

SPECIAL
POINTS OF
INTEREST:

- Timing Sequence
and Hand Speed



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Staying fit and flexible with 'Golf Yoga'. Joey Corona at The Doral Spa in Miami, Florida.

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Hand Speed: a calculated change

by Dr Robert Neal

People in the golf industry have recently become very interested in the 'Timing Sequence' exhibited by golfers. Titleist Performance Institute (TPI) call this phenomenon the kinematic sequence. In fact, golf coaches are becoming comfortable enough with the concept; its importance and how it relates to positions throughout the downswing, that some of them are using these data to assist in their coaching decisions and drill selection.

As many of you are aware, a long-time research focus of mine has been 'segment interactions' in sport and when Golf BioDynamics (GBD) was first established (2000), the hardware of the day was not capable of accurate measurement of the golf club¹. Even measurement of the hand, which moves slower than the club, was fraught with technical problems at that time.² The typical system configuration also had only 4 sensors. With one of those on the head, we were limited to three body segments when examining the timing sequence; the pelvis, upper torso and hand. The decision about how to present the timing sequence data at that time was not easy but I decided to present angular speed of the hips and upper torso around the vertical axis of the segment. For the hand, I believed that the **linear** speed of the hand in the direction of the target was the best correlate with speed of the club head and was better than an angular velocity component².

Our next generation model, which is the standard configuration with the new software, includes the lead arm segment of the upper limb (i.e. left arm for a right-handed golfer). This addition gives us four segments in the chain, permits creation of a *virtual* forearm, and allows us to examine the *connection* between the upper torso and the arm in greater depth than was possible before. Combine these inclusions with the idea that I recently developed regarding the best way to present the angular velocity of the lead arm and hand and we have an excellent way of looking at the efficiency of the golf swing without having to put a sensor on the club! For those who are unaware, the TPI kinematic sequence includes four segments: pelvis, upper torso, a composite arm which is a segment running from the upper torso sensor to the midpoint of the hands, and the club.

So, here's the crux of our story! In golf, the "release" of the club can be described as a combination of ulnar deviation (lead wrist joint) combined with supination (lead forearm) and external rotation (lead arm) of the lead upper limb. In good players, you might also see slight flexion in the lead wrist. Researchers have long recognized that "delayed wrist uncocking" is a hallmark of long hitters. "Holding the angle" and being able to create "lag" at the wrist until late in the downswing is a crucial aspect of an effective and efficient golf swing. For some instructors it might even be the Holy Grail!!!

¹Even the current Liberty hardware (Polhemus), because of shaft deformations during the downswing, cannot accurately measure the club head position and orientation by placement of a sensor on the shaft.

²There is a history as to why the linear speed rather than the angular speed was presented stemming back to inaccuracies in measurement with the old Polhemus hardware as well as a lack of knowing the orientation of

the angular velocity components relative to the hand's anatomical axes.

In anatomical terms, holding the angle at the wrist means maintaining the lead wrist in a radially deviated position until late in the downswing. The rapid "release" of the club is brought about primarily by the club's inertia, and results in rapid ulnar deviation of the lead wrist. The challenge was to figure out how, using a "snap" calibration procedure, we could best calculate and then present such data. The following describes the way I have decided to proceed.

Imagine that during the downswing the hand moves on a plane (I knew intuitively that the hand path graph that appears in the GBD Report was extremely valuable!). This plane may **not** be *parallel* with the target line but in good golfers it will be close. If you examine Fig. 1, you get a sense of this plane by looking at the downswing hand path (red line).

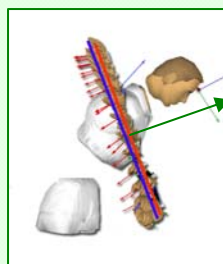


Figure 1. Hand Path DTL (down-the-line) View
Blue= Backswing and Red = Downswing

Mathematically, a plane is defined by a vector (line) that is perpendicular or normal to the plane (green arrow on Fig. 1). The angular velocity of the wrist about this normal axis is actually extremely similar to the angular velocity of the club. In fact, most research using mechanical models of the arm and club have used a simple 2D, planar model of the golf swing (double pendulum) in which the arm and the club move in the same plane and the angular velocity of the club would be perpendicular to this plane.

