

Lawn Bowls Coaching

By

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Foreword

Rob Judson is a lawn bowls coach who resides in Australia at Currumbin Waters. This southern suburb of Gold Coast City is about an hour's drive south of Queensland state capital, Brisbane. Over the years he has been a radar technician, a RAAF pilot, and an accountant, in that order. He is now a retiree. He was regional coaching director for the Gold Coast - Tweed District Bowls Association 1994 to 1996, and was state coaching director for the Royal Queensland Bowls Association 1996 to 1998. He was a member of RQBA's coaching unit from 1993 to 2002.

He privately launched his web site titled 'Lawn Bowls Coaching in Queensland' in April 1997 while convalescing after a stroke. With only a layman's knowledge of web page design, he maintains this site himself. It is a privately funded venture that has no advertising and attracts no subsidy. Its content focuses on the art of coaching and does not set out to provide news about current events in lawn bowling. About 60% of visitors to the site are Australians or New Zealanders.

Many visitors have since asked Rob to publish the contents of his web site as a book. There is no shortage of new and second-hand books about lawn bowls. Many of them have barely recouped their production costs. Once a book is typeset, the process of obsolescence begins, whereas the internet allows continual updating of information, and there is a shortage of information about the art of lawn bowling on the internet. Therefore, Rob published his material as a freely downloadable e-book.

The first edition of this book appeared in October 2000 as a compressed MS Word 2000 document. A revised edition emerged in February 2002. Information in the latest edition reflects many more revisions. It is now in portable document file (PDF) file format because the original MS Word document - even after compression - remains significantly larger, than this PDF version, which therefore requires less time for downloading. The PDF file contains all the information in the web site, except for internet-specific features and material contributed by other writers.



Rob Judson
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Coaching Of Lawn Bowls

Milieu at Bowling Clubs

Coaching at Bowls Clubs

Most lawn bowls clubs in Australia have experienced a sustained decline in membership in recent years. Bowls clubs here control virtually all lawn bowling rinks. Few rinks, if any, are available for public hire. Therefore, participation in lawn bowling and membership of a bowling club mean much the same thing here.

To offset the decline in membership, clubs tend to offer inducements to potential members. A common inducement is free coaching. Many club officials tend to associate coaching with free basic instruction of beginners. At many clubs, this is virtually the only form of coaching readily available. Many clubs have little concept of coaching programs for intermediate and advanced bowlers.

A program of beginner instruction is typically a handful of sessions, each of about an hour. Programs generally have the aim of preparing the client for playing as leader for a social bowling team. In many sports, this is the stage at which instruction in basic skills ends, and coaching for competition begins. In lawn bowls, this is typically the point at which coaching finishes forever.

Some adult beginners feel uncomfortable being coached. They may feel that they surrender a degree of control over their circumstances. They may imagine that to observers they appear to be submissive or incompetent. Many of them are glad when their instructional program ends. An empathic coach can dispel negative feelings.

When basic instruction ends, many bowls coaches actually encourage even keen beginners to discontinue the coaching relationship. Clients are commonly advised to acquire playing experience for several weeks or months, and to "come back" for coaching in "advanced shots" later. There are several issues here. There is:

- the questionable wisdom of interrupting a pattern of regular coaching.
- the separation from a supportive and encouraging mentor.
- the question of whether the novice will be forced to rely excessively on learning by trial and error, which is time consuming at best, and counter-productive at worst
- the intimation that instruction in the basics and in advanced shots encompasses everything needed in preparing for successful competition.
- the question of whether the coach is really keen to resume work with that client, and whether the coach knows any more about the game that is worth teaching.

Novices become exposed to the club culture, which may lack support for continuation coaching. They tend to participate in pairs and singles play, or in playing positions other than lead, within a few months or even weeks after becoming club members. Resumption of coaching rarely occurs.

Only a minority of bowlers have an interest in receiving coaching. Most bowlers are elderly and play socially rather than competitively. The average age of bowlers has increased with life expectancy in the community generally. The average age is probably now higher than it has ever been. Although young elite bowlers justly receive much media attention, their relative numbers are actually quite small. Where there is a latent demand for coaching within a club, a suitable person for providing that coaching usually emerges.

Some clubs make coaching available to their selected teams if they know that their pennant players have an interest in, and are willing to make themselves available for coaching and practise games. Otherwise, they tend to pin their faith on luring elite players from other clubs, or selecting of teams likely to generate synergism in pennant competition games.

Club Coaches

In Australia, there are about 2000 bowls clubs and over 4000 registered coaches. Thus, there is an average of 2 male or female coaches at each club. Many clubs, particularly the smaller ones, have no registered coach. At all clubs, some informal coaching occurs. Players share their knowledge and skill, spouses coach one another, parents coach their children, etc. Therefore, coaching occurs even at clubs without a registered coach.

The bowls coach course has the Australian Sports Commission's approval. It comprises about 20 hours' tuition and a similar period of supervised practical coaching. Coaches receive registration within the National Coach Accreditation

Scheme on successfully completing that course. The registration process marks the beginning of a career pathway. Coaches must continually update and increase their knowledge and skill to improve their competencies. Their registration is renewable every 4 years on proof of updating effort.

Experience as an elite bowler is a splendid attribute for a coach to have. However, many elite bowlers do not have spare time in their playing schedules for regular club coaching. Many of them have little interest in club coaching programs. Performing excellence is not an attribute that one bowler can vicariously transfer to another. Bowling and coaching are quite different processes. Coaches essentially provide their clients with effectual learning experiences. They also require wide knowledge and the teaching skill to present programs in ways that best facilitate the learning process of clients. An elite bowler may or may not have the necessary attributes to be a competent coach. Compared with many other sports, lawn bowling rarely encourages ongoing coaching programs for competitors, so even most leading bowlers have had little experience with the methods and the potential of competent coaching.

A few large, profitable clubs have an elite bowler employed as a bowls coordinator - sometimes with coaching responsibilities. Remuneration in each case differs according to negotiated employment conditions. A few clubs allow elite bowlers to coach for an hourly fee. However, most registered club coaches are unpaid volunteers.

The standard of experience required of coach applicants is a subjective judgment of the club sponsoring the applicant and the association responsible for coach training. Adequate experience in lawn bowling is but one of the course prerequisites.

There need be no conflict between the club coaching role and activities as a player. However, some coaches fail to prioritise playing opportunities and coaching obligations. They present themselves as coaches but are unwilling to devote the time that the role deserves. Most coaches would be aware that club members are apt to draw conclusions about their coaching competency from their ranking as players.

As role models, coaches considerably influence the motivation of their clients to learn. Coaches should:

- emphasise enjoyable participation and companionship rather than game outcomes,
- emphasise the enjoyment and satisfaction that bowling provides rather than the physical skill and fitness that also develop,
- emphasise the opportunity for building self esteem and confidence,
- emphasise the enjoyment of lawn bowling rather than its traditional rigidities, and
- avoid premature prophecies of future success based on nothing more than a few promising early performances.

Coaching Knowledge

Core Areas of Coaching

Club coaching primarily involves responsibilities and activities that help bowlers to become competitive. It may also involve helping bowlers to follow a program of development, and managing supportive services. Supportive services may include administering coaching services within a club; mentoring of assistant coaches; applying new game laws, coaching methods or aids; adopting of new regulations affecting coaching methods, etc. Bowler development may include planning of programs for bowler groups, counselling, or even career counselling, etc.

Coaches help all bowlers to become more competitive. Players with limited aspirations typically discontinue their coaching prematurely. The coaching they receive tends to be limited in quantity more than in quality.

The components of bowling skill are progressive. In the following list, each component relies on the foundational skills listed above it:

Component	Comments
1. Motivation	Is keen, persistent, has 'work' ethic
2. Technique	Has efficient and fluent delivery technique
3. Fitness	Is flexible, energetic, durable, in all weathers and climates
4. Game Techniques	Is accurate with all shots in practice and competition, familiar with game laws
5. Tactical skill	Has specialist (eg singles player, lead, second, etc) skill. Able to evaluate tactical options.
6. Team work	Is cohesive and communicative, synergistic, has skill in game-planning & strategy, leader-like qualities

The core fields of preparation of bowlers for competition are technical, tactical, psychological, and physical (or physiological). These are easily remembered as the two 'T's and the two 'P's. Each of these fields has a basis of knowledge and many practical applications. 'Practice makes perfect' is a philosophy that applies to each of these fields. Coaches do not master all aspects of these subjects immediately. However, they can increase their repertoire of coaching skills as their expertise develops.

Technique

Technique centres on the bowl delivery movement. Technique also incorporates some appreciation of how lawn bowls in motion perform.

There is a common tendency for bowlers and even coaches to have an obsessive focus on the mere mechanics of the delivery movement. Typically, they ignore other core areas of performance. Movement mechanics are visible, measurable, assessable in form and style, and easier to deal with than other areas. Coaches who lack the skills to help bowlers to develop their physical and mental potential are unlikely to have a significant role beyond that of instruction of beginners.

Tactical

There is little published material about the fundamentals of tactics in bowls. Coaches should develop an understanding of head reading, shot options, and head directing and should introduce those concepts in their coaching programs.

Psychological

Champion bowlers often claim that about 80% of their success in major events is due to mental factors. For beginner bowlers, the contribution of delivery technique to successful mastery of the basics is considerably greater than 20%. However, as delivery technique becomes grooved and automatic, it needs diminishing attention. So even at early stages of learning, technique drills do not warrant allocation of 100% of available training time.

Mental skills are the least sport specific of all competition skills. The mental skills in a sport readily transfer to other sports and extend beyond sport to other aspects of daily life. Bowlers instinctively develop goals for obtaining their major needs, such as their jobs, cars, homes, etc. Thus, goal-directed behaviour and related attributes such as self-esteem, self-confidence and drive or motivation are not entirely new to them. Many bowlers also use their imagination freely while reading, or when mentally rehearsing ways of dealing with everyday challenges. Some bowlers have discovered the value of controlled deep breathing and other techniques for moderating feelings of anxiety.

Sport psychologists regard mental skills as the outcome of learning and as readily teachable. They recognise that the minor sports can rarely afford consultancies with them. So, most of them readily acknowledge a need for coaches to introduce mental skills awareness training in coaching programs. Psychological applications include teamwork and sportsmanship.

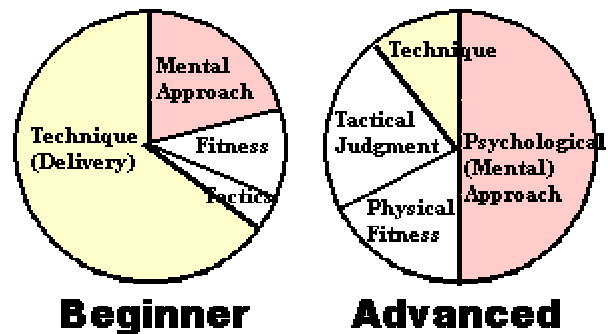
Physical

Physical concepts include general health and fitness. They also embody the competitive 'edge'. Bowlers are generally not receptive to advice about improving physical fitness.

Principles of Training and Practice

The broad principles of training and practice apply in the coaching of lawn bowls as they do for any other sport. Coaches should individualise programs for clients according to their starting age and ability, rate of improvement, demands to be imposed, and ultimate level of achievement desired.

Training activities should be specific to demands of lawn bowling, logically progressive, and be interspersed with periods of appropriate rest and recovery. They should begin with an adequate warm-up, and follow the principle of progressive overload. Progressive overload involves measured increases in the degree of difficulty of tasks, or by increasing the number, duration or intensity of training sessions, or combinations of these factors. It also involves the exposure of actual or simulated pressures of competition in the practice environment. Coaches should use methods that



provide informative and supportive feedback, and interesting variety. They should also make optimal use of available time, facilities and equipment.

Available methods of training and practice of lawn bowling are broadly as follows:

Method	Comments
1. Related practice	Typical 'roll-up', (even a game of tenpin or bocce would qualify)
2. Minor game	'Bolf' ¹ , carpet (biased) bowls, 'Kooka' ² bowls, short mat bowls, etc
3. Game technique practice	Consistency singles, bowling to a marked bulls-eye, etc
4. Functional practice	Leading, bowling to preset heads, etc
5. Phase practice	First 5 ends, last 5 ends, or other phases of typical games
6. Small-sided game	Limited number of ends, jack at set distances, 'phantom' bowler games, etc
7. Modified practice game	No dead ends, nominated hand of play only, rotate positions within teams, team conferencing, etc
8. Full competitive match	Games under actual or simulated competitive pressure

¹ Elements of golf incorporated in lawn bowling activities typically requiring placement of mats and jacks in defined positions on a sequence of rinks.

² A compact form of the game developed by RQBA, and involving indoor carpets 8 x 1 metres in size and the use of 4-inch biased carpet bowls'

The progression from method 1 to method 8 tends to move from less motivating to more-motivating activity, from simulation to reality, from simple to complex skills, and from skill segments to complete skills.

Performance Problem Solving

Coaches should remember to differentiate the domains of the two 'P's and the two 'T's when observing, analysing and correcting problems. Bowlers can have a problem in any of those four areas. If, for example, a problem of short bowling in a competition arises, the bowler must fix it immediately. The problem might well disappear when the bowler consciously gives the bowl more initial elevation, which may generate greater bowl release speeds. The nature of that response is technical or a technique change. However, the real cause of the problem might be, for example, a tendency to underestimate distances up the rink. In that case, the real cause is not technical, but psychological - it centres on judgment of distances. Bowl elevation increase will not be a sustainable solution. Technical changes can provide sustainable solutions only for technical problems, and only psychological changes can provide sustainable solutions for psychological problems.

Planning & Organization

Program Planning

Planning and organization are processes by which coaches review club-coaching needs, plan a range of suitable programs and arrange the resources they need to present those programs when the opportunity emerges. Bowlers can distinguish between coaches who are organised and those who are not. They tend not to patronise disorganised coaches.

Where rain interrupts outdoor coaching programs, clients commonly become inactive, or coaches subject them to replays of videotapes without breaks for analytical discussion. Coaches should consider planning flexible programs, and bring forward topics held in abeyance for presentation either under cover in the event of rain, or indoors at night. Activities that could possibly proceed when rinks are unavailable include:

- Videotaping and appraisal of technique (requires sufficient light, & 10-metre strip of carpet.)
- Viewing and analysis of videotaped technique (follow-up on a green when possible)
- Mental approaches to performance (theory and/or practical)
- Game laws (explanations, demonstrations, quiz, etc)
- Warm up & stretching exercises
- Effective team participation
- Team leadership & communication
- Playing and clubhouse etiquette (particularly junior bowlers)
- Scorecard maintenance (particularly junior bowlers)
- Practice program design.

Coaches should design training programs by identifying appropriate outcomes of training and teach all the prerequisites vital to those outcomes. Topics that may be customary, interesting, or popular, but that would clearly contribute little to planned outcomes deserve no place in the program. Coaches should consider prioritising training content and

scheduling the least important matters last. Then if sufficient time becomes unavailable for completing the session as planned, they would have dealt with all its important elements.

The program should maintain its outcome focus. Any secondary objectives should be congruent with the primary objectives. The criteria for success should be implicit in the definition of the learning outcomes.

Reteaching of existing knowledge or skill should rarely be necessary. However, any general or individual weaknesses in the knowledge or skill of bowlers at the start of a program should receive preliminary attention. Clients that have a physical or other disability may require modified or different programs.

The target outcomes of a coaching program, which typically comprises a sequence of sessions, amount to a broader but similarly defined consolidation of session outcomes. A plan for a lesson should begin with a concise statement of its knowledge and its skill objectives, defining:

- each task in observable & measurable terms (eg "Deliver jacks using demonstrated technique..."),
- the performance conditions (eg "... on a rink of any pace, and for any indicated distance..."), and
- the evaluation criteria (eg "... with an average error of less than 1.25 metres from the jack")

Planning of Teaching Method

Well-planned and documented lesson plans are invaluable for reuse in recurring programs. An example of a typical session plan is appended on page 112.

A teaching alternative is the whole skill or the part skill method. The former option involves teaching the whole of a skill as a unit. It suits teaching of simple skills such as polishing bowls, measuring for shot, kicking bowls, or laying the mat. The part skill method involves teaching the skill in sequential parts, then integrating the parts successively into the whole skill. Coaches should teach parts that occur earliest in a complex skill before the other parts. It suits the teaching of complex skills such as bowl delivery. The chosen parts of the delivery movement might be the stance, grip, delivery action, follow through, integration, and refinement of performance. Coaches should follow a separate plan for each part and a plan to describe the method of chaining learned parts into a composite skill.

Personalised coaching is usually the best method of catering for needs of individual bowlers. If clients are participators in the planning process, they are usually more willing to internalise task challenges and related criteria for success. Station teaching or reciprocal coaching is effective in some circumstances for groups. Group practice plans should minimise the time that clients are inactively awaiting 'turns' and maximise the time they spend engaged in tasks.



Many new clients of club coaches are of mature age. Some of them demonstrate strong motivation. Their personal objectives in lawn bowling may or may not be clear-cut. Driven by a 'need to know' they may have a healthy curiosity about their new sport. Coaches should anticipate that mature age novices must 'unlearn' any unhelpful habits before new learning will replace it. Novices inevitably relate new concepts to their past experiences. Occasionally recommendations that coaches offer appear at odds with their expectations. Coaches should anticipate temporary learning difficulties if such conflicts arise. Many mature age novices are more comfortable 'in charge' of situations than in situations where someone else (e.g. a coach) is in charge. Therefore, coaches should avoid assuming more power and control from such clients than is necessary while coaching. They should use 'question and answer' and reasoning techniques freely. Some elderly clients have restricted ranges of movement in limb joints. However, some of them will be able to improvise effectively. Competent lawn bowling is more about what can be done rather than what should be done.

Coaches should teach firstly any skills that are prerequisites for more complex skills. The sequencing of essential subjects should be logical. They should ensure that planned transitions from each subject to the next are as brief and 'seamless' as possible. In setting the lesson timetable, coaches should try to introduce variety to enhance the interest of clients.

Direct instruction, sometimes referred to as the "chalk and talk" method, is helpful in ensuring that all the subject matter receives attention in the

Taste	1.0%
Touch	1.5%
Smell	3.5%
Hearing	11.0%
Sight	83.0%

available time. Coaches should allocate and conserve available time carefully. Direct instruction is an efficient method for coaching a group of bowlers. However, coaches should particularly avoid making excessive use of the spoken word based on

We hear half of what is said,	50.00%
We listen to half of that,	25.00%
We understand half of that,	12.50%
We believe half of that, and	6.25%
We remember half of that	3.125%

the assumption that clients prefer to learn by listening. Some coaches believe that speaking is teaching, and that hearing is learning. The spoken word, is actually a relatively

inefficient vehicle for a teaching and learning process. Studies show that the rankings of the senses as channels of learning are typically as appears in the preceding table.

Coaches should teach by challenging as many of clients' senses as possible. They could enlist each sense effectively by presenting new skills in the following stages: explanation (sound), demonstration (sight), guided practice of skill (touch), explanation, demonstration and correction of weaknesses (all), and practise of corrected skill (doing). "A picture is worth a thousand words" and clear demonstrations often teach skills not only more effectively but also quicker than the spoken word. Learning by 'doing' is the best method for most skill teaching.

**"I hear, but I forget,
I see, and I understand,
I do, and I remember"**

Organising Aids

Many coaches maintain a kit of commonly used instructional aids. These include cotton wool or metal discs for use as aiming points, lengths of coloured wool for use as aiming lines, etc. The kit should be on hand before the lesson begins to avoid a time-wasting search during the lesson.

Coaches should use game equipment as instructional aids whenever appropriate. They should teach head reading by creating model heads with a jack and some bowls. For example, they should teach measuring for shot by demonstrating with a measure, a jack, and at least two bowls. They should teach mat positioning options by laying mats, as shown opposite, at the extremities of permissible locations.



Coaches should always consider the feasibility of distributing lesson information to bowlers for self-paced learning at home. However, they should follow up with questioning techniques to test compliance with study tasks. Coaches should test the understanding of clients by asking open questions at every stage of teaching. Closed questions, which require single word answers, are of limited value.

Before each session, coaches should organise necessary resources such as booking of rinks, playing equipment, training aids, access to emergency phone and other services, special demonstrators or helpers, etc.

Teaching & Demonstrating

Approach to Coaching

There is a common misconception that coaches teach their own bowling skill, and thus the greater that skill, the better the acquired skill of their clients. Skilful technique is the result of practised conditioning of the subconscious mind. Skilful bowlers give attention to their objective for each delivery, not to the mechanics by which they will achieve it. Their practised imagery of the required line and length automatically translates into appropriate body movements to set the bowl in motion and achieve the desired result. Most bowling skill resides in the subconscious mind and is incapable of conscious recall. Thus, bowlers can teach others their style, but not their performing skill.

Many sport authorities regard teaching competence as more important than any other aspect of coaching skill. A warm, positive verbal and non-verbal style of teaching behaviour is best in most circumstances. A formal style, if positive, can promote learning. A permissive style can reduce learning if it allows clients to drift off set tasks. Coaches should establish any essential rules for safety or other behaviour at the outset. They should know their clients well and address them by their given names. For effectiveness in teaching, and therefore in coaching, bowls coaches need:

- Awareness of problems that learners face
- Respect for their clients' developing abilities

- Courtesy, self control and an even temper
- Honesty in deed and in thought
- Enthusiasm for the sport
- Expectations that clients will enjoy the learning process (in which case they probably will)
- Vicarious pleasure in the progress that clients achieve.

What coaches should do, irrespective of playing background, is to teach with reference to a model or concept of an orthodox delivery movement. Coaches are free to modify the standard movement to minimise the effect of any physical incapacity of clients.

Club coaches should be available to all members of their bowling club, including the best of the players. The top bowlers tend to control their own technical development. They tend to 'network' with one another to provide mutual help and advice. They tend to be unwilling to enter any coaching relationship that might entail the prospect of the coach assuming control of their technical method. They are generally aware not only of their technical weaknesses, but also of appropriate solutions. Any approaches to coaches tend to be from the standpoint of seeking confirmation of their own analysis. Good responses for coaches in relating to the better bowlers include:

- listen attentively - speak conservatively
- use question and answer technique to obtain adequate information
- either confirm the client's analysis or identify more-important defects observed
- either confirm the client's intended course of corrective action, or suggest alternatives likely to be of equal or greater benefit
- use positive and informative feedback
- offer ongoing monitoring to check progress of any changes.

Planning to Avoid Problems

Coaches should insist on punctuality and start lessons on time. They should direct session activities so that they use available time equitably and give due emphasis to all session topics. They could quickly undermine their timetables if they allow outsiders to disturb the continuity of lessons. They should arrange for a club official to intercept and deal with incoming calls during a lesson. They should courteously but decisively postpone discussion with people who approach them during a lesson. When faced with unforeseeable, urgent and important interruptions during lessons, coaches should try to complete the current lesson segment, if possible. They could give their bowlers a practice task so that lesson momentum can continue during their temporary absence.

The lesson plan should segment the available time to maintain good momentum and to maximise the productivity of the entire period. When coaching a group, coaches should avoid having only one client busy at a time.

Many sessions will include some practice of previously learned skills. For skill practice, the coach may vary the task difficulty by changing performance conditions, or evaluation criteria, or both. If tasks have a balanced degree of difficulty, clients experience a "flow" in performing them. They avoid the boredom of tasks that are too easy, and the anxiety about possible failure of efforts on tasks that are too difficult. Any intermediate objectives in programs for teaching new skills should make allowance for a possible plateau in performance improvement. However, at other times rapid skill improvements often compensate for periods of little improvement. Meanwhile the underlying learning process tends to continue at a steady pace. Coaches should consider giving clients enough information so they can evaluate their own performances.

Preparing to Coach

Before each session, coaches should ensure that:

- lesson objectives are clear
- rinks, jacks and mats are available
- coaching aids are handy
- precautions imposed by prevailing weather are taken
- coaching environment is safe, and
- assistants and clients are ready for a punctual start.

Coaches should appreciate the effects of heat, direct sunlight, insufficient hydration, wind chill, rain-soaked attire, and should instruct bowlers how to avoid ill effects from such conditions.

Coaches should be able to recognise and to allow for the physical incapacities of some elderly bowlers. These incapacities typically include: slower learning rate, hearing disability, diminished hand strength and span, diminished limb flexibility, or impaired vision.

Explaining and Demonstrating

Coaches should begin sessions by capturing the attention of clients. They should begin teaching of each subject by establishing its importance and performing context. They should avoid trying to extend teaching by overloading clients with more information than they can assimilate at a time.

Coaches can avoid verbose explanations wherever a good diagram or demonstration conveys the meaning better. Demonstrators should be competent performers, and their demonstrations must be good models of the required skills. Coaches who are able to demonstrate skills or part skills competently acquire enhanced status. Those unable to demonstrate because of physical disability or other reasons should arrange for another demonstrator or a video of a criterion performance.

Coaches should begin demonstrations by ensuring that everyone is paying attention and is in good position to see and hear them.



They should identify key aspects and repeat them as appropriate. Clients might benefit by viewing demonstrations from different vantage points, or by executing movements in synchronism with the demonstrator. Coaches should repeat demonstrations as often as necessary. When a demonstration involves delivery of a bowl, clients sometimes switch their attention to the course of the bowl and its result. In so doing, they fail to observe the follow through phase of the delivery movement. In these circumstances, coaches should adopt measures to ensure that the attention of clients remains focussed on salient features of the demonstration.

Coaches can help overcome any reluctance of clients to ask questions by themselves introducing open 'question and answer' technique in a motivational and informative way. If uncertain of correct answers to any awkward questions, coaches should admit their uncertainty and provide clients with correct answers after consultation with appropriate experts. They could irreparably lose their credibility by bluffing answers that subsequently prove incorrect.

Initial Practise

When teaching groups, coaches may overcome any reluctance of clients to participate by breaking the main group into smaller groups each of two or three bowlers. Coaches can help clients overcome any fears of peer ridicule by engineering practise environments to make them discrete and emotionally 'safe'. They should recognise that many clients will have concerns, to varying degrees, when faced with challenging tasks.

Coaches can help clients to master new skills by setting challenging but achievable practice tasks. They should engineer task difficult so that careful effort yields success in about 50% of attempts. They should avoid leaving the coaching area during initial practice of new skills by clients.

In teaching the delivery movement, coaches will take advantage of helpful skills their clients bring from other sports. For example, a golf stroke involves a grip, stance, swing, and a follow-through, as does delivery of a bowl. A putt on a sideways sloping green behaves somewhat like a biased bowl. Coaches will also be alert to negative influences of previous sports. Again with golf as a case in point, golfers execute a swing side-on and there is an initial tendency for some former golfers to deliver a lawn bowl partly sideways. The unlearning of unhelpful habits commonly takes longer than learning new skills.

Feedback

The ability to use feedback effectively is a major coaching skill. Feedback is the process by which bowlers receive information about their performance, and is indispensable in the learning process. Feedback should focus on elements of performance, not on clients personally.

Sometimes feedback occurs intrinsically. Examples might include the thud of a bowl released too high, loss of balance during the delivery, or the sight of a bowl stopping adjacent to the jack. Coaches should avoid giving feedback that largely states the obvious in echoing feedback that a client receives intrinsically. Clients learn more from visual feedback than from other forms of extrinsic feedback.

When clients are learning skills, coaches should consider giving performance information in the form of demonstrations. Spoken feedback should be brief. At least half of all feedback should be informative. Information may be general or specific. "If you extend your arm in the follow through, your bowl will track along your aiming line" is general information. "You kept your arm nicely extended in your follow through, that time", is specific information.

Coaches should determine an appropriate strategy for feedback. They should expect a lack of fluency by clients in the early stages of practising a new skill and then give continual feedback. They could probably ignore minor and random errors that occur during early practises of complex skills. They could probably allow a few attempts at a new skill before beginning corrective feedback. Coaches may reduce the frequency of feedback as skill of clients improves.

To avoid undermining practise momentum, extrinsic feedback should be brief yet frequent. Several informative or encouraging feedback comments per minute may not be excessive rates. A ratio of about four positive comments to every negative comment creates a supportive learning atmosphere.

Negative feedback can create an error-centred coaching environment. However, reprimands may occasionally be necessary, particularly in dealing with behavioural problems within groups of young bowlers. Negative feedback should focus on the task, not individuals.

The reinforcing effect of positive feedback on desirable attributes of good technique plays a major role in the shaping of capable bowlers. Coaches should use motivational feedback freely. They should give positive feedback whenever a client masters a difficult task. They should praise clients not only for achievement, but also for improvement. Feedback should relate to the session focus. For example, if the coach requests a delivery to an indicated position far from the jack there is no obvious reason to congratulate the client for a delivery that finishes near the jack. Guidelines for giving rewarding feedback are:

- Reward performance, not outcome
- Reward effort more than successful outcome
- Reward success in personal development as well as for mastery of sport skill

Motivational feedback, which may be verbal or given as body language, is normally very positive. Bowlers have individual differences in their responsiveness to motivational feedback. Many bowlers place greatest value on feedback they experience internally.

Communicating

Communicating Process

Available channels of face-to-face communication are essentially both verbal and non verbal. Written information (such as study guides for self-paced home learning) is entirely verbal. However, verbal information is a minor element of interpersonal communicating. Studies suggest that the factors involved in communicating are as the table opposite shows.

