
TAKING AIM – LINE & LENGTH

by **Rob Judson**
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Line and Length

Aiming Line

General Objectives

The aiming line is the required delivery direction. If bowls are to come to rest in the head, bowlers must deliver them at an angle that counteracts the effect of bias. Because bowls delivered along the same line but at different speeds all finish in a straight line, bowlers should not change the aiming angle for a change in head distance. However, an angular shift of the usual aiming line becomes necessary to correspond with any sideways movement of the jack, or with an off-centre object position in the head.

Some bowlers have a fixation on the jack. They tend to bowl 'at' the jack rather than 'to' it. Some bowlers tend not to trust the bias of their bowls. Both groups repeatedly use aiming lines that are too 'narrow'. Their bowls commonly cross the centre line before reaching the head, or displace critical bowls in the head. Narrow bowls are attacking bowls, and bowlers should not attack heads that lie in their favour.

In the course of a game, bowlers should correct any tendency towards narrow deliveries by widening their aiming angle, and should correct wide deliveries by narrowing it. Bowlers should focus along the aiming line to avoid narrow bowling.

Landmarks as Aiming References

Bowlers have several options for selecting aiming line. Some of them use patterns or marks on the mat to consistently position and align their dominant foot in the intended delivery direction. Their aiming line is approximately the forward extension of their anchor foot alignment. An advantage of this method is that changes in mat position relative to the ditch do not affect their aiming angle. If the object position in the head is off centre, they determine the required angular adjustment and correspondingly change foot alignment relative to patterns or marks on the mat. They use the mat like a protractor with a radius of a shoe length (about 30 cm). A drawback to the method is that a mere 1° error in aiming angle results in a sideways error of about 0.5 m at the head.

Some bowlers use rink markers, or boundary pegs, or other reference points on or beyond the bank that correspond with the required initial direction for the visualised path of their bowls. The imaginary line from the selected reference point back to the mat is their aiming line. They tend to visualise the entire green as a large protractor. An associated disadvantage is that different mat positions relative to the ditch necessitate adjusted reference points. Forehand and backhand deliveries obviously have different reference points. Reversal of direction of play for each successive end also necessitates different aiming reference points.

Some bowlers are so familiar with the way their bowls turn according to the pace of green that they use intuitive skill to select a suitable aiming line. Some bowlers simply observe the amount that bowls of other players are turning, particularly during trial ends. They begin a game by allowing for a similar amount of turn, and adjusting the aiming line, if necessary, for their subsequent deliveries. Other bowlers use combinations of these methods.

Aiming Line and Delivery Line

An aiming line is the line of sight. It is the line between the sighting eye and the chosen aiming point. The delivery line is the line that the bowl initially travels upon release. It is the line followed by the bowling hand near the bottom of the forward swing of the delivery arm. The back-foot line is the alignment of the foot that remains in contact with the mat at the instant of bowl release.

In an upright posture, with feet together, before commencement of the delivery movement, a bowler's aiming line tends to coincide with the foot line. The sighting eye tends to be directly above the instep of the 'back' foot. At the same time, if the bowl is held near the hip, the 'delivery' line (in the unlikely event of its being released from that position) is wide of both the aiming and back-foot lines.



As a bowler executes the delivery movement, the head tends to incline towards the shoulder of the delivery arm. This inclination tends to move the aiming line outward. The trunk also tends to incline towards the shoulder of the delivery arm. This inclination has the effect of moving the hip out of the way of the delivery arm, and tends to allow the delivery line to move inward.

The typical outward movement of the aiming line coupled with inward movement of the delivery line tends to bring them into coincidence on reaching the release posture.

Observations and measurements of many bowlers show that, although there are significant individual differences, any horizontal separation between aiming line and delivery line averages less than 3 cm. Bowlers intuitively accommodate any small difference without any conscious adjustment.

Thus, the aiming line tends to move away from the foot line in the course of a delivery movement. Observations and measurements show that the horizontal separation between the foot line and the wider, aiming/delivery line averages 12 cm at the instant of release. This is equivalent to the diameter of a bowl. Separations of up to 20 cm are not rare.

In delivering biased bowls, bowlers accommodate any difference between the foot line and the aiming/delivery line by intuitively adopting a marginally narrower aiming point on the forehand side and a marginally wider aiming point on the backhand side.

