis. The B-plane is then parallel to the target plane. The butt and hands need to move more away and down at impact, keeping the distance in the lateral (depth) dimension. This is the only way to increase the dynamic loft more than "neutral", giving a centered impact.

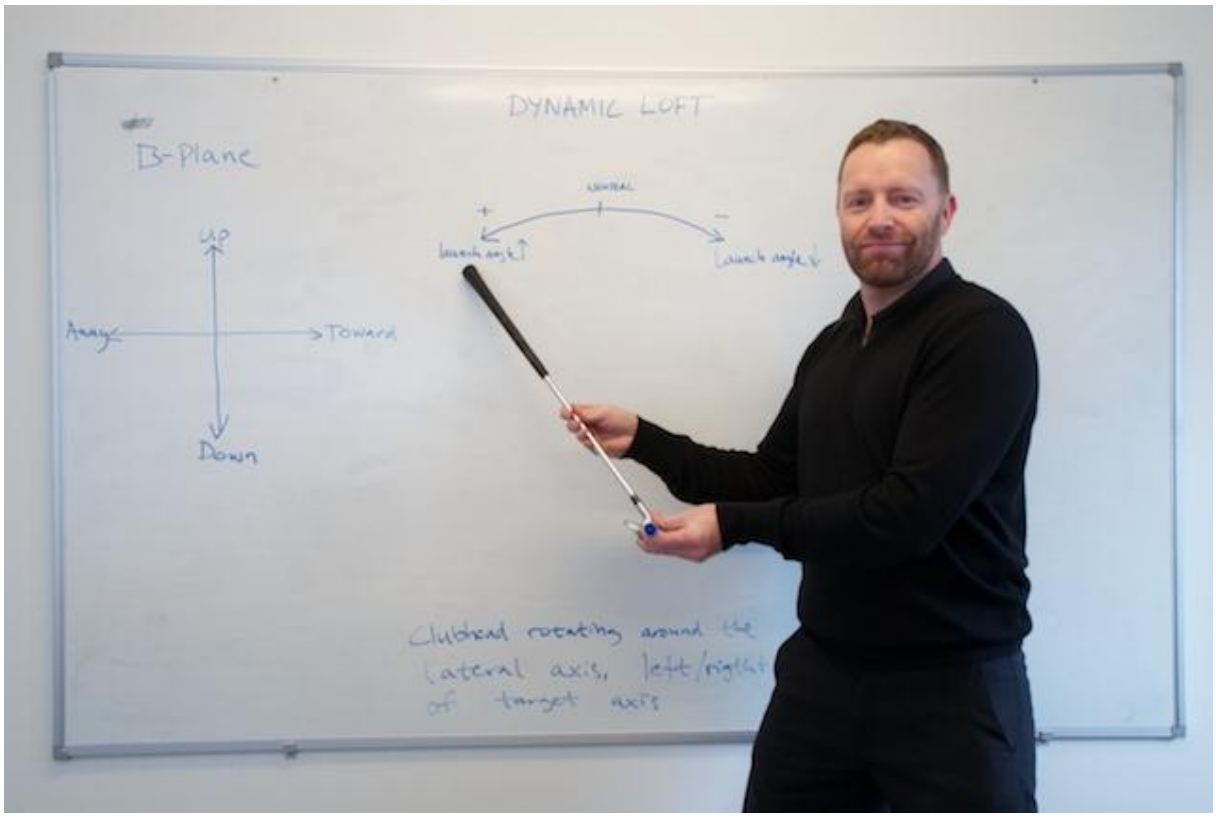

Figure 4. Rotating around the lateral axis

3. Changing the swing plane

Players need to anticipate the ball flight caused by a changed **swing plane**. Although it is the position of the club head through impact that is used to calculate the **swing plane** (before called "vertical swing plane"), I will here consider it equal to dynamic lie (the orientation of the club head around the target axis) (Figure 5). A change of **swing plane** value can then change both the **face angle** and the **dynamic loft** (if the club have loft >0 degrees). The **dynamic loft** will always decrease if increasing or decreasing the **swing plane** value from its "neutral" value.

