The Golf Academy at Cordillera

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Annual Golf Coaches' Review Research Paper

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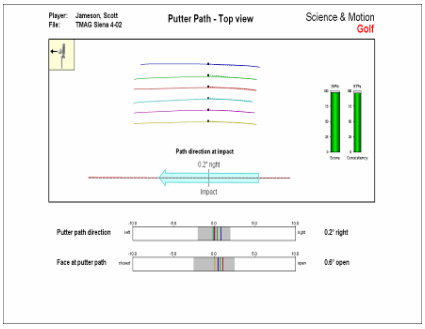
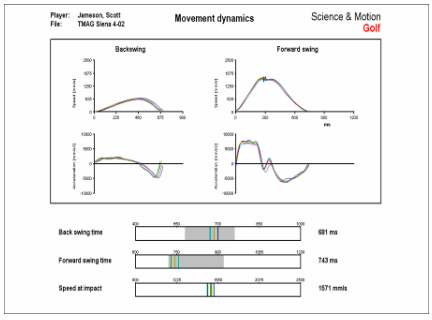
Length of Stroke and Timing Signatures in Varying Handicap Levels

One of the most enigmatic portions of putting has been the relationship between line and speed. We all know that our line is determined by the speed we hit the ball but how do we know how hard to hit the ball? How can one really understand "what to feel" without doing it correctly first? Isn't there a more scientific way to audit feel and help people to become better at hitting the ball the same distance over and over when they want to?

In my Putting Academy at Cordillera I use several tools- specifically for this article I will use Advanced Motion Measurement's 3D Motion Analysis System and the SAM Puttlab created by Science & Motion Sports to teach "feel." These two high tech systems will be used to correlate the data contained below**.**

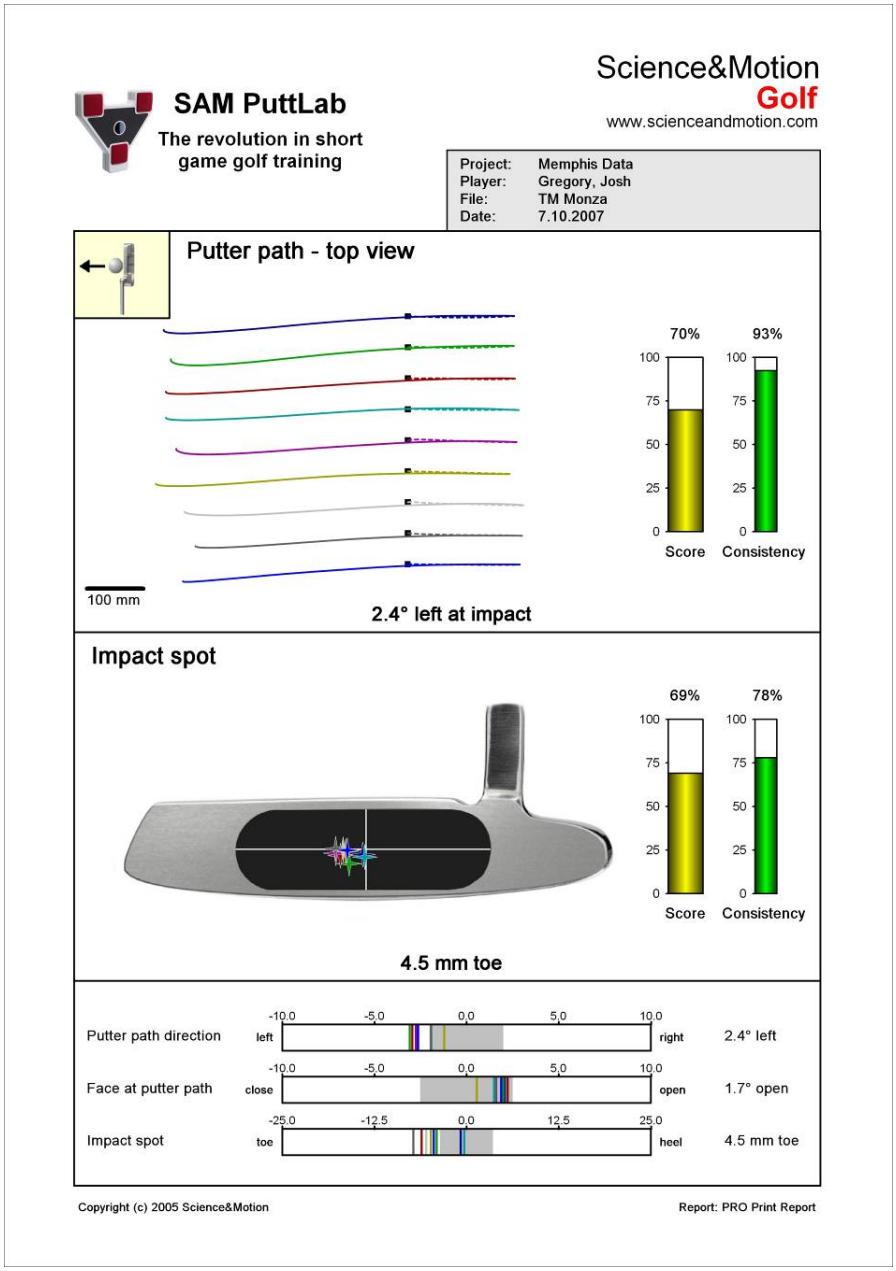




Using the SAM I will correlate the "time signatures" and "stroke lengths" of ten putts in succession charting the backswing speed, forward swing speed, time to impact, and overall putterhead acceleration for players of varying levels.

Hypothesis:

The more rudimentary a player's proficiency level the less consistency we should see in the player's length of stroke and their control of the putterhead's speed and acceleration on the way back and through.

