Notes for web site

“Geoff Mangum Putting Zone”

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SETUP & STROKE TECHNIQUE -- Pivot Never Forward Across the Middle, Stay Back -- In setting up to the bottom, in order to putt the bottom of the stroke, and not the back of the ball, the golfer sets his throat line directly above the middle of the stroke left-right. (This throat line is like the top bar of a swing set so the swing will go sideways beneath it down the line.) Then when he starts to move in making the stroke, he should NEVER LET THE BASE OF HIS NECK wander to the target side of this mid-line. The tendency for the pivot to wander left happens at three points in the stroke: starting the backstroke, starting the downstroke, and going past the middle in the thru-stroke. In the downstroke, the tendency is to let the lead shoulder socket's dipping down and under DRAG the pivot to the front (left for a right hander). The cure for this is to hold the base of the neck stationary right at the start of the downstroke and FORCE the lead shoulder down and under the still pivot. Don't let the lead shoulder drag the pivot with it across the mid-line. The pivot masters the shoulder. This will feel like HOLDING THE HEAD VERY STILL AT THE START, but it's really holding the neck and throat still, and the head stays still as a by-product of this. Once the top of the backstroke is reached, the second time the pivot tends to go forward is when the golfer starts the downstroke with the rear shoulder, and for the same reason this happens at the start of the backstroke. The cure is the same: hold still in the neck and throat. But there is also a new luxury: don't DO the downstroke, just let the stroke shape (arms, hands, putter) simply drop and swing beneath the fixed pivot. That way, the force of the rear shoulder shoving or dragging the pivot is eliminated. Hold still at the top and let the stroke drop. The third time is when the stroke is going past the bottom headed up on a slight rise. If the golfer "chases the back of the ball," he will very likely pull the putt with the lead shoulder headed horizontally back and behind, and this will drag the pivot across the mid-line on a backwards curl. Instead, if the golfer allows the momentum of the putter and arms and hands to "go where they want," the stroke will follow the alignment of the shoulders, will be constrained by the top pivot's remaining still, and therefore the putter head will rise slightly straight down the line. This cannot happen with dead hands and arms unless the lead shoulder RISES vertically above the balls of the lead foot. When this happens, the rising of the lead shoulder will PREVENT the pivot from curling or wandering across the mid-line: the shoulder stalls out and the arms and hands "flap" inward in a pull, dragging the pivot behind. The stalled shoulder may also shove the pivot so that it rotates or spins top-over-to-the-rear. If the pivot in fact wanders towards the rear instead of simply turning in place as the lead shoulder rises past impact, that's probably not ideal but is also not fatal to the line. In any event, whether the pivot at the base of the neck at this point simply spins in place or rotates and also wanders to the rear a bit, the TOP OF THE HEAD will bob backwards like the top of a lollipop (inverted pendulum) whose stick meets the body at the base of the neck. No problem! If you artificially FREEZE the head at this point by using that old lore about "listening for the ball to drop" before you allow your head to move, you are doing this with neck tightness, especially right where the lead shoulder meets the neck at the base. This MUSCLE KNOT makes the stroke jabby and tends to misdirect the rising of the shoulder out of plane, and thus the stroke out of

square. If you MUST have this KNOT in your neck making the shoulder stroke action less fluid and natural, go ahead, but know it's there, and know it will make you force your way thru to a shoulder that rises only vertically past impact.

SETUP & STROKE TECHNIQUE -- See the T, Putt the T -- Every putter presents the shape of a "T" visually to the golfer, with the leading edge of the putter face being the "top bar" of the T and the midline or aimline extending perpendicularly back from the putter face being the "stem" of the T. The intersection of the bar and stem is always at the sweetspot of the putter behind the ball. This means that there is another, imaginary T with the stem aimed down the line -- sort of a "mirror T." The stem of this mirror T SHOWS THE GOLFER IN ADVANCE a) where the stroke needs to go forward past the bottom on a slight rise while remaining square down the line, and b) where the golf ball better go as it exits the setup in a putt that rolls straight where the putter aims. You don't really need a "spot" of grass in front of the ball; just look at your putter and "see the T, putt the T."

DISTANCE CONTROL / TOUCH & TEMPO –

Two Rules for Perfect Lags: Don't Go Long, Don't Be Short -- Yeah, right! But HOW do you DO this? Easy: Rule 1 How-To: The backstroke MUST always last the same time going back without you defining the size of the backstroke -- just pull the trigger, and the downstroke MUST NOT speed up or slow down from your usual timing. Then it's -- just look and putt. The instincts will not fool you with a backstroke that is too big any more than your brain will smash your hand against the door when reaching out to turn a door knob, so don't get into it mentally. Just do it. Once the instincts give you the correct backstroke that goes along with the downstroke timing, there is a subtle secret in physics: IT IS IMPOSSIBLE TO GO LONG WITH THAT BACKSTROKE UNLESS YOU ZIP THE DOWNSTROKE FASTER THAN USUAL. So don't speed the downstroke ahead of the usual timing. [End of Rule 1.] Rule 2 How-To: The reason golfers are short on lag putts is they FEAR GOING LONG. We just sorted that out with Rule 1, didn't we? IT'S NOT POSSIBLE TO GO LONG. So don't chicken out. There are two times golfers chicken out in the stroke before impact: before the backstroke gets as big as it needs to get, and/or after the backstroke gets big but before impact while coming down. The first sort of chickening out makes the golfer STOP the backstroke too soon (so he's short unless he zips at the ball, in which case he's long again). The second sort is a panic at the size of the stroke that causes deceleration coming into impact. So long as the backstroke gets done by instincts (no think, no try, just putt) and takes the usual amount of time, the backstroke gets as big as it gets, and the golfer is not supposed to know in advance and is not supposed to JUDGE the size of backstroke that results. Leave it alone and go with it. [End of Rule 2.] Another way of saying this is simply "Putt with an instinctive backstroke so that the usual backstroke timing and downstroke timing do not get hurried or worried, sped up or slowed down." Trust it and see! Another way of thinking that helps this is the phrase "LET IT GROW, LET IT GO." Let the backstroke GROW as big as it wants to get in the time available, then let the downstroke GO in a smooth gathering of as much speed into impact as it gets without stifling the full head of steam it wants to get within the usual time availablke for making impact from the top of the backstroke. Don't chicken out of the backstroke and don't zap the downstroke.

BASIC ROUTINE & MANUAL

Putting Manual A practical overview of Touch, Stroke Technique, Putt Reading, and other topics.

Five Musts for Great Putting The five "Musts" for great putting are: 1. Tempo, 2. Touch, 3. Targeting, 4. Technique, and 5. Psychology.

Four Fundamental "Elements" of Putting Skill The four basics of putting are 1. Pick a target, 2. Aim at the target, 3. Putt straight, 4. Putt with distance control (touch).

Dead-Eye Putting The purpose of a putting routine is to use effective physical behaviors for gaining putting perceptions that promote your best read and stroke and to use effective postures and movement dynamics to execute your best stroke, and an integrated routine has four keys to effective targeting for optimizing a shoulder stroke from a square setup: eye dominance, eye position, gaze control, and neck-head turn.

TARGETING / AIM

Gaze Dead Straight for Dead Aim Setting the eyes "above" the ball is not enough for optimal targeting because a gaze direction angled down the face as if reading (with forehead higher than chin at address) makes the hole appear off to the inside, whereas a gaze straight out of the face requires setting the forehead and chin at the same height above the surface, and this gaze is the only one that allows you to scan along the putt path from ball to target on the real line with optimal sensing of spatial relations in the putt.

Salute the Dawn Having a straight and level gaze is more important than whether the eyes are positioned directly above the ball or slightly inside, and a reliable way to get the gaze straight and level is to "salute the dawn" with your saluting hand level with your pupils and then bend at address lowering your head towards the ball until the ball "rises" above the salute into vision like a dawning sun coming up over the horizon.

Get Your Head on the Grass for Top Putting To enhance your sense of the putt, simply looking for the line is not enough, and you have to actually pay attention to the grass blades themselves over key segments of the path in order to get a vivid sense of energy and direction for the roll.