Thus, the information exchanged in an interpersonal communicating process usually comprises verbal content, emotion, and body language. Body language encompasses behaviour, gestures, facial expressions, posture, and the like. It is closely related to the tone of voice and emotional signals of the speaker. In some instances, these factors mutually reinforce one another to give clear meaning to messages. When they give conflicting signals, listeners typically give precedence to the non-verbal factors in interpreting the meaning.

Words	7%
Tone of Voice	38%
Body Language	55%

Teaching of skills should be rich in content, or information. Question and answer processes to test comprehension should also be rich in content. Motivational communication should be rich in sincere encouragement.

Circumstances sometimes affect the communicating process. Hearing or visual impairment of clients or noise in the teaching environment may adversely affect good communication. Young clients might not comprehend messages communicated to them because of their exuberance or lack of experience. Communication between coach and client might not be permissible during a competition. The size of a client group affects the range of options for effective communication.

Communicating While Coaching

The coaching process is one of continuous communication. Coaches are role models. Their appearance and behaviours continuously send messages to their clients.

Effective spoken communication also relies on reciprocity. It should involve about 50% sending and 50% receiving. Attentiveness and mutual respect should characterise the listening process. Discourteous interruptions adversely affect the effectiveness of communications. The most effective vocabulary is one that is simple and free of jargon. Bowlers commonly use words like 'weight', 'head', and 'green' ambiguously.

Coaches should speak:

- slowly and clearly (using simple, easily understood and appropriate words),
- concisely (avoiding excessive and irrelevant detail), and
- convincingly (stimulating the learning process)

As shown earlier, the more powerful channel of most communications is the non-verbal, or visual. Well-motivated coaches will have body language that is consistent with their spoken language. Other coaches may demonstrate conflict between their spoken and body languages. Such conflict is typically quite evident to clients.

The best communication style in coaching is circulating among the client group and talking with them individually or in small groups. Coaches can then assess the needs of clients, according to whether each seems under-aroused or anxious, and alert or distracted. Such an individualised style usually earns greatest respect from the clients. If they are separated by distance, coaches and clients can talk on the telephone, internet, or by audiotape. Coaches and clients can otherwise exchange information over a distance by document, floppy disk, fax, internet chat, or e-mail. Media offering both spoken and visual contact include video conferencing and videotape.

The response and subsequent actions indicate whether communication has been effective. If coaches or their clients misinterpret or do not comprehend shared information, they should continue communicating to resolve the difficulty. Any coaches with speech defects or a difficult accent should compensate by speaking slowly and stationing near, and facing clients. They should resolve communicating problems patiently and persistently.

'Game Sense' in Lawn Bowls

Application of 'Game Sense'

Many Australian sport coaches have studied the 'game sense' approach following a visit to Australia in 1996 by Loughborough University's Rod Thorpe. Game sense is the learning that occurs as athletes participate in challenging games. Games are fun, which is the primary motivator of many athletes. A game setting offers an athlete an agreeable, skill-learning environment.

Control of the developmental process is shared between coach and athletes. They organise modified or unmodified games with some provision for competitive pressure. The scope of an athlete's learning includes effective movement, risks & opportunities, attack & defence, positive mental attitude, and physical preparation. The trial and error learning that occurs is partly intuitive. Because the learning occurs under game pressure, there are few transfer problems. Theory merges with practice.

Game sense, as a means of skill development, better suits open skill sports (eg hockey) contested by interactive teams or squads for a relative (win or lose) result. It suits closed skill sports (eg tenpin bowling), contested by coactive performers for a measured result, less readily. In closed skill sports, performing technique may be more critical than in open skill sports. Even so, bowls coaches tend to overemphasise delivery technique and under-emphasise tactics, mental attitude and physical preparedness for competition.

Pedantry versus Activity

Coaching with excessive emphasis on technique tends to cause more harm than good. It tends to condition the attention of players to their technique during competition. A bowler is unlikely to be a successful competitor until an effective technique is autonomous or intuitive. The word 'effective' does not imply 'correct'. The objective in competitive forms of bowls and most other games is more on outcomes (eg winning or losing) than on processes (eg style or technique). Some coaches try to get bowlers to emulate a correct or orthodox model of technique. They tend to classify departures from that model as 'bad' or 'wrong' technique. However, some nationally ranked bowlers have wide individual differences and unorthodoxy in technique.

Coaches should avoid the lack of session momentum that accompanies verbose explanations. They should definitely avoid a pontifical style and any tendency to treat advice in coaching manuals as holy writ. Telling is not necessarily teaching. Information overload occurs very quickly in many individuals. Inattention and resentment can develop among inactive clients. Children, if idle, tend to create action by misbehaviour.

Competent demonstrations by a coach or observation of bowlers engaged in games may be far more instructive than verbose explanations. 'Game sense' learning resulting from experimentation in practice games could dispense with the need for much formal instruction. Bowls coaches should ascertain and allow for the skills that clients have already mastered. Otherwise coaching effort will tend not to address individual needs.

Learning Effective Technique

The game sense approach requires that clients learn by performing in game-like conditions from the earliest stages of their training program, more than they would in traditional programs of bowls coaching. Coaches should allow clients to discover any new or additional information through a question and answer process at convenient intervals during games or game-like practices. With clients busy within a game sense setting, the coaching process appropriately becomes less conspicuous. Where coaches are inexperienced, they could and should take time to confirm observations and remedial suggestions before interrupting activities.

The game sense approach involves teaching of technical skills in a game context rather than in a separate skills session. Intuitive learning by doing may be superior to teacher paced technical instruction. Effective technical skills are often intuitive or 'picked' up. Coaches should judge technique on its effectiveness rather than its compliance with a particular model. They should teach clients how to gather intrinsic performance information. The object of sporting endeavour is oriented more on outcome than on process. The best method of instruction will be the one that yields sustained performance improvement.

Variety and Innovation

Bowls coaches could allow clients to enhance the challenge and potential of the 'game sense' approach by modifying the practice environment. They can occasionally encourage play like the crown green game, whereby clients put the mat anywhere on a 'flat' green, and deliver the jack to any other point on it. This is good 'line and length' practise. For practice on parallel rinks, rink lengths limit the normal scope for increasing head distances, but there is scope for decreasing them below the normal minimum. Coaches can substitute relative targets (eg closest to a jack) with measurable targets (eg playing surface temporarily calibrated like a rifle target). They can use objects (eg spare bowls) to obstruct avenues of approach to a head. They can introduce a system of penalty points (eg for bowls that 'cross' a head) or bonus points (eg for certain 'touchers'). Coaches could encourage clients to vary virtually any normal playing conditions or rules to create an instructive game-like environment for practice.

Coaching of Groups

Individual versus Group

Coach educators sometimes use the word 'mentoring' to describe the tutoring of apprentice coaches by master coaches. Mentoring is often an individual or a 'one to one' relationship. Individual coaching of bowlers by club coaches is typical. It is a particularly appropriate arrangement for coaching advanced bowlers.

However, the number of clients simultaneously requiring coaching might greatly outnumber the coaches and assistants available. The clients may be club 'open day' respondents, school groups, pennant squads, coach updating groups, etc. In those circumstances, and depending on the skill and experience of the coaches, group activities may produce good outcomes despite small coach to client ratios.

Participatory Tasks

Bowlers typically prefer 'learning-by-doing' and group coaching sometimes has a higher practical content than individual coaching. Coach updating workshops offer group involvement, and may be highly practical if organisers are careful to avoid a theoretical bias. Such workshops commonly include intervals of brainstorming of syndicates or small groups of coaches engaged in mutually learning and exploring of set tasks. Group coaching may promote greater variety in task-oriented activities. Participants in groups commonly have greater input and control over their activities.

Group Dynamics

Some people are individually more productive when functioning within a group. Groups tend to become synergistic units with internal cohesion and mutual support.

Particularly within groups, coaches should ask clients to wear nametags initially, and should address them by their given names. Coaches may overcome any reluctance to participate by individuals in large groups by reorganising clients into a number of smaller groups. When coaching a group, they should avoid having only one client busy at a time

Groups of Children

Coaching of junior bowler groups is arguably the most demanding sector of bowls coaching. Coaches of juniors should determine their approach and priorities from the outset. Negative feedback can create an error-centred coaching environment. However, reprimands may occasionally be necessary, particularly in dealing with behavioural problems within groups of young bowlers. Misbehaviour of young bowlers may be a result of insufficient practical activity.

The role entails special regard for continuous supervision, hazardous elements of the coaching situation, planning of safe activities, warning of actual or potential risks, prompt and effective treatment of any injuries, and informative record-keeping. Active observation of groups of juniors keeps them on task. Game sense principles tend to be highly effective for coaching of junior bowlers. Mistakes have the potential to be learning experiences

Juniors of varying ages, abilities and sex prefer not to participate as an aggregated group. They tend to prefer gender separation for coaching, practice and competition. Mismatching of bowling skills or basic movement skills is more likely within aggregated groups. Very young children have longer judgement and response times, and have limited hand and eye coordination. The motivation of young juniors is towards mastery of accurate delivery and other skills of the game.

The motivation of older juniors is towards display of their acquired skills and recognition of their performances. Group coaching, as opposed to individual coaching, of older juniors is largely unproductive. Older juniors tend to be interested in competition play, and should be encouraged to enter regional competitive events. Coaches can desensitise them to typical distractions of competitive environments by introducing actual or simulated competition pressures during preparatory practices. When constituting teams for practice games, it is not a good idea to mix juniors of appreciably different age or ability. Adults do not like playing that way, and neither do juniors. Older juniors like applying their acquired skills in games with or against adult bowlers, but many adult bowlers have a substantial ego-involvement and regard the prospect of defeat by a junior as threatening.

Juniors like fun and variety in their practice activities. In some cases, lack of fun leads to 'drop-out'. Practice activities focused routinely on a traditional form of the game do not fully satisfy these needs. Coaches should be innovative to provide variety and enjoyment. Innovations are not necessarily a diversion from the process of learning, development and improvement.

Station or Circuit Teaching

Organising Circuits of Stations

There are difficulties in presenting a practical program to a large group of people on a bowling green. Individuals are often unable to see demonstrations clearly. Their view may be obstructed, or they are too far away, or they are viewing from the wrong angle. They are often unable to hear demonstrators clearly. The demonstrator's voice does not carry, or is projecting in a different direction, or adjacent chatter is too distracting.

In these circumstances, coaches may break a large group into smaller groups on separate rinks. Coaches may set the same or different tasks for each group. The available coaches demonstrate the set task and objective to each group. They then circulate around the groups, evaluating and helping each group in turn. Coaches can modify set tasks to match

individual needs or to optimise task benefits. If coaches set different tasks at each 'station', groups can circulate from station to station, and therefore task to task, according to a pre-arranged signal or schedule.

Each station engages in tasks of approximately equal duration. On a signal or after a prearranged interval, each group quickly moves from one station to the next. The facilitator at each station repeats the allotted presentation as each new group arrives. However, each updating coach participates in a fresh activity with each change of stations.

Coaches should define a system of self-assessment of task performances so that success is achievable yet challenging for the bowlers involved. They can foster use of intrinsic forms of feedback. They should allow enough time for every bowler to accomplish each task adequately. Circuits tend to provide trainees with greater individual control over the sequence, frequency, intensity and timing of training tasks.

Special Applications of Circuits

One way for coaches to exercise the technical and tactical skill of bowlers is by presetting practice heads. If they preset playing tasks on contiguous practice rinks, each rink could constitute a station in a circuit. This arrangement enables a number of groups equal to the number of set rinks, with at least two bowlers in each group. Coaches should set heads so that the direction of play alternates on adjacent rinks and thereby allows quick 'rink to rink' transitions. Groups should start simultaneously on their own rinks but circulate from rink to rink in the same direction.

Bowls associations tend to favour seminars for coach updating programs. Many coaches feel that lectures do not convey enough participation. Circuits of practical coaching tasks are ideal for updating programs. Mentor coaches divide participators into small groups. They need at least one fully briefed demonstrator or facilitator at each station or location. A bowling green might have enough space for up to seven stations. Other stations could operate in surrounding areas or buildings, as appropriate.

Reciprocal Coaching

Reciprocal Method

Whenever clients requiring training outnumber the available coaches and assistants, station or reciprocal teaching methods may be effective options. After planning a program for the reciprocal method, coaches should produce a set of task cards for issue to participators. Each card should describe the performing task and its purpose, the aspects of performance that warrant observation, task success criteria, and options for either widening the scope of the activity, or varying the task difficulty.

The reciprocal teaching method involves pairing off the client group. One member in each pair then assumes the role of coach, and briefly teaches elements of performing skill. Meanwhile, other acts as client, observer, helper, critical friend, or whatever the task requires. Members then reverse roles, and repeat the exercise. Typically, the group then reunites, evaluates performances, and receives instructions for another reciprocal training task.

For limited tasks, and relatively short periods, reciprocal training can be a highly effective way of spreading scarce coaching resources. This situation is common when coaching a squad of bowlers. The method also offers a high degree of practical involvement.

Application to Coach Training

The reciprocal method is of proven value in the initial training of apprentice coaches or refresher training of registered coaches. It offers time and cost economies when participators necessarily travel to rural areas.

The procedure begins with the mentor coach presenting a model lesson segment to a learner or someone in that role. The scope of the subject matter should comprise a number of easily remembered concepts. Student coaches observe and learn what and how to instruct. Because students observe what and how to coach, they are less dependant later on their ability to convert theory into practice. The mentor coach then invites feedback and discussion about the adequacy of information given, the suitability of the teaching method used, and what improvements might be possible.

The mentor coach then separates the student body into pairs, each with its own rink space. They then take turns in presenting the same model lesson to one another. While reciprocal coaching is in progress, the mentor coach monitors the work of each pair, helping and correcting, as necessary. The mentor coach should not discourage any use of different but equally effective teaching methods. The mentor coach progressively assesses the developing 'workplace' competencies of student coaches. Additional assessment on exit from the coach-training program may be redundant. Student coaches thereby avoid any 'final exam' jitters. Student coaches enjoy their training program much more.

Individual variations in teaching method create the unlikelihood of pairs finishing simultaneously. However staggered finishing times are also the result of the way that reciprocal coaching can accommodate individual teaching styles and learning rates. When the last pair completes its task, the mentor coach consolidates the group of student coaches, and invites their feedback and discussion about the task and about any supplementary information or teaching method variations that emerged. Apprentice coaches would learn how the mentor coach efficiently deals with interruptions and other problems that arise during the course of a program

The mentor coach can then follow similar steps with another model presentation. The reciprocal method is participatory and more effective for learning of coaching skills than traditional methods where students have a passive role. Because learning by doing engages all the senses it is the best method.

Observing & Evaluating

Observing

Careful observation of performances can provide information not only about technique, but also about the physical and mental well being of clients. Coaches should respond immediately to any symptoms of physical or mental stress. Active observation tends to keep junior bowler groups on task.

Reliable observation of technique commonly warrants a number of performance repetitions to eliminate random factors. Experienced bowlers may have obscure faults that warrant many repetitions to enable reliable diagnosis. Less experienced bowlers may have obvious faults that enable immediate diagnosis. To minimise random factors, coaches should normally encourage a 'warm up' of a dozen or more deliveries to allow technique to stabilise before observations begin.

Coaches should work within 3 paces of a client. At that distance, they can communicate in a normal speaking voice, and are well placed to move closer to help with a correction. Coaches should observe body alignments from a point near, but clear of, the delivery line. They should observe forward limb and body movements from a point on the delivery arm side.

Direct observation tends to be more systematic and complete if coaches have handy a checklist of features of a technically sound performance. Such a checklist is appended at page 111. Tripod-mounted video cameras with selectable shutter speeds are an excellent aid to observation. A fast shutter speed produces clearer images of the bowl delivery hand when it is in motion. Slow motion and freeze frame VCR replay features enable detailed study of technique. Clients are also able to observe replays of their performances. Members of bowler groups can learn by observing selected performances of one another. Coaches and their clients can monitor refinement of technique over time by periodic videotaping.

Evaluating

Success in lawn bowls hinges on results, not on form or style. The object of the game is a winning points margin on the scorecard at the end of the game. The quality of the movements executed in compiling the winning margin is not the paramount consideration. Therefore, objectives should not prescribe form or style too narrowly.

Coaches should also have the competence to differentiate between stylistic or unorthodox movements that need correction and those that do not. They should also have the competence to differentiate between causes and mere symptoms of faults and consequential effects. The cause of a fault is sometimes far removed from its observable effect. For example, bowlers who adopt a delivery stance with the bowling hand in front of the body usually take a wide back swing to clear the hip. They may then follow through with the arm angled across the body. In such instances, the initial positioning of the bowling hand is the cause of a fault, and the wide back swing and angled follow through are mere symptoms. That result of that fault may or may not be an inaccurate delivery line.

Errors may be of three types, each of which requires a very different approach:

- Strategic error (eg playing an inadvisable shot, less favourable hand, etc)
 - Perceptual error (eg misjudging distance, delivery line, etc)
 - Execution error (eg wayward body movements)
-

The general procedure for correction of faults is:

- Explain and demonstrate the faulty movement (if it is an execution error)
- Explain the cause of the error
- Explain and demonstrate what should be done
- Explain why the correction is advisable

Coaches should involve clients in selecting errors for attention. Only one error should receive attention at a time. Where several errors are present, the first correction addressed should be the one likely to produce greatest improvement. Otherwise, the error occurring earliest in the movement should normally receive first consideration. If the errors are related, one of them can be the critical error. Correction of the critical error may cause the others to disappear. The error correction procedure should avoid attending to too many errors at once. The more practise coaches have in diagnosing and correcting observed problems in delivery technique, the more proficient they become.

Clients with a physical disability that results in errors might sometimes benefit from an alternative technique more than a correction of technique. Coaches should plan supplementary instruction for any clients who are unable to attain necessary performance goals.

Coaches should ensure that all the subject matter of each session, and of each program as a whole receives proper attention. They are responsible for the achievement of planned learning outcomes. They should document the progress of clients' skill acquisition, the pivotal features of each session, and constructive suggestions for improving future programs. They should also evaluate any help provided by assistants.

The criteria for evaluating coaching effectiveness should be explicit in the performance objective. Coaches should periodically assess their own teaching style by audio taping or, better still, videotaping representative segments of their presentations. Less experienced coaches might benefit from the constructive observations of a mentor coach.

Self-Assessing By Camcorder

Validity of Video Method

The Australian Sport Commission has approved inclusion of video analysis techniques in sport specific and general coaching courses. The number of major sports already using video analysis methods is increasing. Video analysis techniques help coaches to appreciate and improve their coaching methods. The techniques could also help less-experienced coaches in establishing a suitable coaching style.

Adoption of Video

Video analysis can disclose improvements in coaching effectiveness if used before and after coach development training. Coaches can analyse contribution of their personalities to interactive processes, and analyse quality of mediating processes with their clients. They can select their behaviours most amenable to improvement. A competent, critical friend can help in analysis and in providing constructive criticism. Video self-analysis can be used without special difficulty at remote rural venues. The process tends to produce rapid improvements in coaching effectiveness, which leads to better services to clients.

Video Camera Features

A basic, hand held camcorder with an inbuilt microphone is adequate. A radio microphone accessory is unnecessary provided the camera is always stationed within 5 metres of the coach. A camcorder with only a modest zoom/wide angle range is quite suitable. A tripod is necessary if an assistant is unavailable. A spare cassette and a spare battery back and charger may be required. An RF converter, if supplied, is handy for reviewing videotaped activity on a TV receiver. A VHS-C cassette adaptor, if available, is handy for playing VHS-C cassettes in a VCR.

Video Camera Availability

Increasing numbers of bowls clubs have bought a camcorder for use by their coaches. Camcorder ownership is now common among bowlers, other sportspersons, hobbyists, teachers, reporters, property and stock agents, travellers, field officers, farmers, dramatists, etc. They can be hired (Yellow Pages listing "Video Equipment - Hire"). If a camcorder owner is unavailable, a willing friend or someone who has previously used one could be a suitable operator. Operators may need some training and practice to produce realistically assessable results.

Environmental Problems

Adverse environmental problems	Solutions
Raindrops on lens	Avoid showery weather
Wind blowing into microphone	Avoid windy weather, consider early AM or late PM
Noisy air conditioning pumping, refrigeration plant	Consider rink far from clubhouse, time before club open
Noisy greenkeeping machines	Consider cooperation, day, time of day to avoid
Noisy road traffic	Consider green & rink farthest from road, early Sun AM
Noisy aircraft approaches	Consider inactive times
Noisy adjacent players	Consider non playing days
Talkative bystanders	Consider an assistant to shepherd them away

Good Taping Techniques

The method requires the services of someone in the actual or simulated role of a bowler under training. The video should record all facial expressions, body language, and reactions. Temporary removal of shady hats, sunglasses, etc is typically helpful. The camera should record all movements of the client in response to instructions of the coach under assessment. The operator may crop out legs and feet, except when they happen to be the proper focus of attention. The operator need not tape non-interactive events, such as setting up of aids, course of a bowl, etc.

The video sound should include all verbalised introductions, explanations, demonstrations, corrections, feedbacks, questions and answers. To obtain clear sound the operator should shoot from a rather front-on position within 3-5 metres of the coach. The quality of vision and sound produced may be less than perfect, but there is no need for retaping provided the video has sufficient material for a reliable assessment of coaching behaviours.

A reliable assessment requires at least 20 minutes of representative coaching behaviours. A checklist of behaviours worth observing and assessing is appended at page 113. If they wish, candidates can arrange the shooting of more than one of their coaching sessions and use the tape that best reflects their current approach for the assessment.

The Coach's Role

From an awareness of the competencies or range of skills relevant to the coaching of lawn bowls, a coach should plan the session to be video taped so that the behaviours of immediate interest will be foremost. In viewing the video, the coach should self analyse by answering the questions in the table appended at page 113. The coach should allow for any client behaviours that have caused departures from normal coaching procedures. The coach should discuss the videotape and self-analysis with a respected critical friend to optimise the value obtained from the exercise.

The Critical Friend

Critical friends should have sound sport knowledge and behaviour analysis skills. They should appreciate that competent coaching is rarely dramatic or charismatic. They will carefully organise and present feedback, and present it orally, either in person or on tape, and avoid giving only written feedback, if possible. They should informally ascertain why the coaches under assessment chose particular behaviours for modification.

Managing Coaching Risks

Duty of Care

People injured at sporting venues have an increasing tendency to seek redress through legal action. Actions arising out of coaching sessions commonly claim neglect in fulfilling a duty of care. The duty of care exists even when coaches are unremunerated volunteers. Consequently, prudent coaches systematically identify and evaluate the risks entailed in their training programs. They develop risk management plans to protect not only their clients, but also themselves.

Legal claims typically include not only damages, but also costs of counsel. Amounts awarded in successful cases are commonly very high. Premium rates for professional indemnity insurance tend to increase correspondingly. Prudent coaches typically seek the protection of such cover, but the number of insurers that offer it tends to be decreasing.

Risk management planning generally follows the following procedure:

- What are the hazards present that could threaten safe coaching activities?
- How great is the risk of injury or damage that each hazard could cause?
- If injury or damage occurs, how great are the consequences?

Identifying Common Hazards

- Sun, Heat, Dehydration, etc
- Wind Chill, Cold, Dampness, etc
- Insecticide & Weedicide residues
- Slippery green surrounds
- Greenkeepers' electrical extension cords
- Narrow access pathways
- Inattention to safety warnings
- Existing illness of clients
- Vulnerability of clients with a disability
- Stepping other than sideways between green and bank
- Inherent risks of each practice task
- Over-practicing
- Inappropriate technique
- Rearward movement after delivery
- Overcrowding
- Exuberant behaviour of children and others
- Competent supervision
- Positioning of undelivered bowls
- Frayed mats

Personal Safety

In appropriate cases, coaches should advise clients to minimise risks as follows:

- observe moderation in consumption of tobacco and alcohol.
- avoid dehydrating and use shady hats and sunscreen lotions, particularly during the summer months.
- avoid creating obstructions with bowls bags along thoroughfares.
- adopt sensible precautions before practising on a green recently treated with injurious chemicals.
- precede bowling activity by warming up the major muscles with stretching exercises.
- avoid stepping backwards on to the mat or a group of bowls at rest.
- avoid stepping on to loose mats when entering or leaving the green.

General Risk Management Planning Considerations

- Complete a checklist of risk areas before beginning a coaching session.
- Warn new clients about all significant risks.
- Remind regular clients about major risks.
- Warn clients particularly about any new risks of which they may be unaware.
- Ascertain the physical and other capacities of new clients and match practice tasks accordingly.
- Document, distribute and periodically review a coaching risk management plan.
- Avoid using private transport for clients where public or official (club etc) transport is available.
- Become competent at first aid.
- Ascertain the extent of bowls club or association public risk or special cover over registered and unregistered coaches and club member and non-member clients of coaches.
- Ascertain whether the cover under any household or other public liability insurance held would extend to liability for injury and legal costs arising from coaching at a bowls club.
- Consider the advisability of obtaining a sport coaches' insurance policy.

Management of Injuries

- Comfort injured clients
 - Prevent injuries to other clients
 - Give first aid
 - Access a telephone for assistance
 - Make comprehensive notes to aid consequent reporting of the circumstances
 - Review coaching plans & methods
 - Defend actions taken in response to the injury
-

Bowlers With Disabilities (CAD)

Background

Fewer than 100 of Australia's 4000 bowls coaches have a supplementary CAD (Coaching Athletes with a Disability) registration. Just as peer coaching among able-bodied bowlers is common, so the coaching of persons with a disability by persons without CAD training appears to be rather common and is typically highly effective. Among those coaches who have 'given it a go', any concerns about unfamiliarity with the situation, or aggravating the handicap, or about legal liability, or harm to the green, or about limited success usually dissipates. By mastering the challenge, most of these coaches have added stature within their clubs and have enhanced self-confidence.

The approach of individuals with a disability to sport and to lawn bowls in particular is little different to the approach of able-bodied bowlers. A coach will already have much of the knowledge, skill and experience required for successful CAD work.

Sources of Information

In Australia at present, a CAD accreditation course is of only 2 days' duration. Such courses rely on the acquisition of skill through subsequent involvement and experience. The most important sources of information and advice about CAD, particularly about what an individual is capable or not capable of doing, are the handicapped individuals themselves. Each state has a CAD organization, which usually has a white pages listing (eg CAD Queensland). Some disability groups have their own organizations with a white pages listing (eg Sporting Wheelies, Arthritis Foundation, etc). The parents, carers or family of handicapped bowlers usually have helpful information.

For some types of disability, sport authorities have defined classes of disablement to facilitate coaching and to achieve equitable and fair grading for competition. However there appears to be no special international laws of lawn bowls applying to bowlers with a disability. Nevertheless, national laws may exist. In Australia, CAD coaches should familiarise themselves with national law 74, which provides for use of artificial limbs and other supporting aids, feedback to blind bowlers, and positioning of wheelchairs during play. National laws in other countries may differ.

Wheelchair bowlers typically need assistance in moving between the bank and the green. The front tyres of the chair should be at least 200 mm diameter and 50 mm width. The rear tyres should be at least 45 mm wide. In both cases, the tyres should be 'slicks', that is with a smooth tread. Alternatively, wheel covers for narrower or treaded tyres are becoming available. Provided wheelchair bowlers always turn gradually, their chairs are unlikely to make tracks in greens with a pace exceeding 12 seconds.

Individual Interests and Objectives

Lawn bowls attracts people with a disability for much the same reasons as it attracts able-bodied people. Participation provides them with enjoyment and social contact. They are keen to master bowling skills, and may be drawn to the challenges of competing. They anticipate a sense of achievement out of which they can gain self-confidence and the esteem of peers and self, which helps to reinforce a positive attitude to life.

Safe Coaching

Few coaches have the knowledge or qualifications for making a reliable medical assessment of the capacity of a person with a disability to undertake a lawn bowls coaching program. Coaches should demonstrate to applicants with a disability the nature of the minimum physical demands of the sport. The coach and the applicant together should determine whether the latter has an adequate capacity to undergo coaching in lawn bowling. Their aim is to avoid harm or the emergence of medical complications. If doubtful, the coach should seek the written recommendations of the applicant's medical practitioner.

At the initial assessment phase, coaches should be careful to avoid negativity. Most people with a disability have the capacity for physical development through sporting activity. However, they may have previously been discouraged from participating in active sport or recreation. They may lack self-confidence and self-esteem. Female amputees, for example, may be self-conscious. Therefore, applicants with a disability might too readily accept any negativity of the coach. Positive and encouraging approaches by coaches tend to dispel tendencies to negativity by clients with disabilities.

Coaches' responsibilities for environmental safety for CAD are not greatly different to those for general coaching. While CAD athletes neither expect nor need sympathy, they sometimes need help. For example, wheelchair bowlers

need access to clubhouse facilities and generally need help moving on and off the green. Visually impaired bowlers require familiarisation with immovable obstacles or hazards. Coaches must not overlook such matters.