I thought that the best way to determine the hand plane was to use the average plane (plane of best fit) to the hand path on the downswing. The vector that is normal to this plane is then used as the axis about which to calculate the angular velocity of the hand. This representation of the hand angular velocity gives us a measure of the rate of "release of the club" during the downswing. Peak velocity about this axis should occur right at impact. If it does not, then the club has been "released" too early in the downswing and does not have its maximum energy at impact! I have included a couple of graphs illustrating our *old timing sequence* and the *new timing sequence* side-by-side allowing you to see the differences and similarities.

These two figures below illustrate how the sensor attached to the arm (just above the elbow) and the hand (back of the hand) move during the backswing (blue) and downswing (red) as viewed from the target line, that is, looking out toward the target. You can also clearly see that the arm and the hand move on different planes!

Figure 2.

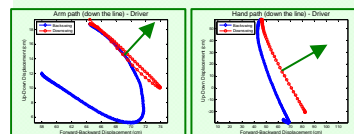


Figure 2. These two diagrams illustrate the arm path (left) and hand path (right) with the green arrows indicating the axis that is normal to this plane. It is about these arrows that the arm and hand angular velocities are presented in the timing sequence graph below.

Illustrated below in Fig. 3A and B are the old and new timing sequences respectively. Remember that the old sequence only has three segments (hips, upper torso and **linear** hand speed) whereas the new one has four segments (hips, upper torso, lead arm and hand). With the new sequence **ALL** speeds are angular and are in the same unit of measurement (°/s).

Figure 3A

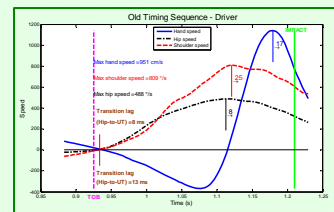


Figure 3B

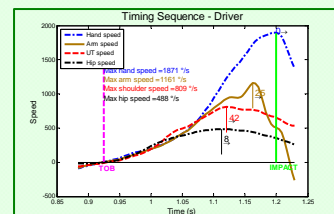


Figure 3A and B. Shown above the old timing sequence for a Touring Professional (A) and the same swing data used to calculate the new timing sequence (B).

Hand Speed...Continued.

Miami is the focus of a new magazine all about GOLF!



The Miami Golf Journal

Inside the Cover:

- Golf tips
- Interviews
- Biomechanics
- Nutrition
- Exploring Golf Courses

Read articles written by Golf BioDynamics

Jim McLean features in Volume Two

<http://www.miamigolfmagazine.com>



Just received...news that the European Teaching and Coaching Conference scheduled for later this year in Birmingham England has been cancelled due to the economic climate.

We hope that it can be scheduled for next year!

WWW.PGAETCC.COM



Lastly, with this new way of presenting the timing sequence, we can make MUCH better interpretations and therefore better understand the transition timing sequence (the timing of the change of direction of movement of the body segments). By examining the figure to the right (Fig. 4), and noting when the sign of the angular velocity components change from negative to positive (the change of direction), you can accurately gauge the quality of the transition from backswing to downswing.

Ideally this change in direction should occur from the ground up (hips, upper torso, arm, and hand). Thus, the new timing sequence allows you to show someone if they are "casting" the club! This is of tremendous value to the golf coach and something that was not possible to do with the 'old timing sequence'!



Figure 4.

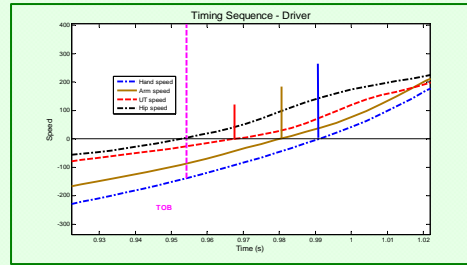


Figure 4. Timing Sequence Driver. The 'Transition' or change of direction illustrated in the New Timing Sequence Graphs of the GBD Reports. When the sign of the angular velocity components change from negative to positive (the change of direction), you can accurately gauge the quality of the transition from backswing to downswing. This is a good example of a quality transition sequence.

All comments or questions to be directed to Dr. Robert Neal: R.Neal@golfbiodynamics.com

Challenging a 42 year old record at the Masters Tournament in Augusta this year were teenagers Danny Lee and Ryo Ishikawa. What is the long standing record? And who still holds the record?

Answer: The youngest player ever to make the cut at the Masters (18 years 11 months). South African Bobby Cole playing as an amateur in 1967.



A warm welcome is extended to Steve Keogh (Canberra, Australia) who joined the GBD Team in Miami recently. Steve will spend 12 months at The Jim McLean Golf School at Doral learning the 'trade'. He will become proficient in using the GBD 3D technology in his teaching as well as becoming a certified Jim McLean Instructor.