Example:

Situation: The lie of the ball is up on a hill while the hands are in their usual height, making a changed dynamic lie at impact.

Consequence: The **swing plane** is shallower (lower value). The hands have moved down and left (inward) along the lateral plane, in relation to the usual ball position. The ball flight starts lower and to the left[2], and then curve left as the spin axis have tilted due to the changed **dynamic loft** and **face angle**.

[2] Assuming that the golfer is a right sided player

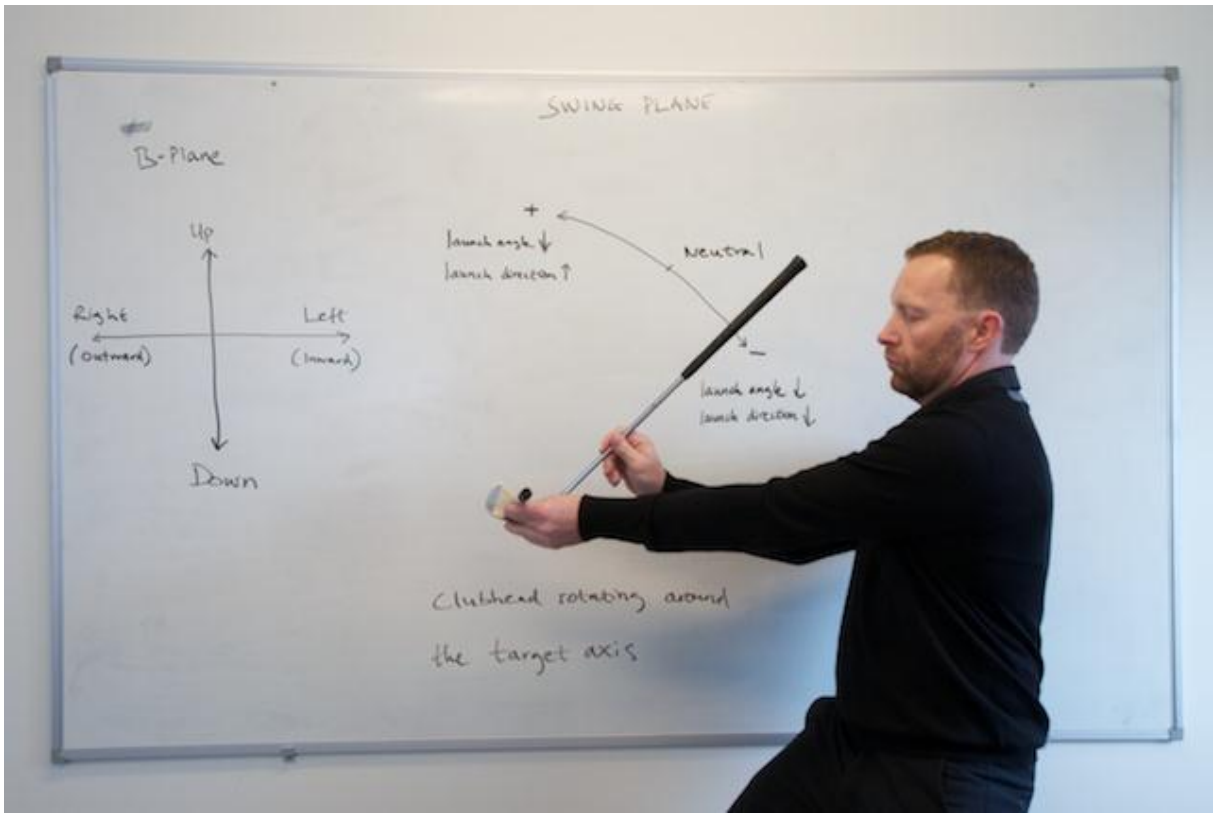

Figure 5. Rotating around the target axis

Summary

It is valuable for TrackMan users to relate the ball flight data to the club data and needed swing actions. If a change of clubface orientation is needed, the coach should identify the axis needed to rotate the club head around and note the TrackMan face angle and dynamic loft values. The changes of these values should then be related to a change of position and orientation of the butt along the B-plane. Control the butt and the clubface will follow.