Coaches should closely monitor the activities of bowlers with a disability and the environmental conditions. Many disabilities cause dehydration or heat stress (including sunburn) more readily than in able bodied bowlers. Amputees may experience stump soreness. Symptoms such as discomfort, fatigue, balance difficulties, profuse perspiration, etc are commonly obvious to alert coaches. However, a 'question and answer' process usually gives earlier warning of physical stress, and would be used freely by careful coaches.

Some CAD Principles

While assessing an applicant, a coach will try to generalise a program that addresses the applicant's mental approach and general fitness as well as the limitations imposed by the disability. The coach would be aware that a congenital or acquired condition (eg amputation of leg) has resulted in a disability (eg prosthesis allows limited mobility), which in turn produces a handicap (eg difficulty in delivering a bowl from a low posture). With the residual range of movement that the diminished body function permits, the coach might broadly conceptualise an individual program to suit the applicant. The coach will also be aware that some disabilities (eg intellectual, visual or aural impairment) present in a wide range of individual differences. Many disabilities cause balance difficulties in posture or during movements. Broadly, disability is the effect of lack of physical or mental structure or function.

Teaching Disabled Bowlers

Coaches should treat bowlers with a disability as individuals. They should avoid treating them as invalids. As with able-bodied bowlers, bowlers with a disability should personalise long term and short-term goals by being given full scope to participate in their goal setting process. They will avoid goals that lack appropriate challenge and risk taking. Coaches should appreciate the extent of their clients' disabilities. They can do this, for example, by blindfolding themselves or getting into the wheelchair and trying to 'practise what they preach'. They should plan to minimise explanations and maximise guided demonstrations for clients with an intellectual disability.

Bowlers with disabilities will not only experience learning errors just like able bodied bowlers, but may take much longer to master bowling skills. Clients with cerebral palsy or intellectual disablement might need a greater number of smaller and frequently reinforced teaching steps. Clients with cerebral palsy may have sensory problems, or muscular reflex or functional problems. Visually impaired clients must rely more on their other senses to obtain information about their performances so that they can make adjustments for improving their accuracy. Sounds from a position up the rink can give a guide to required delivery direction. Some vision-impaired bowlers feel for the corner of the mat to help in aligning their feet for deliveries in a desired direction. Spoken information from a helper can give much information about the unseen head and the finishing positions of delivered bowls. An imaginary clock-face may be used to express the direction of bowls at rest from the focal point of the head. Many vision-impaired bowlers are able to use imagery or visualization just as effectively as normally sighted players.

If customary teaching procedures are not achieving results, coaches should be prepared to follow alternative approaches in teaching skills, particularly those that are complex. Similarly, they might depart from normal biomechanical models for common movements and techniques. They should tailor methods for the capacities of individuals (particularly wheelchair users). They then modify and define skill expectations and target dates accordingly.

Concise, clear and unhurried 2-way communication is as important in CAD as it is in bowls coaching generally. Use of metaphors often stimulates imagery in a positive way. Demonstrations or sketches are typically more comprehensible than the spoken word. Bowlers with some types of disabilities have a lower threshold of 'information overload' than normal. Body language, if not verbal language, keeps coaches informed of how clients are coping with their environment and physical activities. Communication may be the only problem in coaching hearing-impaired bowlers, which may be resolved by facing them when speaking, and giving them some information in written form. Coaches should remember that bowlers with other impairments are rarely deaf, so the curiously common tendency of speaking louder does little to facilitate the communicating process. Coaches should ascertain each client's preferred channels of communication. Before they give guidance involving physical contact (eg for blind or wheelchair bowlers), they should establish an agreeable 'touching' protocol. They should freely use question and answer technique to confirm understanding and to teach at a pace that matches the learning capacity of their clients. Some adults with an intellectual disability may seem childlike but coaches should, with good humour, treat them as adults.

Practise for Disabled Bowlers

Disabled bowlers generally notice that able-bodied bowlers tend to make quicker progress. They sometimes see their own progress as monotonously or frustratingly slow. Their own less competent abilities can imprint poor performance

models on them, and can erode their underlying motivation. The possibility of participating in games or even game-like practices might seem remote.

Coaches generally avoid 'rolling up' or practising with their clients. The underlying reasoning is that if they bowl too well, they could discourage their clients. If they do not bowl well, their unconvincing efforts tend to negate their instruction and divert their attention from the needs of their clients to their own performance problems. However, coaches can selectively help bowlers with a disability by 'rolling up' with them.

Disabled bowlers typically have great respect for coaches. They regard the motivating opportunity to share 'roll ups' with their coaches as demonstrations of acceptance and an honour, notwithstanding any disparity in results achieved. By 'rolling up', coaches thereby provide performance models from which bowlers can adapt time and motion cues for their own efforts. In addition, the results achieved by the coaches help bowlers to set their own challenging and realistic achievement benchmarks. When 'rolling up' with clients, coaches should explain what they are trying to achieve, and why they consider that objective is the best option. When not engaged in delivering bowls themselves, coaches should go about the business of helping their clients in the conventional way.

When clients progress to guided practice, CAD coaches should avoid 'soft' objectives. They should avoid 'protecting' clients with a disability from temporary failures or setbacks. As with able-bodied bowlers, these experiences are important to the learning process. As always, positive, informative, and motivational feedback by the CAD coach is of fundamental importance.

Basic Technique

Preliminary Skills

Protection of the Green

To protect the surface of the green, bowlers should:

- wear approved smooth-soled footwear
- avoid sitting on the edge of the bank, or otherwise submitting the green near the edge of the ditch to foot pressure.
- avoid placing bags on the green surface to pack or unpack bowls.
- release their bowls close to the green surface (i.e. avoid 'dumping' of their bowls)

'Kicking' Bowls

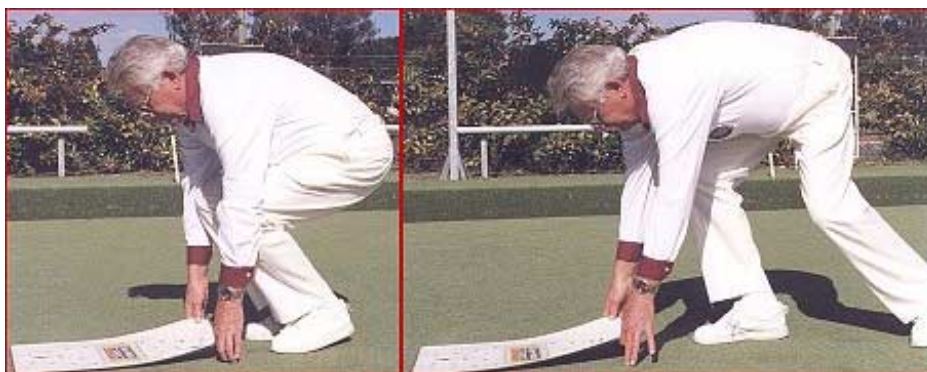
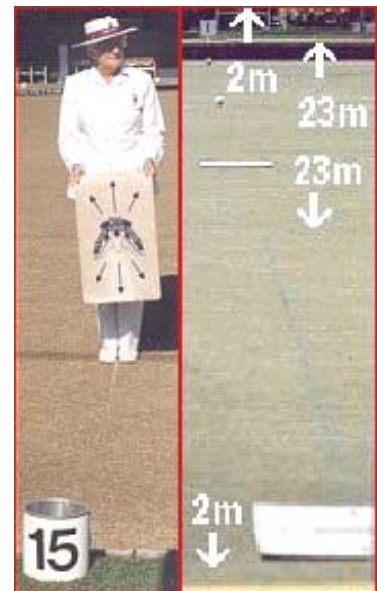
Once the mat is in position, players can 'kick' bowls to a collection area safely to the rear of it. Kicking is the act of moving a bowl with the sole of a shoe so that it rolls a short distance. A bowler places the instep of the shoe lightly on the bowl and either drags it backward, whereby the point of contact moves towards the toe, or rolls it forward, whereby the point of contact moves towards the heel. This method of kicking avoids discolouration of either shoes or bowls by transfer of polish.

Placing a Mat

The mat provides a base for delivering the jack and bowls. It provides some protection against local wear and tear of the green surface. Its front edge (or 'mat line') provides a mark for measuring distances to bowls, to the jack, or to a ditch, as necessary.

The skips decide which team will begin play by tossing a coin. To place the mat, lead players should face the rink number over the rear ditch as shown in the adjacent image on the left. This ensures that if there is no rink centre line, or there is more than one marked line, that they correctly centre the mat lengthwise on the rink.

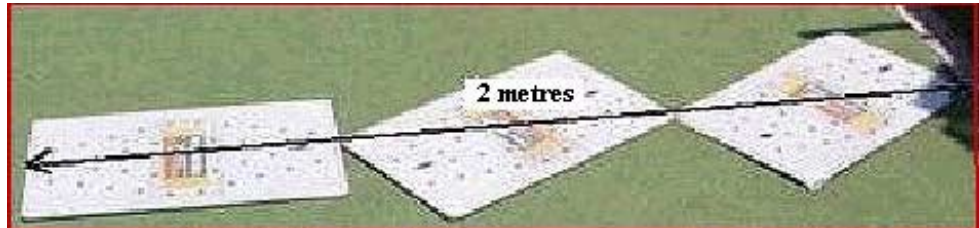
The lead player places the mat aligned with the centre line of the rink, and with its front edge at least 2 metres from the rear ditch and at least 23 metres from the front ditch. White markers on the side bank indicate the latter alignment. The adjacent image on the right shows a mat 2 metres from the rear ditch, and a second mat level with the markers on the side banks. The nearer jack shown is 23 metres from the rear ditch, and the farther jack is 2 metres from the front ditch...



Typically, lead players pick up the mat by the corners of a short side. They then either crouch down, or step forward and genuflect downward to place the mat comfortably and precisely, as the images above show.

The upper picture in the following image demonstrates that a distance of two metres is equal to the total length of two mat diagonals plus one mat length

Following a tied or dead end, the team that was first to play in the previous end again plays first. Players may not relocate the mat during an end, but may straighten it, or temporarily lift it to allow a bowl from an adjacent rink to pass.



Measuring

Measuring to determine the result of an end is allowable after the last bowl has come to rest. Measuring commonly occurs where there is uncertainty about which team has the shot or how many shots a team is entitled to count. Relevant distances are from a point on each bowl that is nearest to



the jack to a point on the jack that is nearest to the corresponding bowl. (The method pictured the lower picture in the image above is incorrect. The tape case is not in contact with the jack, and the end of the tape contacts the bowl beyond its closest point.)

Because measurements are relative, the measuring device need not be calibrated. A measuring device should be a non-elastic object of adjustable length for determining relative distances between the jack and bowls. Popular personal measuring devices include retractable metal tapes and telescopic rods. Metal tapes commonly encase small callipers that are useful for measuring distances so short that there is insufficient separation for use of a tape or telescopic measure. Some measuring devices have locks to temporarily fix their settings.

Bowl Grips

Jack Grip

The best grip for a jack is one where it rests on the closed finger tips with the thumb tip near its crown and applying enough gentle pressure to keep the jack secure. In this grip, the jack is well clear of the palm of the hand and can release cleanly off the tip of the middle finger. The picture on the left in the adjacent image shows this grip.



The picture on the right shows a cupped or clenched grip, which palms the jack and tends to negate the benefit of the tactile sensitivity of the fingertips.

Awkward positioning or movement of the fingers tends to inhibit a clean jack release.

Bowl Grips

A bowl is about twice the diameter and six times the weight of a jack. Unlike a jack, a bowl is not spherical. However, the planes of the running surface and the engraved coaxial rings of the bowl are circular. An essential feature of any bowl grip is that the running plane should be erect and aligned with the forearm and the intended delivery line at the instant of release. To avoid a wobbly delivery and 'standing up' of the bowl, players should use a grip that does not allow the bowl to skew or tilt. The picture on the left of the adjacent image shows a right-handed grip that skews the bowl to the left and tilts it to the right.



An essential feature of a sound grip is that the tip of the middle finger should position under the running plane as the picture on the right shows.

With the engraved rings upright and aligned, and the middle finger tip correctly positioned, propelling force should transmit through the centre of the bowl until its release, and no wobble should occur. A wobbling bowl is not likely to come to rest at its intended position.



When in course, a bowl slowly changes direction towards its biased side. The biased side of a bowl is recognisable by the smaller engraved ring and insignia than their counterparts on the unbiased side. The image above illustrates a typical difference in the appearance of side engravings of bowls.

A bowler has a backhand grip when holding a bowl with the thumb on the biased side. Consequently, the bowler has a forehand grip when holding a bowl with the thumb on the unbiased side.



A suitable grip sometimes results by first stationing a bowl upright on the playing surface. If a bowler then picks it up from behind with the tip of the middle finger centred, the grip used is often a suitable and comfortable one for bowl delivery.

The 'finger' tip grip provides good 'touch' for playing on medium or fast greens, and is probably the most popular grip. For the finger grip, the slightly separated finger tips support the bowl with the thumb tip near the crest of the large engraved ring and applying enough gentle pressure to secure the bowl. The preceding images show the features of an effective finger grip.



Most other grips involve some degree of 'palming' of the bowl. The 'claw' grip (opposite, left) has the tips of the thumb and little finger in (diametric) opposition, with other fingertips

slightly more separated than in a finger grip.

It is a secure grip for fast shots and for play on slow greens. In a 'cradle' grip (above, right), the tip of the thumb adopts a low position on the side of the bowl.

When the hand inverts, as in a normal back swing, the bowl tends to escape from a cradle grip. The few bowlers who use it usually do so because of small hands or lack of finger strength. The palm supports much of the weight of the bowl. To prevent the bowl escaping, a bowler using the cradle tends to articulate the wrist in the back swing to keep the hand under the bowl. The delivery is more a 'shovelling' than a 'swinging' action.

Delivery Stances

Set Up

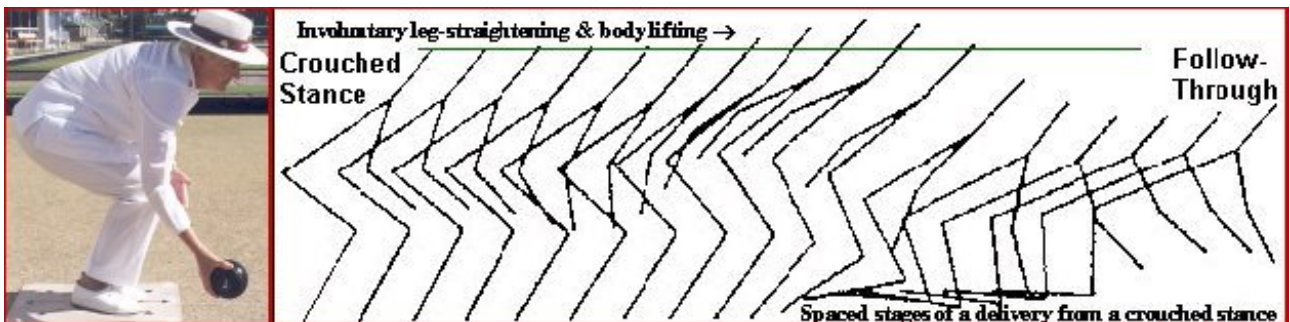
The set up or stance is the posture that a bowler adopts before beginning the delivery action. Bowlers prepare for delivery by anatomically aligning in the direction of delivery. Their sensory feedback and visual feedback thereby mutually reinforce to help maintain accurate delivery line. They also take care to align their feet in that direction

The critical posture is the one at the instant of bowl release. Some bowlers prepare for delivery by adopting the release posture at the outset. This produces a 'fixed' stance. However, most bowlers use an 'upright', 'athletic' or 'moving' stance. They rhythmically move into the release posture during the delivery movement. The term 'clinic' refers to a variant of the upright stance. It seems most popular with bowlers in New Zealand and South Africa. For the clinic, the leading foot advances about half a pace in the set up, or stance (as in the adjacent image), and advances the remainder of one pace during the delivery movement. Using the 'athletic' or 'moving' stance, the leading foot advances the full pace during the delivery movement. One advantage of setting up with the leading foot partially or wholly advanced is that it enables pre-emptive adjustment or 'fine tuning' of line before delivery begins.



The erect posture of an upright stance provides a good perspective view of the head. It avoids leg joint stress during preparations. An upright stance enables bowlers to apply some body momentum to augment the forces that produce bowl release speed. From the 'set' position in the fixed stance, only the arm moves and provides dynamic force.

A somewhat defective form of the athletic or moving stance is the 'crouch', which is a posture like the one in the left picture in the image above. Bowlers should avoid crouching and consequent stress on both knee joints. A free step from a crouch is virtually impossible. The knee joint of the opposite leg would bear extreme stress. A crouching stance necessitates some straightening of the legs and lifting of the body during the delivery movement so that the leading foot can advance without overstraining of the opposite knee joint occurring...



This lifting tends to have the incidental effect of moving body weight back from the balls of the feet to the heels. None of this extraneous movement contributes to simple and accurate delivery of bowls.

Foot Positioning

Bowlers typically begin preparation with feet parallel (unless using the 'clinic' method described above) and adjacent to one another. The next image shows the broad options for foot positioning. The ideal anchor foot position for delivery of a jack or bowl is with the toe about 10 cm behind the mat line. The centre of the heel should position on (left picture) or inside (right picture) the longer centre line of the mat with the toe directed towards the aiming point. The ideal leading

foot position is parallel with but slightly separated from the anchor foot. For a fixed stance, bowlers advance the leading foot a normal pace and complete their delivery preparation with feet in that position. The 'anchor' foot remains within the confines of the mat during delivery and is normally the foot on the delivery arm side. It commonly remains in contact with the mat and thereby helps in sustaining a bowler's mental imprint of intended aiming line.

Because jacks are unbiased, bowlers deliver them directly towards the intended stopping point. A jack should travel parallel to the rink centre line. The line of delivery of a jack is not as critical as that of a bowl. Provided the jack comes to rest within the rink boundaries, a player repositions it on the rink centre line before play proceeds. If a rink has a marked centre line, the possibility of using it as a de facto delivery line arises. A bowler may or not be able to deliver a jack along the centre line comfortably. If cramped, a bowler might find that moving the instep of the anchor foot towards the inside edge of the mat (as in the picture on the right) enables comfortable use of the rink centre line as a delivery line.



Biased bowls follow a curved path, so bowlers deliver them at an angle to the alignment of the intended stopping point. A delivery towards the same side of the rink as the bowler's delivery arm is a forehand. A delivery towards the opposite side of the rink is a backhand. The only differences between forehands and backhands are the direction of the bias of the bowl in the hand and the bowler's initial body alignment relative to the aiming direction.

Footfaulting On Mat Line

Players who position their feet almost touching the mat line commonly foot fault. At the instant of delivery, the leverage of the horizontal trailing leg causes the shoe to flex. The back of the shoe might then not only overhang the toe but also overhang the mat line, thereby creating a foot fault. To avoid the distracting attention of umpires,



bowlers should avoid foot positioning that risks rule infringement. Bowlers should position the toe of the trailing foot approximately 10 cm behind the mat line. There it is far enough forward to ensure that the heel of the leading foot will always clear the mat, and it is far enough back to avoid any risk of foot-faulting. The centre of the heel of the trailing foot should be above the mat centre line.

Weight Distribution

In taking their stance, bowlers should slightly flex their knees and incline their trunk to position body weight over the balls of the feet. They should be poised, ready for forward movement. For a fixed stance, bowlers should position the knee of the trailing leg near the heel of the



leading foot. They should advance body weight over the sole of the leading foot. That posture should put the front knee ahead of the toe, and the chin ahead of the knee.

Delivery Arm

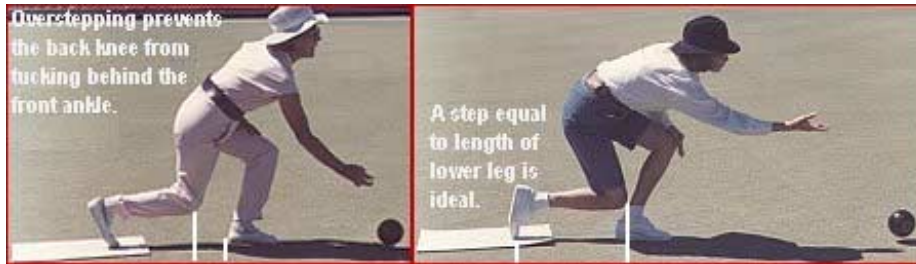
The 'delivery' arm is the one holding the bowl. With shoulders squared, bowlers should align the delivery arm over the aiming line. The picture on the left of the adjacent image shows forward and downward extension of the forearm. To avoid shoulder strain and discomfort, the upper arm should be rather vertical with the elbow near the waist. The centre picture shows this alignment of the upper arm and elbow. Bowlers should avoid angling the delivery arm across the body. The picture on the right shows how unwise use of the non-bowling hand puts the bowl directly in front of the body. Novices could check their delivery arm alignments with one or two trial swings to ensure the arc of movement follows the aiming line. The bowling hand should have enough initial elevation so that an unforced yet unrestrained pendulum back-swing results. Bowlers should direct the focus of attention forward towards their aiming point.

Delivery Movement

Limb & Body Movements

The principal action in any method of delivery is the pendulum-like back swing and forward swing of the bowling arm along the required delivery line. Bowlers should use the same action to deliver jacks and bowls. In the release posture, bowlers should position:

... the knee of the trailing leg near the heel of the leading foot....



... the weight of the body over the sole of the leading foot....



the front knee ahead of the toe....



...and, the chin ahead of the knee. Unless a physical disability necessitates otherwise, bowlers normally advance the foot opposite the delivery arm. The hips and shoulders thereby pivot in similar directions, which minimises twisting of the spine. Further, the outward swing of the hips provides good clearance for the delivery arm.

Rhythm and Timing

The plane of the arm back swing should coincide with the aiming line. The forward step of the leading foot should begin as the arm passes the hip on the back swing. Bowlers should have grounded the heel of the front foot when the bowl reaches its rearmost position.

The opposite arm should move towards a steadying but relaxed position on the thigh of the leading leg. A rigid opposite arm could tilt the shoulder line....



Arm Movement

The plane of the forward or delivery arm swing also should coincide with the aiming line. The bowling arm should accelerate smoothly, so avoiding any need for pushing of the delivery late in the forward swing. It should brush close to the side during its swing. Bowlers should avoid flexing of elbow or wrist so that the radius of the bowling hand's arc stays constant, thereby avoiding an extra movement requiring coordination. They should release the bowl as the arm passes a vertical alignment. The bowl is then at its lowest point and should have attained the required release speed.

Bowlers using upright stances advance their shoulder line during the delivery movement. This gives them a 'stretched' arc to develop bowl release speed. In turn, this gives them more scope for intuitive changes in delivery hand acceleration before they release their bowls.

Stability

A straight trailing leg tends to prevent lowering of the base of the spine and leaves the body C of G in a high and less-stable position. It also tends to cause overstepping and insufficient forward transfer of body weight. The adjacent image shows this fault.

The shoulder-line should lower towards the level of the body C of G, located near the waistband buckle. A bowler's body mass is thereby in the best position to resist movement caused by the reactive force of the forward swing.

Body movement should be minimal during release, thereby avoiding interference with delivery precision. Movement, caused by instability, head dropping or premature recovery at the instant of release, causes inaccuracy and inconsistency.



Follow-Through

Bowlers should smoothly follow through with the arm extended towards the aiming point. This minimises the likelihood of any hand deceleration before the moment of bowl release. The palm of the delivery hand should be uppermost, avoiding any misdirection of the bowl due to turning of the wrist before release.

In the follow-through posture, bowlers should stay down to confirm that the bowl is following the intended line. They should watch the bowl come to rest to assess any correction required, then recover and take a pace forward with the trailing foot.

Biomechanics Of The Lawn Bowl Delivery Movement

General Evolution of Lawn Bowl Delivery Method

Stances in Target Sports.

The delivery movement in virtually all target sports (e.g. archery, billiards, bocce, bowls, croquet, curling, darts, golf, pistol, rifle, snooker, tenpin) is one of hand and eye coordination. The closer that the plane, or direction of the manual delivery movement tracks the line of aim, the simpler is the task of accurate hand and eye coordination. Performers can achieve such conjunction of the plane of movement with their line of sight in two ways.

One method involves a front-on stance, so that the arm has an unobstructed swing backwards and forwards. The delivery posture may involve a sideways lean of the upper body to reduce the separation between the aiming line and the delivery line. A front-on delivery is usual in bocce, bowls, croquet, darts and tenpin. The other method involves a side-on stance and sideways aiming technique, which is usual in golf and archery to allow effective use of the club and bow, respectively.

Restraints on Allowable Lawn Bowl Delivery Method



The laws of lawn bowling (in Australia) require bowlers to adopt a stationary stance with both heels forward of the rear of the mat and the whole of one foot on it, before beginning the delivery movement. Until release of the bowl, one foot must be entirely on or over the mat. Thus, only after the instant of release may a bowler resume any forward movement. The laws also require bowlers to deliver jacks and bowls from a 60 cm by 36 cm mat. The mat not only provides a visible delivery zone, but also protects the playing surface.

To protect their greens from impact damage, bowling clubs commonly require bowlers to release their bowls within a few centimetres of the playing surface. To avoid 'dumping' deliveries, the adopted release posture should have the delivery shoulder no more than the length of the extended arm above the playing surface. Bowls released too high make an audible thump as they make contact with the green.

Statics and Dynamics in Lawn Bowl Delivery Technique

Differentiation of statics and dynamics is a useful basis for studying bowling technique. Dynamics is about the forces that produce movement. Thus the dynamics involved in bowling, that is the forces that produce mechanical movement, centre on the bowl itself, the grip and the delivery arm. Statics is about the forces that produce mechanical stability, balance, or equilibrium and which originate in the other parts of the body. Their primary function is to provide a stable framework for supporting the delivery arm fulcrum, or shoulder. Arguably, the more remote a body part is from the bowl, the less critical it is during delivery.

Dynamic Forces and the Derivation of a Performance Model

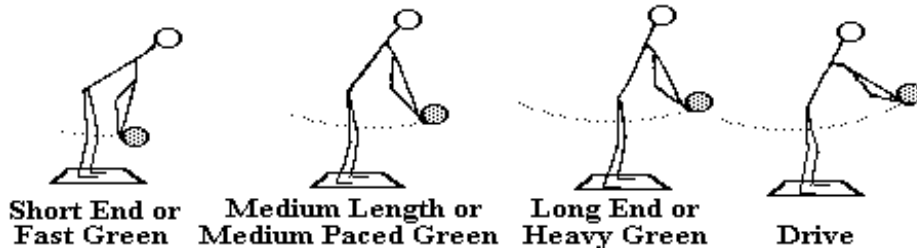
Common Objective of Deliveries

In general terms, the objective of each delivery is to propel the bowl so that it comes to rest as nearly as possible to the jack or other intended position in the head. The objective of an attacking delivery is to dislodge a stationary bowl or bowls before the disturbing bowl would otherwise come to rest at a point beyond that of the target, and perhaps even beyond the confines of the green. Bowlers can execute attacking shots by judging the required line and impact speed to disturb the target, by estimating the extended pathway along which the bowl would continue before coming to rest were its pathway uninterrupted, and then by visualising an object (e.g. a jack) at the notional end point of bowl run. The attacking task thereby becomes a draw shot to the visualised object, and is little different from any other draw shot. Consequently a model for virtually any lawn bowl delivery should be based on the mechanics of displacing a bowl from its point of delivery to the notional end of its run.

'Attacking shots are simply draw shots in disguise.'

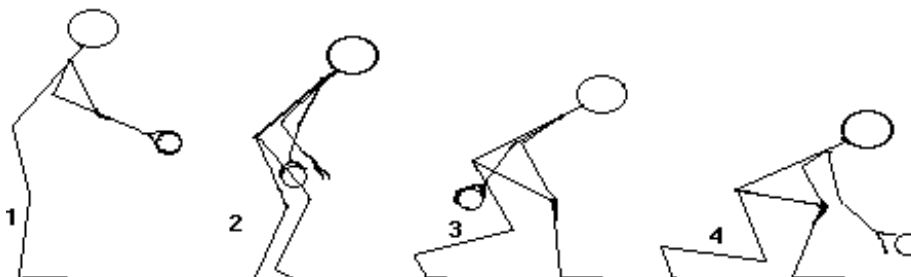
Acceleration Of The Delivery Swing - Muscular Force And Gravity

In Australia, bowls instruction has tended to ignore any role for hand and eye coordination, or for the powerful musculature of the delivery arm and shoulder in the bowl delivery process. The so-called ‘theory of elevation’ would have bowlers controlling the height, or forward elevation of the bowl and arm during the stance. It postulates that the initial elevation determines the rearward elevation at the peak of the back swing, which then determines the bowl release speed. The adjacent sketches illustrate the point.



The ‘theory’ likens the delivery action to the swing of a pendulum, and advocates correction of bowl run distance by conscious adjustment of starting elevation, or height of the bowl. The concept has some practical difficulties, which may explain why it has attracted little favour in other bowls-playing countries. Once bowlers have acquired an efficient and consistent bowl delivery action, delivery preparation should focus on the objective of deliveries, and not on the limb and body movements needed to execute them, which should be automatic. The adjacent sketches show that perhaps 50% of the starting height or forward elevation (sketch 1) will have been lost when a bowl pauses momentarily at the peak of the back swing (sketch 3). Because of their individual technique, some bowlers have a back lift appreciably less than 50% of the initial elevation.