Two Day Workshop



Jim McLean and Dr. Rob Neal, prominent in their respective fields of golf instruction/coaching and golf biomechanics are looking at planning a series of 2 Day workshops for either late 2009 and/or 2010, both domestically and internationally.

A few of the topics expected to be covered in the 2 Day workshop: Modern day golf coaching using 3D and video; What do Tour Players really do? (the evidence—Video, 3D and Trackman data); The 8 Step Swing (the fundamentals, corridors, death moves); The 'Transition' Move (the video and 3D perspectives)— body motion, swing plane, timing and sequencing, rate of stretch and rate of recoil; correct filming techniques – the coach and the scientist comment; swing comparison study (video) – Tiger Woods (2000/since Haney/current); using 3D techniques to guide your coaching decisions; how important is swing technique – 'putting it into perspective'; technical intervention – the fastest way to make a change (BioFeedback Training).

comparison study (video) – Tiger Woods (2000/since Haney/current); using 3D techniques to guide your coaching decisions; how important is swing technique – 'putting it into perspective'; technical intervention – the fastest way to make a change (BioFeedback Training).

We are interested in your feedback. Would this seminar program appeal to you? For all inquiries please email Karen Harrison at K.Harrison@golfbiodynamics.com



How do we teach the X-Factor Stretch?



By Brett Bridgman

PGA Golf Professional
Jim McLean Instructor
Golf BioDynamics Instructor

The downswing transition is one of the most important features of a quality golf swing. If you want to hit the ball consistently and long, then it is crucial to master this key aspect of the full swing.

When examining the body motion of the golfers on the PGA Tour, they all have this in common—the lower body leads in the downswing. That is, the hips move laterally towards the target before rotating. This initial move, known as the X-Factor Stretch (an extension of Jim McLean's original X-Factor) is a measure of how much the lower body leads out before the upper body changes direction. With the Golf BioDynamics (GBD) 3D measurement system we recently looked at a number of PGA Tour Professionals — their average X-Factor Stretch was 17°. The average club golfer may exhibit an average 'Stretch' by comparison of only 0-5! This is a significant amateur-professional difference! It must be part of the power equation.

The reason this transition move with the lower body is so important is that it allows for a weight shift from the right (vice versa for left handers) to the left side and helps the club to drop down on a neutral path or even one that is just inside. It also allows the muscles to develop optimum power by utilizing what we call a stretch-shorten cycle (stretching the muscles before they contract). Most amateurs fail to execute this move successfully and hence the club travels from 'outside to in' and consequently their swing is underpowered.

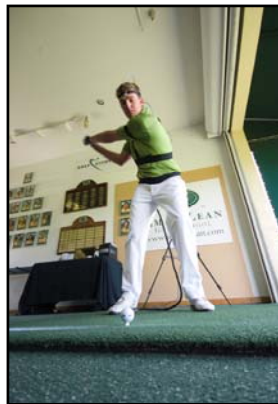
In teaching this 'X-Factor Stretch', we usually need to use a variety drills to help a player obtain the 'feel' for this new movement pattern. Some of the drills I regularly use include:

1. Putting a shaft into the ground near the outside the left foot and hip (opposite for left handers) and asking the student to 'bump' their hips into the shaft from a top of the backswing position (without simultaneous upper body sway or lean) and then rotate the hips on the inside of the shaft through to a finish position. This is a great drill, encouraging correct repetition and it can easily be performed on the driving range.
2. Another fantastic drill can be performed using a device called a Leader Board. Ask the student to take their address position, with both feet on the Leaderboard; initially without a club in their hands. Ask them to pause at the top of their backswing. From here, have them slide their left foot forward (using the Leader Board) before they rotate their body towards an impact position. This should give them a good 'feel' for the weight shift

Rob demonstrating the X-Factor at the top of the backswing



Brett in action with the 3D System at Doral demonstrating the X-Factor Stretch as the hips lead out on the downswing.



(see www.pro-leaderboard.com).

Being able to use 3D technology (you will need a 6 DOF measurement system) for teaching this aspect of swing mechanics is definitely a bonus. To provide the golfer with audio feedback (called BioFeedback Training) as they swing, has been shown to accelerate the learning curve. The player gains a 'feel' for the new movement pattern rapidly, so it can really add focus to their practice session.