In delivering jacks, many lead players simply adopt a line that converges on a point approximately where the jack should come to rest. Where chalked segments of the rink centre line are visible, some lead players like to use them as a track for the jack. To facilitate this intention, some bowlers advocate the planting of the anchor foot on, and aligned with the centre line. That alignment suits bowlers whose delivery line matches their extended back foot line. Other bowlers advocate placement of the anchor foot inside the centre line to the extent that the entire shoe might be clear of it. That alignment suits (arguably the greater number of) bowlers whose delivery line is wide of their back foot line. The amount of anchor (back) foot offset should match the delivery line offset of the individual bowler, rather than reflect any dogma that either option is universally superior.

Aiming Point

A point on the aiming line on which a bowler focuses attention for bowl delivery is the aiming point. Sometimes slight irregularities in texture or colour of the grass provide visible aiming marks on the aiming line. Indoor playing surfaces tend not to have such irregularities. Beginners sometimes benefit from temporary use of aids such as small discs or cotton wool tufts on the green, until they are able to select aiming lines without them.

Some bowlers choose an aiming point within a few metres of the mat. The initial path of a bowl has negligible curvature. They deliver their bowls so that they travel over the aiming point. This method particularly suits bowlers who have a stooped stance, which could be the result of positioning the back knee nearer to the calf than the heel of the front leg...



If the spine were nearly level, sighting with a more distant aiming point would cause too much neck discomfort for most bowlers. Visible aiming points close to the mat are more readily identifiable. However slight errors in aiming point near the mat magnify as the bowl travels to the head.

Some bowlers choose an aiming point adjacent to the 'shoulder' or widest part of a bowl's path. Depending on the profile of the bowl, the shoulder is 55% to 70% of the distance to the head. A bowl will have completed about 1/5th of its total draw when it passes over the shoulder, so a bowl aimed at the shoulder will be narrow. Therefore, the aiming point (and aiming line) must be (25%) wider than the true shoulder to avoid a narrow delivery.

Some bowlers choose a 'jack high' aiming point....



Just as a skip's shoe guides required line and length for jack delivery, so a 'jack high' aiming point provides both line and length for bowl delivery. Adjustments to a jack-high aiming line can be much finer, and arguably more precise, than adjustments to an aiming point within a few metres of the mat. Bowlers who use a jack-high aiming point need to position the knee of the trailing leg as low as the heel of the front foot. This posture puts the base of the spine low enough to enable sighting up the rink without uncomfortable arching of the neck....



Thus, delivery technique can affect the choice of aiming point distance. Different elite-level bowlers use a wide range of aiming point distances with comparable success. The learning curve and ultimate skill of bowlers using any of the foregoing methods appear to be about the same. Coaches or other observers can detect the aiming point distances that bowlers use by watching their eyes as they release their bowls.

Aiming in Windy Conditions

In common with friction of the green, head winds tend to resist the motion of bowls in course. The effect of a head wind is equivalent to that of a green of slower pace. Conversely, the effect of a tail wind is equivalent to that of a faster green. Head and tail winds necessitate similar adjustments in delivery line and speed that equivalent changes in green speed would necessitate. Bowlers are sometimes able to capitalise on this difference by setting up short ends with the wind, and long ends into the wind. However, that approach could get the team into trouble unless each member has practised it regularly.

According to its direction, a crosswind force augments or diminishes the effect of a moving bowl's bias. This correspondingly affects the amount of turn of a bowl in course. Thus, a crosswind produces a wide and a narrow hand. Crosswinds commonly have also a head or tail wind component.

Moderate to fresh winds are rarely constant in speed or direction during the 10 or 15 seconds that a bowl is in course. Plantations or structures adjacent to the green can 'funnel' wind to increase the gusting, backing and veering already occurring. Therefore when such winds are present, heads are likely to be less compact than usual.

Attempts at compensating for windy conditions by altering normal positioning on the mat are inadvisable. Some bowlers suggest that repositioning on the mat can change the delivery line, so reducing the exposure time of bowls to strong crosswinds. Changes in position on the mat can provide changes in delivery direction that would never exceed $\frac{1}{2}$ of 1° . Such a change in delivery direction is insignificant in the presence of shifting, gusty winds. Any benefits would be so small and unpredictable, that such a departure from normal technique is not really worth the effort.

Bowlers who try to fight the conditions are probably unduly distracting themselves from the task of accurate draw shot bowling. They increase stressful pressure on themselves in the process. They should assess the average speed and

direction of the wind, adjust aiming line and delivery speed accordingly and hope for a fortunate result. They should watch jack and bowls during any trial ends to obtain a feel for green speed and wind effects.