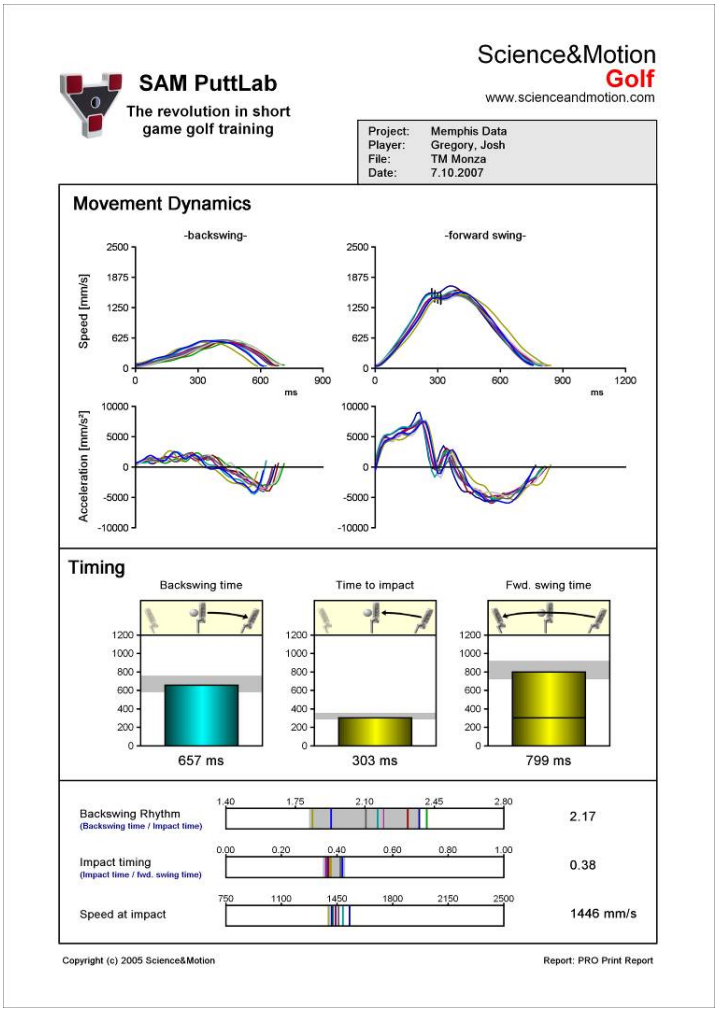


Sample Putter Path Page

We will focus on a few things on this page in regards to the "Putter Path:"

1. The overall length and consistency of the backstroke (shown by the dotted line)
2. The overall length and consistency of the forward stroke (shown by the solid line)
3. The amount of "loops" or "loose motions" going back and or through
4. The amount of "curly-Q's" at the end of the forward swing

Please DISREGARD any information or data shown by the horizontal/vertical impact points on the putterface. We will not be measuring or correlating this aspect of the putting stroke within our study.



Sample Time Signature Page

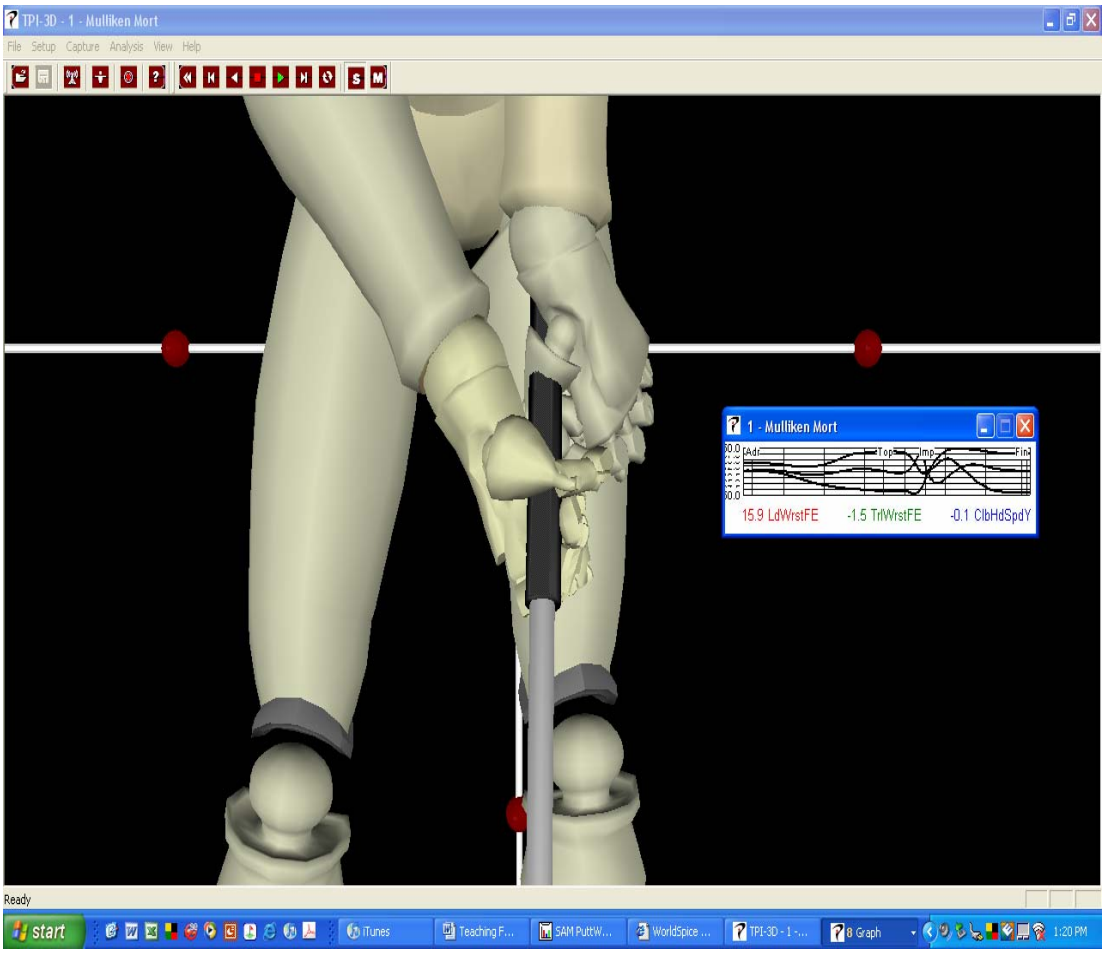
The **top left** time graph pertains to putter head speed on the way back…it shows just how fast the putter is moving in milliseconds. The Tour Average is around 650 ms.

The **top right** time graph shows the speed of the putter into the forward swing, through impact, and into the finish. The Tour Average is around 300 ms.

The **bottom left** time graph is the acceleration of the putter from address to the top of the backstroke. A flat line shows that acceleration is constant, thus, the speed of the putter head at this point is neither accelerating nor decelerating.