During BioFeedback, one of the 3D parameters we focus on to improve the X-Factor Stretch in our golfers is *Hip Sway*. That is, the audio feedback is set to 'sound' only if the player starts the downswing with the correct motion - a lateral shift or 'bump' of the lower body. If a player does not complete the move successfully and only rotates the lower body, then there will be no noise emitted from the computer. Thus, there is instant feedback as to whether the movement was performed correctly or not, on every single swing. Talk about a quality practice session!

I have found using the GBD 3D System (especially for this type of movement) priceless for both the student and myself. Using a quality 3D System for swing analysis and BioFeedback can really give one an edge in terms of quality of teaching.

Of course without 3D, video analysis can still be extremely valuable. With a face-on camera view one might draw near vertical lines from both hips to the respective ankles and examine how far the left thigh travels through this line on the downswing and as well as at impact. We would consider half a thigh to be indicative of a reasonable lower body shift. TPI (Titleist Performance Institute) advocate using a vertical line drawn from the ankle up towards the hip. It then becomes a race to see what hits this line first - the knee or the hip. TPI would like to see either the hip hit this line first, or the knee and hip touch together.

In conclusion, the lateral movement of the lower body as the initial move of the downswing, is not as easy as it looks. With the help of a good teacher, armed with a variety of drills, video and/or a 3D motion measurement system, a player should be able to grasp the 'feel' of this new concept more quickly than ever before.

Any Questions or Comments can be directed to Brett Bridgman
bretto86@yahoo.com.au



Spotlight on GBD Team Members

The spotlight is now on our colleagues in Zurich, Switzerland!



Paul Dougan and Garry Malia, of the Swiss Golf Performance Lab are located in Zurich, Switzerland. Joining the GBD Team in 2008, both are very experienced Teaching Professionals. They have known each other for over 30 years, even playing on the same junior team! Now specializing in performance en-

hancement for golfers of all abilities, they regularly work with elite developing juniors as well as tour professionals. They have in fact recently returned from a 3 Day Training Camp with the Swiss National Team and a couple of days educating PGA Assistants.

Passionate about providing golfers in Switzerland the best possible opportunities to improve their performance, they utilize the latest technology for swing



analysis (video and 3D motion measurement through GBD) and have developed a solid sports science support network for their golfers. Mr. Rolf Boesch (from *Top Focus.eu*) works with their golfers to measure and improve their concentration; Nicole Steinmann Gartmann, physiotherapist and supporter of The Golf Athlete, focuses on injury prevention and physical screening, they even have a nutritionist in the group.

"Working with Rob's system gives us the ability to take technical information and turn it into simple language that players can understand...and the Bio-Feedback is fantastic. We are very proud to part of the GBD team".



From left: Paul Dougan, Rob Neal and Garry Malia

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Want to know more about linking the physical issues of your golfers to the technical problems in the golf swing? How to perform screening tests to identify the problem? What exercises should be prescribed? Consult the premier guide based on sound scientific principles and used by physical therapists — the *Better Body Better Golf* CD from The Golf Athlete.

www.TheGolfAthlete.com



THE GOLF ATHLETE

TIGHT HIP FLEXORS:

THE EFFECT ON QUALITY MOVEMENT PATTERNS DURING THE GOLF SWING—AN OBSERVATION

We have all experienced how our bodies can feel subtly different on a day to day basis. The effects of travel, a heavy workout the previous day or a stiff back can affect how we swing the club, our perceived timing and of course our 'range of motion'. What does that mean for elite level athletes travelling week to week and maintaining a workout schedule alongside their playing commitments?

Recently, Golf BioDynamics Inc. and The Golf Athlete Team (Rob Neal, Michael Dalgleish and Karen Harrison) worked alongside Danish National Coaches and their Men's and Women's Teams at a training camp in Antalya, Turkey.

A full day of plane travel and then a long bus ride from the airport saw players and support staff arrive at the Turkish resort around 10pm. At 9am the next morning we were all on the driving range. As well as taking advantage of the warmer weather, it was a great opportunity to have sports science support (3D Biomechanics—testing and biofeedback, physiotherapy and podiatry) easily accessible during training. Not surprisingly, upon examination, many of the athletes were 'suffering' with tight hip flexors following the travel (assessed via a modified Thomas Test performed by physiotherapist, Michael Dalgleish). Hours of sitting were clearly not conducive to normal length or tone in this muscle group! What we saw in the swing mechanics reflected this as well — a very 'flat' or level hip turn going back (i.e. in 3D — a low 'hip tilt' value at the top of the backswing; often low 'tilt' values were found at impact too) in many of our golf athletes. Thus, the ability of the athlete to move their hips 'on-plane' as they were rotating their bodies, was seemingly compromised by a lack of flexibility in the hip flexor muscles.