Stand in the Scene to Aim Well In orienting to the target, you are also orienting to the total scene, so don't neglect the usefulness of noticing trees or other landscape features beyond the green when you are aiming and setting up for a putt.

The aiming routine and skills (video 10 mins. 22 secs, quite ugly chap, but the info is good -- I didn't film this!)

Sighting the line to aim the putter

Aiming the putter

Checking the aim of the putter

Light Up the Target with Your Putterface Visualize the direction straight out of the putterface as a long straight rod whose tip sweeps side to side over the hole or aim spot as you get a fix on precise face orientation to the target.

Finger Your Target Hand-eye coordination is essentially knowing how to "touch" the end-point of your line of sight, and hence coordinates the arm-hand movement in the brain with spatial awareness of the target location by dominant-eye directional sense plus distance or depth judgment -- so putting to the target is similar to "touching" the target.

Putt Out Your Eyes The shape and geometrical features of your field of vision offers assistance to your putting targeting and stroke that you may not be aware of -- and learning these matters.

Get Cozy with the Ball's Shadow Taking a look at the quarter-sized circle just in front of the ball helps keep the stroke on line by showing you the line of grass the ball will roll across on the way out of your setup.

Point and Putt: A Fresh Way to Fill the Hole on Short Putts For shortish putts, use one of the most fundamental techniques all humans use every day to help locate the target -- point at it!

Putting in the Wind -- Once the wind is strong enough to make the material on your pants legs flap like flags on a sailboat (about 10-15 mph), beware of putting upwind or downwind and allow for crosswind to influence the break or line of lengthy putts. A steady headwind on a 20-foot putt can make the ball stop a foot or more short on normal greens. Going downwind is not that big a deal unless the break is very subtle, in which case the wind can shove the ball a little thru the break. But the tailwind doesn't influence the ball all that much unless it is moving faster than the ball, and this is usually only true for a small segment at the end of the putt when the ball is slowing down. Even then, the ball is settling back down into the nap of the green, so the wind has a tougher time changing the ball's roll unless the green is slick. Crosswinds have a greater "push" effect on the ball if the putt is long and the green is slick. A straight 20-foot putt on a normal-speed green with a 20-mph crosswind can see the ball get pushed quite a few inches to the side by the end of the roll, and this makes planning the ending break of the putt tougher. On short putts on slick greens in stiff wind, don't be shy and certainly don't "baby" the putts. Winds that come and go are obviously more troublesome than a steady wind. Wind that challenges balance can be countered with a wider stance and a lower bend, and perhaps with a more compact stroke as well.

GREEN & PUTT READING

A Slo-Mo Read for Seeing Enough Break Speed determines break, and optimal speed at the hole determines optimal break; the optimal break is obviously between the fastest speed that will drop and the slowest speed that will just get the ball to the hole, and is a lot closer to the slowest than the fastest to make more of the hole available for capturing the ball and avoiding long comebacks.

Crunchy, Toasty, Tasty, Soppy Greens Green speed is much more than just mow height and grass type -- and much of green speed is related to the water content of the green and its turf packing.

Reading Break: Zero in on the Zero Break Line If the green surface for the putt is basically flat although tilted, you can find one aim spot for any putt of the same length by identifying the fall-line through the hole (the "zero break line" or ZBL) where all putts up or down are perfectly straight, walk around the hole in a semicircle from your ball to a side-on putt to the hole of the same length that is perpendicular to the ZBL (and hence has no elevation change up or down from there to the hole), and visualize this putt at regular speed to imagine how far below the hole such a putt would roll low and cross the ZBL; the aim spot for all putts of the same length is that far above the hole along the ZBL.

See the Spider The "fall line" of the green surface at the cup runs straight uphill-downhill thru the center of the cup, and the final path of all putts across the flat-but-tilted surface right around the hole makes a pattern like a spider with the legs all indicating different pathways into the hole, and the head of the spider is the SAME AIM SPOT for all putts. Learning how slope tilt, green speed, and distance of putt make the spider change size and shape a little, so you can accurately visualize the curve or path of the one "leg" of your putt and find the single aim spot or "head" of the spider above the hole on the fall line, is mostly learning how to "see the spider."

Box the Break The only part of the green that matters is the part the ball rolls over from address into the cup, so you can "box" this putt and focus only on this surface while learning something valuable about the break and how to start the putt off so it feeds into the break correctly and goes on to sink -- simplify a typical breaking putt to a break point and then a higher aim spot for starting the putt off, with the intention of having the ball break off the start-line so it turns parallel to the baseline right at the break point.

Reading Putts as Revealed by Going Behind the Hole If a putt's break seems elusive, try going behind the hole for a read, but be careful that you visualize the ball's roll as coming towards you and as slowing to drop-speed in this final entry section of the putt.

Hit the Groove through the Curve To get a more definite sense of the right speed for taking a break without blowing through the break, visualize the final section of the putt curve as a race track banked so that anything faster than the proper speed jumps the track and then deliver the ball with enough speed to keep the ball on the track through the break.

Plumb Bobbing is Plumb Crazy ... Mostly Plumb bobbing only "works" (in a fashion) if you aim the hanging puttershaft down your impression of the startline, so it only confirms what you already sense, and doesn't make you a better reader of the break or make your sensing of the startline any sharper.

All "Methods" of Reading a Putt are Reading the SAME Putt -- When the golfer uses one speed to "see" the break, he may use different "methods" to read the putt, but all methods are reading the same putt. This means that any target spot near the hole for line and distance generated by a particular method has to be the same target spot generated by all methods, and the curvature of the final section of the putt with its implied energy shape into the hole also has to be the same for all methods. There is only one reality, given a particular "pace" or "delivery speed" for the putt over the given surface. If two distinct methods or approaches

differ in the target spot, then one or both are not accurate. When different methods all agree, the golfer should have high confidence that his read is accurate.

One Speed, One Read -- Modern neuroscience teaches that the brain is similar to a flight simulator: its main job is to predict accurately the future consequences of movement, a skill that the brain learns throughout life by ceaseless trial and error, and without which the animal using that brain will die. Animals live because their brains are well-trained and highly skilled at predicting accurately the consequences of intended movements. How does this work in reading a breaking putt? The three principal factors that determine the curving path of a rolling golf ball across the contoured surface of a putting green are 1. the exact shape of the tilts of the surface in relation to flat and level in gravity; 2. the surface speed of the green over the path; and 3. the pattern of rolling speed of the ball over that same path. Of these, the only factor in the control of the golfer is the rolling speed of the ball. From the beginning of a putt to the end of a successful putt in the bottom of the cup, the ONLY section of the putt where the golfer can accurately predict and envision the rolling speed pattern of the putt is at the end, specifically the last several feet of the path as the ball slows and drops into the cup. A golfer who has a consistent tempo and good distance control always delivers the ball into the final few feet of EVERY putt, regardless of length or green speed or contour, with the SAME "terminal velocity" or "delivery speed" -- the ball always drops into the cup with about the SAME rolling speed right as it crosses the lip of the cup on ALL putts. At least, this is true so long as the golfer uses his normal tempo and touch. THEREFORE, when the golfer envisions the break of the ball into the cup, he is implicitly relying upon his normal tempo and touch with its same-every-time delivery speed in order to predict accurately the exact curving path of the ball over the final 3-4 feet of the putt. Once he "sees" this accurately and realistically in his "mind's eye," the remainder of the path of the putt constructs itself backwards from the hole to the golfer's ball at his feet, establishing a startline and a distance for the putt. Great putters use only one delivery speed, and therefore always look for only one read. Once they see this break, then they are able to make choices, but not before. The usual choice is to putt the normal break, using the normal tempo. If the golfer uses tempo A to "see" the break, he jolly well better execute the putt with tempo A as well! Otherwise, he's like Homeros Blanco: "reading the putts in English but putting them in Spanish." The notion that there are multiple breaks to choose from on any putt depending on "how hard you are going to hit it" is alien to great putters. One speed, one read.

