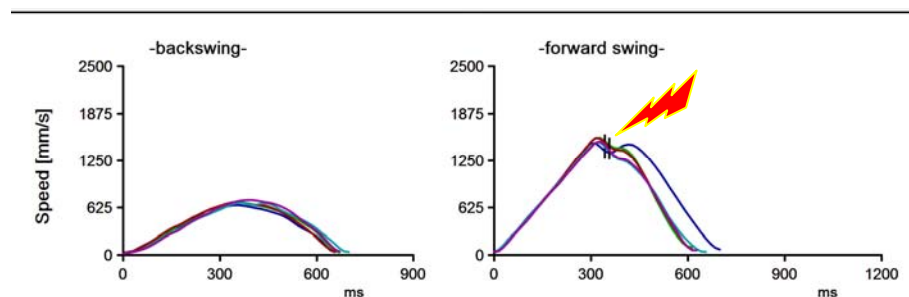


The movement dynamics (often called tempo) is a dimension recorded and reported by the SAMPuttLab that certainly proves *There is More to Putting than Meets the Eye*. Tempo is something desired in every golf swing, especially in putting. The previous concept or definition of tempo is very illusive since it was only perceived and defined by “feel”. The concept of tempo may be defined in a quantitative manner with the SAMPuttLab. The opportunity to measure so many golfers’ putting strokes with this instrument has provided a better understanding of putting dynamics and given insight to developing an optimal tempo. The SAMPuttLab affords an exact measurement of tempo in four different aspects of the putting stroke. The velocity (speed in millimeters per second) and the acceleration (change of speed in millimeters per second squared) are simultaneously measured on the back stroke and then the forward stroke. By way of comparison, the human eye of an instructor may see the event, but cannot produce a hard copy document for viewing. The video tape recording with various additional timing aspects may be able to do a similar thing. The video studio technology is generally only available to tour pros at the various sponsoring company training centers. The SAMPuttLab also has a coordinated video component.

The two dimensions of tempo deserve a review of their respective definitions as we seek to better understand the movement dynamics of putting.

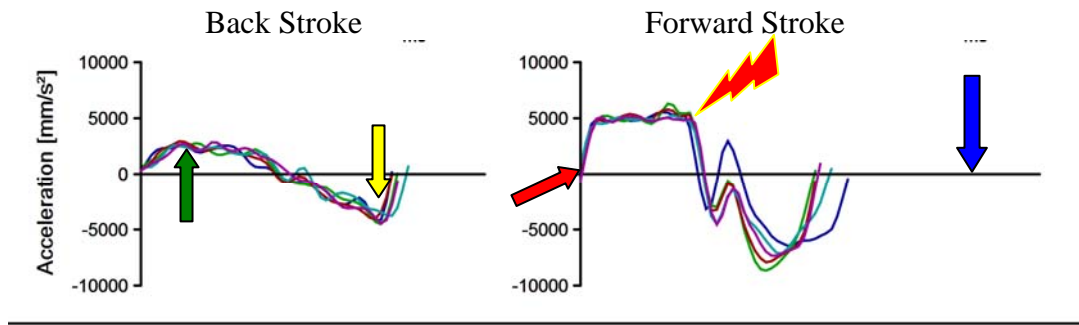
ve·loc·i·ty Pronunciation Key (və-lŏs'ĭ-tē) Rapidity or speed of motion; swiftness. Physics. A vector quantity whose magnitude is a body's speed and whose direction is the body's direction of motion. In other words it is the miles per hour (MPH). The SAMPuttLab uses millimeters per second to document the velocity of both the back stroke and the forward stroke.



**The velocity on the backswing on the left graph approaches 625 mm/second. The more typical speed on the PGA tour is 500 mm/second for a 10 foot putt on a green with a Stimpmeter recording of 12.**

**The speed at impact (Lightning logo) on the forward swing is 1500 mm/second. This is the average speed at impact on the PGA tour for a 10 foot putt on green with Stimpmeter recording of 12.**

ac·cel·er·a·tion Pronunciation Key (ăk-sĕl'ə-rā'shən) *n.* The act of accelerating. The process of being accelerated. Physics. The rate of change of velocity with respect to time.