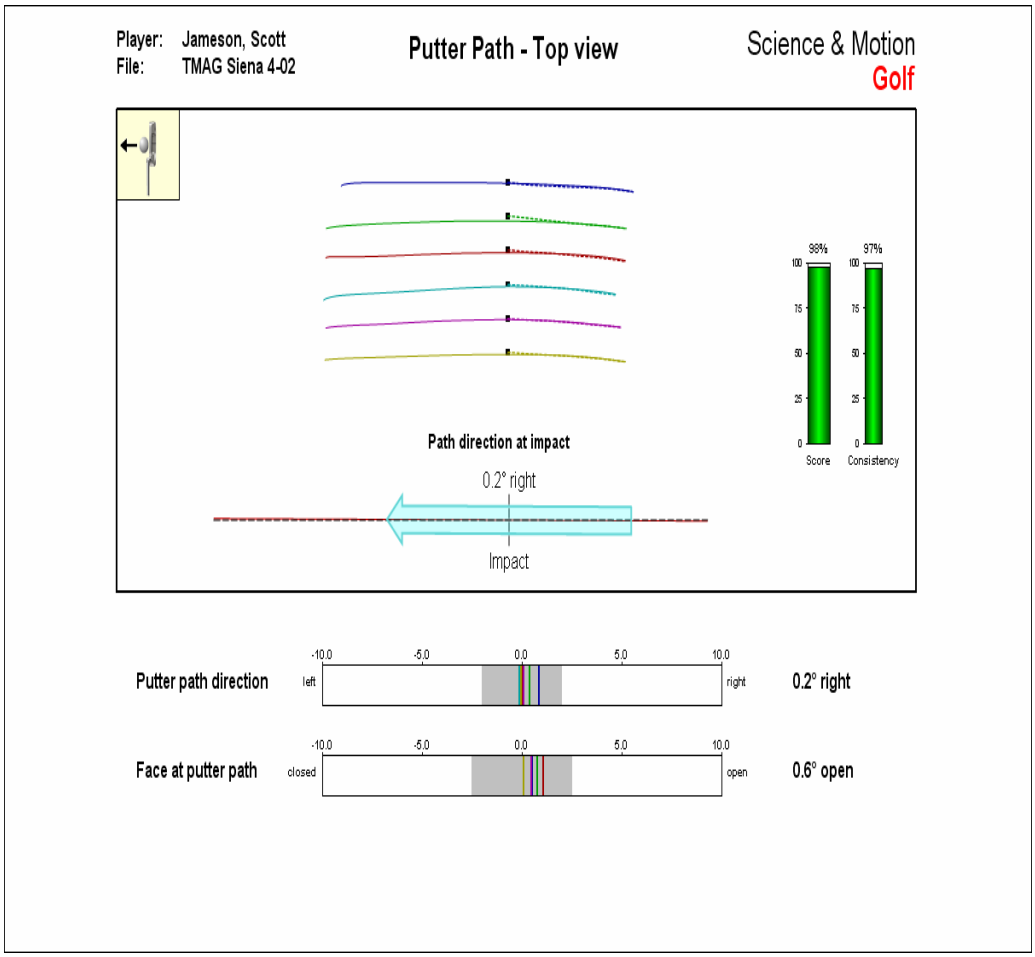
The **bottom right** time graph shows the transitional acceleration of the putter into the forward swing and on to the finish. The steeper the line moves up the more putter acceleration you have and the faster the putter is moving in ms. If the line descends then the putter acceleration is slowing and its speed is diminishing.

One note regarding your "stroke length" and "timing signatures-" It is very easy to repeat a stroke that is consistent in length, acceleration, and timing, if and only if, your impact alignments are sound and solid. In this study we understand that the more basic the players' skill the greater the chance of impact alignment breakdown which will make the post-impact putter path data look very inconsistent. This action will be shown by the excessive "curly-Q's" at the end of the forward stroke graph. It is my thought within this study to test my hypothesis above, showing that stroke length and timing signatures should correlate and do so as players become more proficient.



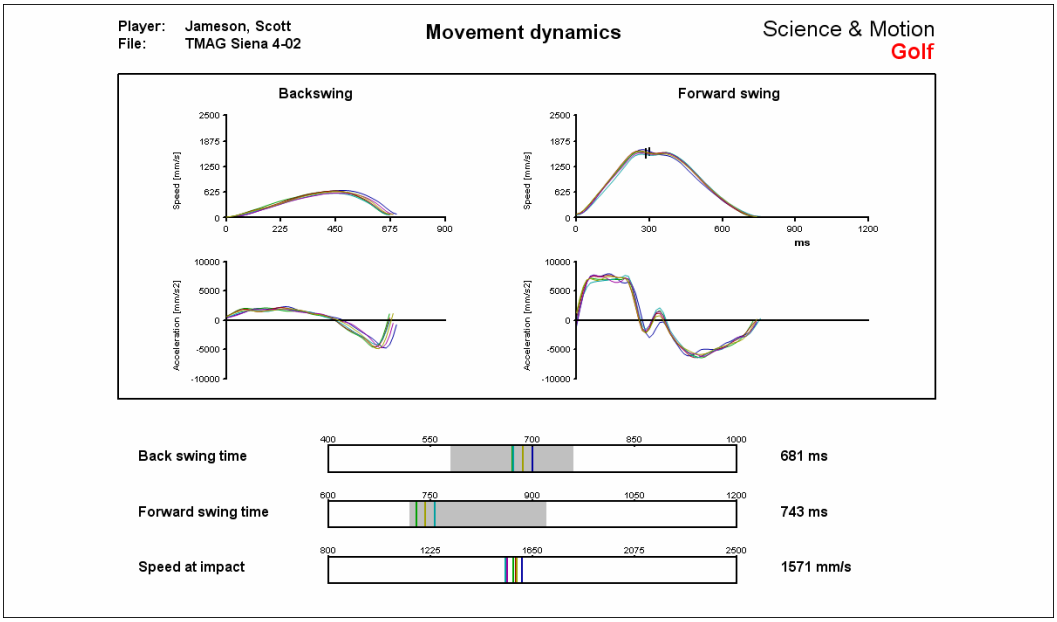
The 3D Analysis of the Professional used in the "correct" putting sample graphs above shows that at impact the forward wrist and rear wrists are in solid alignments as the shaft is leaning .1 (one-tenth) of a degree forward. This is the most consistent impact position that you can have. Whenever the forward wrist "breaks down" and the clubshaft leans back through impact you have added loft to the putterface which makes "feel" almost impossible to have when you need it.

The Tour Professional Stroke Length Graph



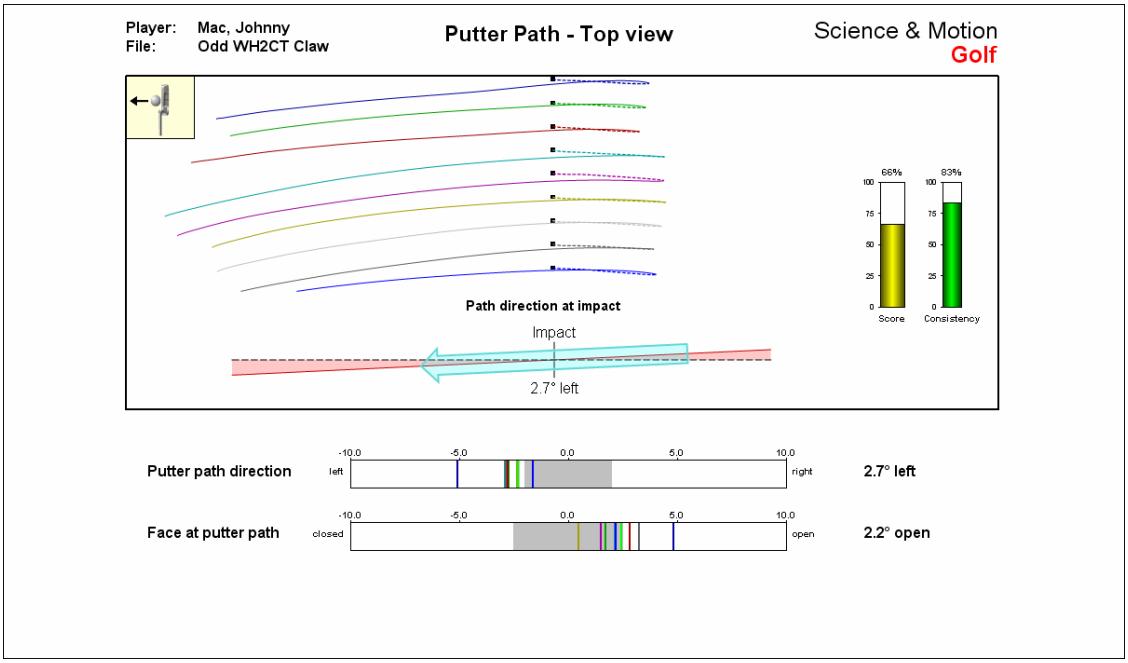
As stated earlier each professional player was asked to hit the same fifteen foot putt ten times without being able to see to the ball's finish position while this data was taken. As you could imagine the backswing length and forward swing length are symmetrical indicating consistency within the length of stroke on the same flat fifteen foot putt.