3 Rules to Sink Breaking Putts -- An intuitive way to approach breaking putts -- so that the chances of sinking the putt are VERY HIGH and the chances of leaving no more than a tiny TAP-IN are virtually certain -- does not require a specific target on the ground. Instead, the golfer simply applies three rules to his breaking putt. Given a straight line from ball to hole along the ground, with one side high and one side low (the "Baseline"), and also given a second straight line up thru the hole on the only straight-uphill line thru the hole (the "Fall-line"), the three rules to apply are: 1. NEVER allow the ball to roll across the baseline to the low side; 2. ALWAYS putt for distance as far as the fall-line and no farther; and 3. Aim as high up the fall-line as necessary to accomplish Rule 1, but no higher. It sort of boils down to just aim high and putt to the fall-line. If the ball rolls low by crossing the baseline, aim a little higher next time! This is fantastic for long breaking putts, and the application of the three rules gets you aiming higher than usual, which is a good thing.

DISTANCE CONTROL / TOUCH & TEMPO

The Core Putt Tune your stroke to green speed for superior touch and reduced "hit" by relaxing and slowing your body and mind down to optimal activity level with your most basic stroke, used as a personal Stimpmeter -- just push the putterhead back until you feel you have to lift it to go further, then drop the putterhead through solid impact to see how far the ball rolls.

One (Slow) Tempo Fits All Putts For consistent and accurate distance and line control, start with a single slow tempo or timing from start to finish for all putts regardless of length of about two full seconds, a nice easy "one potato, two potato" stroke -- your brain relies upon it!

Hickory Dickory You already HAVE a metronome with you on every green you play -- your putter! Just let it swing in your fingertips back and forth to remind yourself of a pro tempo for all your putts.

Stone Cold Putting Truly amazing distance control on a consistent basis for putts of any length is pretty easy if you understand that targeting and tempo establish the backstroke length automatically, and this is much better than "touch and feel," "muscle memory," or any sort of "trying" to get the "hit" or "pace" of the putt just so.

The five factors for touch

Your ball

Your putter

Your tempo

The green's speed

Your targeting move for distance

Optimal Ball Delivery Speed to Maximize Sinks -- The optimal delivery speed of the ball as it crosses the front lip of the cup is one that most reasonably balances three considerations: 1. the need to plow across surface obstacles and irregularities; 2. the effective "capture width" of the hole; and 3. the length of a comeback putt in case of a miss. From the physics of the ball-hole interaction combined with the usual characteristics of modern green surfaces (very improved since 1980), the optimal rolling speed is somewhere between 1 and 3 revolutions per second (rps) at the lip. A speed of 1 rps at the lip will dive deep into the cup and hit the bottom of the cup without reaching the back wall. A speed of 2 rps will dive deep into the cup and hit the back wall very low near the bottom of the cup. A speed of 3 rps will dive into the cup and strike the back wall about halfway up from the bottom of the cup to the top of the cup liner. Whatever rolling speed of the ball that is sufficient to get the ball securely over any surface obstacles and irregularities is also the MAXIMUM desireable speed for maximizing sinks, as both the width of the hole is thereby maximized and the length of comeback putts minimized. In the 1970s and before (when Dave Pelz rolled balls on greens for his so-called 17-inch rule), greens were dramatically poorer in condition than today. Today, balls arriving

with drop speeds of 1-3 rps have plenty of juice to overcome all problems (1 rps being good enough on fine greens and 3 being good enough on poor greens today). Bad golf instruction and fear are the main reasons hack golfers don't putt all the time with these safe, comfortable delivery speeds. The great putter is not fooled by "rules" like "never up, never in" or "always try to stop the ball about 17 inches past the cup if you miss" -- as these "rules" obscure the real "rule." It's not about going past the hole, as no golfer ever wants to be either short OR long.The real "rule" is "get the ball safely in the hole every time!" The better the golfer becomes with touch, the more his putts start to drop within this range. That's because this is the range of delivery speeds that the instincts prefer and try to get to, if only bad instruction would leave the instincts alone.

See also: Touch: Ball-Hole Capture Physics and Optimal Delivery Speed: What's the best overall pace for putts when the ball arrives at the cup?

Take the Break Out Safely Only at 4 and 8 O'clock Putts -- Putts "within the leather" (about two feet) almost never have enough break from contour and green speed to cause the golfer much concern about the pace or line of the putt -- just knock it in, perhaps favoring the high side of the inside of the cup and having no concern for babying or ramming the ball home -- just a nice firm roll into the cup. So on these little putts, there is no effort to "take the break out." But this approach fails miserably with great frequency once the length of the putt grows to three feet and out. The vast majority of decline in putting success evaporates between 3 feet (90%) and 6 feet (50%), as fully 40% of all putting success disappears in this "Bermuda Triagle" of the green. A great deal of these misses is attributable to putting with too fast a pace on the ball, and this is aided and abetted by the general notion that the golfer is well-served to "take the break out" or "take some break out" whenever possible. This is just thoughtless advice. A more careful approach goes like this: First, never ignore the normal break that is there just because you have decided to get rid of it: you need to know what the normal break is to compare the risks of taking the break out with a faster putt, so pay attention. Second, if you are going to take the break out, take enough break out to get the target line aimed inside the cup: it doesn't do any good (or make any sense) to take out "some" break that changes a putt from 3 balls left to 1 ball left, and the change has to be from 3 balls left to inside left. It's similar to the rule about laying up: "If you're going to lay up, then LAY UP." Third, assess HOW MUCH EXTRA PACE is required to get rid of the break. Finally, fourth, you are only now in a position to assess which of the two putts offers your best chance -- the normal pace or the faster pace. At this point, compare the three principal considerations for the speed: 1. consider how much narrower the hole will be for the faster pace; 2. consider the longer comeback putt in case of a miss that goes with the faster pace; and 3. consider how familiar you are with the faster pace compared to the normal pace and whether this makes it too risky to execute the putt with a faster pace, a narrower target, a longer comeback, and less familiarity in executing the called-for pace on the stricter line. In general, taking the break out often requires a DOUBLING of delivery speed, and this shrinks the hole nearly in half and doubles the length of the comeback. All tolled, taking the break out is seldom a good idea. So WHEN do these considerations FAVOR taking the break out? Never on a downhill putt with anything except the mildest slope, because the back lip is lowered away from the ball's direction, requiring even slower pace to stay in the hole, with a more narrow hole and a longer comeback. Downhill putts can get rid of break with a modest increase of speed, but the change from normal pace to unfamiliar pace in light of the delicacy

of pace adjustment too often results in babying the putt instead of a positive effort to putt with just the correct added pace. It's usually better just to accept the break and putt with the normal pace. For uphill putts, there is no need to take the break out of a straight putt (from the 6 o'clock position up the 6-12 line or the "zero break line" straight uphill-downhill thru the cup). Nor is there usually any need to take the break out for putts near the 5 and 7 o'clock positions, as these breaks most often have targets already within the cup. Nor should the golfer take the break out for sidehill putts from the 3 or 9 o'clock positions, as these putts present the greatest break of all, and so require the greatest pace to get the target back within the cup. That leaves putts uphill from the 4 and 8 o'clock positions. That's a fairly safe time to take the break out, if you must, because the back of the cup is tilted towards the putt like an extra backstop, allowing greater speed across the hole, and the misses uphill tend to stop more quickly for shorter comebacks.

