

# GOLF SWING CONSISTENCY IN ELITE COLLEGIATE GOLFERS



**Preliminary Findings Prepared by:**  
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**Study Location:**  
**NCAA Men's Golf Championship 2003**  
**Karsten Creek Golf Course, Oklahoma**

**Purpose:** To assess the consistency of repetitive golf swings, in elite college golfers, with the participants using their Pitching Wedge (**PW**), 5 iron (**5i**) and Driver (**Dr**). This study analyzed:

- (1) the golfer's downswing tempo within repetitive swings with each club and between clubs
- (2) the movement pattern of the golfer's center of gravity (COG)
- (3) the relative positioning of the golfer's center-of-gravity (COG) at ball contact between clubs (*contact cluster*)
- (4) the distance of relative location of COG at ball contact from center balance

**Participates:** 28 volunteers participated in our study (from a field of 156 golfers attending the NCAA Men's Championship-2003); all were right-handed golfers. Players were team ranked from #1 through #5 based on their previous performance.

**Procedure:** Data was collected on the **Dynamic Balance System-DBS** (appendix attached for additional information) during the 2 days preceding the championship. All participates had been hitting golf balls on the driving range and were warmed-up, fatigue was not considered a factor for these elite collegiate athletes. Data collection was accomplished without feedback to the players in order not to influence their normal swing pattern. This study was performed in a golf instructional bay, which allowed balls to be hit toward targets on the driving range while the player was protected from the weather.

Each study participant was positioned on the **DBS** stance force-plate platform and provided with the opportunity to hit balls off our Fiberbuilt hitting mat until they felt comfortable. The hitting mat uses a grid to provided consistency of ball placement. Therefore, the ball placement was used to help position golfers properly, centered over the sensors in the stance mat, without influencing their normal address posture.

5 consecutive PW shots were recorded; the participant was encouraged to perform his usual pre-shot routine before each swing. The same procedure was used for the 5 iron and repeated with their Driver (the ball was positioned on a tee).

**Results:** The graphs and tempo-point data was evaluated for consistency in relationship to the player's performance during the first 3 rounds of this tournament (see groupings below). The authors fully understand that good full swing testing results are not an indicator of golf excellence. However, we believe the overall findings are potentially helpful.

	<u># of Study Participants in each Group</u>	<u>% of Study Participants ranked #1 or #2 in Group</u>
<b>Group 1:</b> 25% of the entire field scored +10 or less:	9	55%
<b>Group 2:</b> 26-50% of the entire field scored +16 or less:	7	43%
<b>Group 3:</b> the rest of the entire field who scored +17 or more	12	17%

Note: Group 1 had more #1 and #2 ranked players, indicating that these participants not only performed well at this tournament be were consistently good performers throughout the year.

**Results (Continued):** See attached Group Examples and Compare to DBS Swing Library Examples

In *general* each group showed the following tendencies:

**Group 1:**

- a. the COG patterns are considered “very consistent” or “consistent” between tested clubs
- b. Consistent downswing tempo with each club AND consistent tempo between tested clubs
- c. the COG at ball contact (“O”) located inside 3rd circle of DBS graph
- d. Consistent Contact Cluster between clubs

**Group 2:**

- a. the COG patterns are “consistent” or “semi-consistent” between tested clubs
- b. This group varied greatly regarding consistency of downswing tempo with each club and between clubs
- c. the COG at ball contact (“O”) location was greatly varied, including contact on the right
- d. *Contact Cluster* is relatively consistent

**Group 3:**

- a. the COG patterns are considered “semi-consistent” or “different” between tested clubs
- b. a fairly consistent downswing tempo with each club AND consistent tempo between tested clubs
- c. the COG at ball contact (“O”) located outside 3<sup>rd</sup> circle and may be back toward the right
- d. *Contact Cluster* is relatively inconsistent

Note: graph analysis was beyond the scope of this study but will be considered for future comparisons.

**Conclusions:**

1. The study participants who performed better during the first 3 rounds of the tournament (Group 1) demonstrated greater consistency:
  - a. in repetitive movement of their COG between the clubs tested
  - b. of the location of their COG at ball contact, between the clubs tested (*contact cluster*)
  - c. of their COG movement pattern was more centralized between the feet (as displayed within the DBS balance zone)
2. All study participants demonstrated consistency of downswing tempo with repetitive swings with the same club and most had good consistency of downswing tempo between clubs tested. This was a common finding among these elite golfers.