The Tour Professional Time Signature Graph



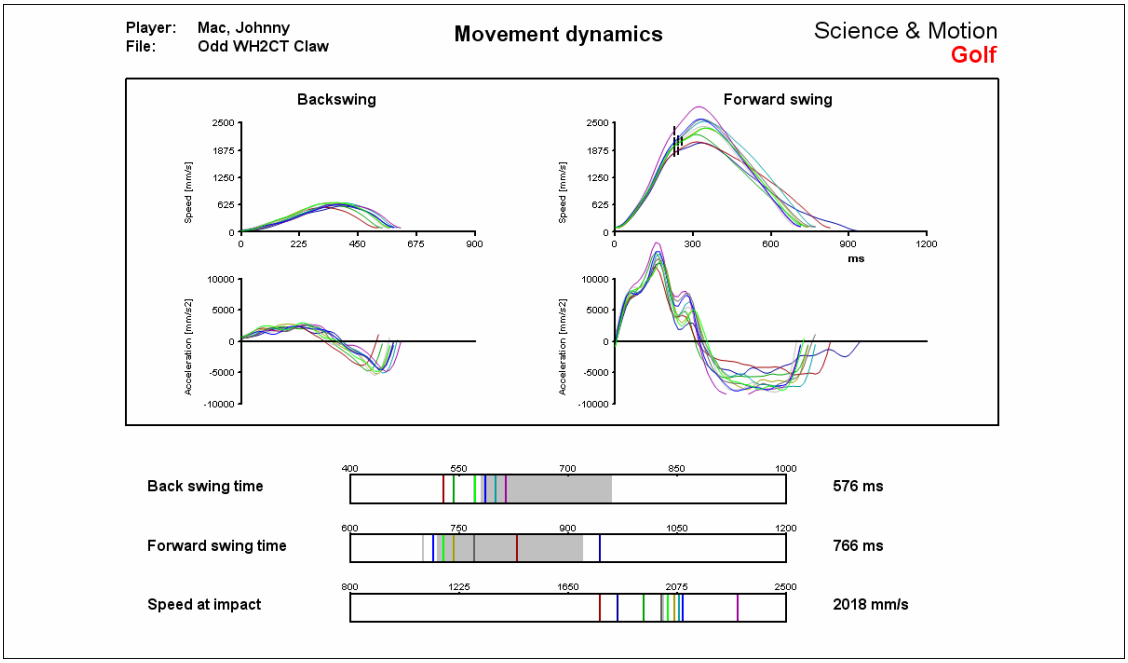
The timing signatures of the above putts show a very consistent motion in regards to speed and acceleration. As you can see the timing signature as all of the lines on the four graphs are not jagged during the backswing and/or forward swing. This shows consistency within this player's putterhead speed and putterhead acceleration back and through.

Scratch Player Stroke Length Graph



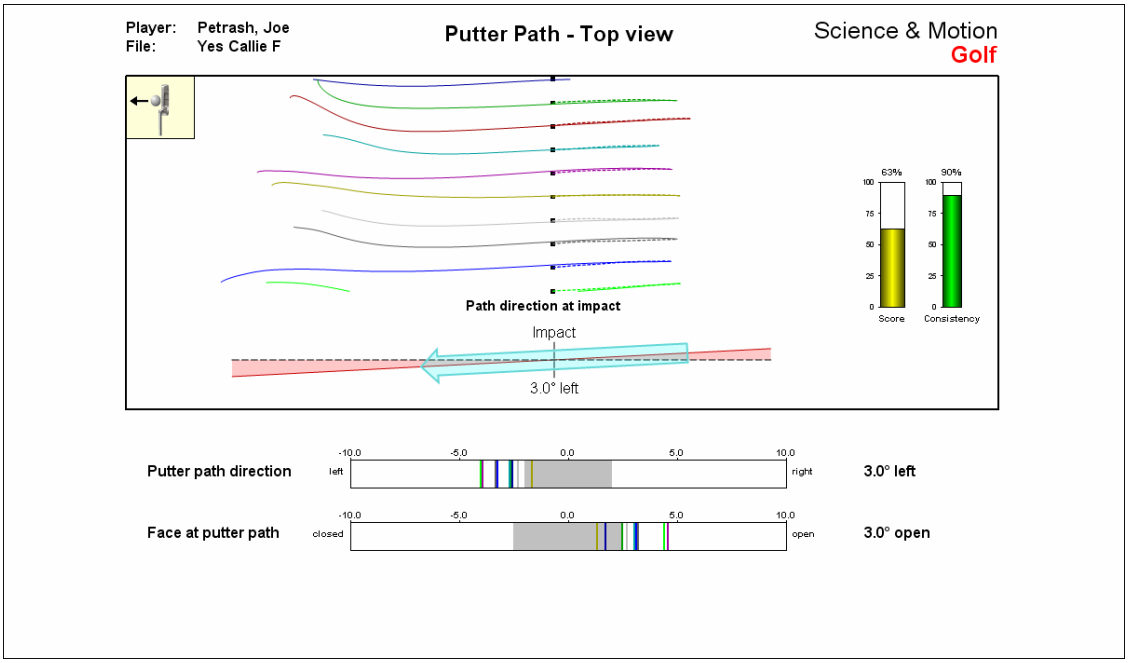
In viewing the overall length of the stroke from the above graph you will see that the backswing length of the stroke is very consistent; however, there are some issues in regards to the follow-through length of the stroke itself. Whenever you see disruptions in the finish length of the stroke this is an indication of improper backswing length/speed/acceleration issues. The overall backswing shape looks reasonable but in viewing this on a closer scale you will see that the direction of the backswing (shown by the dotted line) and the subsequent "loop" of the transition shows some inconsistencies thus the overall lack of general consistency in the follow-through length, shape, and direction.