Avoid conscious attention to delivery arm elevation



The armpit derives its shape from two large tendons. The one at the front attaches to the upper arm a short distance down from the shoulder. It links to a powerful group of muscles that fans out over the front of the rib cage. These muscles contract in the forward swing. The tendon behind the armpit likewise attaches to the upper arm. It links to a powerful group of muscles that fan out behind the rib cage. These muscles contract in the back swing.

It is impossible to isolate muscular functioning so as to produce a gravity-powered ‘pendulum’ swing. During both rearward and forward phases of the arm swing, even novice bowlers intuitively integrate muscular force with gravity force. Further, bowlers intuitively tend to vary those forces in unison. For example, for a short end on a fast green, bowlers tend to reduce not only applied muscular force, but also the amount of back lift, or elevation. For longer ends, or slower greens, bowlers produce greater bowl release speeds by intuitively integrating a number of variables. These include employing greater muscular force, extending the back swing, accelerating the delivery movement, and extending the advance of the front foot to enhance stability during the extended

‘Muscular force is the primary source of bowl momentum.’

‘Generate bowl delivery speed by intuitively integrating muscular force with gravity force.’

For longer ends, or slower greens, bowlers produce greater bowl release speeds by intuitively integrating a number of variables. These include employing greater muscular force, extending the back swing, accelerating the delivery movement, and extending the advance of the front foot to enhance stability during the extended

movement. Once back lift or elevation at the peak of the back swing is maximised, gravity offers no additional contribution to bowl delivery speed. Production of high bowl release speeds typically requires considerable muscular force.

The delivery process generates feedback that includes a neuro-muscular sensation of, or 'feel' for the action. Bowlers use this neuro-muscular activation to regulate or adjust bowl release speed, and consequently bowl run distance. This is an aspect of a hand and eye coordination process.

There is considerable disparity in the extent to which even international bowlers use gravity force to augment bowl delivery momentum. Some bowlers have free-swinging deliveries; others have a compact arm swing and a 'pushing' action. A few bowlers accentuate a pushing action by flexing the elbow as the bowl approaches the release point. The explosiveness of a pushing delivery allows less scope for making any intuitive adjustments to arm movement. 'Pushers' make little use of bowl elevation, and intuitively employ greater muscular power in their delivery action. With comparable practice and experience, they achieve results of comparable accuracy.

A definite follow-through phase should occur after the delivery movement and before the recovery to an erect posture. Bowlers who lack a follow-through phase may start an anticipatory reduction in arm acceleration even release of their bowls. This error typically results in short bowls because of insufficient release speed.

Arc Length Of The Forward Swing

The upper arm joint has a range of motion of about 230°, which exceeds that of any other joint in the body. In an erect posture, the back swing limit is not far past the hip. The more bowlers incline their trunk and shoulders forward and down, the more they can extend their back swing limit rearwards. Trunk inclination thereby correspondingly extends the available length for the forward swing. The virtual limit of the forward swing is the point where the hand reaches the lowest point of its arc, directly below the shoulder. According to step length, this position is typically near the toe of the advanced foot.

Therefore the back swing limit primarily determines the available arc length of the delivery arm for its task of generating bowl momentum. At the limit of the back swing, the bowling arm is momentarily stationary. A bowler must give the bowl sufficient angular acceleration so that when it reaches the release point, it will have sufficient momentum for the delivery. Depending on the environmental and tactical demands at the time, the required release speed of the bowl is typically in the range 10 – 30 kph. Bowlers can ensure that a generous back lift is within their range of movement by adequate forward inclination of the trunk. If they have good back lift, they can reduce the need for explosive muscular force to generate required arm speed. A more even balance between gravitational acceleration and muscle-powered acceleration enhances the scope for more fluency of movement, and for intuitively, delicately, and accurately adjusting that movement should the bowler sense the need.

"A free back lift minimises any need for 'pushing' of bowl deliveries."

Simultaneous Shoulder Advance

A simultaneous advance of the shoulder can, to a minor extent, augment the forces that produce bowl delivery speed. There is a partial advance of the shoulders during the back swing as the opposite foot moves forward. There is further advance of the shoulders as knees and ankles flex, the lowered trunk glides forward, and the delivery arm accelerates during its forward swing. It is during the latter phase that shoulder advance has the potential to contribute to bowl delivery momentum. Body weight usually moves when the shoulders advance, so use of good technique will avoid an unstable delivery posture. A sustained follow-through after bowl release usually indicates effective use of shoulder advance.

'A smooth follow-through usually indicates optimum use of shoulder advance.'

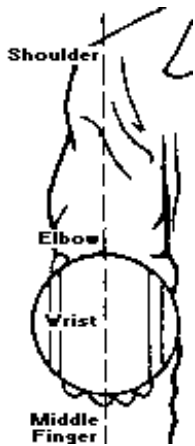
Negligible augmentation of the forces producing bowl momentum by advancing the shoulders can occur in a delivery from a fixed stance. From the 'set' position in a fixed stance, movement of only the arm is available for generating dynamic force. Nor does augmentation occur where the timing of any shoulder advance does not coincide with the forward movement of the delivery arm. Any contribution to bowl release momentum due to shoulder advance would rarely exceed 10%. Rapid shoulder advance that typically

'Delivery of a bowl is an exercise in hand and eye co-ordination'

occurs during in fast deliveries tends to be matched by a proportionate increase in muscular force.

Direction of Bowl Delivery

Delivery of a bowl is an exercise in hand and eye co-ordination. A bowl will initially follow the line of movement of the bowling arm. This result requires a stable delivery posture with no tendency for sideways overbalancing and consequent drifting away from the intended line. In the set up, or stance, bowlers can check delivery arm alignment by one or two trial swings to ensure that the arc of movement tracks the aiming line. The arm alignment should form a right angle with the shoulder line.



Some bowlers take more care with the alignment of their feet than the alignment of their arm. Without due regard to the direction of their arm swing, or to the hand and eye co-ordinating basis of bowl delivery, some bowlers assume that their bowl will inevitably run in the direction in which their feet point. Vision-impaired bowlers must sometimes rely on this technique. Should the feet, hips or shoulders be so misaligned that a bowler feels 'twisted' or uncomfortable in the delivery posture, sensory feedback tends to conflict with visual feedback during the aiming process, and accurate hand and eye coordination may become more difficult. Nevertheless, provided the arm is travelling in the intended direction

The alignment of the arm is more important than that of the feet.

when the bowler releases it, the bowl should initially continue in that direction, irrespective of any misalignment of the feet.

If the arm begins its movement on an incorrect line, a bowler will always face the additional task of regaining the intended line before the moment of release. The most common cause of misdirected deliveries is a set up in which the elevated arm is angled across the body. In helping to support the weight of the



bowl, the non bowling hand sometimes causes such misalignment of the bowling arm, as the images above show. In consequence, the back swing is either to a position wide of the hip and outside the correct line, or is swivelled around the hip to a point inside the correct line, as the adjacent images show. A round-armed swing accompanied by hip rotation is likely to pull the bowl inside the correct line. If the arm drifts off line during the delivery

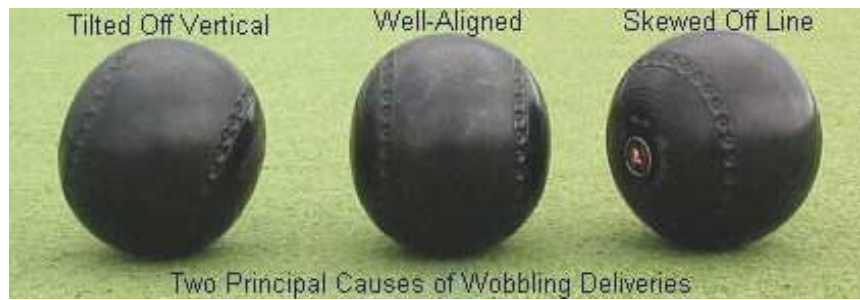
swing, the bowler has the additional task of regaining the intended line before the moment of release. To regain the intended line, bowlers tend either to either loop the back swing or converge the line of forward swing so that the intended line is regained in good time.

For directional consistency, bowlers should avoid using bowls that are too large to be readily manageable. They should adopt a comfortable grip that reliably secures the bowl. The grip should enable the hand to transmit propelling force through the centre of the bowl, as the adjacent image shows. Bowlers without disabilities normally achieve this if the end joint of the middle finger is behind the centre of the bowl, and is the last point of contact when the bowl is released. The muscular force it finally imparts should thereby transmit through the centre of the bowl. That should prevent any skewing of the delivery. Further, if the middle finger is in the same plane as the bowl's centre of gravity, the two digits on either side of



it can best assist grip strength and stability. However if the last point of contact with the bowl is other than the middle finger tip alone, the bowl could skew off its intended delivery line.

Wobble affects the direction of bowl run. Bowlers can achieve a wobble-free run of their bowls only if their coaxial engraved rings are upright and directed at the aiming point at the instant of release. They should grass their bowls so that these rings are upright and not skewed left or right. Otherwise their bowls will wobble or 'stand up', thereby reducing the effect of the bias. Bowls released too high ('dumped') can tilt and turn before grassing and setting out on a line different to the intended line.

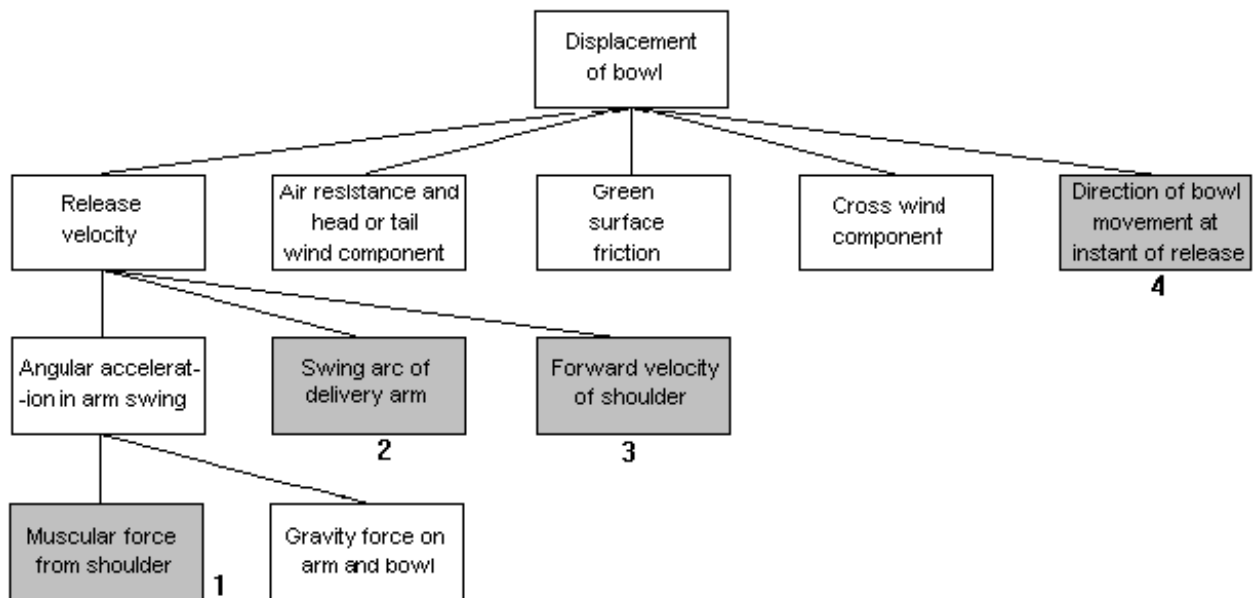


Controllable Dynamic Factors Involved in the Bowl Delivery Process.

Thus the four controllable dynamic factors of any bowl delivery process are: the applied muscular force produced in arm and shoulder, the arc of the bowl delivery arm, an extent of shoulder advance, and the direction of bowl delivery. In general terms, the objective of each delivery is propelling the bowl so that it comes to rest at an actual or visualised point in or beyond the head. This is equivalent to displacement of each bowl from the point of delivery to the actual or notional end point of its run.

'Accurate bowling amounts to accurate line and length.'

Performance modelling is a conventional way of studying the biomechanics of a sport and optimising its techniques. The following model represents the performing objective of lawn bowling and the factors involved in achieving it. The model is valid for delivery of jacks or biased bowls. The shaded blocks are the controllable factors. Wind, green friction, and gravity are uncontrollable factors. Arm acceleration and release velocity are produced by combinations of the foregoing factors



All controllable factors are capable of being simulated with a bowls testing chute. A video camera with a fast shutter speed option is an excellent tool for observing a bowlers technique for producing bowl momentum.

Static Forces and Implications for Technique

Mechanical Leverage of the Delivery Forces

'For every action, there is an equal and opposite reaction'. (Newton's 3rd Law). A delivered bowl has momentum produced by the arm's angular acceleration, which a bowler generates by intuitive integration of muscular force with gravity force. The complementary reaction is the transfer of rearwards force transmitted through the arm to the shoulder socket, as the image on the right shows.

Contraction of chest muscles that attach to the upper arm, a short distance down from the shoulder produces the muscular component of delivery force. The shoulder joint operates as a fulcrum. The resistance is the combined mass of the arm and the bowl.

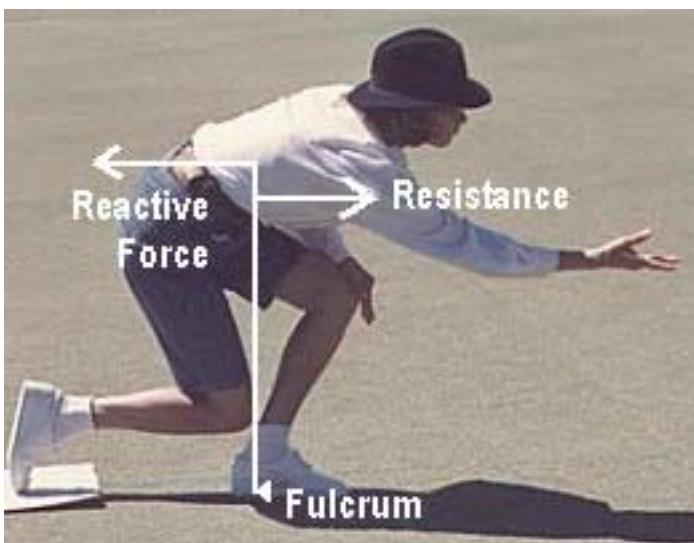


The centre of gravity of that mass is typically somewhat below the elbow, so the resistance arm is longer than the force arm. (Because of a jack's reduced weight, the resistance arm is somewhat shorter when the projectile is a jack.) Thus, the muscular force component operates through a third-class lever (as in the image on the left), which is the primary mechanism of generating high delivery speeds when they are required. The gravity force component acts through the centre of the arm's mass. Therefore it has no mechanical advantage.



Bowl delivery force results in a rearwards reaction force at the shoulder. This force

transfers to another lever that extends through the lower body and legs to the feet, which act as a fulcrum. The resistance to any rearwards toppling motion is the mass of the body, which is typically centred in the belly area, somewhat below shoulder level. Therefore the delivery reaction, or toppling force applies through a second-class lever (as in the image on the right), and has some mechanical advantage.



As the image on the left indicates, the lower the shoulder, relative to the height of the centre of body mass, the less is the mechanical advantage of the toppling force, and the greater is the bowler's stability.

Base of Support

Bowlers' feet form a base of support for their body weight. When the body C of G is directly above the feet, the posture is statically stable. If the reaction force of bowl delivery produces movement that takes the body C of G near the edge of, or beyond the support base, a rearward or sideways toppling of the bowler is typically apparent as jerkiness or stumbling. If the body C of G remains well within the support base, the delivery movement is also dynamically stable. The image on the right shows a stance with a short base of support



A delivery posture with one foot advanced is virtually universal. As the image on the left shows, this posture elongates the base of support. It provides greater resistance to rearward movement of body C of G as a reaction to delivery force, without compromising dynamic stability. It also allows stable forward movement of body C of G as the trunk inclines forward and the shoulders advance.

The advance of the front foot is optimally about the distance of a natural walking pace. A shorter distance results in reduced length of the base of support, which allows less freedom for stable forward movement of body C of G. A longer step causes greater difficulty in

advancing the body C of G into the support zone of the front foot, which in turn forces the groin muscles to play a major, and perhaps uncomfortable role in supporting body weight.

If the back knee is too high, the knees and hips tend to be prevented from flexing adequately, and the body C of G remains relatively high. This renders the base of support relatively narrower, and causes reduced stability both forward and sideways. A high back knee is often accompanied by an almost horizontal body posture that forces the adoption of an aiming point sufficiently near the mat to avoid neck discomfort that could result in aiming at a point further along the rink.

'Get the back knee well down, and body weight well forward'



In advancing one foot, bowlers must be careful to avoid placing the front foot on a line that narrows the separation between that of the back foot. The proper direction of advance forms a right angle with the original hip line. Any narrowing of the base of support could induce sideways instability as a side effect of avoiding forward or backward instability.

'Step straight without converging on the line of the back foot.'

Choice of Front (Leading) Foot, and Back (Anchor) Foot

Most bowlers advance the foot opposite the bowling arm. The minority who advance the foot adjacent to the bowling arm include some bowlers with disabilities that make that option more comfortable, or more controllable. One might speculate about why a right hand player ought not to step off with the right foot to reduce hip rotation. In a forward position, the adjacent foot may obstruct the delivery hand and bowl, and be likely to cause bowlers to make contact with their shoe or ankle unless they intuitively widen their delivery line. With the opposite foot forward, the hips – which may be quite wide - have rotated and narrowed their effective width helpfully, enabling a delivery line closer to the mid line of the body. Bowlers may then release their bowl under the body C of G, thereby minimising sideways instability. With the opposite foot forward, bowlers can then position their eye line or sighting line more readily over the delivery line.



Sideways Positioning Of Back Knee

If the front foot is directly in front of its corresponding hip to enhance stability, one might speculate that the hips and body would be squarer with the back knee positioned in front of its corresponding hip, than if the back knee is near the heel of the front foot. Some sideways freedom of movement of the back knee can positively enhance sideways stability. Any instability towards the left can be neutralised by intuitively swinging the back knee to the left. Opposite sideways instability may be neutralised by intuitive movement of the knee to the right. Anchoring the back knee against the heel of the front foot could negate such adjustments of body balance.

Placement of the back knee near the front heel, though turning the hips slightly out of a squared alignment can enhance dynamic stability. In this posture, the horizontal back leg angles from back ankle towards the front ankle. The bowling hand swings over and obliquely across the calf and passes very close to the inside of the front shoe. Bowl release occurs virtually under the body C of G, and under the aiming line. This technique tends to reduce the 'leverage' of destabilising forces.

Position of the Opposite (Non-bowling) Hand and Arm

Once the legs provide a stable base of support for bowl delivery, that stability can be extended to the shoulder girdle by anchoring the non bowling arm near the front knee and using that arm as a brace. The hand or forearm can rest near the front knee. If it is too rigid, the non-bowling shoulder might be propped up, so tilting the shoulder line. It could also prevent adequate trunk inclination and adequate forward movement of the body C of G.

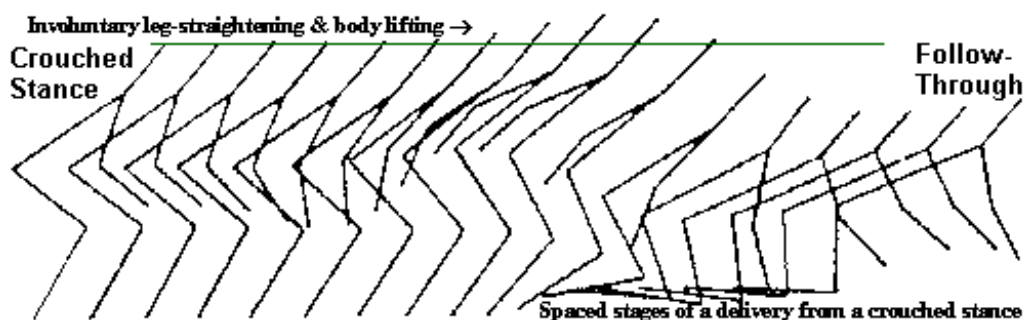
Crouched Delivery Posture

Some bowlers favour a crouched posture in preparing for bowl delivery. The crouch is equivalent to the *demi-plié* in dancing. Because it puts considerable stress on hip, thigh and calf muscles, it is generally unsuited bowlers without good muscle tone.

'Crouching deliveries are hard work'

Many bowlers who use a crouch are unable to take a pace immediately forward from that posture. The muscular strength in the 'back' leg is insufficient to support body weight while the opposite leg executes a forward pace. To relieve muscular tension, such bowlers intuitively execute a *relevé* (another dancing term, which simply means they partly straighten their legs) before starting a forward pace. The head and body of many of the crouching bowlers rises

several inches as they begin a delivery movement. These supplementary movements all add to a bowler's co-ordinating task and contribute nothing to generating bowl delivery speed or controlling delivery line.



Extension of Bowling Arm

When preparing for a delivery, bowlers should avoid rigidly extending their arm forward. The weight of the bowl at the end of the arm represents a considerable moment of force that shoulder muscles can only support through third-class leverage. Such repetitive straining of shoulder muscles can lead to injury. The upper arm avoids most strain if nearly vertical and if the elbow is near the waist. The elbow may be flexed to allow the forearm to extend forward, yet avoiding any feeling of strain or discomfort.

Recommended Bowl Delivery Procedure

Ordered List of Elements of A Delivery Movement

The following list sets out the sequence of elements of a delivery movement in lawn bowling. Usage of the terms ‘left’ and ‘right’ is valid for right-handed bowlers.

Preparatory Positioning

- Well-practised mat laying procedure
- Right foot along delivery line
- Left foot slightly separate but parallel
- Toes about 10cm behind front of mat

Grip

- Middle finger centred on running sole
- Bowl rings upright and aligned
- Right thumb near shoulder of large ring
- Bowls suitable size & grip comfortable

Stance

- Shoulders square to delivery line
- Right arm sufficiently elevated
- Right arm extended along delivery line
- Left hand not drawing right arm off square
- Knees comfortably flexed
- Weight over balls of feet
- Shoulder line forward of toes
- Attention directed forward

Delivery Movement

- Right elbow angle remains fairly constant
- Left heel lifts as right arm passes hip
- Left foot advances parallel to delivery line
- Left foot advances a normal walking pace
- Sufficient amount of back swing
- Left heel grounds as forward swing starts
- Left foot settles parallel to aiming line
- Forward swing smoothly accelerates
- Right knee moves to position behind left ankle
- Left hand moves to left knee
- Attention still directed forward
- Bowl released at lowest point of swing
- At least 90% of weight over left foot
- Shoulders forward, above left knee

Follow Through & Recovery

- Right arm extended along line, palm upward
- Attention focused on moving bowl
- Recovery separated from follow through
- Steps forward off mat

General Recommendations

Like putting in golf, delivering lawn bowls does not require maximal speed, so a variety of techniques are capable of providing results of comparable accuracy. Some diversity is apparent in the delivery techniques of elite-level bowlers. Good technique reflects practiced fluency, simplicity, efficiency, consistency and accuracy. It avoids extraneous movements, each of which unnecessarily adds to the coordinating demands placed on bowlers.

‘Keep it simple’

The instruction of novices initially requires reference to a model of sound technique. As they acquire experience and skill, developing bowlers may depart from that model. Such departures represent unorthodoxy rather than error, unless they clearly diminish the accuracy of results.

‘Unorthodoxy is not error’

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 Australian bowlers

- to adopt terms like 'pendulum swing',
- to speculate 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 accept 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 in synchronism 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.

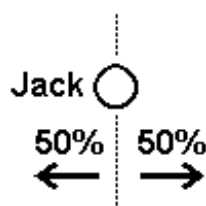
Elite bowlers prepare for a delivery by confidently 'saying' to themselves that their bowl will run its course and stop precisely at the intended spot. They use imagination to 'see' their bowl following the exact path to accomplish that result. They develop a 'feel' for a good delivery from the weight 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)

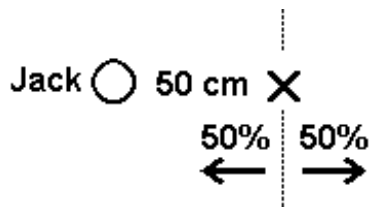
A common error that bowlers at most levels of the game make is that of 'short' bowling. Subconsciously perhaps, they feel that a bowl that almost 'made it' is a better attempt than a bowl that 'overdoes it'. However, since a jack rarely moves forward, bowls that stop beyond 'jack high' have tactical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

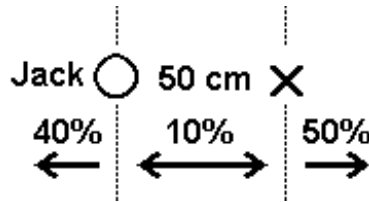
When the jack is the aiming focus, on average half of bowls are likely to stop before jack high, and half to stop beyond it:



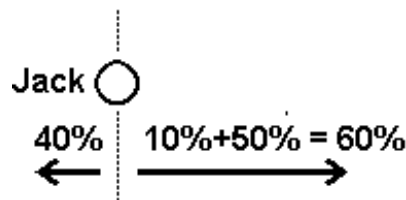
Thus about 50% of deliveries are likely to result in short bowls. If bowler adopts a point about 50 cm beyond the jack as the aiming focus, about 50% of bowls are likely to stop before that point, and 50% to stop beyond it:



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.

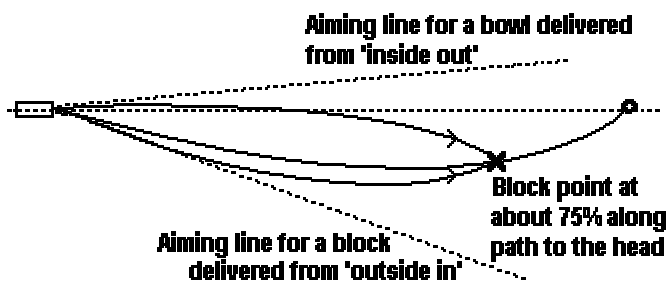
An objective of blocking is discouraging or preventing opponents from playing their percentage shot. When there are short bowls near the head, a bowl that moves to 'plug' a gap between them could constitute an effective block. If the preferred option is a straight drive, one bowl could block either forehand 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 touch. 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 grasping 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.

Bowling Practise

The Potential of Practice

The term practice applies not only to bowling movements, but also to development of mental and physical capabilities. Research suggests that it takes about 1 million repetitions of a sporting skill to attain a high level in performing it. Systematic practice is the key to achieving sustainable improvements in performing skill, powers of concentration, and self-confidence. A small improvement in the performance of each player can considerably increase the scoring potential of a team or a side. The outcome of many games is not so much which team played the better, as which team wasted fewer bowls.

Practising Newly-Learned Skills

Progressive Stages of Skill Learning

The objectives of skill practice vary according to the learning stage of bowlers. Beginners may have some difficulty in delivering bowls using recommended technique. Their movements may lack fluency and consistency. At the beginning stage, they are trying to develop motor programs for bowl delivery and this is the objective of initial practice. They may exhibit learning errors or performance errors. Learning errors indicate uncertainty about the nature or sequence of movements that constitute delivery of a bowl. Performance errors are execution faults (e.g. limb misalignment, instability, etc) and are not the result of uncertainty about the required movements. Learning by trial and error has some merit. However, it entails the risk of practising and imprinting inefficient or inadvisable technique. Bowlers should eliminate any errors at the earliest possible stage.

After a few hours of coaching and practise, most beginners advance to an intermediate stage of skill acquisition. They are then able to deliver bowls in a reasonable approximation of sound technique. Occasional errors still occur, but bowlers improve in accuracy, consistency, timing, and self-confidence. Deliveries appear more fluent. At this stage, the objective of practice is refinement of their motor programs.

Months or years later, as bowlers approach mastery of their performing skills, the final stage of learning begins. Motor programs are so highly imprinted they are automatic. With seeming ease, bowlers are able to deliver with graceful and consistent fluency and obtain very accurate results. The scope for further improvement is more limited, and is usually based on the identification of subtle and seemingly minor imperfections in technique. If the bowlers make corrections, the objective of their practice then becomes the perfecting of the modified motor program.

The mastery of tactical and mental skills involves similar processes of learning, practicing, and improvement. Bowlers typically master the process of accurate delivery before they learn complementary skills. They should master accurate draw shot play before they seriously attempt to learn to play attacking shots.

Learning Bowl Delivery Technique

As bowlers initially practice their delivery technique and develop motor programs for the process, it is useful for them to have a coach available to provide informative and motivational feedback. A coach should also record observations and suggestions on a checklist containing the elements of a delivery movement equivalent to list appended at page 111.

If a camcorder is available, the coach should also create tapes of each client's delivery technique, accompanied by a concise appraisal, for the client to play back and study at a convenient time. This arrangement should minimise the risk of learners practising and imprinting inefficient or inadvisable technique.