Delivery Speed Control

The Concept of 'Elevation'

Many years ago, an Australian lawn bowling author gave some thought to the mechanics of a bowl delivery chute. He was aware that the exit speed of a bowl varied according to its starting height on the chute rails. He then postulated that a bowler should regulate bowl delivery speed by controlling starting elevation of the delivery arm. He called the concept 'the theory of elevation', possibly to give it connotations of a scientific truism.

This led to overemphasis here on the role of the delivery swing arc (or 'elevation') in producing bowl delivery speed. The 'theory' encourages bowlers

- to favour terms like 'pendulum swing',
- to imagine that they can somehow disengage their delivery arm from the powerful musculature of the upper arm and shoulder,
- to imagine that pivoting of the delivery arm virtually under the influence only of gravity force is possible, and
- to imagine that bowlers retain imprints of the amount of elevation used for successive deliveries to the extent that fine adjustments of elevation are possible.

A more rigorous study of the underlying biomechanical science would suggest that only intuitive and coordinated integration of muscular force and gravity force acting together can determine the speed of the delivery arm, and therefore the bowl release speed.

While other conditions remain constant, the run distance of a bowl varies with its delivery speed. Therefore, bowlers should correct any tendency towards long or short bowling by slower or faster delivery speeds, respectively. Integration of muscular force, the arc of the delivery arm-swing, and any simultaneous forward momentum of the fulcrum or shoulder of the delivery arm produces bowl delivery speed. Therefore, bowlers should correct delivery speeds by intuitively varying the movements that produce those speeds.

Perceptions of Distance

Some bowlers misjudge lengthwise distances separating bowls in a head. The distance beyond a jack at which an object is fully visible depends on the height of the eye line and the distance to the objects, but is generally at least a metre. Therefore, in the following illustrations, the ditch (left) and the bowl (right) are at least a metre behind the jack.



The distance beyond a bowl at which an object is fully visible similarly depends on the eye line height, head distance, bowl size, and bowl orientation (upright or flat) but is generally at least two metres. Therefore, in the following illustrations, the ditch (left) and the jack (right) are at least 2 metres behind the bowl.



Skips sometimes guide jack deliveries of lead players by planting a foot at the desired head distance. Leads can then adopt a delivery speed to propel the jack so that it gently comes to rest in virtual contact with the skip's shoe.

Bowlers can adapt the same technique in generating suitable release speeds for biased bowls. Once the jack is in place, bowlers can integrate visual awareness of its distance away with anticipatory neuro-muscular 'feelings' of appropriate delivery arm speed. Bowls then delivered on a good line should have successful prospects.

Bowlers who use a jack high aiming point could imagine there is a skip's shoe or an equivalent object located there. Alternatively, they could imagine that on a jack-high, crosswise alignment there is an imaginary line, or the lip of a ditch, or the skirting of an invisible wall. Whatever the visualised barrier, the perceived task is to deliver a bowl at a speed that will propel it to just reach the object before coming to rest.

Improving Control of Delivery Speed

Beginner bowlers have busy minds. They think about things like arm elevation, timing, step length, trailing leg positioning, and follow through posture as they deliver a bowl. These busy thoughts are an unavoidable phase in the process of learning delivery technique.

A corrective delivery for a bowl that stops a metre short requires only 2½ more revolutions. Bowlers should make such fine corrections by 'sensing' the extra bowl speed required to reach the objective. Conscious adjustment of arm elevation can easily cause over-correction. Undue conscious attention to limb movements during delivery can lead to a condition called 'paralysis by analysis'. Bowlers should condition themselves to trust their practised delivery technique to make appropriate adjustments subconsciously.

With regular practice, bowlers' movements become less awkward, more precise, and more consistent. Eventually their delivery technique becomes almost as automatic as blinking or breathing. Their minds are then clearer. They can give full attention to judging the line and length required for each delivery.

Bowlers should practise a 'grooving of their delivery', which is a rhythmic harmonising of mind and body. Out of the process come accuracy, consistency, self-confidence, and enjoyment.