Scratch Player Time Signature Graph



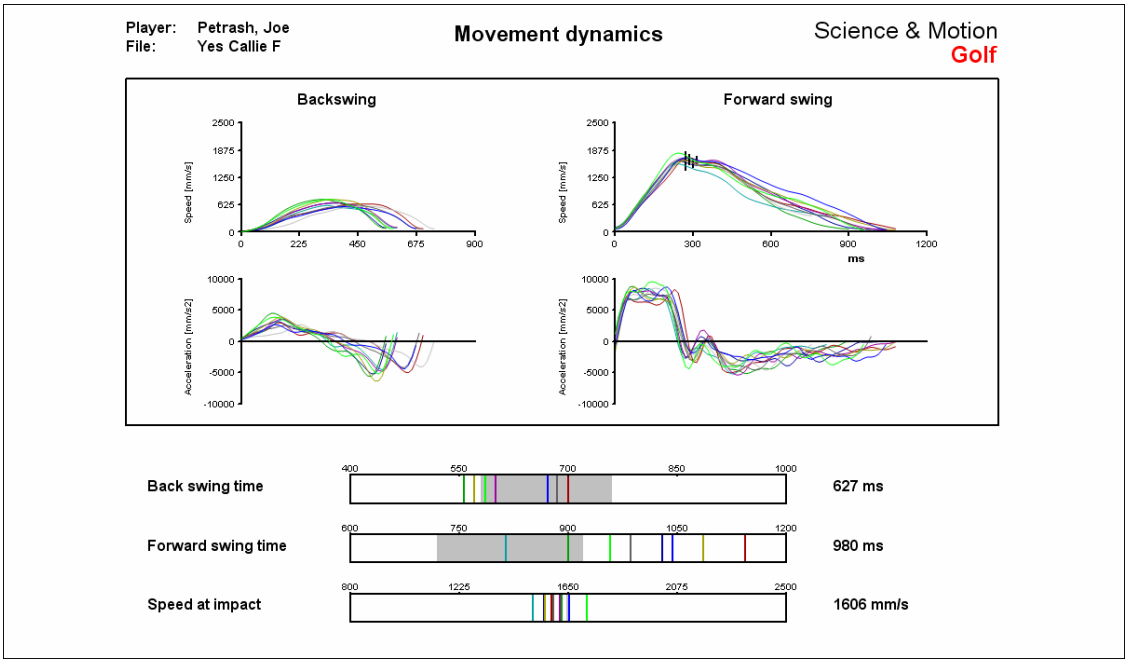
Above we stated that the backswing length and shape was reasonable (this player is a scratch player!) but it is not at all close to the forward and backswing graphs of the Tour Player. As noted the real issues were shown in the follow-through stroke lengths and this was mainly due to poor consistency of the backswing length and acceleration. In fact if you look at the backswing acceleration graph on the bottom right you will see that the lines are “tight” but do not appear as “one” as shown by the Tour Professional. Subsequently there was a lack of overall consistency in forward swing length. These issues and player compensations are shown very dramatically in the Forward Swing speed and acceleration graphs above. As this scratch player fights his backswing acceleration consistency the forward swing speed and acceleration graphs are greatly compromised as a result

10 Handicap Stroke Length Graph



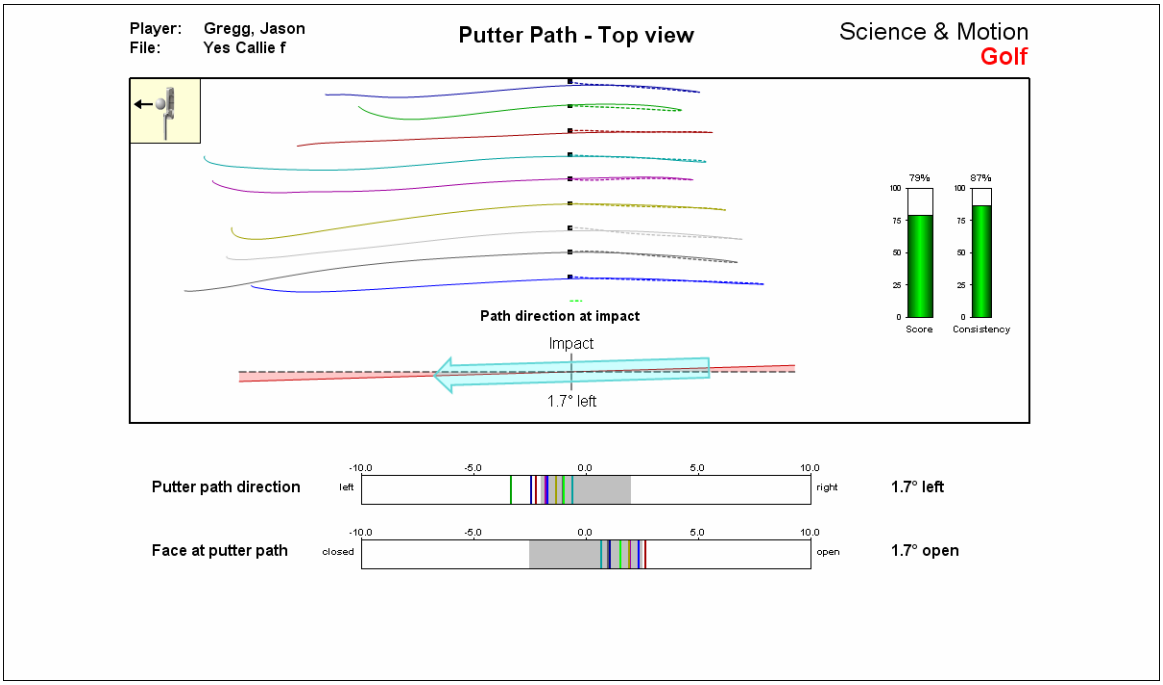
As a 10 Handicap player you begin to see inconsistencies within the backstroke length and the follow-through direction and length as well. This is easily shown through examining the backswing lengths on the right of the graph above as well as the symmetries and overall direction of the follow-through lines to the left of the dots. The "curly-Q's" show the excessive hand action of this player trying to make up for the improper motion of the stroke they perceive internally as they putt and see the previous ball's reactions.

10 Handicap Time Signature Graph



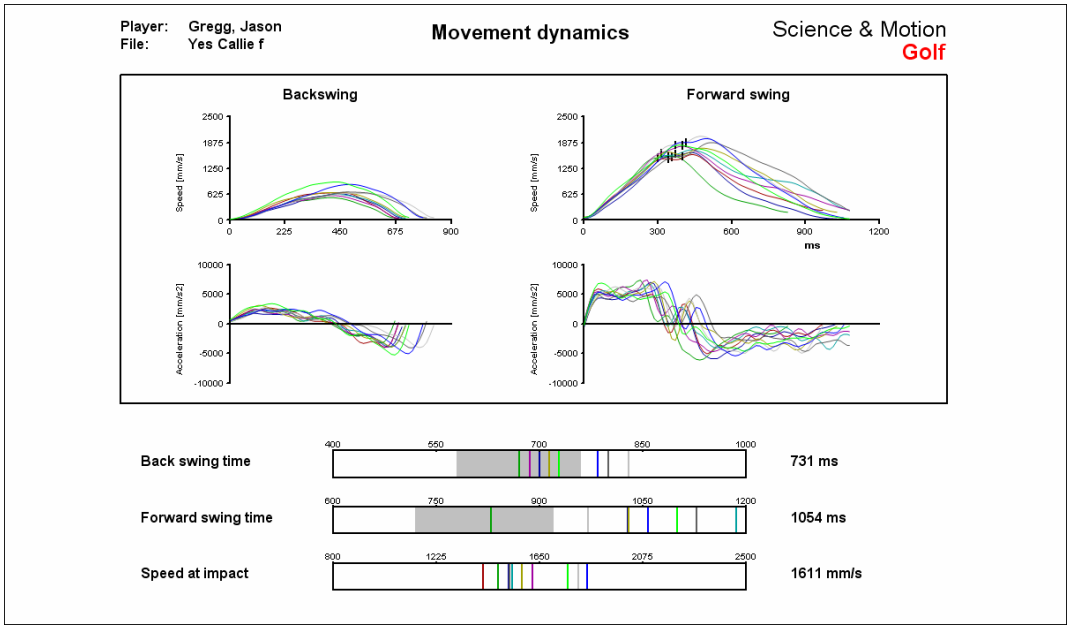
Now that we have seen that the normal 10 handicap player has some type of swing length issues, it is interesting to note that, yes; the timing graphs become more inconsistent as well but do not indicate the brutal inconsistencies we saw above in stroke length. This helps us to understand that one's stoke can vary in length and timing, but if there was one part to this equation that overcomes another it would be the fact that you can still putt to a relatively successful level if you timing signatures are not grossly out of sync. There is not much difference between a 10 handicap and a scratch player on the putting green except a few three putts and a few missed up and down's with some being contributed to leaving the ball on the incorrect side of the hole.