At the beginning stage, bowlers should develop an efficient and consistent (or 'grooved') technique for delivering a jack. (For indoor practice, a home hobbyist could probably construct an inexpensive, portable ramp of the type appended on page 116.) Accurate bowling requires a fluent, consistent and efficient delivery for both forehand and backhand. Any technical shortcomings require correcting before practising for accuracy is likely to be productive. Bowlers should maintain their smooth and consistent technique during faster deliveries. Long ends in combination with slow greens make appreciably faster deliveries necessary on some days. Observations by a coach or on camcorder footage should disclose whether technique falters when limb movements accelerate.

There is no need for a jack or equivalent target during the beginning stage of learning bowl delivery technique. The focus should be on delivery process, not on outcome accuracy. At that stage, solo practice is normally preferable to partnered practice. Solo practice enables bowlers to retain full control of the practice environment and to exclude

friendly but unhelpful distractions. A delivery preparation ritual or routine should help bowlers to maintain a self-confident and concentrated approach to the process.

Practising to Refine Learned Skills

This phase of delivery skill development corresponds with the intermediate and automatic stages of skill learning. Bowlers pay reducing attention to the efficiency of technique and increasing attention to its efficacy. Attention switches from process to outcome.

Identifying Practice Needs

In short, practice needs involve perfecting or correcting. The needs may be an element of a longer-term program for improving bowling skill, or informal, shorter-term activity for maintaining skills or eliminating identified performance errors.

The first consideration in planning practice needs for a longer-term program of development should be that of establishing the entry-level abilities of each bowler. The next consideration is the standard that each bowler realistically aspires to, and how much time each has for achieving that standard. Longer-term plans will have some identifiable, intermediate stages. Bowlers should commit to achievement of those milestones at definite points in time. They also need to agree upon what they need to learn and practice by way of technical, tactical, psychological and fitness skills for each of those stages. Bowlers who aspire to a specialist position in teams need a plan tailored accordingly.

From time to time, weaknesses will emerge in performing skills. Correction and practice to eliminate weaknesses is a continual priority. Bowlers should acquire the ability to convert weaknesses into strengths and to keep their individualised program on track. Practice requirements during a longer-term program should follow a challenging and evolving progression according to circumstances and the stage of skill attained.

For establishing their immediate practice needs, bowlers should review and identify their present performing strengths and weaknesses as a first logical step. Self-testing might pose such questions as:

- Can I identify any general weaknesses (eg. short bowling, accuracy on long ends, drawing to the ditch, etc)?
- Can I deliver the jack precisely to the distance I want?
- Do I have a weakness on either forehand or backhand?
- Do I have a weakness related to length of end?
- Do I have a weakness when a short bowl obscures a clear view of the jack?
- Does a bowl in the draw unduly distract me?
- Do I have any weakness in any of the shots – particularly shots of moderate speed?
- Do I have a weakness related to certain paces of green?
- Do elements of the competition environment upset my concentration?

Common Shortcomings of Club Practice

Most lawn bowls clubs have prescribed periods each week when practice or 'roll-up' rinks are available to members. Bowlers who take advantage of these opportunities are typically observed to deliver all four of their bowls on the same hand to a centred jack at either end of the rink from a mat usually placed a constant distance away. In those circumstances, there is less recognition of practice needs than of practice wants - typically enjoyment and self-satisfaction.

When bowlers share rinks during 'roll-ups', they often participate in impromptu games of singles. In those circumstances, competitiveness might sometimes provide challenges that take bowlers out of their 'comfort zone'. However, any form of practice that is not based on immediate needs, that is not clearly defined, and that is not subsequently evaluated, is unlikely to produce any particular skill development.

Most bowls books and manuals contain a few practice exercises. To the extent that these illustrate classical layouts for learning and practising the shots of the game, they are useful if, as is often not the case, they are well described. However, 'boilerplate' practice drills might not correct particular weaknesses and might not produce much general improvement. It is not possible to present a generic training program that inevitably provides all things to all bowlers. Practice tasks should always be structured to directly address the identified and individual needs at the time. Once practice needs are clear, precious time and energy is not spent in practising skills that do not immediately require practice.

Defining Practice Tasks

Design of practice tasks involves addressing the practice needs. Partnered practice may be more beneficial than solo practice at the intermediate and advanced stage of skill learning. This form of practice better emulates the tempo and atmosphere of a game. It also offers a competitive element to the activity, and the possibility of improvising games from the practice tasks. This is the 'game sense' approach.

There are differences between tactically sound bowling and accurate bowling. If a task requires delivering a bowl so that it comes to rest at a particular point on the rink, the essential demand is accuracy. If a task requires delivering a bowl so that it comes to rest at or slightly beyond a particular point on the rink, the essential objective is tactical soundness, i.e. avoidance of short bowling. In an accuracy test, bowls similar distances short or long should score equally. The mechanical demands of accurate bowling and tactical bowling are similar, but the objectives are not readily reconcilable and should not be combined. For accuracy, bowlers should aim for the required position. For tactical advantage, bowlers should aim for a spot about a half-metre beyond the 'required' position.

Where practice tasks involve positioning of bowls or other equipment, a clarifying diagram should support its description. Bowlers can simulate realistic practice tasks by setting heads with spare sets of bowls. Presetting of heads requires negligible extra equipment. To allow variety in the configuration of heads, at least four spare bowls are desirable. They need not be from a matched set. Any bowls will do. Coloured stickers or strips of masking tape visible from the mat would distinguish bowls for or against the bowler. Bowlers should participate in setting their own practice heads. They should also set mirror images of heads for practising both hands of play. A few practice tasks involving preset heads are appended on page 114.



Essentially, defining a practice task directly addresses the practice needs, and describes what the task is and what action it requires. The definition should expressly or implicitly incorporate enough information to dispel virtually any doubts about what the task requires. Information typically required is:

- **Applicability** Beginners, novices, club competitors, and/or association players? Singles, pairs, triples and/or fours players? Leads, seconds, thirds, and/or skips?
- **Objective** What is the objective? What is the task? How is it started? How does it proceed? How does it end?
- **Time** How much time is available? How should it be allocated?
- **Setting up.** Number of bowls required? Are other bowlers involved, and how? What equipment or aids need to be in place?

Defining Task Performance Conditions

Defined conditions for task performance are closely linked with the task definition and purpose. These might include weather conditions, safety precautions, playing surface speed, presence of actual or simulated distractions or competition pressure, etc.

Condition details should indicate how the task should proceed. That information might include suggestions about how degree of difficulty can be engineered to match it with the ability of the bowler undertaking the task. Alternatively, it might include suggestions about changing task procedure to provide variety. Some examples of suggestions for variety are:

- **Draw Shot Accuracy.** Arrange a practice green with mats set at differing distances from the rear ditch and from the jack, with jacks at differing offsets from each rink's centre line, and with line of play alternating on successive rinks. This is a form of circuit practice.
- **Draw Shot Accuracy.** Arrange games that disallow driving.
- **Contested Accuracy.** Arrange 'consistency' singles' games
- **Accuracy Over All Distances.** Arrange games requiring presetting of the jack (eg 21 m for 5 ends, 34 m for next 5 ends, 28 m or random lengths for last 5 ends)
- **Simulated Increase in Degree of Difficulty.** Arrange games that disallow change of hand of play, except at the start of an end.
- **Hidden Jack.** Use a spare bowl to hide the jack after centring it.
- **Position Bowling.** Pin out a cross with 2 ribbons (2-3 metres in length) that intersect under the jack to create 4 quadrants for receiving bowls in position-bowling practice
- **Versatility and Adaptability.** Arrange games requiring teams to rotate positions (eg lead to 2nd) after a specified number of ends.

- **Tactical Decision-Making Ability.** Require discussion of team tactics at head after each half-end (after 8th & 16th deliveries)

‘Phantom’ Bowler

Another game that provides a team with technical and tactical practice under simulated pressure is the ‘phantom bowler’. This exercise is attributed to Jimmy Davidson former English National Bowls Coach, and appears in the Scottish Bowls Coaches Manual. It has proven equally effective in Australia.

A fours team competes against a ‘phantom bowler’ who would ordinarily be the team coach. Team members deliver their bowls from the mat. The phantom bowler at the opposite end of the rink either places or kicks bowls into the head. The opposing skip directs the team’s players from the head in the usual way. The team plays a couple of trial ends, during which the phantom bowler assesses their standard or ability. The phantom bowler ‘delivers’ the first bowl each end. Order of play then alternates in the usual way so that the team’s skip plays the last bowl.

The phantom bowler avoids ‘drawing the shot’ too often. Otherwise, the team would get too much practice in attacking play, and insufficient experience at establishing, consolidating and defending a head. The phantom bowler tries to give players adequate opportunities to test their skills whatever their positions in the team. During or after each end, the phantom bowler uses open question technique to encourage positive discussion about the standard of the green, the tactical opportunities and risks that emerged, and how the team handled those challenges.

Practising the Drive

The practising of drives demands some precautions. Bowlers should correct any technique problems during practice sessions. Should they encounter difficulty in diagnosing a problem, the best course of action is to go back to the basics and work forward from there. If no coach is available, bowlers can help one another with reciprocal observation and suggestion.

Preset practice heads make good targets for driving practice. Bowlers can mirror their target practice configurations to balance forehand and backhand practise. To balance the challenge and success of practise tasks, they can vary the size of their targets. They can also vary head distances. Further, they can set front bowls to make wide drives wick towards the target.

Bowlers should make the rink for driving practice safe. They should consider using a ditch rink to practise driving. About a half of all scattering bowls should thereby come to rest harmlessly in the side ditch. They should avoid a rink behind which people congregate or there are glass panels. Flying jacks can cause harm. They should consider placing the target bowls within 2 metres of the front ditch. Scattering bowls would thereby not travel far before reaching the ditch. They should alert any players on adjacent rinks of potential danger. They should pad the face of the bank to avoid accelerating the wear and tear of the facing material.

Defining Task Criteria & Evaluation

The definition of a practice task should indicate the criteria for success in achieving its objectives. Preferably, the criteria should be stated in terms that enable comparison with other performances. Detailed criteria usually infer some system of measurement.

Performances in many sport performances require measurements in terms of distance (eg centimetres) or time (e.g. seconds). Measurements in such universal units enable evaluation of individual improvement over time, or comparison with performances of others. Linear measurement produces the most reliable indicator of lawn bowling accuracy during practice. However, it typically requires the services of a helper. The helper needs a few seconds to measure and record the distance between each bowl delivered and the jack, or the separation between the actual track of each forcing shot attempt and the requisite track to the target.

Performances in some target sports (eg archery, shooting) are evaluated according to whichever band surrounding the target’s bulls-eye each projectile penetrates. Occasionally, coaches mark (eg with chalk) an equivalent target on the surface of a green to enable practising bowlers to aim for a jack centred in the bulls-eye. The main advantage of such practice targets for bowling practice is that the result of each attempt is available quicker than if measuring. Bowlers earn ‘points’ according to the band in which each bowl comes to rest. The main disadvantages are that there are no widely accepted standards for target size and configuration or for scoring scales. Some coaches set up other practice tasks that likewise earn points according to how closely each bowl achieves its intended purpose. Again, lack of standardized practise tasks and scoring systems means that aggregate points normally have only local and temporary meaning. Scorecards for games (eg singles) produce totals expressed in points. However, they convey even less

meaning. They indicate which player finished closer to the jack more often, but do not indicate even an approximation of the average distance from the jack of the finishing points of each player's bowls.

Scores expressed in universal linear measurement scales are very much more reliable for comparing performances. They offer 'benchmarks' for development and improvement programs. The measured result for a practice session is commonly the arithmetic average result of all attempts, including any that resulted in bowls finishing outside rink boundaries.

Results of each practice task enable and warrant a process of review. In setting expectations from practice, bowlers should recognize that plateaus sometimes occur in the rate of skill improvement. Causes of setbacks in improvement may include cognitive changes (e.g.: changed method of selecting aiming angle), technique changes (e.g.: altered grip), psychological problems (e.g.: anxiety), or physiological problems (e.g.: ill health). Temporary plateaus in skill improvement are normal and should not affect the process of setting objectives for self-development. The outcomes of practice typically disclose current strengths and weaknesses, and indicate an appropriate focus for the ensuing practice session.

Measuring Draw Shot Bowling Accuracy

Limitations of Game Scores as Performance Indicators

Post-Game Analysis of Score Cards

Competitive bowls performances are not quantifiable by measuring, weighing or timing like they are in sports like jumping, weight lifting or swimming. Thus, improvements in bowling accuracy over time or comparisons between individuals are difficult to quantify where event scorecards are the main yardsticks. Winning performances in bowls are relative. The winner has the greater accumulation of points awarded after intermediate passages of play (ends) according to the number of bowls closer to the jack than any bowls of the opponent. Form of bowlers changes over time, so results of games (even against the same opponent) are inconclusive indicators of improvement.

Club selectors have a need for data on individual performances in trial and pennant fixture games. Coaches also could make effective use of such data. One of the problems in collecting it, especially considering that the performance of a side is the aggregate of several separate games, is that it is so time and labour-intensive.

Forms of feedback that provide data are the official scorecards of each game. Scorecards do not indicate who played well, but at least they indicate whether a team got away to a good start, and whether they faded, or sustained their effort to the end. Another form of feedback that selectors can seek is the subjective opinion of managers and players as to who played well and who did not. This form of feedback gives also some indication of team motivation and cohesion. Selectors should crosscheck subjective opinions to minimise mistaken observations or personal bias. They should collect this type of feedback as soon after the completion of a game as possible while details are fresh in the minds of the observers.

Consistency Singles

‘Consistency’ singles is a popular game in many clubs. Typically, it requires bowlers to draw to a jack to earn 4 points for the closest bowl. The second closest bowl earns 3 points. The third closest bowl earns 2 points. The fourth closest bowl earns 1 point. Other bowls do not score. Why the game has the name ‘consistency’ is a mystery. Accuracy is far more decisive than consistency in determining the outcome of a game.

As a performance indicator, consistency has most of the disadvantages of normal game scoring. Close bowls may not score if other bowls are closer to the jack, and wayward bowls can score if there are no close bowls to beat.

‘Lead's Scorecard’

A form of feedback occasionally worth considering is a lead's scorecard (see below), so-called because the lead is the only player in a fours team with enough time to maintain it without detriment to other playing responsibilities. In the example below, the focus of interest is the "We" team comprising White (lead), Large (2nd), Driver (3rd), and Jack (skip). If the game were an intra-club pennant trial, interest would also focus on the individuals in the "They" team.

End	We				They			
	Lead	2 nd	3 rd	Skip	Lead	2 nd	3 rd	Skip
1	-	-	-	-	1	1	1	2
2	2	3	4	4	-	-	-	-
3	-	-	-	-	2	2	3	1
4	-	1	1	2	1	-	-	-
5	1	2	1	1	-	-	-	-
6	-	-	-	1	1	1	2	-
7	2	-	1	2	-	1	-	-
8	-	-	-	-	2	1	2	3
9	-	-	-	-	2	3	4	5
10	2	4	2	3	-	-	-	-
11	2	2	2	-	-	-	-	1
12	1	1	1	-	-	-	-	1
13	2	2	1	1	-	-	-	-
14	2	2	-	-	-	-	1	1
15	2	3	3	4	-	-	-	-
16	2	3	4	2	-	-	-	-

17	-	1	-	1	2	-	3	-
18	-	-	-	-	2	4	4	3
19	-	-	-	-	2	4	4	3
20	1	-	-	-	-	1	1	1
21	2	4	6	6	-	-	-	-
22	-	-	-	1	2	2	3	-
23	-	2	2	3	1	-	-	-
24	-	1	-	1	2	-	2	-
25	-	-	1	1	2	2	-	-
Adds	21	31	29	33	22	22	30	21
Lead	S.White				V.Black			
2nd	V. Large				A.Small			
3rd	A. Driver				A.Bowler			
Skip	K.Jack				B.Pegg			

On the first end, the "We" team was down a shot after leads had played. It remained one shot down after both second and third players had played. It was down two shots after skips had played and the result of the end determined accordingly. White recorded all this on line 1 of the card. On the second end, The "We" team was up two shots after White had played. It was three shots up after Large had played. It was four shots up after Driver had played. It was still four shots up after the skips had played, and the result of the second end determined accordingly. White recorded all this on line 2 of the card, and used the same routine to record subsequent ends. Where the measured result of an end disclosed an error in recorded interim scores, White correspondingly altered them. The skip (Jack) helped White's task by signalling the interim score after each player in turn had played both bowls.

Analysis For "WE" Team

Line		Lead	Second	Third	Skip
1	Scores for, after turn	21	31	29	33
2	Scores against, after turn	22	22	30	21
3	Net scores, after turn	-1	+9	-1	+12
4	Less net score before turn	n/a	-1	+9	-1
5	Contribution to team score	-1	+10	-10	+13

Leads or selectors insert column totals for the "We" team in Line 1 of the following analysis, and for the "They" team in Line 2. They complete Line 3 by subtracting each total in Line 2 from the corresponding total in Line 1. This produces an unadjusted value for each player's contribution. Line 4 is simply the accumulated surplus or deficiency inherited from the previous player which when added to Line 3 produces in Line 5 the adjusted contribution of each player.

The analysis for the "We" team indicates that the skip and the second scored well, the third player did not, and the leads were evenly matched. However, such conclusions may be somewhat misleading. For example, the second player or skip may have encountered a particularly weak or 'out of form' opponent. The third player may have contributed to the good result of the skip, by playing numerous position bowls that did not directly contribute to the score. Over the course of several games however, aberrations tend to disappear. If Black kept a corresponding card for the "They" team, periodic cross checking should disclose any recording errors.

Such a scorecard is adaptable to triples games. However, like the scorecards of any game, a lead's scorecard has limited usefulness as an indicator of accuracy or other aspects of performance.

Broad Measures of Bowling Accuracy

Nature of performance in games

Typical objectives in the course of a game include delivering:

- a jack or bowl as nearly as possible a particular distance along the rink,
- a bowl on a particular line to impact with one or more stationary bowls in the head, and
- a bowl so that it comes to rest as nearly as possible to a particular position in the head

Outline of an Accuracy Test of Jack Rolling

Leads should be reliable in delivering the jack to an indicated distance. This is conventional wisdom, but no benchmarks are known to exist. Inaccuracy in jack delivery might be symptomatic of corresponding bowling inaccuracy

This test involves measuring the accuracy achieved in delivering 32 jacks. Task requirements assume use of a typical rink approximately 38 m ditch to ditch. Direction of jack delivery reverses after 8th, 16th and 24th deliveries. After each jack delivered comes to rest, a scorer centres it, then measures and records the distance between the indicated distance and the distance actually achieved. Test completion time is saved if distance indicators such as chalk marks, golf tees etc, are available. Scorers should place an aiming object on the indicator at the required distance from the front ditch, and remove it once each jack is in course.

A specimen score sheet appears below. Players should position the mat at the specified mark near the rear ditch, and scorers should position the aiming marker at the specified distance near the front ditch as shown on the sheet. The (centred) distance markers for positioning of the mat and indicating run distance objective are as follows:

- ‘T’ marks. 2 metres from the front and rear ditches.
- ‘M’ (Middle) marks. 4 metres (5 ordinary paces) in from each ‘T’.
- ‘C’ (Central) marks. 8 metres (10 ordinary paces) in from each ‘T’

Delivery Number	Mat Posn.	Objective Posn.	Distance (approx)	Measured Distances			
				1-8	9-16	17-24	25-32
1, 9,17,25	T	M	29 m				
2,10,18,26	T	T	34 m				
3,11,19,27	M	M	25 m				
4,12,20,28	T	T	34 m				
5,13,21,29	C	M	21 m				
6,14,22,30	M	T	29 m				
7,16,23,31	M	C	21 m				
8,16,24,32	C	T	25 m				
				÷ 32 =			

With one or two bowlers per rink, about 30 – 40 minutes per player is the average time to complete the test. Scorers average the results of all 32 deliveries to obtain an average (distance) error. If desired, a scorer may also identify errors short and errors long to determine the net error. (However, the net error is not the average error. For example, if errors long total 12 metres and errors short total 20 metres, the net error is 8m (difference) ÷ 32 (deliveries)= 25 cm short, but the average error is 32m (sum) ÷ 32 = 1.0 metre.)

Tasks for testing bowl delivery accuracy

Draw shots aimed at finishing as close to the jack as possible typically constitute at least 80% of all deliveries in competitive play. Therefore, most testing involves measuring the accuracy of both length and line as represented in draw shot placements. Routines that exercise accuracy of both line and length involve delivering bowls that will come to rest either in a designated target area, or as nearly as possible to an object position. Averaging the frequency with which bowls come to rest within an area of standardised dimensions is a broad measure of accuracy of bowling into a target. The area of the target affects the degree of difficulty of the test task. The section below headed ‘40-bowl accuracy test’ discusses testing that involves measurement of the distances between a jack and the positions reached by bowls.

Interpretation of test results

A sample of measurements of how nearly a bowler achieves delivery tasks under test conditions allows reasonably reliable inferences to be drawn about the accuracy of performances and current level of skill. Periodic measurements of bowlers' draw shot accuracy enable the setting of individual benchmarks. Such benchmarks are useful for evaluating individual improvement over time.

Typical distribution of results

In games of bowls, heads are typically longer than they are wide. Bowls delivered towards a jack or other destination near the opposite end of the rink tend to come to rest in an elliptical zone, the longitudinal axis of which is about 40% (i.e. √2 - 1) greater than its crosswise axis. This is the statistical outcome of delivery speed errors combined with delivery line errors. A method of constructing an elliptical target zone appears on page 118.



A target zone that is about 40% longer than it is wide effectively gives equal weight to line errors and delivery speed errors. Any sideways error (eg missed wrestling attempt) is directly proportional to the delivery line error. However, a lengthwise error (eg error in jack roll distance) is proportional to the square of the delivery speed error. Thus, length errors tend to be greater than sideways errors.

The layout on the right is an example of a target zone. Its length is 40% greater than its width, so it tests delivery speed and line accuracy fairly equally. The ditch and the boundary alignment define its limits on two sides. A single bowl indicates the alignment of the remaining sides.



Target zones that are separated from the boundary require additional markers for designating their limits. Pegged tapes or marked lines sometimes make better markers than jacks or bowls. Bowlers are at a distinct disadvantage if target zone boundaries are indistinct or ill-defined like the task in the image on the right.

'Scoring Zone' as a Target

The scoring zone is the area, typically of about one square metre, around the jack that normally encloses most, if not all, of the bowls lying at rest in scoring positions. During competition, players can visualise a scoring zone of a size appropriate to their level of skill. A pattern for construction of a practice scoring zone is appended at page 117. Bowlers of novice or intermediate standard should contemplate a larger size of scoring zone related to their current level of skill. The following image shows a chalked scoring zone formed by outlining a template. The base is nearest the ditch, and the 'apex' points toward the mat.



Target Zone Choices

Performing tasks that are more 'line' than 'length' practices include: drawing through an isolated bowl or jack, drawing to the centre line, drawing to a side boundary line, or drawing to between markers or bowls aligned lengthwise. Ways of increasing the degree of difficulty of the exercise include leaving the delivered jack uncentred, changing the hand of play more frequently, narrowing the defined scoring zone, or practicing in a variable cross wind. Averaging of sideways error distances is a measure of accuracy. Any penalties applicable (eg for missed impacts, bowls finishing out of bounds, etc) can significantly change the object of an exercise, and need clarifying at the outset. The fluctuations in recorded measurements are indicators of technical consistency

Routines that are more 'length' than 'line' practices include: delivering jacks to indicated lengths; drawing bowls to an imaginary crosswise 'line' (e.g. 2 m from ditch), or to a crosswise alignment indicated by bowls or other markers; or drawing bowls to the plinth (edge of the ditch). Ways of increasing the degree of difficulty of the exercise include: requiring successive deliveries to incrementing or decrementing lengths, changing objective distance substantially and frequently, increasing average 'end' length, setting the objective near the front ditch, shortening the defined scoring zone, or practicing in a variable head or tail wind. Averaging of lengthwise error distances is a measure of accuracy. Any penalties applicable (eg for distance errors that exceed imposed limits, loss of bowl in the ditch, etc) can significantly change the object of an exercise, and need clarifying at the outset. The fluctuations in recorded measurements are indicators of technical consistency.

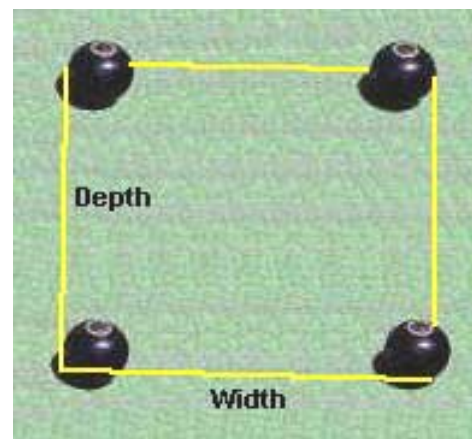
Simultaneous practice of accurate delivery line and speed is the most common mode of practice. Practice procedures that produce measured results tend to be of greater benefit. Routines that challenge both line and length accuracy include: drawing to a visible, hidden or ditched jack, to a receiving or covering position, or to a blocking position - although effective blocking often challenges the accuracy of line more than length. Reducing the area of the scoring zone, and varying the hand of play, end length, etc frequently can increase the degree of difficulty. The nature of the scoring system, or practicing while fatigued, or in the presence of actual or simulated distractions can likewise increase difficulty. Practising in adverse environmental conditions (e.g. slow green, strong wind, etc) likely during a forthcoming competition also increases difficulty.

Measures of Bowling Consistency

Margin for Error Test

Some Australian clubs have used a 'margin for error' test for several years. To begin the process, candidates complete their usual 'warm up'. The test does not require use of a jack. The tester specifies the forehand and backhand aiming references. Candidates deliver all of their four bowls in a specified direction and at a speed sufficient to enable them to run a medium distance. The object is to minimise the separations of the finishing points of the bowls by optimising the consistency of the delivery movement. Candidates should not attempt correction of delivery line or release speed.

After four bowls delivered to the forehand side come to rest, measurement of the width and depth of a rectangle that would enclose them follows. The same procedure repeats for four backhand deliveries. The average of the two widths and two depths is the 'margin for error' for the eight deliveries. Inconsistent results produce large values that warrant checking for inconsistent or faulty technique.



Possible Adaptations of the Test

The merit of combining forehand and backhand consistencies is not obvious. Some bowlers vary their delivery action according to their hand of play, and separated 'margins for error' may have greater value.

Four deliveries on each hand is rather a small sample for drawing reliable conclusions. However, bowls may be rolled back towards the delivery zone by helpers after marking the finishing position of each bowl. That procedure would enable a greater number of deliveries, and thus more reliable averaging.

Turns in the margin for error test do not alternate as in the tempo of a normal game. Consequently, the challenge to short term memory of the 'feel' of the delivery movement is appreciably less in the test compared with normal game play. Margin for error testing may be organised so that it follows normal game tempo, but recorded results should indicate the testing method used, and be evaluated accordingly.

Consistency is a factor of accuracy. Bowlers typically improve accuracy through practice over time. Improvement in consistency normally accompanies improvements in accuracy. Practice routines primarily for improvement of consistency are not in general use. In any case, accuracy routines adequately yield improvements in consistency also, and are of wider general value.

40-Bowl Accuracy Test

Recommended Method

The method of measuring draw shot accuracy advocated here is not new. As practice bowls come to rest, the method simply involves measuring the distance of each to the jack. Measured draw shot errors during practice (preferably under conditions that simulate competition) when compared with individual benchmarks indicate improvement in draw shot accuracy. That comparison also allows some inferences about likely competency at faster deliveries. Even novices are occasionally able to position a bowl against the jack. Even a champion is unlikely to be able to better such bowls. However, bowling accuracy depends on low average error for all shots, not on an average error that omits the results of wayward shots. The main inconvenience of this method is that measuring and recording the result of each bowl takes 10-20 seconds. Then, totalling and averaging at the end of the test takes another minute or two.

Procedure

Group Organization. Bowlers work in pairs, a pair to each rink. That arrangement enables completion of the test within about 60 minutes.

Order of Play. After a few warm up ends, each bowler proceeds by delivering all four bowls. On ends 1 to 5, the first two bowls are forehands and the last two bowls are backhands. On ends 6 to 10 the first two bowls are backhands and the last two bowls are forehands. This sequence enables valid comparison between forehand and backhand accuracy.

While one bowler is at the mat delivering four bowls, the other bowler measures, records results and kicks measured bowls clear.

Number of Ends. The test involves playing of 40 draw shots: 20 forehands and 20 backhands in 10 ends. Each bracket of ends (1 to 5 and 6 to 10) comprises three ends of medium length, one end of maximum length, and one end of minimum length. There is no need to deliver the jack at any stage. For ease of setting up the rink, bowlers simply centralise the jack at the specified point. For a minimum length end the mat is on the 2-metre mark and the jack is at the 23-metre alignment, or vice versa. For a maximum length end, the mat and jack are at opposite two metre marks. For a medium length end the mat is on the inner end of the chalk line and the jack is at the centre of the opposite chalk line, or vice versa.

Special Occurrences If the jack moves, the measurer replaces it before measuring. Measurers record no result for any bowl delivered on the wrong bias. They return the bowl for re-delivery. If a bowl on the correct bias comes to rest out of bounds, the measurer records the actual distance between it and the jack. If a bowl comes to rest in the ditch, the measurer adds 0.5 metres to the distance to the point where it entered the ditch. That extra distance is an arbitrary value of the overrun.