Intuitively Adding Sections of a Putt -- The brain has a very accurate intuition system that operates beyond conscious awareness. For example, if a putt runs 20 feet across a green and then climbs up a steep tier 4-5 feet and then continues past the top edge for an additional 10 feet, the brain can treat this one putt as two separate practice putts and then "add" the two together. The golfer makes a practice stroke that sends the ball to the top edge of the tier (so it won't roll back towards his feet), and then makes a practice stroke for a 10-foot putt (the remaining distance to the hole from the top edge). Then, the golfer makes a stroke that is simply "bigger" than the biggest of the two practice strokes. Exactly "how much bigger" is a non-conscious process of the intuition, so "don't ask, just do it." It's even better if the first practice stroke is the smaller distance, so that the second practice stroke is the bigger of the two; in that way, the REAL stroke is "bigger than the last stroke." The brain has an amazing capacity to get the "addition" exactly right. This same process works for going down a tier: one putt to the topple the ball over the top edge, and a second putt from wherever such a putt would stop by itself past the bottom edge of the tier for any remaining distance to the hole (with the bigger of the two stroke being the last practice stroke). Another application of "stroke addition" is for lag putts, as in the Zeno's Lag Ladder drill, where the long putt is divided into halfway there, and three-quarters way there, with the practice strokes being halfway there, then three-fourths the way there, then a real stroke that "adds" in another increase the SAME as the step up in stroke size from 1/2 to 3/4, and certainly no smaller than the larger of the two practice strokes (the 3/4th stroke).

Long Lags: Putt "to but not thru" the Fall-line -- On long lag putts, obviously the golfer wants to stay on the pro side of the line from ball to cup, or else the putt has no chance of sinking. But a less obvious rule is that the golfer always wants to putt as far as but not farther than the fall-line straight uphill-downhill thru the cup. The combination of staying on the high side and putting the correct distance is essential to sinking any lag putt, but there is a little-noticed side benefit of using the fall-line as the distance reference (beside this being the correct distance reference to making the putt): to wit, if the putt is the right distance but the aim or the read or the stroke is a little off and the line is slightly wrong, so that the ball finishes high or low of the cup, the ball will settle down onto the fall-line at the end of its journey with the right distance. This means that your second putt is a straight putt along the fall-line, either uphill or downhill, or at worse is a putt with only minor break so the target is probably safely inside the hole. The best miss on long lags is a little high on the fall-line for a

straight downhill tap-in, but a miss a little low also on the fall-line is certainly acceptable as well.

Let it Flow for Distance Control -- For near-perfect tempo that is the foundation of distance control or touch, learn to let the putter and arms drop in sync with the shoulder frame in a gravity free-fall pattern of natural acceleration to the bottom of the stroke arc and then get the lead shoulder casually up and out of the way so the putter and arms can continue in a pendulum swing to a smooth, mirror-symmetric finish.

Count Gravity -- If your stroke tempo uses gravity to set the pace of acceleration down of the putter head (from the top of the backstroke to the bottom of the stroke arc), then the principle of ISOCHRONY in the physics of a pendulum's action means that EVERY stroke, regardless of backstroke length, always reaches the bottom of the stroke arc in exactly the same amount of time. A putt with a backstroke that is 1.5 feet in length, and a putt with a backstroke that is 3.5 feet in length, take EXACTLY the same time from top of backstroke to bottom of stroke arc. And this time period does not at all depend upon you or a sensitive touch or feel. The time your stroke takes depends only upon the length of your putting pendulum, which is the length from the pivot of your system to the end of your putter. For EVERY normal-sized adult with a conventional length putter, this time is approximately 1/2 a second. ANY golfer can simply observe this time directly by lifting his arm back as if to putt and then just relaxing so the arm drops back to the side, and watch the timing. The deep meaning of this fact of life is that a gravity-based stroke tempo teaches the golfer how to count to two. Instead of just saying "one .. two," the whole trick is to observe the spacing between the two that is GRAVITY'S SPACING and learn to count so that your pace of count matches what gravity is doing. That way, your "two" will always match perfectly the moment in the stroke's free-fall when the putter head reaches the EXACT bottom of the stroke arc. Knowing IN ADVANCE when this point in the stroke will occur is invaluable in learning and using am accurate and repeating stroke motion. Distance control and impact squareness then begin to grow into your game like a welcomed fungus! So learn how your putter counts to two.

Count the Tempo -- The green speed is objective, as are all elements of putting touch EXCEPT the "subjective" sense of timing, which makes the stroke tempo susceptible to speeding up under pressure or slowing down under muscle tightness. The cure is to learn a basic "one .. two" count that is always the same -- that is, that has the same timing and spacing between the one and the two. The "one" is casually completed as the backstroke completes itself fully coasting to the top, and the "two" is when the stroke reaches the exact bottom of the stroke. On long lags especially, assess green speed, uphill-downhill adjustments, and distance to target, then just count the stroke for great touch.

Breathe for Touch -- At address when looking down at the ball, turn the head targetward while breathing in thru the nose casually, and time the completion of a not-especially-deep inspiration to coincide with the arrival of the face and gaze looking dead at the target. This is the lifting open of a bellows that expands the chest a little over a specific time, depending upon the target distance. Then, just relax to allow the breath to escape smoothly as the head turns back along the line from target to ball. Nothing forced. Pause looking at the ball a moment for the gaze and sense of balance to clarify after the head stops moving. Then start the backstroke in coordination with the same nasal in-breathing going back to the top of the

backstroke, so the chest expansion and timing of the breath establishes the backstroke length instinctively. From the top of the backstroke, relax (release the bellows) and allow the downstroke (into thrustroke) to transpire as the breath escapes smoothly thru the nose.

Short Putts are Tough to Sink! Short putts require extra care in targeting because the closeness of the hole makes it too large a target for good line control, too visible in the periphery so that you are tempted to move your head for a peek, and not far enough off to your side to generate a substantial angle in the neck-head turn as a cue to the location of the hole in relation to your setup positioning -- so be extra careful!

Making Long Putts versus Avoiding Three-putts -- Don't Confuse Apples and Oranges Substituting a big, fat target as a way to avoid three-jacking is not a good way to get better distance control, which is the real problem, but there is a way to avoid long comebacks while trying to sink monsters by keeping sharp targets for top distance control and supplementing this with some reasonable boundaries.

Zeno's Lag Ladder Long putts that cause concern about coming up too short often cause the golfer to blow the ball too far past the hole, and a useful approach is to take a practice stroke to a target merely halfway to the hole, then take another practice stroke to a second target halfway between the first target and the hole, and then make the real stroke not shorter than the second practice stroke and with the same size increase in the stroke -- one big step halfway there, then two halfsize steps the rest of the way.

Downhill Putts Easy as Pie All downhill putts share the same targeting problem -- if the ball rolls too far across the hill, it will miss high; and if it fails to roll far enough across the hill, it will miss low. The best way to handle downhill putts is to aim for the pie.

Putting Green Tiers are Taller than You Think! To get all the way up a putting green tier, visualize how far a ball perched on the top edge would roll on level green after it comes off the bottom of the tier, as this is the energy you'll have to add in the putt just to get over the hump itself, regardless of getting to the bottom of the tier or past the top of the tier.

SETUP & STROKE TECHNIQUE

The "Take-off" of the Putter from the Aircraft Carrier of the Green -- A straight stroke is one that rolls the ball wherever the putter face is aimed at address. When a ball rolls on a tilted surface, the "hoop" or axis of rotation of the ball is perpendicular to the surface, rather than being "straight up" in relation to gravity and the top of the sky and the center of the earth. (This is a bit counter-intuitive.) The putter face and the sole of the putter are fixed in a relationship by the loft of the putter face. So the trick is to stroke thru the ball in a manner that does not wobble the hoop out of its desired relationship to the surface. The "what" of this is not to stroke thru the ball with the toe up or with the heel up, and instead to make sure the putter sole is flush to the surface as the putter rises into and thru the ball. Otherwise the loft of the putter (with heel up or toe up) will impart a wobble to the ball's roll out of square with the surface. (A zero loft at impact accomplishes the same thing, but alas that is too rare.) A good image to see this dynamic is to imagine the putter as an airplane during take-off, with two wheels under the sole of the putter. A good, straight lift-off the runway is achieved only when BOTH wheels come off the ground at the same time and with the same

directionality and speed. But alas, greens are not runways that are flat and level. Instead, greens right at the ball are generally flat but tilted. That makes the green more like the deck of an aircraft carrier at sea. The putter still has to make a good take-off, even if the deck is flat but tilted out of level to gravity. So if the ball and putter head are "below the feet" at address, the take-off still has to be good. Likewise, if the ball and putter are "above the feet" at address, the take-off still has to be good. In fact, ANY tilt or slope in the green at address has to be respected in the dynamics of the take-off of the stroke. Granted, it is POSSIBLE to hit a ball at your target on line with the toe up or the heel up and with a wobbling hoop that is out of kilter to the surface, but that stroke does not send the ball where the putter face is aimed at address or where it is pointed at impact, either. What's at stake here is knowing what to expect and knowing what to do to get it so you can learn to do it consistently without surprises. Every stroke ought to take off "square" from the deck.