20 Handicap Stroke Length Graph



As we examine the difference between the 10 and 20 handicap player you will see a huge difference between the levels of these types of putters! As seen in the above graph this player has trouble controlling the length of his stroke back and through providing general inconsistency on putts of any distance or shape. Remember that this mid-handicap player was asked to hit the SAME length putt over and over (15 feet) and this lack of consistently shows that his player cannot control the overall feel and putting stroke length from stroke to stroke- this is where all the three putts come to light. And as you can tell this would make it very hard for this player to develop a consistent “feel” on the greens because nothing is constant from putt to putt and stroke to stroke.

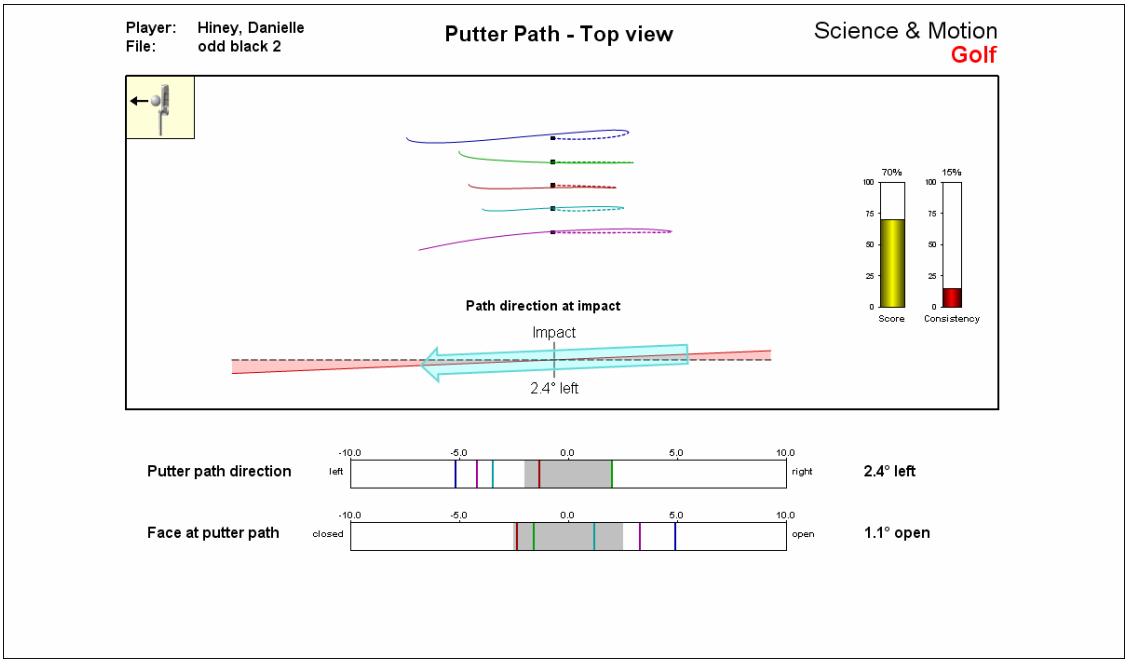
20 Handicap Time Signature Graph



Examining the four graphs above helps us to see that each of these strokes had a very different "timing signature" and logically if you cannot move the putter back and through the same speed on the same length putt you are going to have problems with pace. Something interesting to see…the backswing timing graphs do not show that big of difference between the 10 and 20 player, but the swing length and forward swing speed and acceleration graphs are very, very inconsistent! This is the biggest difference between these two players. As stated earlier, you MUST control your swing length and forward swing speed and acceleration.

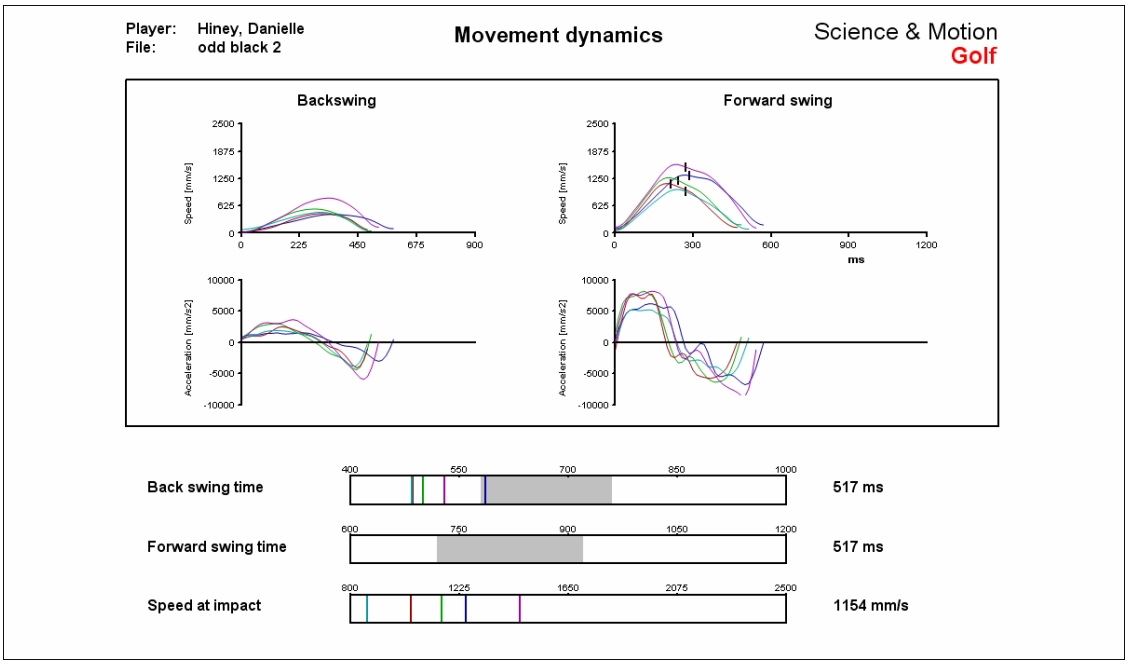
Now the point must be made did this player have trouble with his speed because his swing length was off or have trouble with his swing length because his speed was off? I believe that it can happen either way! If you watch someone who takes the putter back super slow they will adjust and move through much faster when they have allowed the backswing tempo to become too slow. However the opposite argument can be made that when this player takes the club back too long or too short his subconscious takes over and adjusts his swing length thorough the ball to accommodate and when this reaction occurs his timing signatures will become grossly inconsistent.