Recording. A calibrated rod or a flexible tape measure is suitable for measuring.



A suitable form for recording of measurements for each bowler is appended at page 119, and is as follows:

Player Name:

		End →	1	2	3	4	5			6	7	8	9	10		
		Length→	M	S	M	L	M			M	S	M	L	M		
		Mat→	C	I	E	T	C	Row			C	T	E	T	C	Row
Hand ↓	Jack→	E	T	C	T	E	Totals	Hand ↓	E	I	C	T	E	Totals		
Fore→	Bowl 1→						F ₁	Back→						B ₃		
Fore→	Bowl 2→						F ₂	Back→						B ₄		
Back→	Bowl 3→						B ₁	Fore→						F ₃		
Back→	Bowl 4→						B ₂	Fore→						F ₄		
Totals							1-5							6-10		

C=Centred, 4 m from ditch, E=Centred, 6 m from ditch, I=Centred opp. 23 m mark, L=Long, M=Medium, S=Short, T=2m mark

Rating of Overall Accuracy

The mean overall error is the aggregate of the 10 column totals divided by 40 (the total number of deliveries measured). Since the early-1990s, hundreds of Queensland bowlers representing all levels of bowling skill have undertaken the test. The median results they have achieved are as follows:

Group Description	Average Error
Novice, pre-pennant	1.5 - 3 m
Pennant - 5th division	~1.5m
Pennant - 4th division	~1.4m
Pennant - 3rd division	~1.3m
Pennant - 2nd division	~1.2m

Pennant - 1st division	~1.1m
Junior State Squad	~1.1m
State Development Squad	~0.95m
Junior State Singles Rep	~0.9m
State Squad	~0.75m
State Singles Representative	~0.55m

Variable winds or slick greens may adversely affect test results. Deferment of testing if the wind is gusting and continually changing direction should be an option. However, results on the day tend to be affected more by the form, focus and feelings of the participating bowlers than by environmental variables.

Particularly for the initial ends, the individual results of the first test ever undertaken by bowlers are often affected by the distraction of coming to terms with an alien procedure. Some candidates seek to undertake a second test as soon as possible so that they obtain starting benchmarks in which they have confidence. Bowlers that subsequently undertake training programs are able to repeat the testing procedure from time to time and obtain measures of their improvement. Intervals between tests might typically be 6 to 8 weeks. Such intervals are long enough for sustainable improvements to have occurred. They are short enough to provide regular progress indicators, to identify any pauses in improvement, and to enable detection of any aberrations in test results.

Forehand and Backhand Error

The total of forehand rows $F1 + F2 + F3 + F4$ is the aggregate error of the 20 forehand deliveries. Therefore, average forehand error is the total divided by 20. Similarly the mean backhand error is $B1 + B2 + B3 + B4$ divided by 20.

Random mean error differences from test to test between the 20 forehands and 20 backhands are unlikely to be of concern. However, superiority in the accuracy of one hand of play could limit shot selection options. Any necessary technique refinements and subsequent practice should focus on the less accurate bowl delivery hand of play.

Starting Slowly or 'Fading'

A useful comparison is the mean error of the first twenty deliveries (totals of columns 1 to 5, divided by 20), with the error for the last twenty deliveries (totals of columns 6 to 10, divided by 20). The test should be preceded by a couple of trial ends to enable candidates to warm up and assess the environmental conditions. A bowler's first attempt at the 40-bowl test typically results in a greater error for the first five ends than for the last five ends. Subsequent tests typically produce a much smaller improvement in accuracy the last 5 ends. Initial unfamiliarity with the process is then no longer a factor, and only the task of assimilating the conditions of the playing surface remains.

A large difference in error for the first five ends compared with the second five ends warrants attention. A bowler might fail to warm up properly, take some time to focus undistractedly on the task or to establish appropriate delivery line and length. For whatever reason, the results suggest a 'slow starter'. Conversely, a bowler might tire, sustain injury or discomfort, lose concentration, develop anxiety, or fail to notice changes in playing conditions. For whatever reason, the results suggest a 'tapering off' or a 'bolter'.

Excessive Reliance on Corrections

In each of the ten ends, the hand of play changes before the third delivery. Therefore, just as delivery 2 is an opportunity for bowlers to improve on the result of delivery 1; on the opposite hand, delivery 4 is an opportunity for bowlers to improve on the result of delivery 3.

Some bowlers take insufficient care with the first of each pair of deliveries. They tend to use the first delivery as a 'sighter' and the second delivery as a 'correction'. They place excessive reliance on the correcting capability of their second delivery. Elite-level bowlers take care to achieve the tactical objective with every delivery. When they achieve it with their first delivery, their second delivery becomes a bonus.

Thus, another useful comparison is the mean error of deliveries 1 and 3 (total 10 ends \times 2 = 20 deliveries) with that of deliveries 2 and 4 (also 20 deliveries). The total of rows $F1 + B1 + B3 + F3$ is the aggregate error of the 20 "first" deliveries. Therefore average "first" delivery error is that total divided by 20. Similarly the mean "second" delivery error is the total of rows $F2 + B2 + B4 + F4$ divided by 20.

Typically, there is marginal improvement in the mean error of "second" deliveries. However, there may be excessive reliance on "second" deliveries if their mean accuracy is disproportionately better than that of "first" deliveries. Where the mean accuracy of "first" deliveries is significantly better than that of "second" deliveries, there is a possibility that

each carefully executed and reasonably successful first attempt is followed by feelings of release of pressure and a more relaxed but less disciplined second delivery.

Consistency

Consistency' is the opposite of inconsistency. Inconsistency is a measure of bowl 'scatter' around the jack. The larger the scatter, the less consistent is the performance. For example, consider a case of bowlers A and B, in which the first half dozen measured errors of Bowler A might be 1.0M, 0.1M, 1.5M, 0.0M, 2.2M, and 0.6M. Those of Bowler B might be 1.0M, 0.9M, 0.8M, 1.1M, 0.7M, and 0.9M. A and B each has an average error of 0.9M, i.e. 90 cm. A brief examination of the results shows that Bowler B's results are fairly consistent, whereas Bowler A's results are highly variable, even though A got three bowls (2nd, 4th and 6th) closer to the jack than B managed to get with any attempts.

Appended at page 120 is a method for determining consistency from measured errors in accuracy.

Automatic calculation of consistency, in addition to all the averages defined above, occurs by keying the recorded test measurements into the table at '<http://home.austarnet.com.au/coaching/result40.html>'. Offline, a prepared spreadsheet is useful for calculating averages, standard deviations and consistency factors. The only task then remaining on each occasion is keying in the measured error for each test delivery. The computer calculates test results, virtually instantaneously. If a computer is not available and the tested group is not large, a pocket calculator may be an acceptable alternative.

The method involves use of a work sheet for entering error distances, calculating their standard deviation, and deriving consistency expressed as a percentage. The standard deviation is a measure of inconsistency of a bowler's errors. In the previous case, A's calculated standard deviation (or probable error) is 77 cm, and B's is only 13 cm. A's consistency factor is 37%, which is fair to poor and warrants diagnosis. By reducing bad deliveries (e.g. #5 = 2.2 m), A would not only become more consistent, but also reduce average error, thereby becoming more accurate than bowler B. B's consistency factor is 93%, which would be exceptional - anything over 70% is extremely good.

Inconsistency at the 'head' is commonly caused by inconsistency in a bowler's delivery action on the mat. When bowlers produce consistency results less than 40%, they and their mentors (possibly aided by a camcorder and a VCR with slow-speed replay) should analyse every phase of the delivery movement in an effort to spot occasional departures from grooved technique. Elimination of those variations could yield not only greater consistency, but also reduced mean error, i.e. improved bowling accuracy. A checklist for identifying variations in technique might include the following:

- Is the delivery process rushed?
- Does the bowler follow a routine for getting set on the mat?
- Does the aiming method appear to vary from shot to shot?
- Does the bowler wobble during the delivery process?
- Does the delivery action or follow-through vary from shot to shot?
- Does the bowler seem distracted by the testing process?
- Does the bowler seem fit and healthy with good eyesight and a competent judge of line and length?
- Does the bowler recall any poor deliveries and their likely causes?
- Does the bowler remember feeling any variations in balance or movements?

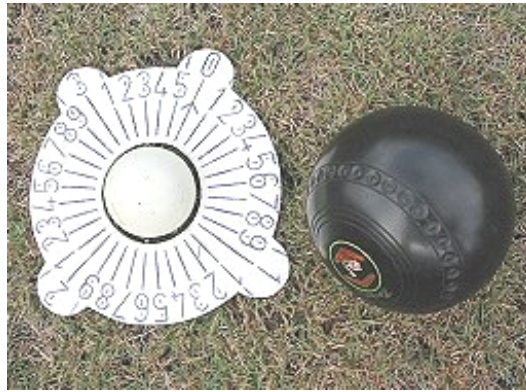
Target Bowling

Limitations of Draw Shot Accuracy Test

The various results calculated in the draw shot accuracy test constitute average finishing distances of bowls from the jack. That test takes no account of direction from the jack of bowl finishing positions. For example, a bowl that is a metre long is recorded no differently from a bowl that is a metre short. The usual task of bowlers is to draw their bowls as closely as possible to specific positions in the head, and distances alone suffice for many purposes. However, any persistent delivery faults often produce consistent error patterns in results achieved. For example, some bowlers might be consistently short: other bowlers consistently narrow, etc.

Bowls Target Protractor

Archers and shooters obtain knowledge of their results from their used targets. Bowlers can derive similar results by adopting an equivalent marking method. First, they require some form of bowls target protractor equivalent to the device in the following image:



This protractor was made of 3 mm Masonite. White enamel makes it damp proof, and provides good contrast for markings. The darker, zero line points up the centre of the rink towards the mat. Protuberances marked 0, 1, 2 and 3 readily identify 360/0°, 100°, 200° and 300° lines, respectively. Intermediate lines appear every 10°. The bowl in the image is at about 070°.

The protractor's inside diameter is large enough to slip over a jack readily. It is small enough for ease of centring and for providing adequate area for scalar markings. In this case, the inside diameter is 7.5 cm. The protractor's outside diameter is large enough to give it strength, to provide sufficient width for reasonably length of sighting lines, and provide sufficient space for numbers that are readily legible while standing. It is small enough to avoid interfering with close bowls and provide ease of handling. In this case, the outside diameter is 19 cm.

In use, it is a good idea to mark the green under the jack. If an approaching bowl is likely to have its course obstructed by the protractor, the marker can lift both jack and protractor, and exactly replace and align them after the bowl has passed.

Measuring Procedure

Many suitable procedural steps: e.g. working in pairs, playing warm up ends, measuring and recording duties, removal of measured bowls, etc are similar to those suggested for the Draw Shot Accuracy Test. The number of bowls allowable depends on the amount of available time. Bowlers should deliver a similar number of bowls as their partners, and should deliver similar numbers of forehands and backhands. Recording may be less prone to error if bowlers deliver all their forehands before any of their backhands, or vice versa. Forehands and backhands really require separate marking sheets and target charts. Bowlers should similarly separate results for shorter and for longer end lengths.

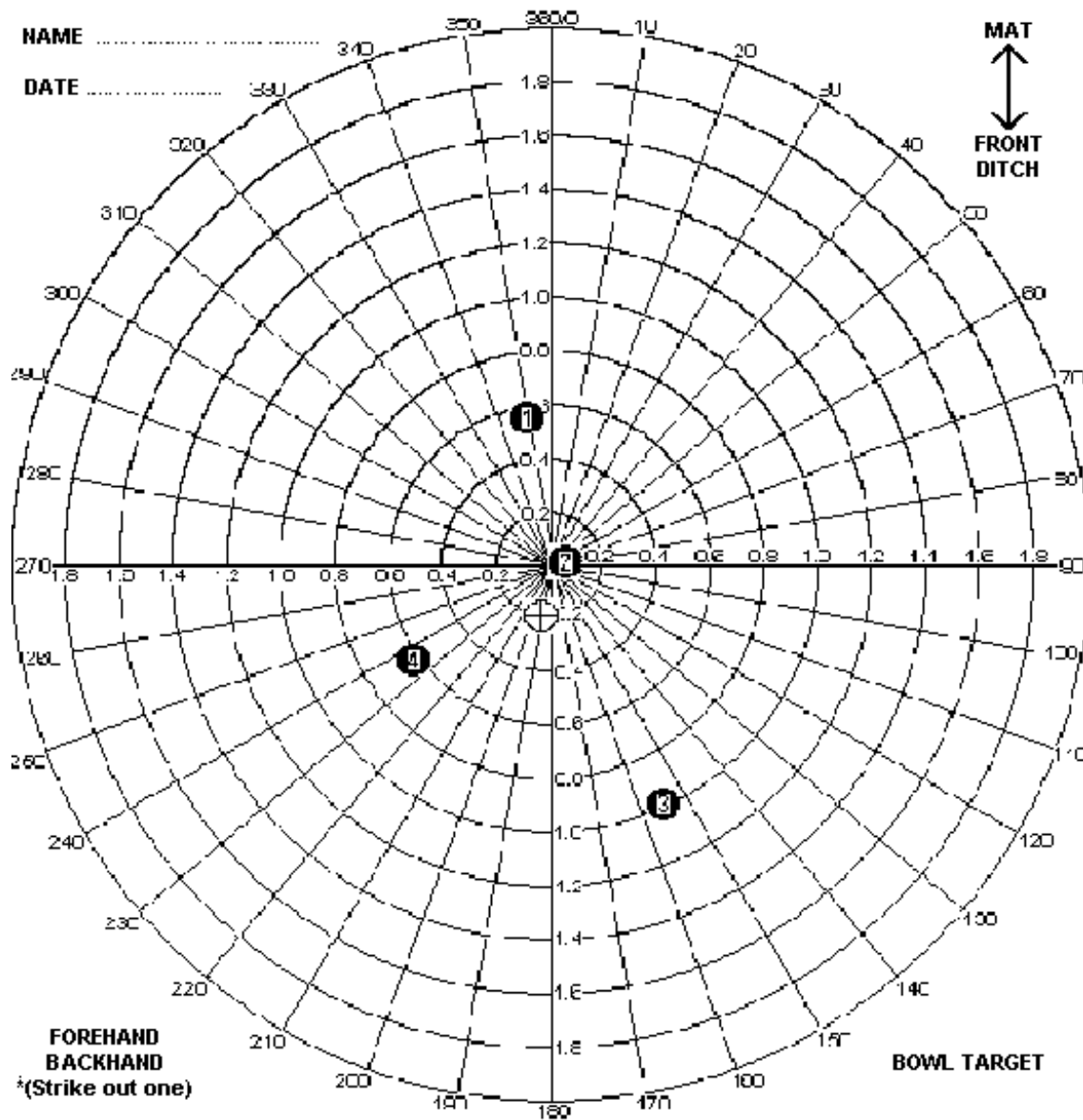
The procedure requires the measuring and recording of each bowl's finishing direction and distance from the jack. (A direction centrally between 150° and 160° would be 155°). A suitable sheet with four specimen entries is as follows:

Name.....			Date...../...../.....			End Length.....m			Fore/Back Hand		
No	Direction°	m/cms	No	Direction°	m/cms	No	Direction°	m/cms	No	Direction°	m/cms
1	349°	0.55m	9			17			25		
2	070°	0.07m	10			18			26		
3	155°	0.99m	11			19			27		
4	235°	0.62m	12			20			28		
5			13			21			29		
6			14			22			30		
7			15			23			31		
8			16			24			32		

Had the marker not removed each bowl after measuring and recording, those bowls would be located as follows:



However when bowlers plot the values of each bowl on to a bowling target, a similar picture emerges, as follows:



The target then shows the result of the same four deliveries (marked 1,2,3 & 4). The spread of these finishing positions indicates accuracy, and the possible presence of any consistent error tendency. The target also shows a spot about 0.2 m from the jack in the direction 190°. That spot could be considered the 'epicentre' of the pattern. Bowlers can estimate the position of the centre with satisfactory accuracy in many cases. A blank target plotting sheet is appended at page 121.

Calculating The Resultant Of All Test Deliveries For Plotting On A Target

A step-by-step procedure for precisely calculating the 'epicentre' of the pattern of test bowl finishing positions is appended at page 122

Interpreting Results

From the centre of the target, the resultant of the finishing positions of all test deliveries has a distance and a direction. The distance to the resultant position from the jack (variable R in step 6 of the calculating procedure) is typically much smaller than the average of the (error) distances to the finishing positions of each test delivery from the jack. The reason is that opposing errors offset one another in target bowl calculations. For example if a test delivery is 2 m past jack high, and another is 3 m short of jack high, offsetting produces a result (for those two deliveries) of 1 m short. However, the average of the error distances is really the average of 2 m and 3 m, which is 2.5 m.

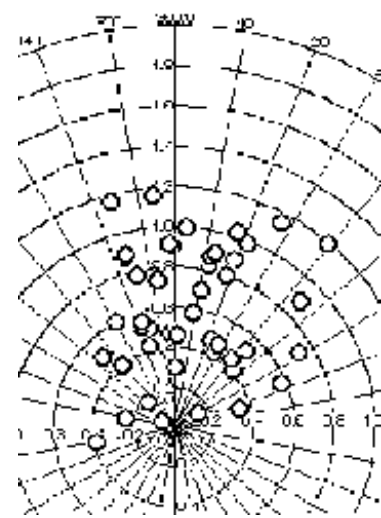
The direction of the resultant of the finishing positions of all test deliveries is relative to the viewpoint of an observer behind the head. Irrespective of the actual direction of the line of play on the rink, a direction of the resultant around 000° (i.e. 350°, 360/000°, 010°, etc) indicates a tendency for bowls to finish in positions farthest from the observer. From the viewpoint of the player on the mat, they indicate a tendency for bowls to finish before reaching the jack. In other words, the player's short deliveries tended to be shorter than the long deliveries were long.

A direction of the resultant around 180° (i.e. 170°, 180°, 190°, etc) indicates a tendency for bowls to finish in positions nearest the observer. From the viewpoint of the player on the mat, they indicate finishing positions behind the jack. In other words, the player tended to bowl long.

Angles near 090° (i.e. 080°, 090°, 100°, etc) are to the left of the jack from the viewpoint of the player on the mat. Differences in interpreting such a result arise from right or left-handedness, and from whether the delivery direction is forehand or backhand. For a right-handed player, such angles indicate narrow bowling for forehand deliveries but wide bowling for backhands. For a left-handed player, angles near 090° indicate wide bowling for forehand deliveries but narrow bowling for backhands. Angles near 270° (i.e. 260°, 270°, 280°, etc) are to the right of the jack from a player's viewpoint. For a right-handed player, they indicate wide bowling for forehand deliveries but narrow bowling for backhands. For a left-handed player, angles near 270° indicate narrow bowling for forehand deliveries but wide bowling for backhands.

The use of two sheets for each player tested enables separation of forehand and backhand delivery results. Such separation avoids much complexity in interpreting results.

The adjacent diagram shows the resultant of bowl finishing points for each player in a trial squad of experienced bowlers. There are two points for each player: one for result of 20 forehand deliveries and one for the result of 20 backhands. The sectors trimmed off the target contained no data. The bottom of the image is the direction of the front ditch, and the top is the direction to the mat. The finishing points are distributed rather evenly about the vertical mid-line. This indicates that the distances 'narrow' largely offset the distances 'wide'



Except in one instance, the resultant finishing points are all 'above' a horizontal line through the centre of the grid. In other words, all but one of them is between the mat and the jack. The mean distance error of the 40-bowls delivered by each bowler (determined as a step in target bowling calculations) was 1.51 m. For every bowl that averaged 1.2 m long, another bowl averaged 1.8 m short. The mean, or average, of 1.2 m and 1.8 m corresponds with the 1.5 m mean. The result of offsetting 1.2 m long against 1.8 m short is 0.6 m short, which corresponds with the median bowl finishing point apparent on the target. In other words, short bowls averaged about 0.6 m shorter than long bowls were long. Had the players aimed at a position 0.6 m (2 ft) behind the jack, the circles on the target might very well have all 'moved down' the diagram so that they clustered around the bullseye.

Lawn Bowl Dynamics

Choosing Bowls

Buying Second Hand

Novices need their own set of bowls as soon as they can afford them. They can achieve savings through buying second hand. However, if they are disinclined to bargain, they may do better to buy a new set. They have no choices regarding bowl size, etc if the seller has only one set available at the time and place. They should remember that the seller is unlikely to be an impartial adviser.

Prospective buyers should avoid bowls with extensive scratching of the running sole. Frequent driving on greens with gritty ditch beds often results in the scratching of spinning bowls. Bowlers should empty grit from their bowls cases regularly. Wear and tear over time or deliberate reshaping can affect the bias of bowls. Particularly if contemplating the purchase of used bowls of uncertain origin, they should have the set of bowls table-tested to ensure that they have complying bias.

Testing involves comparing the curvature of the entire path of each bowl in a set of any size as they traverse the table, with that of a 12.7 cm (size 5) master bowl. Table testing should show that each bowl in the set not only has bias exceeding the allowable minimum, but also has equal, or matching bias. The bias or turn of bowls should be marginally greater than that of the master or reference bowl. The margin provides an allowance for minor testing variables, and for a small reduction in bias due to wear.

Brand or Make

No one brand of bowl is technically superior to any other. All brands have exact raw material specifications. Their products have comparable running surface hardness and durability. The precision of bowl manufacturing processes is universally high.

Bowl Weight

Bowl sets are commonly made in several weights. Heavyweight bowls are about 4% heavier than medium weights of the same size. Extra-heavyweights are only about 3½% heavier than heavyweights of the same size. As no bowl may weigh more than 1.59 kg, the limit means extra heavyweight bowls are unavailable in the largest sizes.

These weight differences are not unimportant but they are not very large. Many bowlers lack the tactile sensitivity to detect the differences (just as many bowlers are unable to detect differences in the feel of right and of wrong bias). The claimed performance merits of bowls of a particular weight are sometimes so exaggerated that they are patently misleading. When asked for reasons for their choice, extra heavyweight bowl users commonly give unpersuasive responses. The marginally greater inertia of extra heavyweight bowls is of negligible benefit in attacking play.

The heavier the bowl, the greater is its stability in windy conditions or on small imperfections in the playing surface. However, bowlers using extra heavyweight bowls are obliged to work a little harder. Given that an extra-heavyweight is about 3% heavier than a heavyweight bowl, it experiences 3% more friction against the playing surface during its run. (The force of friction is proportional to the perpendicular force between the surfaces in contact.) That 3% extra friction would translate into a corresponding reduction in run distance for a given delivery speed. To avoid short bowling, bowlers using extra heavyweight bowls must add 6% $((1 + 0.03)^2 - 1)$ to their delivery speeds.

Bowl Model

Modern bowls, sometimes called 'minimum bias' bowls, are an advantage where the pace of green exceeds 14 seconds. Their reduced aiming angle, relative to bowls with pre-1987 bias, brings the awareness of the object position in peripheral vision closer to the aiming line, thereby making judgment of delivery speed and aiming line relatively easier.

Some bowl models have paths of more even curvature than others. Some models have paths of less curvature until they approach the end of their run where the curvature increases, and overall bias requirements are achieved. Bowlers sometimes describe the shape of paths of different models of bowls with metaphors such as: bananas, crescent moons, hockey sticks, etc.

The similarities in the finishing paths of different bowl models are greater than observable differences. Experience at head directing or with comparisons using bowl delivery chutes tends to confirm those similarities. This is not to say that

there are no differences in finishing paths; merely that they are commonly exaggerated. Particularly on fast greens, a reduced 'hook' in the finish of a bowl, makes drawing to the edge of the ditch or 'resting' against the front of a stationary bowl relatively easier to execute. On slower greens however, bowls with a 'straighter' finish could reduce the differences in tactical possibilities of forehand and backhand approaches into tight heads, thereby offering skips and thirds in particular, fewer options. For singles players, leads, and seconds, choice of bowl model is more a matter of personal preference than of necessity

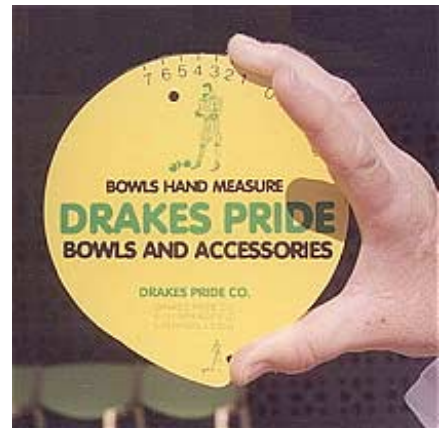
Bowl Size



The most critical option when choosing bowls is bowl size. Arguably it is more important than all the other options combined. Bowl sizes, from smallest to largest are: 00, 0, 1,2,3,4,5,6, and 7. Diameters are in the range 115 to 130 mm. Handling comfort is the main consideration in choosing the size of a bowl. Any variation from the measured size should err on the side of being slightly small than too large. In most instances, bowls that are too large cause greater handling difficulty than bowls that are smaller than the measured size. Bowlers can estimate a suitable bowl size by encircling a bowl, so that the tips of middle fingers and thumbs approximately touch as in the left image.

By placing the thumb of their bowling hand against the stop on a bowl size card indicator, bowlers can read their maximum size from the printed scale under the tip of the extended middle

finger as in the right image.



A gripped bowl should not fall out of the hand when inverted. The grip should be secure and comfortable. Bowlers should feel that their bowls ideally suit them. They should choose their bowls from the range of options that they 'feel' are right for them. After size, the most important aspect of choice of bowls is the confidence with which bowlers own and use them.

Bowl Speed Mechanics

The Nature of Bowls Greens

Bowls greens are level rectangular surfaces up to 40 metres square. Many outdoor greens have playing surfaces of groomed natural grass. Surrounding the green is a ditch wide enough to trap bowls that overshoot the playing area. Ditches may also assist drainage of the green. The level of the green is at least 23cm lower than its immediate surrounds, or bank. The extension of the exposed face of the bank forms the outer limit of the ditch.

Pace of Green

Leafy, damp, soft greens have high friction and are 'slow'. Brownish, dry, firm, mown and rolled greens have low friction and are 'fast'. The harder surface of faster greens provides lower friction losses. Bowls thereby have lower rates of slowing down, or decelerating.

The pace of green is the measured time in course of a bowl that comes to rest 27 metres from the delivery point. Measurement of the pace requires merely a tape of adequate length and a digital watch. Different areas on a bowling green may yield different timings because of variations in grooming treatment, surface moisture content, etc. Head winds tend to assist the braking effect of the green and result in timings lower than those for windless conditions. Tail winds tend to have the opposite effect.

The required release velocity for a 27 metre run is 16.2 kilometres per hour when pace is 12 seconds, but only 10.8 kilometres per hour when pace is 18 seconds. On faster greens, bowls require lower release velocities (33% less in the examples given) to run a specified distance. Time (pace of green) equals distance (27 metres) divided by speed (mean velocity). The lower the required mean speed of a bowl to run a particular distance, the higher is the pace of green. Whatever the pace of green, bowls and jacks released at the same time and velocity will be in course for similar times and will run similar distances. The turning effect of bias is largely irrelevant to pace of green considerations.

Retarding Force of a Green

Readers know that a bowl or a jack in motion slows down and eventually comes to rest, even if not prematurely stopped by an object in its path. Natural grass and synthetic greens have elastic or deformable surfaces. The energy that propels a bowl dissipates by compressing the surface of the green along the bowl's path. A universal law of science is that energy cannot be created or destroyed. The mechanical energy of a moving bowl progressively converts into heat energy, which fractionally raises the green surface temperature under the moving bowl. In absorbing the mechanical energy of a bowl, a green presents a braking force.

From experiments with falling objects Galileo (1564-1642) found that gravity is a form of acceleration. Sir Isaac Newton (1643-1727) found that the force applied to a body of given mass is proportional to the imparted acceleration. This relationship applies generally, not just to instances where gravity is the acceleration force. Deceleration, or retardation, is negative acceleration and produces a braking force.

The general formula for calculating the friction force f of a green in bringing a bowl of mass m to rest is

$$f = m \times a, \text{ where } a \text{ is the rate of deceleration of the bowl.}$$

For a particular bowl, mass m is constant, so

$$f \propto a,$$

i.e. the rate of deceleration of a bowl is proportional to the friction force of the green that eventually brings a bowl to rest, where final velocity $v = 0$. The rate of deceleration of a bowl in motion is constant.

Bowl Deceleration Rate

Deceleration of a bowl in motion occurs at a constant rate. In these circumstances, the general formula for calculating the deceleration is:

$$a = \frac{2S}{t^2}, \text{ where } S \text{ is the run distance, and } t \text{ is the duration of the bowl's motion.}$$

For a known pace of green, both S (27 metres) and t (pace of green in seconds) have known values and deceleration a calculates, as follows:

$$a = \frac{2 \times 27}{t^2} = \frac{54}{T^2}, \text{ where } t \text{ is the measured pace.}$$

Values of the decelerating effect for a range of green speeds is as follows:

Green Pace (secs)	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Bowl Deceleration a (m/sec ²)	1.10	0.84	0.67	0.54	0.47	0.38	0.32	0.28	0.24	0.21	0.19	0.17	0.15	0.14

The marginal extra weight of heavyweight (4%) and extra-heavyweight (3.5%) bowls causes extra surface contact area and friction. Such bowls would have marginally higher bowl deceleration rate for each pace of green. Bowl deceleration rates are of little direct value, but they constitute the basis for some interesting relationships.