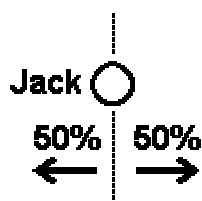
Elite bowlers prepare for a delivery by confidently 'saying' to themselves that their bowl will run its course and stop precisely at the intended spot. They use imagination to 'see' their bowl following the exact path to accomplish that result. They develop a 'feel' for a good delivery from the weight of the bowl, their perceptions of the pace of green, and senses in their bowling arm and shoulder. Such rehearsal provides a mental pattern for a largely automatic delivery movement to produce the bowl speed required. They use hand and eye coordination for intuitively integrating gravity force with muscular force in executing the movement.

Avoiding 'Short' Bowling (Under-bowling)

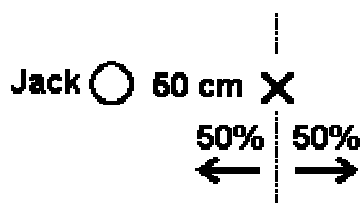
A common error that bowlers at most levels of the game make is that of 'short' bowling. Subconsciously perhaps, they feel that a bowl that almost 'made it' is a better attempt than a bowl that 'overdoes it'. However, since a jack rarely moves forward, bowls that stop beyond 'jack high' have tactical potential, whereas few bowls that stop short of the jack are of much value.

Again subconsciously, many bowlers feel that the 'resting toucher' is the 'ultimate' objective. However, a bowl behind and within about 30 cm of the jack is a commonly a much better outcome. The resting toucher has a delicate quality to it, and some bowlers make the mistake of being so delicate with their delivery movement that their bowls stop short where they have little tactical value.

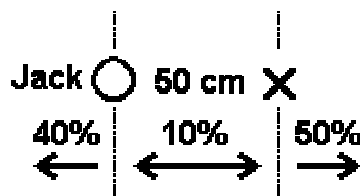
When the jack is the aiming focus, on average half of bowls are likely to stop before jack high, and half to stop beyond it:



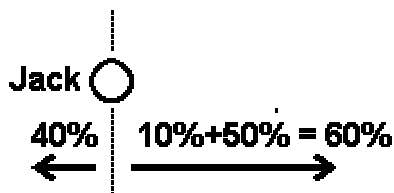
Thus about 50% of deliveries are likely to result in short bowls. If bowler adopts a point about 50 cm beyond the jack as the aiming focus, about 50% of bowls are likely to stop before that point, and 50% to stop beyond it:



Now if, say, 10% of bowls stop beyond jack high, but short of the alignment of the objective point, then only 40% of bowls will have stopped short of jack high:



In other words, if a bowler adopts a point 50 cm beyond the jack as the aiming focus, the number of short, ineffectual bowls could reduce from about 50% to perhaps 40%:



This seemingly small difference constitutes a very powerful tactical improvement.

Drawing to Positions

Drawing to Receive

'Receivers' are simply bowls positioned near the likely destination of any movement of the jack. Any movement of the jack is generally rearward. Therefore bowls can rarely serve as receivers unless they are past jack high.

To place bowls in a receiving position, bowlers should simply visualise that the jack is already there and draw to it. A moved jack's line of retreat is commonly about 45 degrees to the rink centre line. Bowls at rest in the head tend to block the pathway of approaches to receiving positions from that direction. That commonly obliges bowlers to approach a receiving position from the opposite direction. This approach is around the head rather than through it. In other words the uncluttered approach is generally 'outside-in' rather than 'inside-out'. To 'cover' an opposing bowl, bowlers treat it as a jack and draw as close to it as possible. Bowlers can use any bowls near the required receiving position as guides for the required delivery speed.

Drawing to Block

A 'block' is a short bowl perceived as obstructing a strip of the rink 12 to 14 cms either side of the path of the opponents' percentage shot. The placement of an effective block is more precise, and is a more exacting task, than the placement of an effective receiving bowl. The different models of bowls now in use have some differences in their paths, which makes the art of effective blocking more exacting today than in earlier years. Because a block is a short bowl it would rarely qualify for inclusion in a team's count of shots. Therefore a missed attempt at blocking constitutes a wasted bowl. Consequently today's bowlers seldom use blocking tactics, even where a block would be a percentage shot.

An objective of blocking is discouraging or preventing opponents from playing their percentage shot. When there are short bowls near the head, a bowl that moves to 'plug' a gap between them could constitute an effective block. If the preferred option is a straight drive, one bowl could block either forehand or backhand attacks. Blocks located 14 metres or slightly greater distances from the mat obstruct the largest possible sector of possible lines of delivery.