36 Handicap Stroke Length Graph



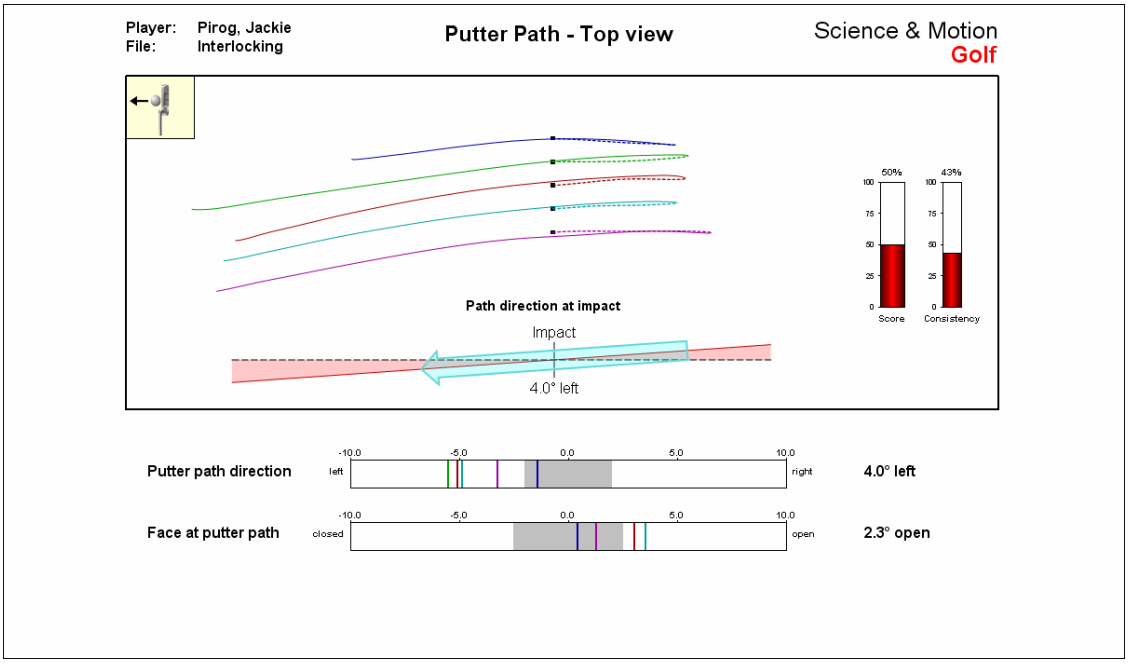
It is not very surprising to see that a 36 handicapper has little “feel” in backswing shape, direction, or length thus they will have no control of the putterhead in general.

36 Handicap Time Signature Graph

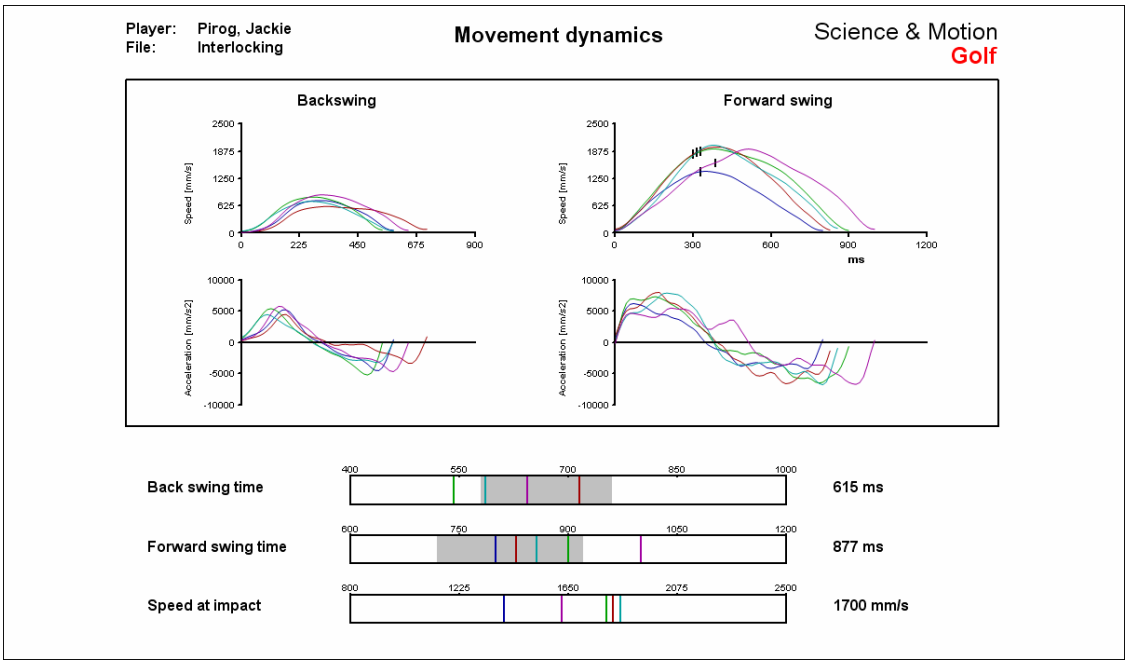


With this being stated you will also find that the timing graphs are all over the board as well. This player has no idea what to “feel” thus they will have a hard time with any outcome driven type of practice. The key for this player would be to help them to understand how to FEEL the proper length stroke for putts of differing lengths and then to associate the proper speed and acceleration required to make this happen with the proper putter stroke length.

The Beginner Stroke Length Graph



The Beginner Time Signature Graph

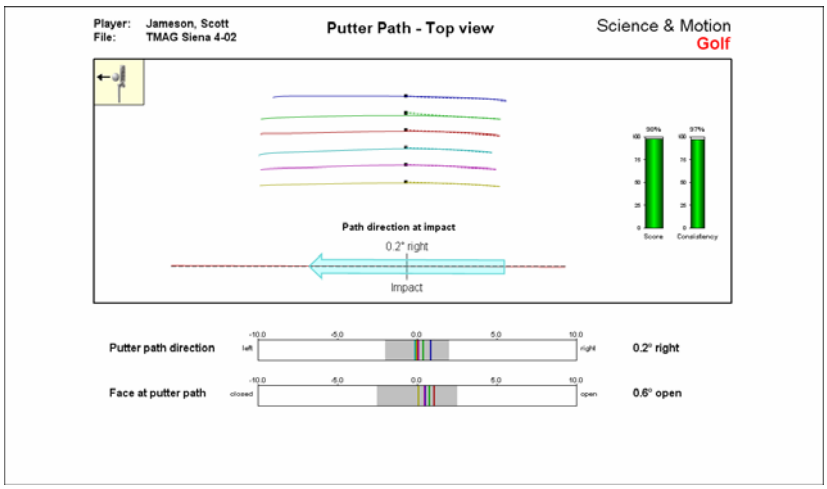


Just for fun we tested several players who have never played golf and this is what we saw as a sample graph for length and timing. There is no consistency in stroke length, stroke direction, backswing/forward swing consistency in speed and acceleration. However