Drop the Turtle and Let It Settle to the Bottom of the Pond -- Conceptualizing the downstroke as a non-movement is tough! Here's a cutesy way of getting really good at it. Imagine you are standing thigh-deep in a pond in a putting address posture, holding a big turtle by its carapace instead of a putter handle, with the turtle's face aimed down the line of the putt. Make a backstroke that lifts the turtle gently to the surface of the water and then "release" the turtle to let it glide downward and forward in front of your stance. Now imagine that the "turtle" is the putter head, and releasing the putter head from the top of the backstroke allows it to glide back down the path to the address position at the bottom of the pond and then it glides up and down the line, with you simply keeping up with it.

"Dead Hands", "Dead Arms" thru the Bottom Means "NOT USING" Them -- The one time "dead hands" matters is right thru the bottom of the stroke. Why? Because "dead hands" keep the putter face square at this critical time. How? Because otherwise -- i.e., "using" the hands thru impact -- means CHANGING the path of the stroke and/or the face angle of the putter, while the putter head in physics is doing all it can despite you to go straight and square thru the impact zone. When you stand still at the top of the body once the backstroke is finished, and simply allow the hands and arms and putter to drop and swing beneath the stable pivot of the base of the neck, the putter head falls straight back to the address position and re-squares and THEN going forward of the bottom the putter head WILL swing slightly upward and straight down the line ... unless you prevent it by "using" the hands or by blocking the stroke with stoppage in the shoulder frame or arms or hands. The inherent momentum of the putter head, coming back to square from either a straight-back path for the backstroke or a path slightly to the inside, is initially redirected by the "memory" of the body structures and tissues in a somewhat elastic manner to retrace the backstroke path coming down to the bottom. But once the putter head finds the square-on path entering the bottom area of the stroke, IT KEEPS THIS MOMENTUM AND DIRECTIONALITY going forward unless the golfer changes it. What is meant by "dead hands"? Hands that are "dead" are hands that are not being used. They are not necessarily "lifeless" in the sense of being totally relaxed or "loose" and without muscle tone; instead, the hands are "unchanging" during this critical part of the stroke. Neither are "dead hands" necessarily "soft" as usually desc ribed, although the experience of "dead hands" MAY feel "soft". It's quite possible to have "dead hands" with a "death grip" on the putter handle. So HOW do you do it? How do you make sure you have "dead hands" thru the impact zone? The trick is knowing HOW not to use the hands. The motion is the natural dropping and swinging of the putter from the top of the backstroke

down and thru and up, while the top of the body (base of neck and line of throat) is stable like the top bar of a swing set. So the motion in terms of the hands has several key segments. Don't use the hands going back away from the ball -- use the lead shoulder to shove the lead arm and putter back as a unit. Don't use the hands to "stop" the putter as it nears the top of the backstroke -- allow the swinging to drift or coast to its own conclusion while the arms and hands stay the same in terms of steady muscle tone and shape. Don't use the hands to start the downstroke -- instead, let the putter and arms and hands all drop "wherever gravity wants to take them", which is straight down at the ground swinging beneath the top bar of the swing set to the bottom of the stroke and then up and down the line. All that is fine, but only now are you entering the impact zone, so here comes the critical "how to": Don't use the hands to "hit" the ball -- instead, let the stroke transpire as if there were no ball present and all you are doing is watching the putter head bottom out right where it is supposed to and then the arms and hands and putter all rise down the line as a unit. More specifically, don't come unglued in your "togetherness" or "coordination" of the shoulders, arms, hands, and the natural motion of the putter head. If you use the hands to either pull or push the putter thru impact, the hands will get ahead of the shoulders and arms while leaving the putter behind the hands (bad). Similarly, pulling or pushing the stroke with the arms and not the shoulders will leave the hands and putter behind (bad). Pulling the stroke with the lead shoulder or arms will leave the hands and putter behind (bad). Shoving or powering the stroke with the rear shoulder or arms will leave the hands and putter behind (bad). In order not to come unglued, simply have your body take its cue from the putter's motion in gravity and "ride" the putter down to the bottom and "ride" the putter up and down the line, while staying still at the top. The body follows the momentum and directionality of the stroke down and thru. The lead shoulder does not pull ahead, the rear shoulder does not push ahead, the forearm muscles do not activate to pull or push the putter, and the hands don't activate either. The stroke just happens. If you can make it two inches past the front of the ball this way, the ball will roll straight. Everything after that is window dressing for the gallery (ask Seve Ballesteros, with his "gore the bull" flourish lifting the putter down the line with one hand). Get "straight" first, and then add "bigger" to the stroke later without messing up the timing. All of this means that only a "patient" and "self-secure" golfer can have "dead hands." Any sense of urgency or anxiety about guiding the direction of the "hit" or powering the "hit" is highly likely to spoil the stroke, and this style of "hit" putting can only be tamed after years of piling on bailing wire and chewing gum to hold things together in the "use" of the hands, arms, etc. It's just not a long-term solution. Get really good! Don't use the hands OR the arms -- just ride the putter down and thru without messing it up. You can think of "dead hands" or "dead arms" in a number of ways, but what matters is that you don't actually "use" them in the stroke. So what do you think and feel instead? The feeling is that the lead shoulder clears out of the way once the bottom of the stroke is reached, so as not to block the on-going progress of the stroke, but does not clear out of the way ahead of the putter. The best way to think and feel this is "to let" the momentum of the stroke shove the lead shoulder straight up from the ground and out of the way, albeit that this "shove" is gentle and the action subtle. Feel the momentum of the stroke itself doing the upstroke for you. Another way to think and feel this is to make sure the rear shoulder does not stay behind the gathering downward speed of the stroke as it falls to the bottom. The feeling is that IF the rear shoulder stays with the stroke, this very "staying with" the hands and putter coming down infuses the hands with a feeling of uselessness. This feeling is one in which the hands keep their steady muscle tone, but are nonetheless cancelled out of the stroke motion by the rear shoulder's "staying with"

the stroke. The hands become "soft" (or perhaps slightly "softer") and this feeling happens right thru the bottom. Still another way to think and feel this is to focus on the forearm muscles when your stroke reaches the top of the backstroke -- kill these muscles and the arms will remain "dead" in the down-and-thru stroke, and so will the hands (as the forearm muscles "move" the hands about the wrists). There is a pretty big, categorical difference in the brain between "using" and "not using" muscles and body parts. Learning how NOT to use muscles and body parts is quite a trick and takes some re-configuring how the golfer approaches the stroke both mentally and physically. The sooner you get onto this problem, the sooner you will get a LOT better in your putting.