**Relevance:**

**Coaching:** We hope the information will help coaches convey the importance of balance and consistency to their players who strive for greater excellence in golf. We also believe improved balanced motion could help reduce fatigue during multi-day tournaments.

**Golf-Specific Physical Performance Programs:** Appropriate golf-specific conditioning, including “core strengthening/stabilization” is helpful for improved performance and to reduce the risk of injury. As many of these golfers swung repetitively outside of the “balance zone,” we believe that more specific balance training, with appropriate feedback, could improve their spinal stabilization during performance.

**Sports Medicine:** The authors believe that repetitive golf swings in which the COG moves significantly toward the player’s toes can cause increased spinal stresses, increased muscular fatigue, and require compensations during the swing which might lead to additional injuries.

**Junior Programs:** We hope this material helps coaches convey the important aspects of consistency and balance to their junior golfers, which, will help their performance and enthusiasm for golf.

**Club-Fitting:** We believe the *Contact Cluster* demonstrates a consistency of COG motion, which is influenced by the club. This information’s relevance to club-fitting will require further investigation but is, at least, a method of analyzing consistency.

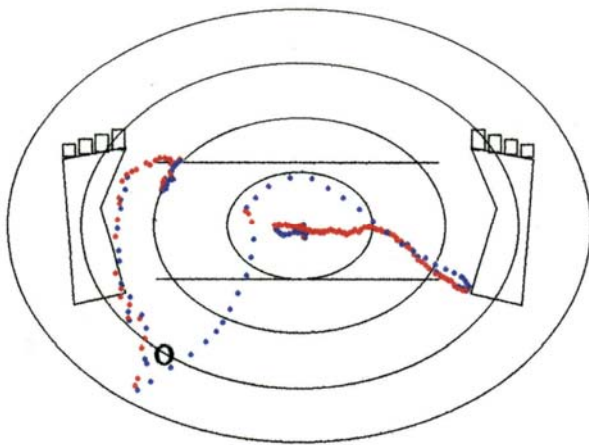
## Example of *Dynamic Balance System – DBS Swing Patterns*

### NCAA Men's Championship—5/2003      **Group 1**

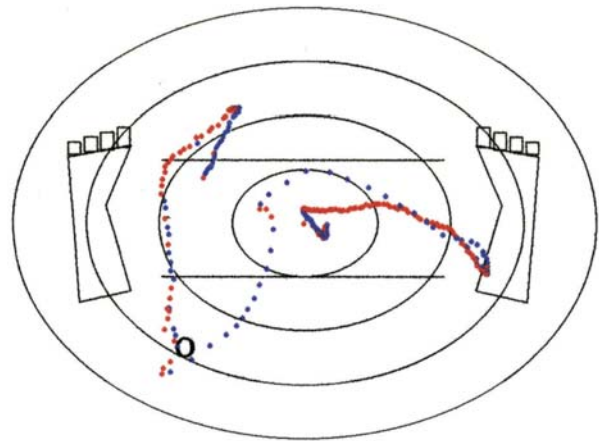
Group 1 in *general* demonstrated:

- e. the COG patterns are considered “very consistent” or “consistent” between tested clubs
- f. Consistent downswing tempo with each club AND consistent tempo between tested clubs
- g. the COG at ball contact (“O”) located inside 3<sup>rd</sup> circle of DBS graph (*see Swing Library examples*)
- d. Consistent Contact Cluster between clubs

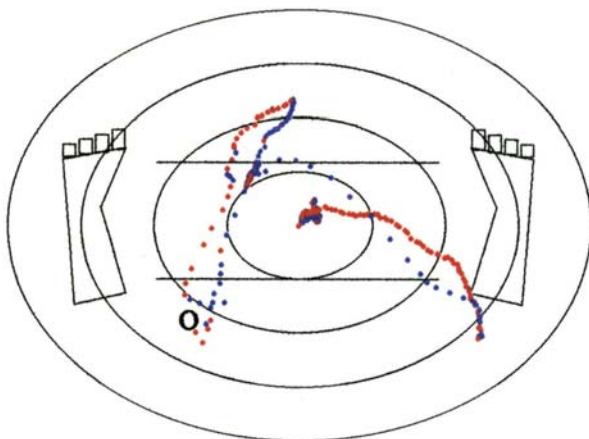
Student Golfer Info in this example: Age 21, Player Rank #1, Average Score = 72



**Pitching Wedge (PW)**, Tempo-Point = 33  
COG moves from center toward Right heel, then balanced over center, hip turn toward ball contact “O” with COG toward Left Heel-finishes in balance zone