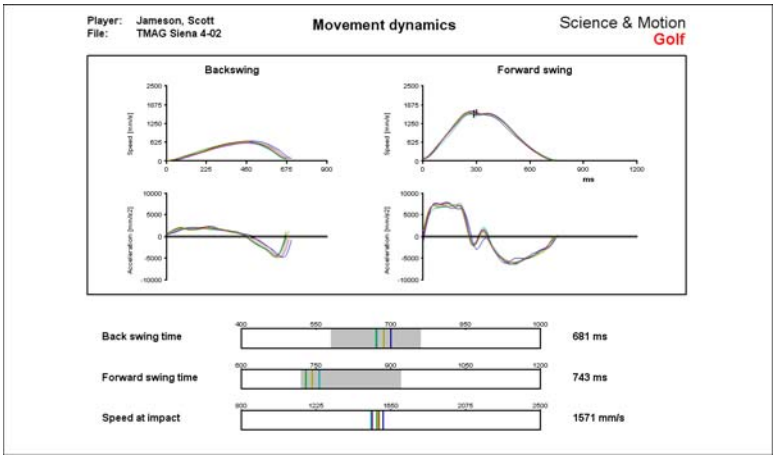
these strokes are “natural” and have no conscious thought in them unlike the 36 handicapper above. The 36 handicap player has more evidence of curly-Q’s due to their hands taking over in order to try and force the ball where they want it to go. While the total beginner has no eveidence of controlling the ball with their hands, they move the putter and just see where it goes. Thus the point must be made that the only real difference between a total neophyte and a 36 handicappers’ is that the more experienced player has learned to better manipulate their hands NOT improved their strokes or timings in general!

The Mechanical Conclusion: The SAM proves that in order to have “feel and control” on the greens you must do several things at once in order to reproduce the same stroke:

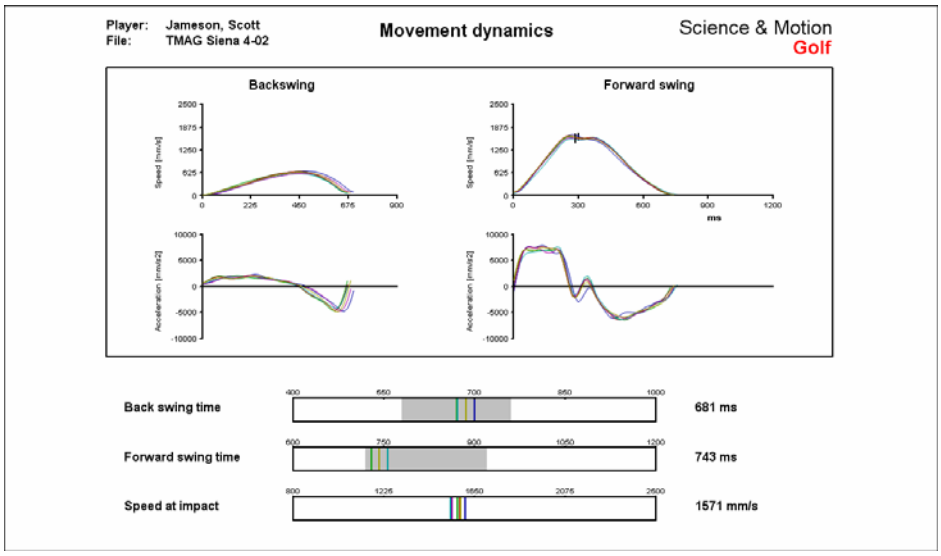
1) You must control the overall length your backstroke and follow-through on putts with the same general length.



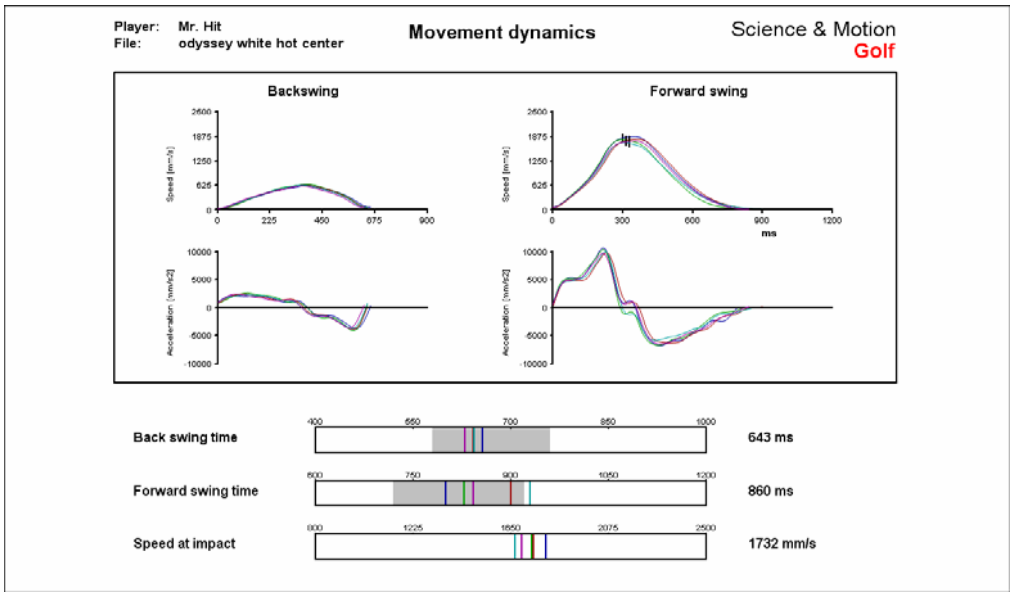
2) You must control not only the overall speed of your overall stroke, but its acceleration as well; thus, all the lines on each graphs will almost appear as “one.”



3) As a “swing” putter (like Crenshaw) you must accelerate into the impact zone, maintain a constant velocity through impact in order to control the ball’s reaction. This is shown on the bottom right graph by the “table-top” looking acceleration curve. Impact occurs at the point where the “table-top” falls off on the right side. This is the acceleration signature of a player who plays on fast greens.



4) As a “hit” putter (like Price) you must accelerate off the beginning of the backstroke and into to the ball with a “popping” type of action. This is shown on the bottom right graph as acceleration begins, table-tops just before impact and then accelerates once again into the ball (shown by the steep peak) and then drops off rapidly. The second acceleration is the “pop” through impact seen by Price and is usually a mark of someone who has grown up on slower greens.



5) During the forward swing and into and through impact your wrists should remain as solid as possible allowing the clubshaft to return to the golfball in a position that will allow it to propel the ball as consistently as possible.