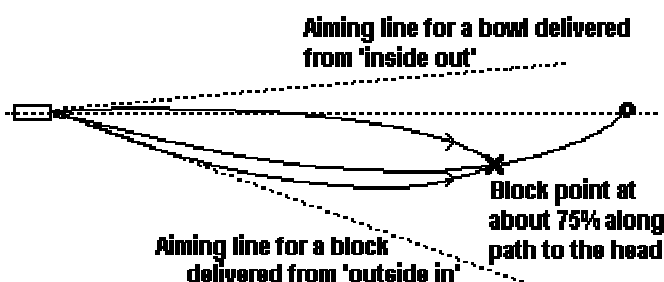
Another objective of blocking is applying pressure to and possibly inducing anxiety of opponents by placing them at tactical disadvantage. A block can discourage opponents from playing the percentage shot and can force them to change to a less favoured shot. If alternative shots entail approach paths that are impassable, risky, or unplayable, they might attempt the preferred shot. However, the presence of a block can induce anxiety, distraction and possibly error. Blocks

located about 14-15 metres from the mat tend to have greatest psychological impact. Bowlers sometimes perceive bowls as blocking the preferred path when they are actually safely clear of it.

To place bowls in a blocking position, bowlers should simply draw to an imaginary jack at the required blocking point. To position blocks from the 'outside in', they need to enlarge the aiming angle, or aim wider than the normal aiming line. If they require a block on the forehand side, they deliver the block with a forehand. The required enlargement of the aiming angle (compared with a draw to the centre line) depends on the ratio between the distance to the blocking point and total head distance:

'Outside In' Aiming Angle to Block					
Block Distance ÷ Head Distance	50%	60%	66%	75%	80%
Extra Aim Angle	85%	75%	66%	60%	50%

Because short blocking positions are well forward of the head, there are generally no obstructions to prevent an 'inside out' approach. To position blocks from the 'inside out', bowlers need to adopt a rather fine aiming angle on the opposite hand. If they require a block on the forehand side, they deliver the block with a backhand....



An advantage of an 'inside out' delivery is that blocking bowls in course do not leave the rink of play. Play on the adjacent rink could temporarily obstruct an 'outside in' delivery. The required aiming angle to block the forehand side is a proportion of the aiming angle needed for a backhand draw to the head. The required aiming angle depends on the ratio between the distance to the block and total head distance:

'Inside Out' Aiming Angle to Block					
Block Distance ÷ Head Distance	50%	60%	66%	75%	80%
Draw to Block ÷ Draw to Head Aim Angles	15%	25%	33%	40%	50%

Bowlers need a rather compact action to reduce delivery speed on fast greens so that blocking bowls run little more than 14 metres. They should practise both 'inside out' and 'outside in' placement of blocking bowls, on both hands, and at various distances. They should then test the effectiveness of their blocks by attempting the shots that the blocks should obstruct.

Bypassing Blocking Bowls

The Unchanged Objective

There are several ways that bowlers can avoid the nuisance of blocking bowls. The presence of a block should never change a bowler's objective. In his book *How to Become a Champion at Bowls (1939)* Dick Harrison wrote: "It would not be any use merely to get inside [or outside] without reaching the head in such a manner that the player's bowl would finish close to kitty, either to 'save' or to get the actual shot."

Ignore the Block

A way of neutralising a block is simply that of playing the opposite hand or playing shots requiring a line comfortably wide of the block.

Another way is to ignore the block. In many cases, bowlers treat as blocks short bowls that are actually well clear of the path of well-directed bowls. In short, they look like blocks but are not. Even if a short bowl evenly straddles the path of well-directed bowls, the chances of missing it are much greater than those of hitting it. One bowl can block an approach 25 cm wide. Competent club bowlers have an aiming line variation of at least ± 50 cm at the head. Therefore, the chances of hitting a block are less than 25%.

Another related way of avoiding the block is to aim through it. In his book *The Modern Approach to Lawn Bowls* (1969) Fred Soars wrote: "Players, faced with a block, should not let it worry them. One tip is to take your green through the short bowl. You're bound to miss it if you aim at it!" Given the average accuracy of even competent club bowlers, it is hard to disagree.

Change the Target

Another way of avoiding a block is to discontinue attempts at drawing a resting toucher. Two other attractive finishing points are alternative objectives for draw shots. One is opposite the block and about 1/3rd of a metre and 45° from the jack. The clear approach is inside the block. The bowl crosses the head just before it comes to rest.