Hands-on treatment to 'release' the tight muscles (trigger point therapy) made a measurable difference (using 3D). It seemed that the muscle releasing techniques allowed the athletes to more easily achieve the correct 'hip tilt' positions during their golf swing. They all reported that the correct movement 'felt easier' with good results being achieved almost immediately after the intervention.

It certainly raises questions about the role of this type of 'maintenance' for performance enhancement. Are your golfers aware of the physical interventions available (e.g. stretching, massage, muscles releasing techniques, dry needling, acupuncture etc) to keep them in good shape for playing? While the combination will be different for everyone, having a good support team in place can assist your golf athletes in becoming more educated on this important topic thus helping them to perform at their optimum.



Above: 3D Testing and BioFeedback Training on the range in Turkey



Left: Michael Dalgleish, providing manual therapy on the range, 'releasing' the hip flexors of a young female golfer from the Danish National Team.



Stretching to improve your X-Factor Stretch



Everyone has heard the stories about how flexible Tiger is and how he has had to work hard at gaining joint stability and strength. Most of us wish we had that problem! The truth is, as we age we tend to lose flexibility and we all know intuitively that this can be detrimental to our golf game.

It is generally agreed upon that improving flexibility can help improve performance and reduce injury. A more flexible athlete is a more mobile athlete; and this is certainly a positive when considering skill acquisition and performance enhancement.

There are numerous ways to improve flexibility and our focus here is not on stretching immediately prior to an athletic event, where the preference is for more dynamic stretching as opposed to static stretching, but on stretching to gain length change in muscle and improve the range of motion around a joint. For this result, the choices are generally static passive, static active and PNF stretching techniques.

So, the real question - why is flexibility so important when it comes to creating a powerful and efficient golf swing? And, more specifically, trunk rotational flexibility? Well, flexibility in trunk rotation (or the ability to create separation in rotation between the hips and shoulders) is essential for creating a good coil at the top of the backswing (the X-Factor) and then allowing for a lead out of the lower body or hips (X-Factor Stretch) in transition.

A poor coil and/or poor lead out with the hips on the downswing (X-Factor and X-Factor Stretch respectively) affect not only the ability of the body to develop speed and power, but it also negatively affects the hand path and the plane on which the club moves, often promoting an over-the-top motion. This can result in inconsistent shot making and off center contact. Together the X-Factor and X-Factor Stretch are highly correlated to swing efficiency, power generation and driving distance.

So when you are stretching for golf, don't forget to stretch in rotation as well! Improving or at least maintaining your trunk rotational flexibility will require some isolated stretches and then, some in rotation. The muscle groups you should be targeting: Hip flexors, gluteals, and latissimus dorsi, side trunk muscles and the thoracic spine or upper back.

A few general rules for stretching:

1. Warm-up first, at least 10 mins. When muscles are warm they are more pliable and thus more receptive to length change.
2. Try to target the major muscle groups and then focus on those areas that are important for your golf swing.
3. Stretch to the point of discomfort never pain. Hold the stretches for 15-30secs; and repeat 2-3 times. Feel the tension in the muscle reduce the longer you hold the stretch. Do not bounce.
4. Focus on your breathing and try to relax during the stretch. Proper technique and good posture are also very important for optimal results.
5. Always ask yourself are you feeling the stretch in the structure you are hoping to stretch?

Athletes will often use supplemental therapies alongside their stretching techniques to assist in maintaining flexibility or range of motion. Some examples of supplemental therapies/interventions include physical therapy, massage therapy, acupuncture, trigger point therapy, dry needling and even yoga. Find out what works for you or your clients.

Yes, stretching regularly does take some self-discipline, but the benefits are tremendous. Remember, stretching for just 10-15 minutes 3-4 times per week is enough to make a difference to your golf game. Don't sacrifice distance through a lack of flexibility. It is easy to change!

Stretches designed to help improve trunk rotational flexibility:



Left: Hip flexors, Side trunk and lats.

Below: Sitting side trunk and lats



Left: Similar to above (left) but adding spinal rotation.

Below: Mobilization of the thoracic spine



For more information please contact either Michael Dalgleish at Michael@thegolfathlete.com or Karen Harrison at K.Harrison@golftbiodynamics.com.