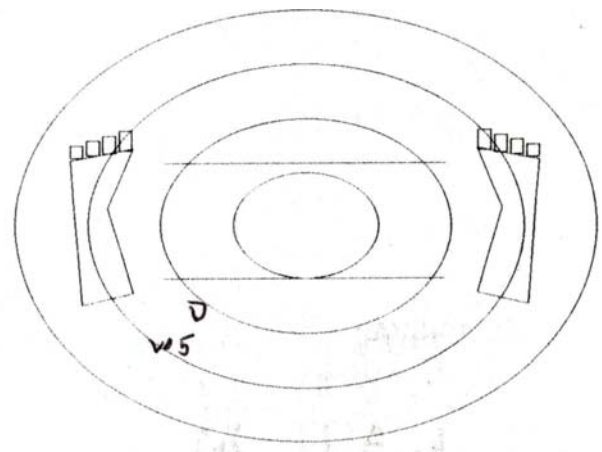


**5 iron**, Tempo-point = 36  
Golfer's COG pattern is the consistent with the PW pattern



**Driver**, Tempo-point = 38

*Note:* Consistency of tempo-point between clubs  
Patterns of COG motion during the swings are consistent



**DBS Contact Cluster**

Observe consistency of this golfer's COG at ball contact with the different clubs

## Example of Dynamic Balance System – DBS Swing Patterns

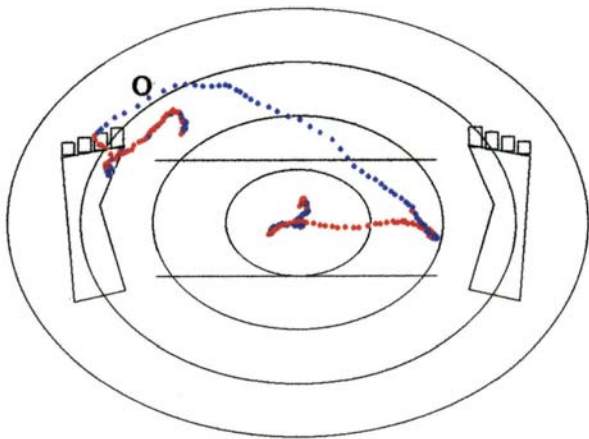
### NCAA Men's Championship—5/2003      **Group 2**

Group 2 in general demonstrated:

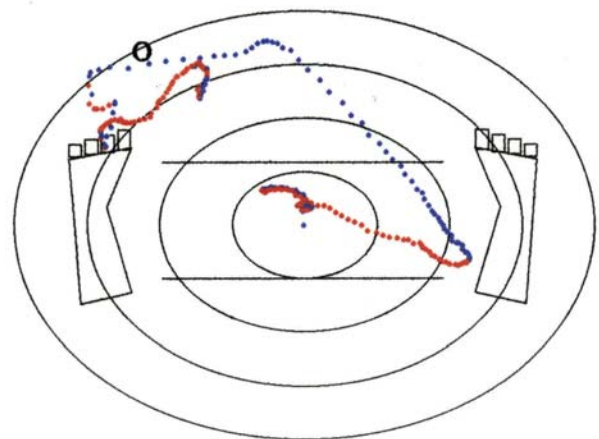
*See Examples from DBS Swing Library for comparisons*

- h. the COG patterns are considered “consistent” or “semi-consistent” between tested clubs
- i. This group varied greatly regarding consistency of downswing tempo with each club and between clubs
- j. the COG at ball contact (“O”) location was greatly varied, including contact on the right
- d. *Contact Cluster* is relatively consistent

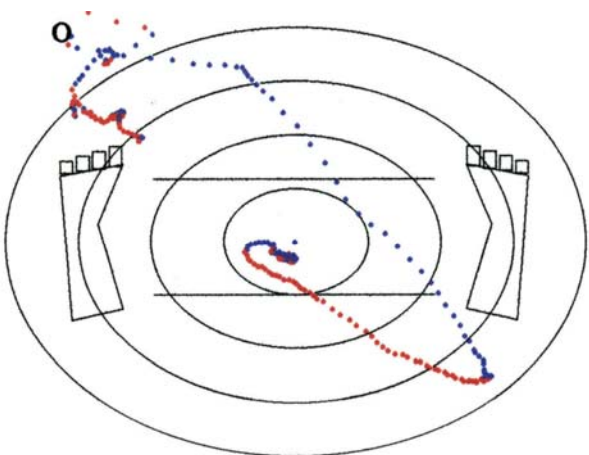
Student Golfer Info in this example: Age 23, Player Rank #3, Average Score = 71.7