The other finishing point is behind the block, about 1/3rd of a metre and 45° from the jack. The clear approach is around the block. The bowl comes to rest before reaching the centre line. In his book *Fundamentals of Lawn Bowls* (1960) Albert Newton wrote: "To bypass a block two feet from the jack, visualise a jack - a second jack - behind the block and draw to it. It is not necessary to be on the jack to get the shot."

Sidestep the Block

Another way of avoiding a block involves using the foot on the non-delivery side as the anchor foot. Bowlers then take the widest possible sidestep with opposite foot and deliver a forehand from that wide position....



The large sideways change of the bowl release point can produce a delivery line that passes safely around a block on the forehand side or inside a block on the backhand side. A side step to the backhand side is not really an option because the hip and thigh on delivery arm side would obstruct the arm swing. In his book *Improve Your Bowls* (1987) Tony Allcock wrote: "At a critical point in a match he [a skip in the Bournemouth Open tournament] found himself comprehensively blocked by an opposition bowl. Taking advantage of his considerable height (well over six feet), he planted his left foot towards the side of the mat, stepped fully three feet to the right and nonchalantly delivered a perfect forehand past the blocker and sweetly into the head."

'Using' the Mat

One other way of avoiding a block is a procedure sometimes called 'using the mat'. The expression possibly dates from the time when mats were considerably larger than the mats of today, and from when the manicured and even playing surfaces of today were not so common. A mat measures only 60 cm by 36 cm. It allows only slight changes in shoe positioning without infringement of foot-faulting rules....



Some bowlers allow studied attention to their footwork on the mat to distract them from achieving a tactically effective shot.

The theory of 'using the mat' is that by changing foot position on the mat, the bowl follows a different line and proceeds safely inside or outside a block. The reasoning usually suggests that, by moving the bowl grassing point sideways six inches or more, its new line should safely clear a five inch bowl blocking bowl. Most printed diagrams of the method rely on gross distortions in scale to explain the theory. If the aiming angle is unchanged, and the aiming line shifts six inches, the clearance past the block would be about an inch. Few bowlers could reliably deliver a bowl with such fine tolerance. Competent club bowlers have a delivery line variation of at least ± 50 cm (20 inches) at the head. Most bowlers would be better off using the second method (above). They would be better off ignoring the block altogether and delivering their bowl in the usual way from the centre of the mat.

For most bowlers, the usefulness of the technique known as 'using the mat' is questionable. In his book, Tony Allcock also wrote: "Only by bowling from the same position on the mat can you remain confident of picking out the line. Moving to the back of the mat in particular carries a hazard, because it means you will be grounding the bowl perilously near the front edge...Using either the inside or outside of the mat is another matter, and while I rarely do so myself it is a ploy not to be discounted out of hand."

Attacking Shots

Descriptions of Shots

The names that bowlers give to shots, other than conventional draws to the jack, fall into one of three classes according to:

- Tactical intention (block, receiver, shot, 2nd shot, etc)
- Mechanical objective (trail, rest, wrest, etc) or
- Delivery speed (drive, ditch weight, 'yard on', etc)

'Yard On' Shots

A rest or resting shot involves using bowls at rest to obstruct the bowl in motion so that it stops in a favourable position. The wider the cluster of bowls, the easier is the shot.

A wresting shot has more impact speed than a resting shot. Both the wresting and the wrested bowl tend to move and diverge after impact. Bowlers can sometimes wrest or push one of their own bowls into a more favourable position. They can sometimes force an opponents' bowl within the head to a position less favourable for them.

A run-through or wick shot has a more oblique impact than a wresting shot. The key to success of the shot is the distance and direction of movement after impact.

A trail shot involves pushing the jack out of position and then 'trailing' or following it. A bowl that sets the jack in motion but does not follow it is not really a trail shot.

To execute yard-on shots, bowlers should first decide the finishing line and speed that their bowl needs for achieving the intended result. They next visualise an imaginary jack where their bowl would ideally come to rest if there were no obstructing bowls at the intended point of impact. They then follow their usual routine for playing a draw shot to the imaginary jack.

Running Shots

Running shots, ditch-weight shots, swinging shots, timing shots, firing shots and drives involve a range of relatively high delivery speeds. Any of them is likely to result in a dead bowl. These shots have the common intention of wresting the jack or one or more bowls out of the head. If they result in disturbing the head, possible outcomes include a toucher in or out of the ditch, dead bowls, or a dead end.