**This graph from the SAMPuttLab measures the change of speed or acceleration in millimeters per second/squared on the back stroke and the forward stroke. The horizontal black line identified on the right with a blue arrow is neutral and is the bench mark of no acceleration. A recording that stays on the black line is not changing acceleration; fast or slow. The recording above this black line indicates acceleration and those below indicates deceleration.**

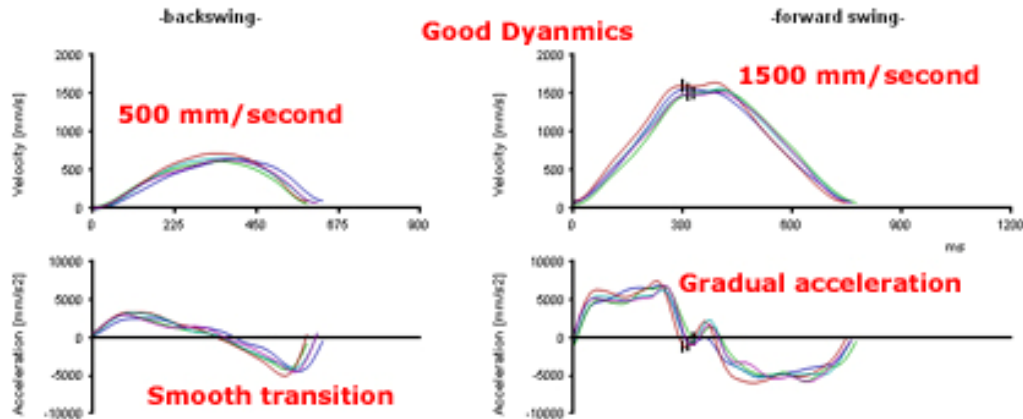
**The graph on the left shows an example of the change of velocity during the backstroke. Notice that there is an increase in change of speed when the putter starts to move backward from the resting position.(green arrow) As the player gets near the end of the back stroke to change directions for the forward stroke, there is an abrupt slowing of acceleration as you would expect.(yellow arrow)**

**The graph on the right shows the change of speed of the forward stroke. The sudden acceleration after the transition from the backstroke to the forward stroke is indicated by a red arrow. After a moment of rapid acceleration this player's motion dynamics changes to a more gradual acceleration pattern as depicted by the horizontal recording as he approaches impact. (Lightning logo) This pattern is representative of a player who has a tempo of a ball Stroker. Notice the instrument is so sensitive that the putter head hitting the ball (impact) results (Lightning logo) in the rapid deceleration with the vertical recording going almost straight down. This represents the rapid deceleration of the putter head following impact.**

This aspect of the SAM PuttLab is very revealing. What is recorded in mm/sec or mm/second squared is beyond the eye to perceive, let alone record by photography for the instructor or player's subsequent viewing. *"There is More to Putting than Meets the Eye"*. A video can record the motion, but the player generally only feels velocity and cannot perceive the variations in acceleration. Subsequent illustrations will show the micro motion changes in acceleration that only could be documented by such a sophisticated instrument as the SAMPuttLab. The following examples are good illustrations of the psychomotor phenomena.

*PGA Player Movement Dynamics:* This is an example of typical movement dynamics of PGA Tour Players. In this example all 5 strokes are similar in pattern, but not identical in recording. The maximal velocity of the back stroke for this player is 625 mm/second which is just above the typical PGA player's 500 mm/second. The forward stroke

velocity is 1500 mm/second at impact which is typical for a PGA tour player. The acceleration on the back stroke is minimal above and below the neutral horizontal black line. The transition is smooth without steep curves. The acceleration is very gradual into impact. In this case it is representative of a Stroker's pattern.



**PGA Tour Players Dynamics whose dynamics are those of a Stroker.**

The above illustration shows the print out of the dynamics of the back stroke and forward stroke of a professional golfer. It shows the recorded results of five successive putts of about 10 feet in length. Each putt is recorded in a different color. The remarkable feat is that this professional golfer was able to reproduce the same pattern dynamics time after time. Therefore a very consistent putting stroke is predictable for this player.

The typical PGA tour professional golfer's acceleration on the back stroke (left lower quadrant) is very minimal with gradual deceleration as shown with tracing falling below the horizontal line. The transition is illustrated with a sharply vertical line as the putter comes to a halt and changes direction. The acceleration in the forward stroke (right lower quadrant) is sharply upward reflecting the change of direction and then typically follows an acceleration path specific to that player until impact.

All players have increasing velocity as they approach the ball, although the pattern will vary uniquely to each player's stroke as seen in the illustrations below depicting the various signatures. Almost all players have an increasing acceleration unique to them as they approach the ball. There are a few exceptions. Players with excessively long back strokes and those who have been trained to stop the putter abruptly at impact show deceleration at impact. The deceleration is usually unrecognized by the golfer until scientific recordings like these reveal the problem to them.



All golfers, amateur and professional have a pattern to their putting stroke. I have come to understand this pattern as a personal signature, similar to one's autograph. This will be discussed in Chapter 13.