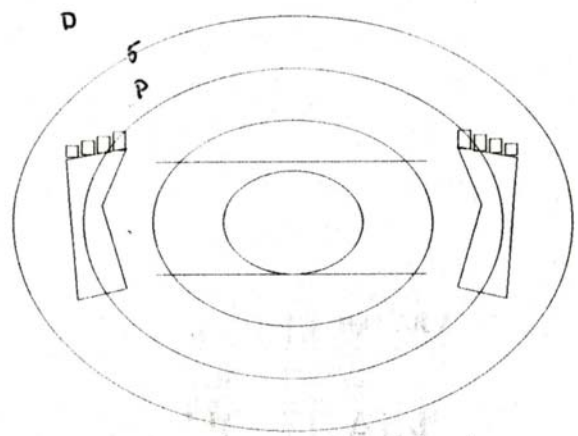
**Pitching Wedge (PW)**, Tempo-Point = 57  
COG moves from center toward the middle of the Right foot, then diagonally toward Left toes, after ball contact (“O”) golfer finishes on the Left toes



**5 iron**, Tempo-point = 50  
This Golfer's COG moves further to the right during backswing then further left and toward toes at ball contact



**Driver**, Temp-point = 45  
*Note:* Tempo-point is not real consistent between clubs  
Patterns of COG motion between the swings are fairly consistent  
With increasing club length this golfer moves further right then left with possible sway



**DBS Contact Cluster**  
Observe relative consistency of of the golfer's COG at ball contact with the different clubs

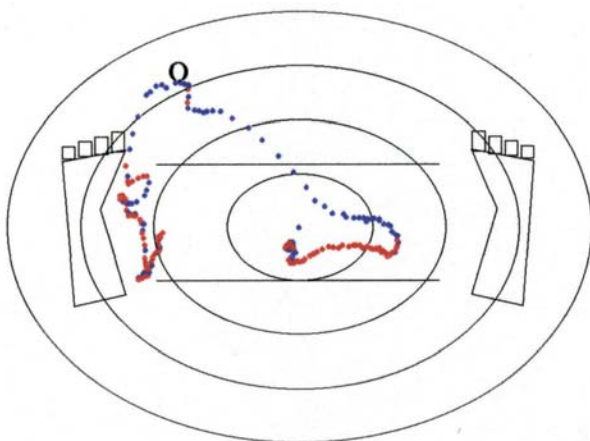
## Example of Dynamic Balance System – DBS Swing Patterns

### NCAA Men's Championship—5/2003      **Group 3**

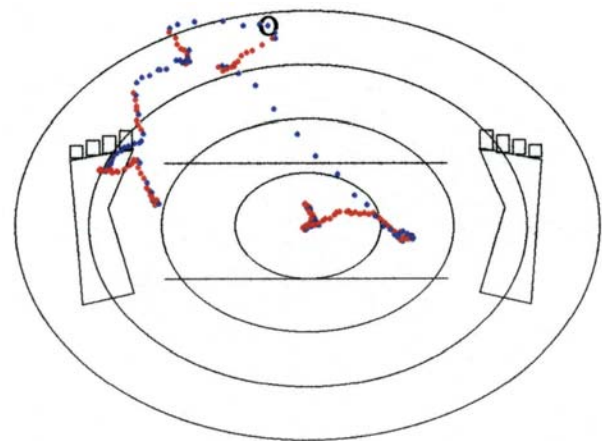
Group 3 in general demonstrated:      *See Examples from DBS Swing Library for comparisons*

- k.** the COG patterns are considered “semi-consistent” or “different” between tested clubs
- l.** a fairly consistent downswing tempo with each club AND consistent tempo between tested clubs
- m.** the COG at ball contact (“O”) located outside 3<sup>rd</sup> circle and may be back toward the right
- d.** *Contact Cluster* is relatively inconsistent

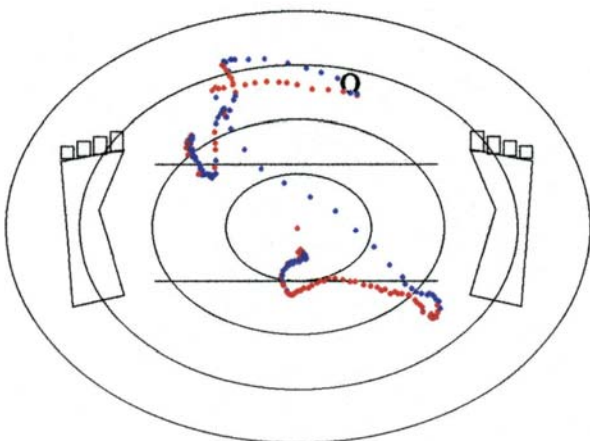
Student Golfer Info in this example: Age 21, Player Rank #3, Average Score = 73.5