Line of Throat Matches Top Edge of Putter Face -- In adopting the address setup to the putter as flatly soled and aimed, the golfer creeps his feet in to the handle of the putter as poised in space until his naturally hanging arms and hands "dock" with the handle, but then the real work of "squaring up to the putter as aimed" just begins. The golfer squares up for two main reasons: 1. so the stroke will work with good biomechanics to send the ball straight sideways out of the setup in the same direction that the putter face is aimed, and 2. so the golfer from beside the ball will be in a good posture with the head, neck, and eyes to run his line of sight along the ground away from the putter face on the same line the putter face aims in order to check where in fact the putter face has been aimed. The line of the throat is key to getting square, and then the gaze direction straight out of the face is key to the side-on targeting. Once the hands have reached the handle so that the feet are the correct distance from the ball, the golfer sets the line of his throat to match the top edge of the putter face (the two lines are about the same length) in terms of both having the same orientation in space. So long as the neck / throat is perpendicular to the shoulder frame (no sideways tilting of the head during the setup), then setting the throat to the top edge of the putter face also squares the shoulders parallel to the putt line. Setting the throat line also sets the line across the skull from top of ear to top of ear across the bridge of the nose parallel to the line of the putt. Once the throat and shoulders are square to the aim of the putter face, the golfer shakes down from the shoulders like a doll suspended hanging like a puppet in a closet as each pair of joints sort themselves into conformance with the squareness of the shoulders. The body settles each pair of joints downward from the shoulders -- hips, elbows, knees, ankles -- until the golfer settles into "happy feet." Not all golfers will have "happy feet" with hips as square to the line as the shoulders, but that's okay -- the shoulders count much more than the hips, and for the hips and feet, the key watchwords are "comfort and balance." Once the golfer has "happy feet," he needs to make sure that his gaze is aimed perpendicular out of his face and his neck and head bend is such that he faces square down at the ball. Setting the gaze avoids the usual mistake of gazing down the nose like reading a book, which generates misperceptions of the target location in relation to the shoulders; the pupils then join the line of the skull, the line of the skull and the shoulders parallel the line that the putter aims along, and a simple "apple on a stick" head turn will drive the line of sight in the same line the putter face aims as far as the target. This head turn simultaneously verifies that the putter face aim is on target and gives the golfer the final "polishing off" of distance information for an instinctive stroke. The putter face is aimed at the target and the golfer is in the best setup position to make the same-every-time straight stroke that rolls the ball the same way the putter is aimed, with superb touch.

Hand Freely Swings Sideways when Distance Back from Ball is Correct -- A fundamental for a good setup for a straight stroke is a distance back from the ball that eliminates reaching the putter head out to the ball or reaching the putter head back in to the ball. Once the putter is aimed behind the ball with the sole flat to the surface, the golfer should creep the feet forward until the naturally hanging arms and hands "dock" with the handle as poised waiting in space like the Space Shuttle docking with the International Space Station. This leaves the aim of the putter face undisturbed. It also leaves the arms and hands undisturbed in the sense that there is no reaching in or out of the arms and hands during the setup, so that at the end of the process the arms and hands hang naturally AND the putter is flatly soled and well aimed. There is only one distance back from the ball that corresponds to the golfer's specific setup postures for that putt (hopefully always the same postures). This being the case, the golfer can test his distance back from the ball by simply relaxing his rear hand (right for a right-hander) and watching how it swings off the handle. If the hand swings ONLY sideways from the handle, then the arms and hands are hanging naturally without tension and the distance back from the ball is correct. If the hand swings in towards the thigh, the golfer is too far from the ball and is reaching the putter head out to the ball, keeping unnecessary and unreliable tension in the arms and hands in order to "hold still" in the setup. If the hand swings towards the nose, the golfer is standing too close to the ball, and the arms and hands again have a tension that is unnecessary and unreliable. By keeping the putter flat and adjusting the closeness of the feet to the ball, the optimum setup is achieved and known. Straight putting is then easier and more consistent.

Hold Still at the Top, Do Nothing for a Straight Stroke -- The key to a consistent straight stroke is timing the bottom of the stroke and then delivering the putter from there square thru the ball down the line at least an inch or two. There are many ways to use the body to get this brutal fact accomplished, but the objective is to use the simplest, most consistent, most pressure-resistant technique possible. Here's one to consider: Let your tempo always deliver the putter to the bottom of your stroke with the exact same timing from top of backstroke to bottom of stroke, every putt, while holding the base of the neck still during the downstroke, and then "do nothing" -- the putter head will square itself right at the bottom and then the still neck will require that the putter head, arms and hands gently rise up past the bottom on a path that is square and down the line for at least a few inches. The momentum of the putter head and the coordinated arms and hands, swinging beneath the fixed pivot at the base of the neck, will define by itself, effortlessly, the correct dynamics of the putter head thru impact. Try this on a straight five-footer: make the nice-tempoed backstroke, then hold the base of the neck still, and "do nothing" so that the hands and arms simply drop wherever gravity wants to take them -- the putter swings down beneath the pivot, squares up right at the bottom, and then rises past the bottom in a casting square and down the line thru impact. When gravity handles the timing, the putter head always reaches the bottom of the stroke right on time every time. When the hands and arms instead "bring" the putter down, the chances of accurately bottoming out at the correct spot at the right time get pretty iffy, and the likelihood is that bringing the putter down will slop past the true bottom with the toe lagging open, for a miss to the outside of the right line. For a really dumbed-down and reliable straight stroke, just hold still at the top of the backstroke and "do nothing" as the hands, arms, and putter perfectly time the bottom in an effortless, square stroke.

Skull Line -- The line across the skull from tops of ears inward taking in the temples, outside corners of eye sockets, inside corners of eye sockets, and bridge of nose is a permanent and useful feature of the bones of the head that allow squaring the whole body up to a putt. (These 9 points of the skull will also include the 2 pupils if the gaze is directed straight and level out of the face.) If you wore glasses, with a line across both lenses connecting the corner pieces, the ear pieces and line trace the skull line. Once the putter face is aimed thru the ball, matching the skull line to the putter face so the skull line passes perpendicularly thru the putter face's sweetspot and thru the center of the ball, aligns the head and face square to the intended line of the putt off the putter face. By the neck being straight out of the shoulders, orienting the skull line and head to the putter face works thru the neck to square the shoulders to the putt. By the upper torso not being twisted in the waist area on the hips, the shoulder alignment works downward to square the hips, and the hips in turn square up the knees and ankles. Thus the golfer squares the skull line and settles down the body into "happy feet" ready to make a straight putt. The settling of the feet into a square setup is always last, but everything starts with the skull line.

Elbow InTurn -- A good way to avoid forearms rolling open or shut during the stroke is to preset a little tension in the arms by turning the elbows in towards one another a little. This has the effect of "twisting" the arm assembly tight like a rag as the two bones of the forearm roll outward by the elbow action at one end while the wrists hold the opposite end taut with the thumbs aimed down the top of the shaft and the palms stay opposed, on the other end of the "rag." This body action in the setup holds the forearms in position during the stroke and prevents them from rolling open going back or closed going thru. A partial approach is to turn only the lead-side elbow inward and commit to the notion that only the lead side matters, with the rear-side hand and arm not being allowed to assert control during the stroke. This tip is basically a prophylactic against an unconscious "pull" action of the arms, and may not be needed at all, depending upon your mechanics.

Hold the Tube -- To practice putting with "dead hands" that do not lift or manipulate the putter during the stroke, but that remain heavy and low with steady grip form and pressure, make practice strokes with nothing in your hands other than a thin imaginary tube not much bigger or heavier than a fat pencil or a section of copper tubing about as thick as a nickel. The hands only get active in response to a desire to move something inert and heavy, like a putter head. Focusing in the stroke so that the hands are simply on a comparatively weightless tube helps avoid handsiness, especially at the start of the stroke.

Fixed Eye on Grass -- Pick a small blade of grass immediately in front of the putter face's sweetspot, in the gap between putter face and back of ball. Look at this blade with a mind engaged solely on the look of the grass and then start the backstroke with the only thought of waiting for the putter face's leading edge to come back to this spot with the sweetspot moving right over it, and as soon as the sweetspot arrives back at the grass blade, transition the stroke from arcing down to arcing up, keeping the pivot stable in space albeit rotating in place as the fulcrum of the shoulder frame as it rocks up. That ought to be enough, so you don't necessarily have to make sure you still are fixated on this spot after the ball is gone, but you can if it makes you feel better.