A Method of Calculating the Pace of Green

Pace of green is calculable from a timed delivery over any measurable distance. The calculation requires a transposed version of the formula under the previous heading. The equivalent pace of green T for the standard 27-metre test distance becomes:

$$T = \sqrt{\frac{27 \times t^2}{S}}, \text{ where } t \text{ is the elapsed time and } s \text{ is the measured run distance}$$

Bowl Delivery Speed

The formula for calculating the required delivery speed u of a bowl to run distance s is:

$$u = \sqrt{2as}$$

, where a is the deceleration rate of the bowl.

The required delivery speeds of bowls to run a particular distance on a green of a particular pace appear in the adjacent table.

On very fast greens, bowlers tend to feel that they attain necessary run distances by doing little more than allowing their bowls to trickle out of their hands. Nevertheless for a run distance of 28 metres on a 20 second green, a bowl delivered at less than 10 km/hr will stop short.

Required Delivery Speed (kph)

Head Distance (m)	Green Pace (sec)				
	10	12	14	16	18
21	17.1	14.3	12.2	10.7	9.5
24	18.3	15.3	13.1	11.5	10.2
27	19.4	16.2	13.9	12.2	10.8
31	20.8	17.4	14.9	13.0	11.6
36	22.4	18.7	16.0	14.0	12.5

A transposition of the previous formula takes the following form:

$$s = \frac{u^2}{2a}$$

In unchanged environmental conditions the value of $2a$ is constant so $s \propto u^2$, i.e., run distance of a bowl is proportional to the square of the delivery speed. Therefore any error in run distance of a bowl is proportional to the square of any error in delivery speed. For example, on an 11 second green, a 28 metre run distance requires a bowl delivery speed of 5 m/sec. Suppose the actual delivery speed is 5.25 m/sec, which is a 5% error. The extra run distance obtained is proportional to the square of the error:

$$s = 28 \times \frac{105 \times 105}{100 \times 100} = 30.87 \text{ m}$$

Thus the extra 5% of delivery speed produces an extra 2.87m of bowl run, which constitutes a 10.3 % error in the result. This compounding effect of delivery speed errors makes accuracy in distance more difficult to learn and master than accuracy in delivery line. Driving speeds of leading bowlers measured on police speed guns as a novelty feature at bowls carnivals commonly show values in the 30-50 km/hr range. Delivery speeds for drives are typically about 3 times those of draw shots.

Delivery of a Bowl from a Chute

Testing of bowls requires a consistent and controllable mechanism for launching the bowls. The most commonly used device is an inclined ramp with a narrow track for providing fine control over launching direction. Following its release from an elevated point on an inclined chute, a bowl accelerates as it rolls downward under the influence of gravity.

Tables used for bowls testing allow test runs in the range 8 - 11 metres. Their fast surfaces have an equivalent pace in the range 21.5 to 27 seconds. The combination of short runs and fast surfaces requires only short, low launching chutes.

Required Elevations for Chute Deliveries

The exit speed u of a solid sphere (such as a bowls jack) launched from elevation h on an inclined chute is available from the general formula

$$u^2 = 2hg$$

Lawn bowls are oblate spheroids. Although they lack the spherical symmetry of jacks, the angular momentum they develop in rolling down a chute does not significantly differ from that of equivalent spheres. Therefore the mechanical behaviour of bowls conforms quite closely with the general formula.

Transposition of the previous formula to calculate the required elevation h of a bowl for an exit speed u produces

$$h = \frac{u^2}{2 \cdot g} = \frac{0.7u^2}{g} \quad (\text{approx}), \text{ where } g \text{ is gravitational acceleration (981 cm/sec}^2\text{)}$$



Experimental run distances required may exceed the length and width of a bowling green. Run distances of bowls of nearly 55 metres are achievable by setting up a chute diagonally in one corner of a green. Variations in pace of green will correspondingly affect run distances.

By combining the formulas for *a*, *u* and *h* (above) and substituting for *a* and *u*, another formula for calculating required elevation *h* emerges:

$$h = \frac{2.8s}{t^2} \quad (\text{approx}), \text{ where } s \text{ is the required run distance and } t \text{ is the pace of green.}$$

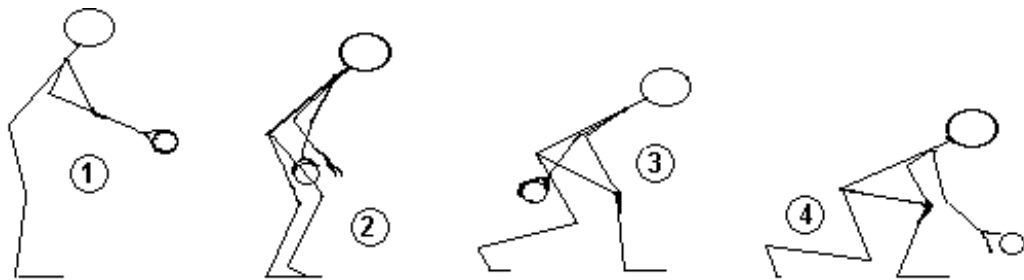
Required Delivery Chute Elevation (m)

Head Distance (m)	Green Pace (sec)				
	10	12	14	16	18
21	1.63	1.14	0.83	0.64	0.50
24	1.87	1.30	0.95	0.73	0.58
27	2.10	1.46	1.07	0.82	0.65
31	2.41	1.68	1.23	0.94	0.74
36	2.80	1.95	1.43	1.09	0.86

The adjacent table shows the required release height (cm) on a delivery chute for a bowl according to the required run distance and the pace of green.

Elevation in Manual Deliveries

Bowlers commonly use gravitational force in generating required bowl delivery speeds like the method shown in the following figures (1) to (4). They elevate the bowl in the set up (1). They use some gravitational energy to augment muscular force in producing the back swing (2). On completing the back swing (3) the bowl might have only about half of its initial elevation as bowlers bend their bodies into the delivery posture. Bowlers use muscular force augmented by gravitational energy again in producing the forward or delivery swing (4).

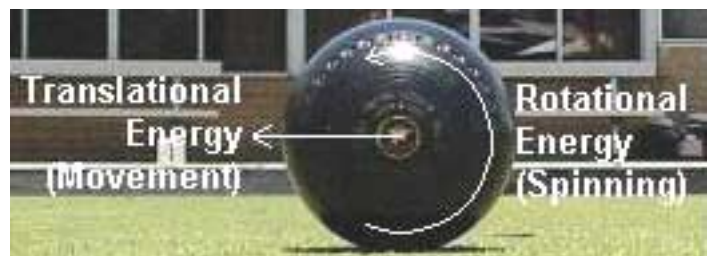


1 Upright stance facilitates judgement of required line and length
2 Co-ordinated gravity and muscular forces initiate back swing
3 Optimum step length is equal to length of lower leg
4 Lowered C of G gives a broad, stable support base and avoids bowl 'dumping'

Bowl Impacts - Wrestling and 'Run Through'

The mass of a bowl in course not only changes position but also spins. Thus it has translational energy (movement) and rotational energy (spinning).

As a bowl leaves an inclined chute, there is a relatively smooth transition as it begins its run along the green. However a manually delivered bowl has no rotational energy as it contacts the green. It is not possible to impart topspin. Therefore a manually delivered bowl initially skids as some of its translational energy converts to rotational energy. The conversion of energy continues until the bowl has angular velocity, or spinning speed, at which skidding stops. Bowlers intuitively impart the total energy required to deliver a bowl that will run a particular distance in given circumstances.



A bowl has about 7 times the mass of a jack. If a bowl collides with a stationery jack, little variation in speed or direction of the bowl's movement may be perceptible. The jack will tend to move in a direction opposite to that of the point of impact. If a jack collides with a bowl at rest, negligible movement of the bowl may occur.

'Impact' refers to the mechanical action of a bowl in motion (impacting or wresting bowl) on a bowl at rest (impacted or wrested bowl). The last paragraph but one indicated that a bowl in course has translational energy (movement) and rotational energy (spinning). Upon impact, the wresting bowl may retain much of its spinning energy, but may transfer much of its energy of motion to the wrested bowl, forcing it to move.

Bowlers sometimes deliberately play impact shots. They sometimes use the term 'wresting shots' to describe attempts at forcing a bowl at rest either into or out of the 'scoring zone'. They sometimes use terms like 'follow-through' or 'run-through' to describe a wresting bowl that displaces a stationary bowl yet retains sufficient momentum to advance to a tactically advantageous position in the scoring zone. Because of the tactical possibilities, the basic mechanics of bowl impacts are worth consideration.

Contrary to the expectations of some bowlers, experiments show that the distance and direction that the wresting and wrested bowls move after impact is virtually unaffected by whether the bowl at rest is on its 'side' or is 'upright' when impact occurs. The main variables that determine distance and direction of subsequent movement are impact speed and angle of impact. The tolerance for error in impact speed is typically about $\pm 2\%$. An impact speed error of $\pm 2\%$ translates into a run distance error of $\pm 4\%$, or about ± 1 metre. In the context of 'yard-on' shots, an error of a metre would usually result in failure to achieve the tactical objective. For both wresting shots and follow-through shots, the tolerance for error in delivery line is typically less than one quarter of a degree. An error outside the latter tolerance means missing the targeted bowl altogether. Therefore, accuracy of delivery line is usually more critical than bowl speed accuracy. In any case, tactical success of wresting shots or follow-through shots typically has rather small margins for error.



In explanation of wresting shots and follow-through shots, the term 'Notional Run' is the extra distance that a bowl would have rolled before coming to rest had its course been unobstructed.. The term 'Impact angle' is the angle between a line through the point of impact and the alignment of 'full-face' or 'dead-centre' impact. Thus the angle of full-face impact is 0° , and the angle of oblique impacts cannot exceed 90° . 'Wrested Distance' or 'Follow-Through Distance' is the distance that the corresponding bowl moves after impact before coming to rest. 'Wrested Angle' or 'Follow-Through angle' is the angle between the direction that the corresponding bowl moves after impact and the direction of 'Notional Run'.

Wresting Shots

Impact Angle	0° ('full-face')	30° (about. 5 cm 'off-line')	50° (about 9 cm 'off-line')
Wrested Angle*	About 0°	16–20°	44–46°
Wrested-Distance	45-49% of Notional Run	41-47% of Notional Run	22-30% of Notional Run
(.:) Required Notional Run	About twice the required wresting distance	About twice the required wresting distance	About 3 – 4 times the required wresting distance

**The Wrested Angle tends to be of similar size to the Impact Angle*

‘Follow Through’ or ‘Run Through’ Shots

After impact, the retained rotational energy of the wresting bowl retains a component of momentum in the direction of

Impact Angle	0° (‘full-face’)	30° (about 5 cm ‘off-line’)	50° (about 9 cm ‘off-line’)
RT/FT Angle*	About 0°	7–10°	16–25°
RT/FT-Distance	18-19% of Notional Run	30-32% of Notional Run	58-59% of Notional Run
(∴) Required Notional Run	About 5 – 6 times the required run-through distance	About 3 times the required run-through distance	About 1½–1¾ times the required run-through distance

motion before impact. The remaining translational energy produces a component of movement of the wresting bowl at right angles to a line from its centre to the impact point. The resultant of these two components defines the direction and distance of follow-through.

Delivery Angle Mechanics

Static Characteristics of Bowls

Lawn bowls are spheroids with greater curvature near their running sole, or plane of maximum circumference, than near the poles of their spinning axis. Small rings, or ‘discs’, engraved around these poles identify their locations. Because of their shape, bowls are statically unstable except when resting on either of their discs. On a firm surface, unsupported bowls will topple and rock into a stable position. On an uneven or deformable surface such as a leafy bowling green, they may rest stably other than on one of their discs if the area of contact extends under their centres of gravity.



Manufacturers mould and shape bowls so that there is fractionally more mass on one side of the bowl. This shaping moves the centre of gravity away from the bowl's plane of maximum circumference. The C of G offset of a bowl with the old (pre-1987) bias is about 0.9 mm. Modern bowls have an offset of about 0.75 mm.



This offset provides an arm for a moment of toppling force created by the bowl's own weight. The moment of force is equivalent to a weight of about 23 grams tugging downward at the small disc. This moment of force constitutes the bias of the bowl. The slightly reduced C of G offset of modern bowls gives them less bias. Bowls placed with their running sole on a firm surface invariably topple towards the smaller ring, or biased side.

The asymmetric shape of a bowl creates asymmetric weight distribution. This unequal weight distribution creates a bias. Readers can readily demonstrate this with a tennis ball and a piece of blu-tack© about the size of a pea. Roll the unmodified tennis ball along a level surface and

it runs straight, like a jack. Now apply the lump of blu-tack© to the tennis ball. Grip the ball with the blu-tack© facing the forehand or backhand side. The weight of the blu-tack© is enough to create a bias. The tennis ball will follow a parabolic path just like a biased bowl. Note that the procedure did nothing to alter the shape or contour of the running surface. The lop-sided weight distribution creates the bias and turns the tennis ball. Alteration of contour of a bowl will affect bias if it changes the asymmetry of weight distribution along the spinning axis of the bowl.

Mechanics of Bias

Rotating objects such as flywheels and bowls in motion share some common physical properties as shown in diagram A in the adjacent image. In drawings 1 and 2 the object is stationary. Drawing 1 shows how a downward force at one end of the rotational axis tends to topple the object. Drawing 2 shows an equivalent effect results from a horizontal force applied from the opposite side near the top edge of the object. If the object rotates, gyroscopic effects apply. The toppling force at the top edge moves 90° in the direction of rotation, as shown in drawing 3. This causes the object to change its plane of rotation instead of toppling, as shown in drawing 4.

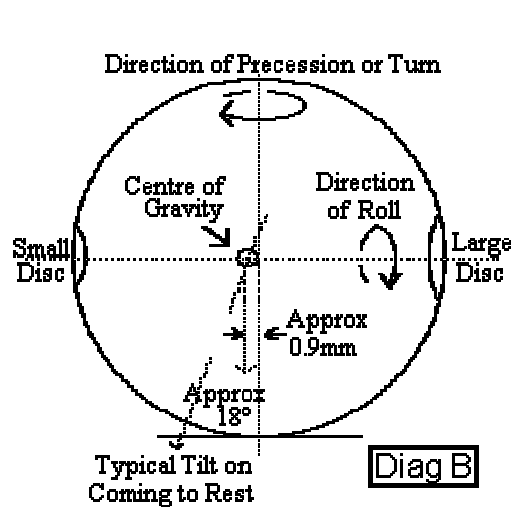
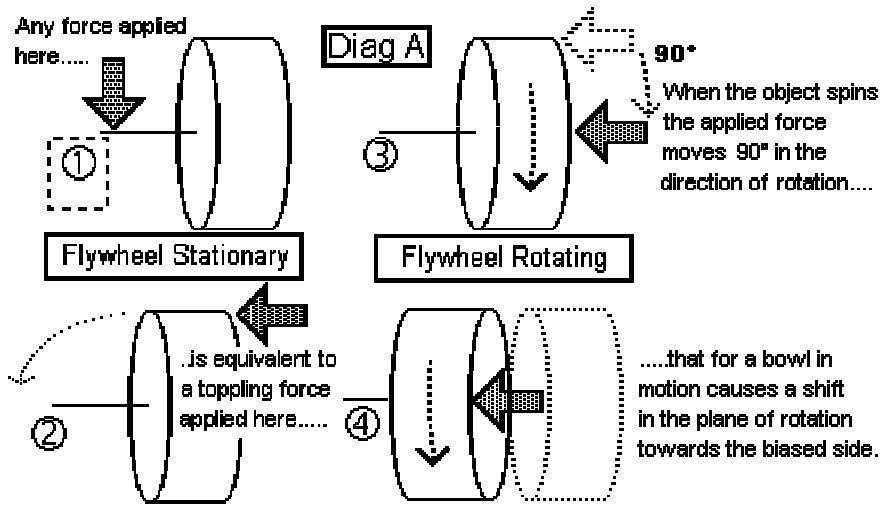
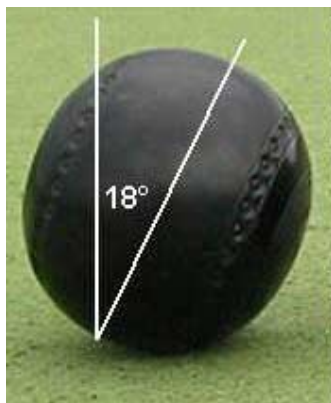
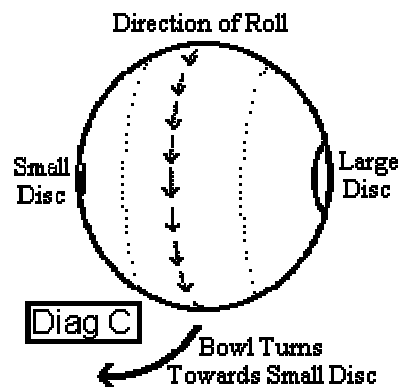


Diagram B shows how the same principle applies to biased lawn bowls. It shows the cross section of a bowl advancing towards the reader. The moment of the weight of the bowl acting downward from the offset centre of gravity creates a toppling force. This moment of force has a tendency to topple the bowl towards the reader's left. However as the bowl rotates towards the reader, gyroscopic effects cause the force to move 90° so that it acts from right to left at the leading point of the bowl's plane of rotation. This causes the bowl to turn to the reader's left towards its smaller disc as in diagram C.

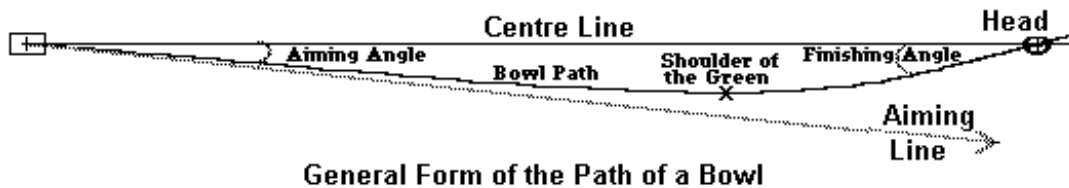


As a bowl follows its characteristic curved path, it progressively tilts towards its biased side. The angle of tilt as a bowl comes to rest is about 18°. At that point the centre of gravity is above the point of surface contact. The bowl then either remains at the angle, or rolls over on to its small disc.

A bowl's total turn, or 'precession', depends on the offset of its centre of gravity. As a bowl slows down, its rate of turn proportionally



increases. The rate of turn also depends on the profile of its running sole. Bowls of all sizes of a particular model have profiles similar to one another, but different to those of other models or manufacturers. The profile of the running sole affects the shape of a bowl's path, i.e. the relative position of the shoulder, and the sharpness of the finishing angle, both of which appear in the following diagram.



General Form of the Path of a Bowl

Some bowlers believe that different grass varieties or different playing surfaces (synthetic or lawn) affect the line of a bowl. However, evenly groomed surfaces of equal pace will all result in similar bowl performances. If a particular type of grass appears to affect bowl performance differently, testing will show that the pace has changed.

Any cross wind present will tend to align with the horizontal arrow in flywheel diagram A (2). If its direction is from right to left in that diagram, it acts with the bias of the bowl and increases the amount of turn. If its direction is from left to right, it acts against the bias of the bowl and reduces the amount of turn.

Bowl Aiming Angle

Aiming line is the required direction of delivery to offset the turn of a bowl due to its bias. Aiming angle is simply the angle at the point of delivery that the aiming line makes with a straight line to the object position in the head.

Irrespective of size, all bowls should have a bias not less than that of a standard test bowl, and all bowls in a particular set should have the same bias. However different types of bowls have different amounts of bias. Bowls with the 'old' (pre 1987) bias required an approximate aiming angle as follows:

$$A = \frac{1}{\text{arc tan } \frac{0.5}{a}}$$

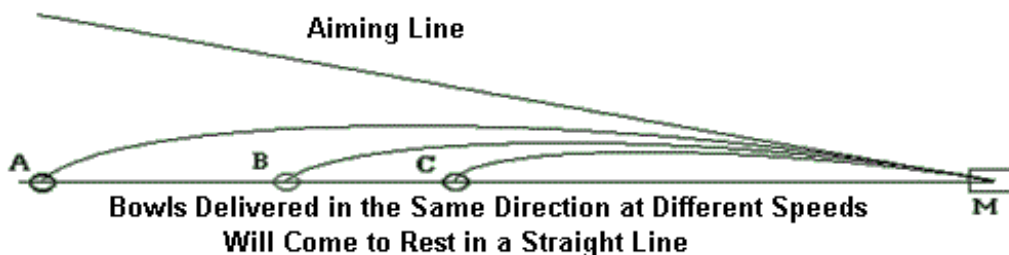
, where A is the angle (radians), and a is the rate of deceleration (m/sec²) of the bowl.

The faster the green, the greater is the required aiming angle to offset the bias. Use of the preceding formula produces the aiming angles in the last row of the following table for a range of green speeds:

Green Pace (secs)	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Bowl Deceleration a (m/sec²)	1.10	0.84	0.67	0.54	0.47	0.38	0.32	0.28	0.24	0.21	0.19	0.17	0.15	0.14
Aiming Angle A (degrees)	2.6	3.4	4.3	5.3	6.4	7.6	8.9	10.3	11.8	13.3	15.0	16.7	18.5	20.3

In 1987, bowls authorities approved a master bowl of reduced bias that replaced the existing (pre-1987) reference bowl. The reduction in bias was about 18%. So bowls manufactured to the newer bias standard require aiming angles of about 82% (approx 4/5ths) of corresponding aiming angles of older bowls. Bowl manufacturers introduced a range of new models with the reduced bias. Licensed bowl testers use the same master bowl for table testing of bowl sets of any size. Allowable bias is the same irrespective of bowl size. Some bowlers mistakenly believe that small bowls have more turn or bias than larger bowls.

Although cross winds affect the aiming angle, the run distance s does not. As the following figure shows, bowls delivered in the same direction at different speeds will come to rest in a straight line:

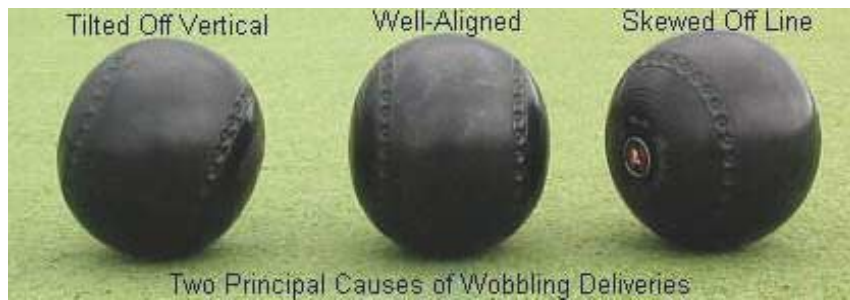


Fast attacking deliveries require a reduced aiming angle. Bowl speed and aiming angle combinations vary not only with tactical requirements but also from one type of bowl to another. Bowlers can succeed with controlled speed by drawing to an imaginary jack beyond the target so that the expected path of a bowl will traverse the target's location.

The slower the green speed, the larger is the aiming angle required by a fast attacking delivery to an object bowl in the head. The longer a bowl is in motion, the more its bias makes it turn. Bowlers tend to drive with an individually comfortable and consistent rhythm and pace. For a particular driving speed, a bowl on a slower green experiences greater friction, greater deceleration, lower impact speed and greater time in course from mat to target. The greater time in course allows greater turn, so the bowl requires a greater aiming angle. Drives on slower greens using aiming lines suited to faster greens, will run narrow and miss the target by typically up to a metre.

Bowl Wobble

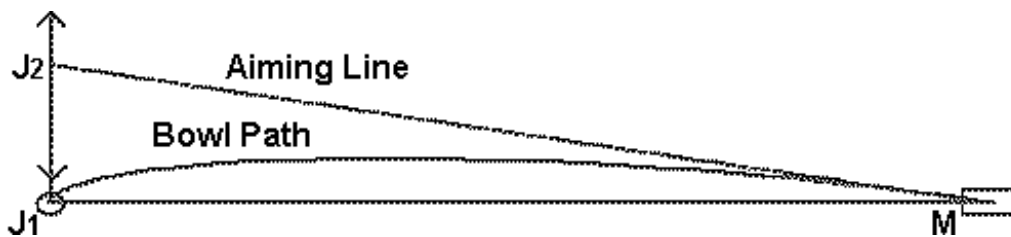
There are two principal causes of bowl wobble. Wobble occurs if the coaxial engraved rings of the bowl are not parallel with the direction of delivery. The spinning axis is thereby not square to the delivery line. Wobble also occurs if the engraved rings are tilted instead of being vertical. These conditions appear in the following figure:



Bowls canted left or right or skewed left or right to the same degree will all wobble identically. A correctly aligned bowl will wobble if wrist or finger movement occurs during delivery or if a bowler applies propelling force other than through its centre. In either case the bowl is likely to begin its course either off square or tilted.

Wobble is an unstable condition that generally damps out while a bowl is in course. A driven bowl might wobble until it strikes its target or enters the front ditch. The slower the green, the quicker wobble dissipates. While wobble persists, it effectively reduces the offset of the bowl's centre of gravity. Consequently wobbling bowls turn less than normal. Random wobble causes random bowling accuracy. Some bowlers grip the bowl in a canted position for delivering a drive. They force a wobble, which makes their bowl follow a straighter line. There is no way of imparting a sustained tilt for the run of a bowl.

Length of Curved Path



In the preceding diagram, J_1 represents a jack. Line MJ_1 is the direct line to J_1 , and is readily measurable. The diagram also shows the superimposed path of a bowl. The length of the curved path to J_1 is equal to the length of MJ_2 , where J_2 is the point on the aiming line that is 'jack high'. The length of MJ_2 , and therefore the run of the bowl is:

$$MJ_1 + \cos A, \text{ where } A \text{ is the aiming angle.}$$

The extra run distances of Classic Deluxe bowls along their curved path, compared with the direct distance to their final position appear in the adjacent table. The extra run is much smaller than many bowlers suppose. The extra run of bowls with the new (1987) bias is even less than the values in the table.

On 'fast' greens, bowls leave the centre line of the rink by several metres before they draw in again. Some bowlers intuitively speculate that the total extra distance travelled by bowls is several metres. The actual run distance of a bowl can be found by dropping markers as it passes, extending a cord from marker to marker, and then measuring the straightened cord after the bowl comes to rest. The curved path of a test delivery to measure pace of green on, for example, an 18 second green will exceed the direct distance (27 metres) by no more than 119 cm, or about 4.5%. On a 12 second green the actual difference would be only 24 cm, or less than 1%.

**Extra Run of Bowl (w/ pre-1987 bias)
In Reaching Destination by Curved Path
Compared with Direct Distance (cms)**

Head Distance (m)	Green Pace (sec)				
	10	12	14	16	18
21	9	19	34	58	92
24	10	21	39	67	106
27	12	24	44	75	119
31	13	27	51	86	136
36	15	32	59	100	159

Basic Tactics In Lawn Bowling

Setting Competition Goals

Game Formats and Procedures

In common with sports like golf, shooting, archery, etc, lawn bowling is a target sport. Lawn bowling games take the form of singles, pairs, triples or fours according to the number of bowlers in each team. A game is played on a rink, which is a demarcated strip of a bowling green. An end begins when the first player lays a mat and delivers an unbiased jack, which serves as the focal point for a head.

The projectiles used in the game are bowls, which two opposing bowlers or teams of bowlers alternately roll along the rink towards the target bowl, or jack. The bias of bowls causes them to travel a path of increasing curvature as they slow down. Thus, a bowl provides forehand or backhand approaches for entering a head. Players grip a bowl with its biased side either on the left or the right depending on the chosen hand of play. The line, speed and objective of each bowl delivered depends on whether its purpose is creating, consolidating, defending or attacking the head, any of which can be the tactical key to winning the end.

The specified conditions for a particular game specify the number of deliveries allowed each player before an end is completed and progressive scores are determined. On completion of each end, a player or team receives one point for each of its bowls resting closer to the jack than any opposing bowl. The direction of play on the rink reverses for successive ends, each of which follows a sequence of the laying of a protective mat, delivering of the jack, and delivering of the allowable number of bowls, in turn.

The specified conditions for a game indicate when play is to end and a winner is to emerge. Team games (pairs, triples and fours) usually finish on completing a specified number of ends. The winner of a singles game, or a game within a set, is usually the first player to accumulate a specified score of points. The winner of a sets match is the first player to win a majority of the specified maximum number of games (usually 3 or 5). Scorecards should show the points won for each end completed and the cumulative scores in each game. A scoreboard at the end of the rink should show the cumulative scores in each game and, for games comprising a specified number of ends, the number of ends completed.