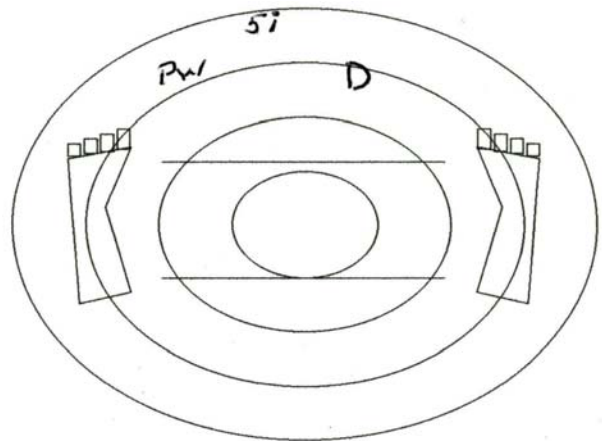
**Pitching Wedge (PW),** Tempo-Point = 40  
COG moves from center toward Right heel, then diagonally toward Left toes, after ball contact “O” golfer finishes onto the Left foot in the balance zone



**5 iron,** Tempo-point = 39  
Golfer's COG moves further toward the ball (weight over the toes) before ball contact



**Driver,** Tempo-point = 40  
*Note:* Consistency of tempo-point  
Patterns of COG motion during the swings are semi-consistent  
With Driver, COG at ball contact is toward the right



**DBS Contact Cluster**  
Observe relative inconsistency of the golfer's COG at ball contact with the different clubs

## APPENDIX -- 1: **DYNAMIC BALANCE SYSTEM -- DBS**

The Dynamic Balance System (DBS)<sup>TM</sup> provides visual, auditory and enhanced video feedback to help train kinesthetic awareness of balanced movement. The DBS has several screens to show weight transfer, and various screens to track, in real-time, the movement of the golfer's center-of-gravity (COG) during the swing including a screen to help train stabilization during Chipping and Putting.

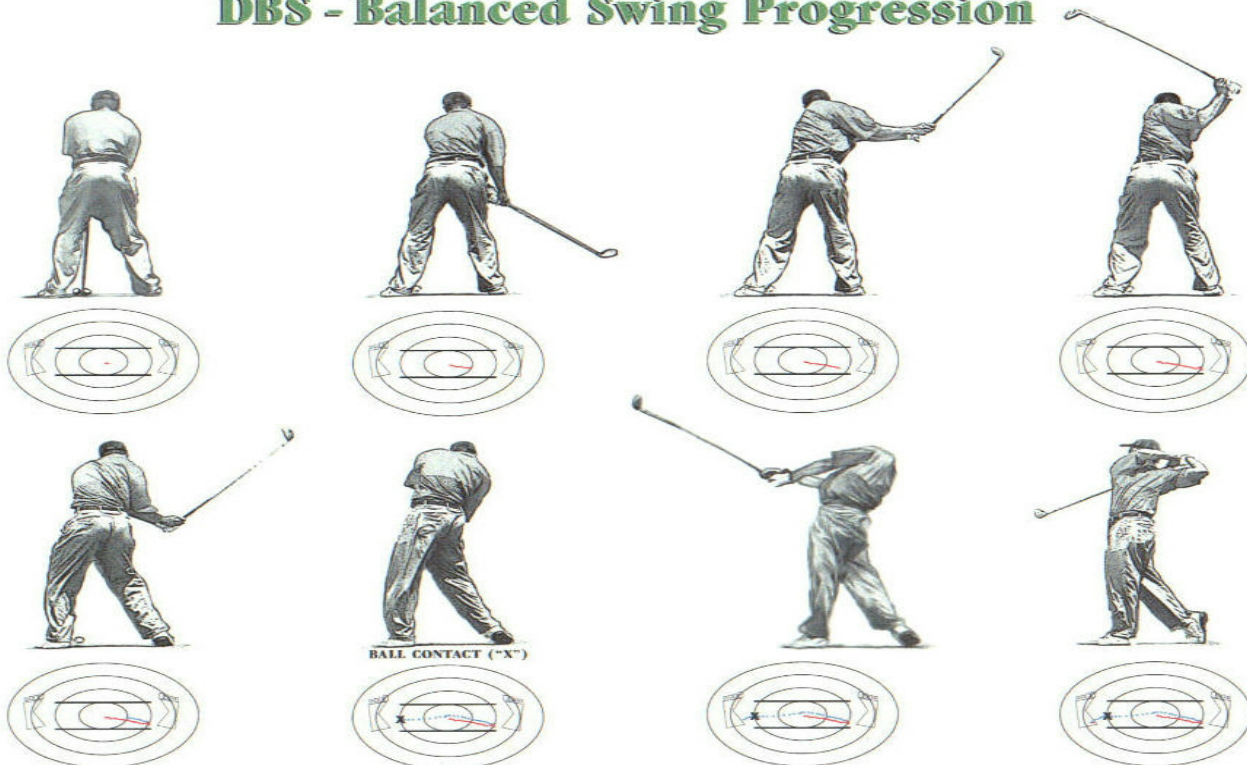
We believe that a balanced swing takes place primarily within a “balance zone” represented by a rectangular area between the arches of the feet, forward to the “balls of the feet” (metatarsal heads) and back to the inside of the heels.