Shoulder C -- The motion of the lead shoulder socket in space is solely responsible in a "dead hands" stroke with what happens to the putter head. The lead arm and hand simply translate the shoulder socket action to the putter head in a transparent manner. The small movement of the shoulder socket is amplified by the length between socket and putter head of the arm, hand, and putter shaft. Hence, it is key to move the shoulder socket correctly to avoid poor stroke paths and twisted putter faces thru impact. My recommendation is to move the shoulder socket straight down and back from a level start, then reversing this back to level, then continuing moving the socket now up and back -- all while the pivot of the shoulder frame at the base of the next rotates in place. Doing this has the socket trace a curve in space that, seen from facing the golfer's face, looks like a mirror-reversed "C." (From behind the golfer, the socket traces a normal-looking "C.") The socket starts in the middle of the C and moves down and back to the bottom of the C, then back to the middle, then up and back to the top of the C. This C is normally only a total height of 3-4 inches, so the move down and back is not much over 2 inches deeper than level, and the move up is about the same above level. But the arm and putter shaft amplify this motion so that the putter head moves a foot or more back from the ball and a like distance forward. The gear ratio is on the order of 1 to 6. But the real key is that the C stand upright in space (or at the very least not have any bend in its shape going from bottom to top). If the C is seen as a bow aiming an arrow along the line of shoulder alignment, the bow should be upright for a vertical-plane straight stroke. And don't quit on the upstroke, so that the top of the C is left unfinished in the degraded form of a simple "J." Keep the pivot steady and finish the top of the C with the shoulder socket not only going up, but back as well.

Simon Hilton, PZ Coach, Bad Ragaz Switzerland, illustrating the Shoulder-C:

Simon Hilton PZ Coach Golf Club Heidiland Bad Ragaz, Switzerland Club Tel. +41 (0)81 303 37 00 Tel. 0041-8130213814 Mobile 0041-792388778 email Simon

Putt the Bottom -- Nothing is more critical to the accuracy of the stroke in terms of line than transitioning the forward stroke right at the bottom of the stroke. By playing the ball slightly forward of the bottom of the stroke (which may vary from the middle of the stance to a little forward of that, depending upon your putter design and setup), and keeping the stroke casual and non-percussive at impact, a nice smooth stroke will send the ball off solidly with a nice smooth roll, but only so long as the stroke bottoms out right where it ought to and then transitions upward into the back of the ball. The key is not allowing the pivot of the stroke, at the base of the neck between the two shoulders, from swaying off the bottom at the start in the backstroke and from "following after" the ball in the thru-stroke. The upper torso remains square to the putt line, the pivot stays in place although it rotates with the shoulder rock, and the downstroke has the shoulders leveling out right at the bottom of the stroke and then transitioning upward going thru impact. The feeling is of a casual levering of the putter up thru the back of the ball. In a well-practiced tempo, the stroke always hits the bottom on the same count, so counting your tempo "one .. two" or "one potato ... two" always has "two" coinciding with the exact bottom of the stroke. There are many ways to key off this exact bottom (staring the putter face at the bottom and not up behind the ball, counting, feeling the shoulder level out, watching a spot of grass for the putter face to arrive coming into impact,

feeling the hands reach bottom, etc.), but doing so is critical to a straight stroke with solid impact.

Slap Putt -- Bending at address with your palms hanging down facing each other, imagine someone standing astride the line of the putt a few feet towards the target to your side, and extend the rear hand across your torso to shake hands with this person: the forearm will rotate closed across the torso by 90 degrees and the palm will reorient from aiming down the line to aiming behind you, with the thumb on top. This is a "pull" stroke. A sound putting stroke is not a "handshake" extension across the torso, but is a "slap" with the rear-hand's palm swinging with nice extension thru the bottom of the stroke and then heading straight up towards the sky until the end of the thru-stroke is attained. With the lead-side hand, it is a "slap" with the back of the wrist and hand headed to the sky.

Waiter's Tray -- Knowing the ending position of the body movement is an important key to performing the motion accurately. In the case of a straight putting stroke, the end of the follow-thru has certain features that are not especially normal, the main one being that the putter head stays out above the line of the putt and the putter face does not twist closed. In order to fully appreciate the artificiality of this position, it is helpful to continue past a normal top of follow-thru until the lead arm is all the way to horizontal above the ground. At this point, the putter face should still be out over the line of the putt and also the putter face should be aimed straight up at the sky, as level as a waiter's tray. The only way to get to this position without arm or hand manipulation is to keep the shoulder socket on the lead side headed up and back while the palms are kept unchanging. It's quite an uncomfortable extension. The discomfort in this extreme position is resolved by the arms taking over with the shoulder lifting giving up, and by the forearms extending out from the shoulders with forearm rotation. In a poor stroke action, then, the extension discomfort causes armsiness and handsiness and the putter comes inside off the line and the putter face twists shut. The cure resides in slowing down the stroke, keeping the upper body relaxed, and then moving the shoulder up casually without worrying about the discomfort of the extreme end-position, since you are only headed in that direction and the trip will actually end a lot sooner. Judge your stroke form by the end-position of the follow-thru to make sure the putter face is still over the line aimed square.

Feet-to-Ball Setup - Pick Up the Quarter How far out should the ball be away from your feet? It's a matter of balancing the shoulders above the feet, so try this: treat the ball like a quarter you just spotted on the ground, walk up to it to pick it up, and when you plant your foot to bend down, that's the right distance back from the "quarter" -- usually about two putterheads.

Bounce the Putter to Locate the Ground To stabilize your stroke and make sure your putterhead returns to impact in a vertical orientation for a solid roll, set the length of your putting system from pivot to turf by tapping the putterhead lightly at address and keep the pivot stable in your stroke.

Set Up to the Ball, Then the Putt To make sure the setup never changes and therefore the stroke dynamics don't alter from putt to putt, set up to the ball itself first, and then to the putt, so that you don't pull the trigger unless the two setups coincide.

Sidehill Putts Tend to Run Lowside All sidehill putts tend to get lost to the downhill side, and you need to conform your setup to the surface, not to gravity, if you want to avoid losing the putt to the amateur side.

The Big Gap You should play the ball forward of the middle of your stance (which is the bottom of your stroke arc), but maybe you should place the putterhead down not behind the ball but in the middle of the stance -- and this Big Gap can be useful.

Get a Grip on Putting: Keep the Pressure Light and Constant Keep your grip pressure light and constant throughout the stroke to avoid snatching or casting the putter, abrupt transitions in the stroke, or tempo fluctuations, as this promotes a smooth stroke, with good accuracy in the stroke path, and consistently solid contact.

In Putting, the Knees Hold the Hips, the Hips Hold the Head! Your visual attention to the putterhead-ball interaction at impact ought to keep your head still in putting by itself, but if you nonetheless have a problem, try "marrying" the sense of stillness in your hips to the pivot point in the center of the base of your neck ("hips and head hold still"), while the arms and shoulders turn back and through on this stable pivot.

Groom the Green's Mane with the Takeaway Sure the putter stroke needs to move straight back and thru, but there's more to it: the putterface orientation has to move as a unit and stay square, at least for five or six inches on either side of the ball.

The Shoulder Move Plus a Stockton Tip for Straight Strokes Cut strokes, pulls and putterface twists come mostly from the use of hand and arm muscles to start the backstroke, as this casts the backstroke out beyond the line of the putt, and using a simple shoulder push to start the stroke keeps the hands dead while giving you a good start on the backstroke.

Stroke Path Straight or Arc? - BOTH The long-running and never-ending debate over whether the stroke path should be straight-back-straight-through or inside-square-inside detracts from the true fundamental of "a square face moving square thru impact". A closer examination of the mathematics and geometry of the putting stroke reveals that a straight shoulder stroke, because of its rising back and thru and the tilt of the plane of motion, is BOTH straight and arcing inside-square-inside. The trick is keeping the shoulder sockets rocking in the same plane throughout the stroke.

The Rib Cage Crunch In the backstroke, don't let your descending rib cage get shoved forward by the midriff and pelvis, as this twists the shoulderframe and throws the stroke path curling inside on the way back -- instead, AIM the bottom of the rib cage straight for the pelvis, and move the lead shoulder socket straight down at the balls of your lead foot to keep the shoulderframe "rock" within a straight vertical plane aimed parallel to the startline of the putt.

The Battering Ram Stroke In order to "flush" your putts for pure, straight rolls, think of the stroke as swinging a battering ram suspended beneath two handles or ropes straight and level thru the ball.