Controlled weight shots are simply variations of the draw shot. Some bowlers unnecessarily depart from their routine draw shot technique for controlled weight shots. They should assess any likely adverse movement of the jack before playing attacking shots.

When delivered bowls need to remain within bounds on coming to rest, they require line and length combinations that would allow them to remain 'live' should they miss - possibly in receiving or covering positions. Bowlers could adopt a tactically positioned imaginary jack to guide the delivery of such bowls.

Running shots require a reduction in aiming angle combined with extra delivery speed. Aiming at an imaginary jack, which would usually be at a point beyond the confines of the green, is less helpful for fast shots. For early practice of running shots, a guide to the required delivery speed and aiming angle is:

Notional extra run past target	Aiming angle compared with normal angle (for drawing to target)
10%(eg 2.5 metres if target at 25 metres)	70%(2/3 rds of normal angle)
20%(eg 5 metres...)	60%(3/5)
30%(eg 7½ metres...)	50%(1/2)
40%(eg 10 metres...)	40%(2/5)
50%(eg 13 metres...)	30%(1/3)

(Note that the percentages on each row total 80.)

If the aiming line and delivery speed combination requires correction, bowlers should correct whichever factor is at fault. If the combination is nearly correct, they should consider adjusting aiming line rather than delivery speed and rhythm. Intuitive judgement of suitable bowl speed and aiming angle combinations is the product of practice, experience and appreciation of the performance of one's own bowls.

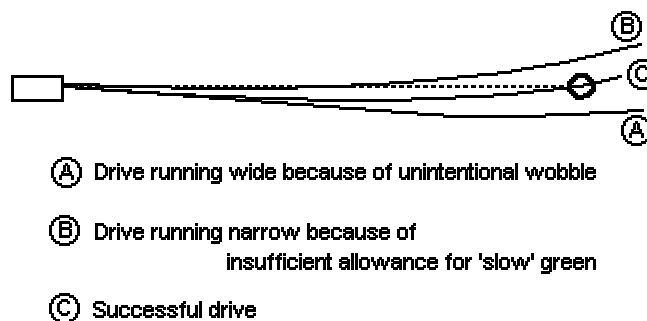
Drives

Driving technique should vary little, if at all, from draw shot technique. Some players make deliberate but minor variations of normal delivery technique. They might use the claw grip to better secure the bowl during the faster swing of the delivery arm. They might delay their step so that body weight transfer synchronises with the quick forward swing of the delivery arm.

Bowlers should consider planning fast shots so that they will swing outwards as they near the target. Outward swinging drives may have less risk of disturbing bowls in the head that are outside the target zone.

Bowlers sometimes drive with an unintentional wobble. In setting up for driving, some players grip their bowl with its rings tilted about 20° or more with the intention of inducing a wobble. Wobbling drives run virtually straight, which some bowlers find easier to aim. They sometimes describe what is actually wobble as making a bowl 'stand up' or 'run on its edge'.

Bowlers tend to have a narrow range of driving speeds and sometimes make insufficient allowance for the greater deceleration and turn of driven bowls on slower greens....



- (A) Drive running wide because of unintentional wobble
- (B) Drive running narrow because of insufficient allowance for 'slow' green
- (C) Successful drive

For early practice of drives or running shots exceeding ditch 'weight', a guide to the required delivery speed and aiming angle is:

Notional extra run past target point	Aiming angle compared with normal angle (for drawing to target) *
67%(2/3rds) (eg 17 metres if target at 25 metres)	1/4 of normal
80%(eg 20 metres...)	1/5
100%(eg 25 metres...)**	1/6**
150%(eg 37 metres...)	1/10
200%(eg 50 metres...)	1/12

* Bowls delivered with wobble require even smaller aiming angles.

** A notional run of 50 metres (e.g. 25 metres past a target at 25 metres) requires similar force to that of a delivery along the green's diagonal, from corner to corner.

A cluster of 1.5 kg bowls has considerable inertia. To scatter them an appreciable distance an attacking bowl requires considerable momentum. Few drives fail to achieve their tactical aims because of insufficient speed. However, many drives fail because bowlers sacrifice control and accuracy in generating excessive delivery speeds.

Where the aiming line and delivery speed combination requires correction, bowlers should correct whichever factor is obviously at fault. If the combination is nearly correct, they should consider adjusting aiming line rather than delivery speed and rhythm.