Top golf professionals, sports performance trainers, and Physical Therapists utilize the feedback from the DBS to help convey the ‘feel’ of properly balanced movement patterns. The DBS movement graphs will vary based on many factors including, the golfer's flexibility, body type, swing style, and instructor's teaching concepts. However, we believe that COG motion within the “balance zone” will reduce the risk of biomechanical irritation and help with consistency of ball contact. Currently, through a partnership with PGA Learning Center,<sup>TM</sup> a library of tour professionals' balance swing graphs is being compiled.

During the swing, the DBS graphs 3 seconds of movement of the golfer's COG; 2 seconds before ball contact and 1 second after contact. An “X” (or “O” in saved file graphs) indicates the location of the golfer's COG at ball contact. The figure below shows an idealized and biomechanically sound sample graph of the movement of a golfer's COG during a golf swing.

In general, with a mid-iron, the golfer's COG is balanced between his feet at address. The golf swing results from rotation of the upper body (and to a lesser degree the pelvis) over stable, but not rigid, base of support, the legs. During the backswing, as the upper body rotates to the right (in a right-handed golfer), indicated by the red line, the COG moves in a slight arch toward the right heel. The forward swing (blue line) indicates movement of the COG back toward the left. Ball contact (X) is usually made with the COG just left of center. The swing is completed with the COG moving to a stable finish position on the left leg.

### **DBS - Balanced Swing Progression**



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### **Appendix 2:**

#### **COG Pattern Consistency:**

One of the authors (DG) evaluated each study volunteer's graphs and chose a representative swing performed with each club. The golfer's COG motion was assessed based on observing consistency of address position, distance and direction of movement during backswing, initial forward movement direction and distance, COG path into ball contact, and finishing position.

"Very Consistent" COG Pattern= 1 or less variations of COG motion between club swings

"Consistent"= no more than 2 minor observed variations

"Semi-Consistent"= overall movement pattern similar but multiple variations were observed

"Different"= COG pattern was significantly dissimilar between one or more of the tested club swings

#### **Contact Cluster:**

The DBS marks the location of the golfer's COG at ball contact with an "X"

(on swing graphs retrieved from saved files, as used in this study, ball contact is a "O")

The authors believe the body position at ball contact should be about the same with full swings using each club in the bag. The ball contact COG position, for each of the 3 clubs used in our study, were marked. The furthest distance between contact points were measured (on the DBS printout).

"Consistent" Contact Cluster = distance was *generally* ½" or less

"Relative Consistent" Contact Cluster = ½ to ¾"

"Inconsistent" Contact Cluster= greater than ¾"

#### **Downswing Tempo (*DBS Tempo-point*)**

The DBS displays 3 seconds of the golfer's COG motion; 2 seconds of time before ball contact and 1 second after ball contact. This pattern is displayed, on the computer monitor, as a series of "dots", each representing 1/100<sup>th</sup> of a second. The DBS displays a "Tempo-point number" which is the number of "dots" from the furthest "dot" to the right (which might be the top of the backswing) to ball contact (*see explanation above*).

For example: a Tempo-point of 33 means it took the player 33/100<sup>th</sup> of a second to move from the furthest position to the right to ball contact.