Pushing or Pulling Putts? It's the Lead Elbow, Stupid! To keep the putterface moving square and straight thru impact, don't let the lazy lead elbow drift towards your hip, but keep it headed straight along your toe line for a bit past impact.

Slice Your Thumb Knuckle For a straight-back and straight-thru stroke path, run your thumb knuckle along a a razor-sharp blade -- OUCH!

Nail Your Putts for Solid, On-Line Impact Visualizing putterhead-ball impact as similar to hammering a nail into the ball is one of golf's oldest putting tips, and it helps tremendously with your management of the downstroke for solid, consistent rolls.

Putt the Sleeve Box Imagining the ball not as a round sphere but as the butt-end of a sleeve box gives you a superior sense of squaring the putterface and a sense of the starting direction of the putt.

Foto-Finish Impact Visualizing the putterface as if remaining behind the ball during the backstroke helps guide the stroke path back to square impact for solid, flush putts.

Roll the Hoop for True Putts Visualize the ball as only a solid disk vertical on its edge in the plane of the putt, with only one dimple on the back equator, one dimple on the front equator, and a central dimple on the top, and roll this hoop or disk to the hole with your solid putting stroke.

What the Heck is a Forward Press Good For? A forward press is a bad trade for a little rhythm in your stroke, and at a minimum requires careful attention to how it is performed to avoid creating problems.

Make a Beautiful Stroke Once you have oriented the putterface behind the ball, your targeting tasks for direction are completed, and with a sense of distance and speed in mind, the only thing left to concern yourself with is making a beautiful stroke.

To similar effect, see Beverly Fergusson's nice take on the subject.

PRACTICE

Putting Practice Pointers The difference between swatting balls across a practice green and sharpening your putting skills is mostly working on something specific in your putting, whether it be targeting, reading, setup, routine, stroke mechanics, or something purely psychological.

Indoor Putting Exercises Indoor putting practice and drills need not always be about stroking a ball into a drink glass, and your putting would be well served to add some exercises that sharpen relevant perceptual skills and specific stroke movements.

The "Report Card" Game for Short Putting Skill Try the Report Card Game to sharpen up short-putting skills under pressure with readily understandable feedback in a reasonably short, well-defined exercise.

Baseball Putting In this game for two players, test your skills under pressure to sink a 15-footer to strike out your opponent with the bases loaded, tying run on third, and the count 3 and 2!

Drills for Skills A collection of dozens of new drills to train putting target perceptions and stroke movement skills, arranged according to four simple tasks: pick target, aim at target, putt straight, with good touch.

Claim-Jumping "21" -- The popular putting game "21" for 2 or more players is for one player to pick a hole the players all putt at and the closest ball earns the player 3 points, with a sink earning 4 points, and topping a previous sink earning 5 points, with the top-point earner selecting the next putt, until one player reaches or exceeds 21 and wins. The CLAIM-JUMPING TWIST is to make the game more cut-throat, with new rules for the following 2 scenarios: First, if no player sinks the first try, then the closest to the hole must still putt out in order to "claim" the 3 points. If he fails to sink the leave, the next closest player backs up radially away from the hole 3 feet and has the chance to putt for the "unclaimed" 3 points. If the first / closest player instead sinks his leave and successfully "claims" his 3 points, then the next closest player still has a chance: he backs up 3 feet and putts -- if the next player misses, the first player keeps the 3 points and picks the next hole; if the next player sinks, however, he "claim jumps" the first player by erasing his 3 points and is rewarded with 1 point for the trouble and selects the next putt (gains "the honor"). Any others players are just out of it and need to lag closer to get a shot at "claim jumping." Second, if one player sinks the initial putt, then he "claims" 4 points, but if any subsequent player can top that with a sink, the subsequent player "claim jumps" and erases the first player's 4 points and is rewarded with 5 points and gains the honor. Any second or subsequent "top" erases any other player's points and gains the topper one point more than the topped player had. PLAYING HINT: You should discover that when both players stay in a range where their lags are both close, the scoring favors the next-closest lagger but only advances slowly with single points, like a defensive soccer or hockey game. If the player with the honor selects longer putts, the game starts to favor the better lagger and the scoring advances by 3 or more points per putt. Towards the end of the game, if the player behind has the honor, he tries to lag closest and get 3 or more points, but if the leader can snag the 1-pointers, he can eventually get over the top anyway. When the leader has the honor, though, the player behind may intentionally try to lag less close than the leader in order to play defense and keep hold of the leader's shirt-tail by erasing any leader points while slowly trying to catch up 1 defensive point at a time.

"In-a-Row" Game -- For two or more players. One player selects a hole and a distance out from the hole and has 5 tries to sink the first putt. If he fails in 5 tries, he stops with "0 in a row." If he sinks a putt before his 5 tries are exhausted, he then continues putting so long as he can string together a row of sinks. Once the string ends, he has "in a row" however many putts he sank in a row. The next player also has 5 tries to get started on a series of sinks from the same distance (not necessarily from the same location) and tries to sink 1 more "in a row" than any other player. The player with the longest string "in a row" gets 1 point and the honor of selecting the next hole and distance. The first player to reach 5 wins the game. Two

players can usually putt at the same time, more or less, so there is no waiting turns and the game moves along.

EQUIPMENT

The Long and Short of Putter Length and Lie Don't let the putter wag the puttee; figure out a setup that is best for a good stroke, and then fit the putter to your needs, or else you'll get stuck with "average golferitis."

The Dimple Error in Putting On rare occasion, it's possible that the putter face's striking the raised edge of a dimple on the back of the golf ball might misdirect the roll enough to cause the putt to miss,but this happens only rarely over a small range of putts on unusually fast and true greens, but in any event can be guarded against by careful attention to ball alignment and/or selection of soft-covered balls or putters with soft face inserts.

PSYCHOLOGY

Bubbleheaded Putting Thinking is Stinking! but my advice to "use your brain" stands. A great deal of the brain has nothing to do with that little voice we use to think with. Using the brain to putt means "shut up and putt" -- not bothering yourself with pointless thoughts, concerns, worries about the putt -- and the end result is your conscious awareness is empty except for the moment itself in a clarity that allows your brain-body to perform at its highest level.

The "Mechanics of Instinct" in Putting: The Neurophysiological Paradigm for Applied Research The present study is an examination of the neurophysiology of putting as revealed in recent studies of putting. At this time in the history of putting science, a new paradigm is emerging that focuses upon the human actor in terms of the perceptual and movement processes of brain and body. Early research initiatives lack a thorough grounding in the rapidly advancing field of neuroscience, and such a sound theoretical foundation is essential to efficient and meaningful progress in this promising approach to putting science. The study examines in detail neurophysiological investigations into putting visual processes and putting pressures. The study probes the theoretical limitations of these studies, and proposes future lines of research.

The Neurophysiology Of Golf Putting: The Mayo Clinic Takes a Stab at the "Yips" The Mayo Clinic is undertaking a study of the "yips" in golf--the mysterious affliction in putting manifested by freezing over the putt, shaky hands, and a stabbing stroke. Previous researchers have classified yips as an occupational focal hand dystonia, a type of movement disorder apparently caused by degeneration of neural circuitry following decades of the same hand movement. The Mayo Clinic team departs from earlier researchers by assigning a prominent role in the etiology of the yips to psychological rather than neurological factors. They have also opted for a behavioral definition of yips that does not distinguish between the contributions of anxiety and dystonia. The team may therefore have difficulty identifying effective therapy. [After this paper was communicated to the Mayo Clinic "sports medicine" team, they added Dr Charles Adler from the Mayo's movement disorder neurology clinic in Scottsdale AZ, and the team thereafter did an about face in a second paper to conform to the suggestions in this paper: ""There isn't much known about golfers' yips, so this is an important initial study," said Christine Klein, MD, in an interview seeking outside comment.

"A common perception of the yips is that it's psychogenic, and Dr. Adler's work shows that it may be neurogenic instead." Dr. Klein is the Lichtenberg professor of clinical and molecular genetics at the University of Lubeck in Germany."]

geoff@puttingzone.com

website: http://puttingzone.com