Strategic Aims

Some competitors would express their tactical aim for an event in terms of winning at all costs, or winning if possible. However, a focus on winning has some difficulties. First, it is suggestive more of ego-involved, than of task-involved motivation for participating in the sport. In other words, there is sharper focus on 'destinations' than on the positive experiences of 'journeys'. Second, some people have conditioned themselves to equate winning with success, and losing with failure. They would thereby have difficulty in expressing their aim for an event, other than in terms of winning. Third, some people would consider that an aim expressed other than in terms of winning would be a recipe for not winning, or that losing is automatically a conscionable outcome. Even top-ranking competitors experience competition losses, and most competitors in all sports experience more losses than wins. Fourth, event outcome, i.e. winning or losing, depends on many factors outside the individual control of either competitor. Competitors can control only their own performances. Where one competitor is outperforming another, that other has no way of changing the likely result of the contest other than by improving performance. Should the competitor in the lead continue to outperform, any winning aims of the other would be in disarray and no longer relevant. Towards the end of the game, that opponent would tend to experience distraction, anxiety and powerlessness because of the score line.

A preferable form for a strategic aim might be: "To secure the greatest possible advantage of shot numbers through low-risk tactics, or failing that, to secure the least possible shot disadvantage". Such an aim would apply to the delivery of every bowl in every end of the match, whatever its possible or probable outcome. It would imply a quality of performance that sustains pressure on opponents right to the last bowl of the game. Sometime, the calibre of relative performance will yield a winning result, which is a bonus or reward for that particular effort. However, the basic strategic aim should relate to ability and performance, not to winning.

Basic Tactical Concepts

Establishing the Head

Tactics are an element of all sports and games. The use of tactical skill in the course of play is neither unfair nor poor sportsmanship. It mainly involves the exercise of common sense and the avoidance of poor decisions.

Competitive bowlers should have a thoughtful approach to each game. They should watch jack and bowls during any trial ends to obtain a feel for the green conditions. Trial ends of full length best indicate the approximate aiming angle required. If there is a cross wind, competitors should determine whether the wide hand or the narrow hand is the kinder side of the rink. When all other things are equal, the narrow hand is commonly the easier hand to play. The aiming angle will be narrower, and the smaller angular distance between the destination point and the aiming point is normally easier to accommodate during the aiming process.

Leads should avoid playing 'around the clock', i.e. playing the same hand, end after end. If one side of the rink is kinder, the team should direct its play on that side. Leads should also avoid the temptation to change hand for their second delivery. By changing hand, a lead can immediately leave opponents with resting opportunities on both sides of the jack. Singles players or skips might wish to change to the opposite hand if the opponents are favouring it with telling effect.

Bowlers should avoid bowling short, particularly when not lying shot. A team is bowling short if more than half of its bowls are stopping short of jack high. Players should be mindful of the need to avoid short bowling, especially when their team is not holding shot. Short bowls tend to block access to the jack. Any movement of the jack is usually rearward, leaving short bowls in ineffective positions.

Bowlers should avoid bowling narrow when lying shot. A team is bowling narrowly if more than half of its bowls cross a direct line to the jack or other destination. Narrow bowls tend to disturb the jack or to leave resting opportunities for the opposing team on the opposite side of the head.

If the green is rather slow, foot traffic near the ends of rinks will gradually increase the pace of green there. A team more alert to this effect can, if first to play, place the jack near the 2-metre mark with the expectation that opponents might not allow for the extra pace and lose bowls in the ditch. Skips could consider locating the jack near the two-metre mark if opponents seem shy of the ditch or troubled by faster grass there. It might also be a good location should one or more members of the opposing team be 'niggers'. A team that prematurely attacks the head could ditch many of its attacking bowls. A team should avoid locating the jack at the two-metre mark if their opponents seem able to ditch it with running shots at will.

If the lead and second players are more adaptable than their opponents, the team might profit from frequent changes of end length. For the start of a new end, skips of teams to play first should consider mat and jack location. If they allow leads to choose their own length, they should ensure that the length is consistent and is providing their team with a competitive edge. They should consider maintaining a winning length, or changing what has tended to be a losing length. A medium length would provide a winning opponent least scope to change length for the ensuing end. Medium length could be a safe choice for the first end. There is then least risk of an improper delivery due to length error because of a misjudgement of green pace.

Team Tactics

When a club or players themselves form a team, it should be the most competitive team possible. This involves the teaming of players who not only will demand 100% of themselves, but also will help each other to produce a 100% effort. In other words, the team should comprise the strongest players available, consistent with the likelihood that they will work together in a mutually supportive way. Whether they are close friends, or even well acquainted with one another, need not be a key consideration.

The more cohesion within teams, the more successful they tend to be. Healthy team cohesion results in points on the scoreboard. Uninhibited, positive communications using considerate words and body language are cohesive. The ability to foster team harmony and cohesion is a basic tactical skill. The maxim that 'a champion team will usually beat a team of champions' applies. Occasionally it falls to a skipper to bail a team out of trouble, but the earlier players are equally responsible for ensuring that the team does not continually get into trouble.

Teams with compatible members are sometimes unsuccessful because of inappropriate tactics when under pressure. Competitors should avoid spoiling their performances by hurrying delivery preparation. If an opponent misses a drive, there is no obligation to hurry a delivery to shorten the delay before the opponent's next drive.

Competitors should apply themselves undistractedly throughout a game. They should avoid wasting easy opportunities to add to the score when not under pressure. Any member with a weak opponent should maximise that advantage for the good of the entire team's performance. They should remember that no team wins a game until the opposing team irrecoverably loses it.

Leads and seconds should never 'niggle' at (i.e. gratuitously attack) the head in personal attempts at beating their opponent. This behaviour can place a team four shots down when the second leaves the mat. Unsolicited advice from thirds can irritate and erode self-confidence of their skips. Skips should avoid this problem by having a courteous understanding with their thirds about their need for information or suggestions when on the mat themselves.

Once regularly selected to play in the skip position and thereby to act as tacticians of teams, some skippers tend to feel that their tactical wisdom becomes less fallible. Some of them become quite unreceptive to advice or enlightenment on their tactical method. Skips generate team cohesion by avoiding an egocentric personal style and adopting a consultative approach to team tactics. Effective skips can do this without compromising their responsibility and decision-making authority.

A skip's early duty is the forging of a good relationship with the third. Other forms of mutual support and respect flow from there. Everyone in a team should feel the equal of the others. A skip is part of a team, not above it. Skips should confer with their teams before each game. Skips could consider stationing new or inexperienced thirds at the head to better communicate their tactical thinking.

Skips of newly constituted teams should ascertain the shot repertoire of each player. They should ascertain which players like feedback about length errors. If the third is a better driver than the skip, the team can use the third to do more of the driving if any heads develop in a way that driving becomes advisable.

Game Planning Basics

Lawn bowling is a coactive sport where teams play games by taking turns, rather than an interactive sport like hockey where all members of opposing teams are continuously engaged. Therefore, key aspects of a competition game plan apply intermittently while the team has possession of the rink. The plan should be embraced by all members of the team, and committed to writing where circumstances permit.

Generally, a game plan will reflect a chosen strategy, and will include the intended tactics for achieving it. Simplicity is an attribute of a game plan that makes it easier for competitors to remember when under pressure. Complicated or highly detailed game plans tend to be forgotten in tight contests.

A game plan should allow for changes should particular tactics prove unproductive. Therefore, flexibility is another positive attribute for a game plan provided a team changes its tactics in a coordinated way.

A game plan should not ordinarily contain tactics designed to mask known weaknesses. Weaker elements of performance should receive attention during the training and practice plan of the individual or team, rather than as elements of a game plan. Careful attention to shortcomings in the days or weeks before the starting day of a competition should have replaced weaknesses with new strengths.

If the competition green is obviously slow, or exposed to a gusty, variable wind, the game plan should reflect a determination to minimise short or narrow bowls, and to avoid continual changes of delivery line in efforts to 'fight' the wind.

Post competition analysis should include relating performances to relevant game plans.

Shot Selection

Head-Reading Basics

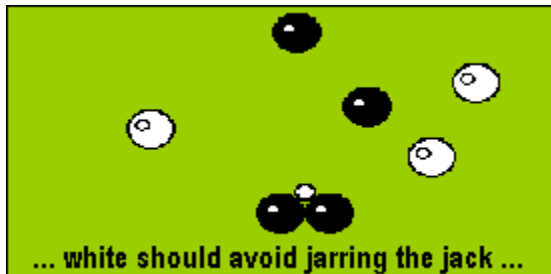
A good method for a team to use for evaluating its options is the SWOT procedure. SWOT is an acronym for Strengths, Weaknesses, Opportunities, and Threats:

- What is our shot advantage now? What are the strengths or preferences of the bowlers whose turns are to follow?
 - What is our present deficiency of shots? What are the perceived weaknesses of each team?
 - What opportunities or potential rewards does the head offer? What is the degree of difficulty entailed with each?
 - What are the threats or risks entailed with each option? What is the scoring effect of the worst outcome?
-

In identifying tactical opportunities, skips will have regard to the number of ends remaining in the game, of deliveries remaining to complete the end, and of the cumulative scores (including the margin in the current end). They should always seek to identify the 'percentage' shot.

Once holding one or more shots, skips should continually assess the likelihood of attacking play by opponents. Opponents competent in attacking play could attack at an early stage in development of heads. The more shots a team holds, the greater the likelihood of attacking play by opponents.

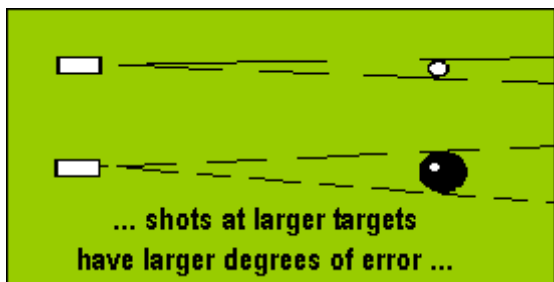
Attacking play is not always a sound option of a team that is down one or two shots. Skips should carefully evaluate risks. The possibility of loss of an occasional end by a shot or two should not cost a team the game. Misfortunes during attacking play can make a disadvantage worse. If a team



has only one shot saving bowl in the head, dislodgment of that bowl could greatly increase the shot disadvantage. If opponents have numerous receiving bowls behind the jack, disturbance of the jack might hand them an even larger count of shots. However, if they are deficient in bowls behind, a team could exploit that oversight. When well positioned to win a game, a team should consider leaving risk-taking to the opposition.

Controlled weight shots are difficult to play accurately on fast greens for the same reason that the wide hand of play is typically the harder. Playing surface and random wind variations tend to have a relatively greater effect on bowls in course on fast greens. Skips can halve the degree of difficulty of particular shots if they can offer players two attempts at them. Players who miss at the first attempt thereby do not waste the 'feel' for an appropriate correction.

An isolated jack or a bowl presents a narrow target. The wider a target, the greater is the likely success of attacking shots. A bowl is wider than a jack, and a group of bowls presents a wider target than an isolated bowl. The nearer the target, the wider is its relative size. Therefore, attacking shots tend to be more successful in shorter ends.

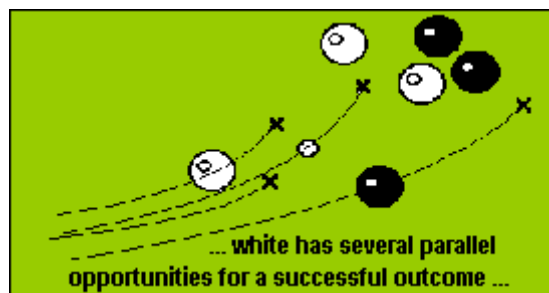
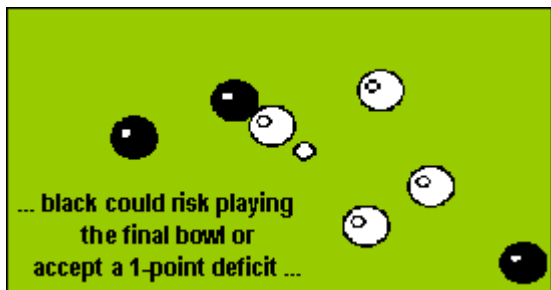


Sometimes a particular approach into a head offers a number of positive outcomes in combination. There may be combinations of favourable

wicks, rests, wrests, run throughs, and trails on offer, each with minimal associated risk. The line of entry into the head that would produce a favourable outcome can sometimes span half a metre or even more. Such situations represent a low degree of difficulty.

Basics of Selecting the Shot

Singles competitors should remember that draw shot play is pre-eminent in their games. Singles heads contain



fewer bowls and they tend to have larger gaps through which bowls can pass. Leads and seconds should draw to the jack until defensive placements beyond the jack become advisable. This approach creates a basis on which the third and skip can build.

Before the start of each end, skips should review the progress of the game. During early ends of games, skips might consider difficult or risky shots that offer high rewards if successful. During later ends of games, skips of teams leading comfortably

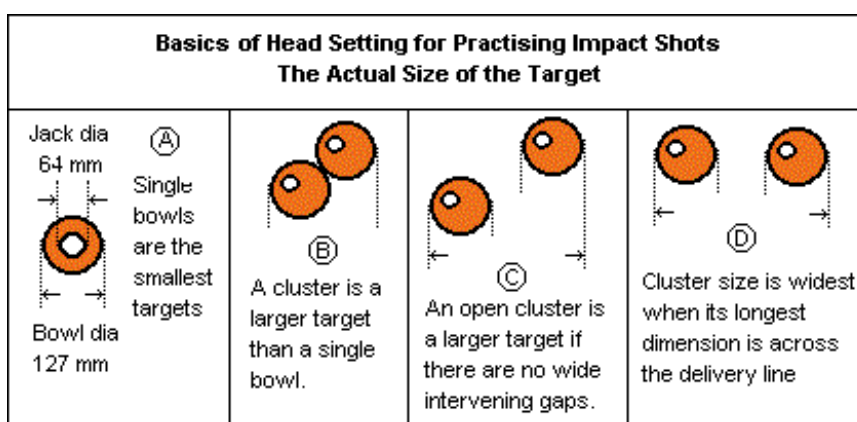
should tend to avoid risky shots. In games that are part of a side's match or a round robin event, skips should consider ways that their teams might improve their margins to maximise the cumulative scores of their side.

In the course of an end, skips should monitor how many shots the team with the advantage is holding. They should also monitor how many deliveries remain for consolidating or disturbing the head. Timing is an important element of successful changes in tactics. The team holding shot should balance the merits of drawing more shots or placing bowls to defend shots already held. The team not holding shot should balance the merits of bettering opposing bowls or killing the end.

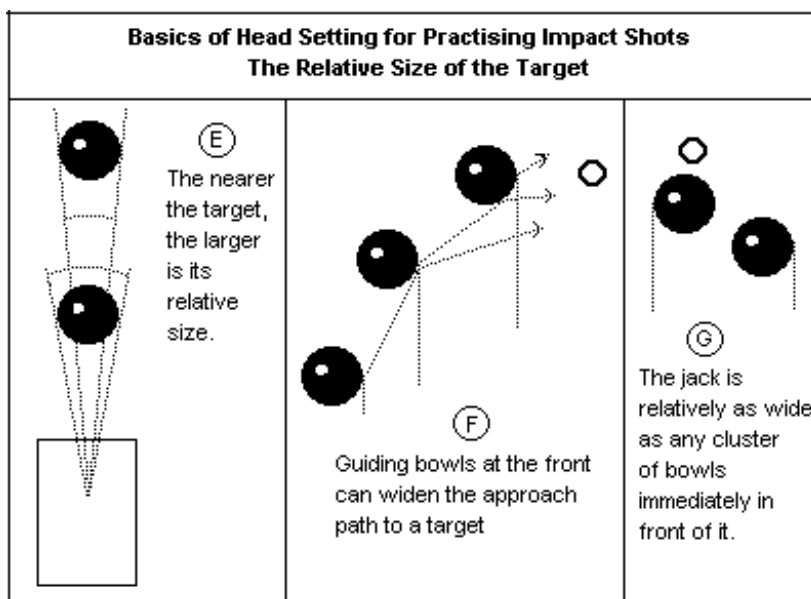
Degree of Difficulty

The closer the mat is to the head, the easier the shot. Bowlers should engineer practice of new skills so that tasks are achievable. They could initially place the mat about 10 metres from the practice target. If unable to achieve a 50% success rate from there, they could place the mat even closer. Once they better a 50% success rate, they can move the mat farther back. Eventually they will achieve success over realistic distances.

Generally, the slower the green, the larger is the margin for aiming errors. Also, the larger the actual size of the target (See diagrams A to D), the easier is the shot:

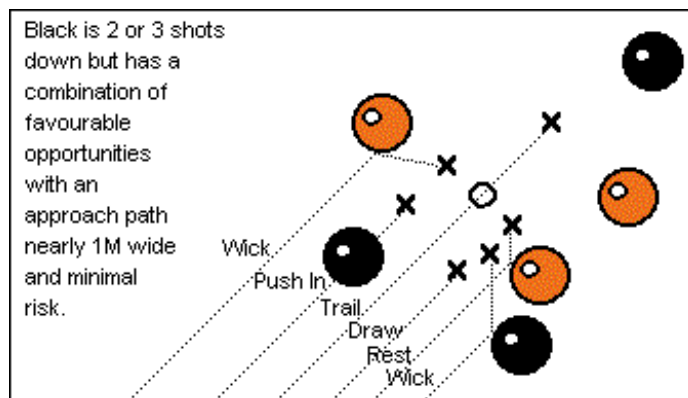


Bowlers should master shots at large targets before advancing to small targets. Generally, the larger the relative size of the target (See diagrams E and G), the easier is the shot. Also, the more wicking opportunities there are in front of the target (See diagram F), the easier is the shot:



A head can provide a number of positive outcomes in combination. It could offer interrelated wicks, rests, wrests, run throughs, and trail shots, etc, each with minimal associated risk. The more options there are, the greater the likelihood

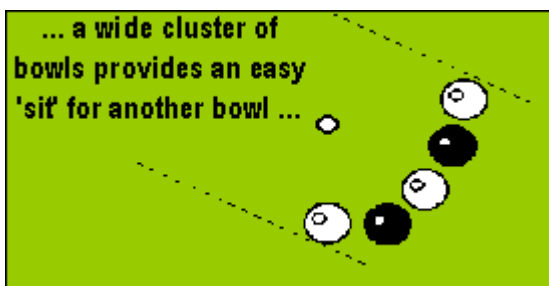
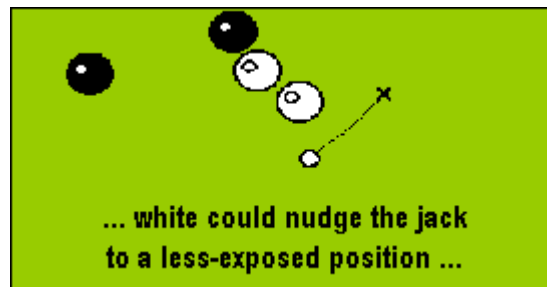
of success. The lines of entry into the head that will produce a favourable outcome can sometimes span half a metre or more:



Particularly on fast greens, bowls enter the head from the flank. Opportunities may not be recognisable from the mat. Close inspection of the head for shot selection and planning is then advisable.

The team holding shot has the following options:

- Adding another shot
- Blocking an opponent's preferred approach into the head
- Placing a bowl in anticipation of rearward movement of the jack
- Nudging the jack into a less exposed position
- Dislodging one or more of an opponent's shot saving bowls.

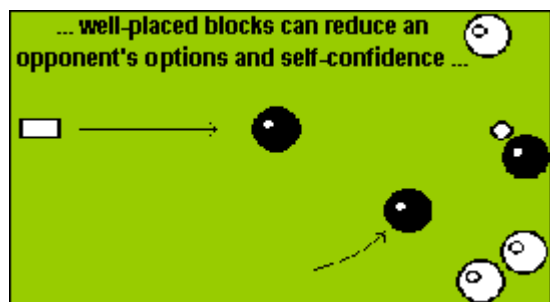


Drawing to add another shot usually has good prospects of success. An extra shot provides an element of insurance should opponents move a shot bowl. However, it may have little value in a close, jack high position or if it creates a cluster of shots that presents a large, easy target. Bowls at rest can assist the achievement of another shot by obstructing the run of a bowl out of the scoring zone. A deflection or 'wick' off another bowl can favourably redirect a moving bowl. A slowing bowl could come to 'rest' in a

good position against a stationary bowl. A bowl in course could push another of the same team's short bowls onward into a good position. It could push another short bowl onward and follow at a reduced pace before running through to a good position.



The nuisance effect of short bowls is common experience. The blocking of a bowler's preferred approach into the head has both physical and psychological effects. In a physical sense, a block forces an opponent to adjust aiming line, or delivery speed, or both,

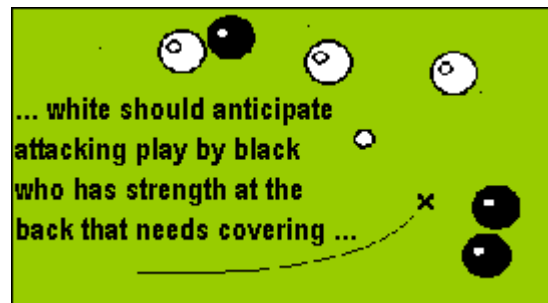


or to switch hands. Psychologically, a defensive and highly visible block astride the delivery line 14-15 metres from the mat sometimes makes opponents apprehensive. They may be distracted from good preparation for their next delivery.

Blocks tend to be more effective on slow or medium paced greens. On slower greens, the span of required delivery angles for the full repertoire of shots is narrower and varies less for different delivery speeds. Thus, bowl paths are more predictable. Blocks are more effective when an opponent has fewer options.

Alternative avenues of entry to the head may be impassable, risky, or unplayable. Positioning of blocks has lower margin for error than positioning of receiving bowls. Skips should use the most accurate of their available draw shot bowlers for positioning them.

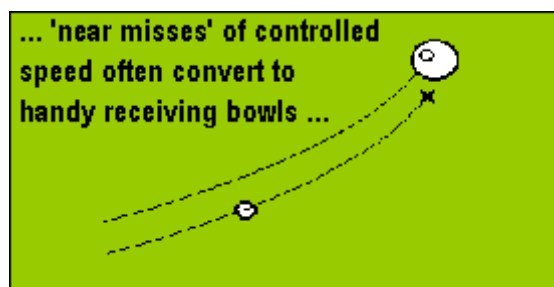
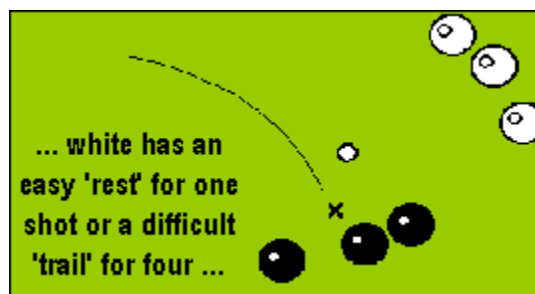
The placing of a bowl in anticipation of rearward movement of the jack should neutralise the benefit to opponents of disturbing it. Bowlers best do this by placing receiving bowls in the path of the jack's likely movement. They should consider the merit of having the best back bowl, which commands not only the ditch but frequently also several square metres of the rink adjacent to it. If opponents have bowls at the back of the head, a good defensive tactic is to match them. This tactic is particularly sound if the speed of attacking bowls is difficult to forecast. When the opposing team lacks potentially scoring bowls but has bowls positioned beyond the jack, there is likelihood that they will attack the head. Teams holding shot should normally obtain covering strength with receiving bowls beyond the jack before they adopt blocking tactics.



The team not holding shot has the following options:

- Drawing for shot or to save
- Wrestling shot bowls out of the count
- Moving the jack to save or to score
- Killing the end

Like their opponents, the team not holding shot can also use gentle wicks, rests, wrests and run-through shots in the process of drawing for shot or to save. If the jack is in the ditch and a team is one shot down, it should favour drawing for shot. If the bowl runs into the ditch, the team's position is no worse. If the team is several shots down, it should favour drawing to save. However, a team saves nothing if its bowl runs into the ditch. The team not holding shot can also play firmer attacking bowls. However, if not holding shot on completion of an end, they should at least have bowls in the head that restrict the opponents' scoring margin.



Wrestling shots need enough velocity to achieve their purpose. Fast wrestling shots usually become dead if they are off target. Slower wrestling shots can yield 'live' bowls in receiving positions if they miss their target.

Players of the team that is shots down may try to engineer movement of the jack towards their receiving bowls once they have receivers in place. This tactic is often productive where opponents have a toucher on the jack. To avoid movement of a close opposing toucher with the jack, separating them with a

gentle wrestling shot might be a sound preliminary tactic. The trail shot is a common way of moving the jack. The attacking bowl forces the jack away from opposing bowls and follows in a similar direction before coming to rest. Faster versions of the shot can follow or 'trail' the jack into the ditch.

Aggressive opponents sometimes unsettle novice players, who might wonder whether accurate draw shot play is their best tactical option. However, even accurate drivers usually have more misses than hits, particularly on medium to long ends. If there are generous gaps between bowls lying shot, and there are blocking bowls ahead of the jack or receiving bowls near the ditch, or both, there is not much for an opponent to drive at. Recorded observations of more than a dozen interstate-level fours games on Queensland greens with a pace of about 16 seconds showed that the percentages of reaching shots played were as follows:

Fast Shot Frequency of Members of Highly-Ranked Fours Teams				
	Leads	Seconds	Thirds	Skips
Reaching Shots (including drives)	0%	9%	19%	27%
Drives (included in previous)	0%	1.8%	3.5%	8.4%

In other words, these are the approximate ratios of reaching shots decided as tactically opportune by expert and prudent players. The observations showed that accurate drivers tended to use the drive somewhat more than average. To benefit team performances, clubs could identify any tendency towards excessive use of drives or reaching shots generally by recording statistics for practice games and making comparisons. They could bracket percentages to obtain comparable benchmarks for 4-bowl pairs games.

Communicating

Communicating the Choice of Shot

Skips should acquaint their teams with their tactical thinking. Brief opportunities to communicate within teams occur when changing ends. Team members can exchange views in mid-rink out of earshot of opponents. Skips should avoid unsettling their teams with flamboyant changes of end length.

Skips can use verbal head directions effectively when conditions are favourable. Noise from the environment or hearing impairments of players adversely interferes with verbal directing. Skips (and thirds) should avoid verbose information.

If the tactical circumstances are complex or if the required shot has a fine margin for error, they could invite players to the head for a personal inspection.

A simple direction such as "beat your last bowl" is often all that a player requires. Skips should avoid vague directions, such as "be up", "put one behind", or "come through the head". Sometimes they require a bowl in a position that is the same distance from the mat as another bowl at rest. In such instances, they could indicate that the bowl at rest is a guide for appropriate delivery speed or length.

They should avoid negative instructions such as "don't hit that bowl in the approach". Otherwise, they make bowlers more aware of the risks of a shot than of its positive tactical objectives.

Alternatively, skips can use visual signals in directing a head, particularly if circumstances are unfavourable for verbal directions. They should not leave their leads guessing about where to place the mat and jack. They can use the fingers on one or both hands to beckon (bring the mat farther forward), to push (take the mat farther back), or to pat downward (place the mat right there). They can plant a foot or hold a white cloth to indicate where they want a jack or bowl to come to rest. They can similarly indicate the required point of impact for an attacking shot. They can use an outstretched arm to indicate the required hand of play.

Skips should accurately communicate the result of shots. If a skip reports a delivery that is a metre short as being "two metres short", the corrective attempt is likely to be a metre long. Skips should indicate distances in front of or behind the jack, which are hard to gauge from the mat, by planting a foot in a jack high position. By converting distances along the rink to distances across the rink, skips give players on the mat a better visible guide to the requirements or result of shots. Skips and thirds must remember to mark all their teams' touchers.

Skips should incorporate positive motivational messages in their verbal and non-verbal communication. They should acknowledge careful attempts at playing as directed, particularly when those attempts produce favourable results. They should avoid any temptation to offer undeserved praise. For example, a draw to the jack that finishes over two metres past the jack is not a good attempt by most criteria and hardly deserves accolades as a 'handy back bowl'.

Communication Within Teams

Body language and oral communication of skips should be mutually consistent; otherwise, they convey mixed messages to teams. Players are likely to take more notice of body language than of spoken communications. Communication initiated by skips has some inherent limitations whereby:

- communicating may be rendered difficult by environmental noise
 - communicating opportunities are limited by physical separation on the rink, which may give rise to inferences of aloofness
 - communicating may be limited to bowl playing directions
 - motivational and cohesive feedback might be overlooked
 - communicating may be primarily one way
 - communicating among team members as they change ends might be infrequent.
 - casual communicating among the rest of the team might not be task-oriented.
-

Those limitations may be minimised by:

- shortening lines of communication: possibly through collective pre-game tactical planning, and by free exchanges when changing ends.
- developing unambiguous signs and gestures for communicating information when distance or environmental noise inhibits communicating orally
- inviting two-way communication among all members of the teams, which provides a network for evaluating observations and suggestions.
- including informational and motivational exchanges when teams confer on change-overs
- accepting that skips retain responsibility for the team and the ultimate authority for decision-making, but that skips are equal partners in the communication and mutual support processes.

Courtesies During Games

Bowlers should address one another by their given names during the course of a game. It is good sportsmanship to acknowledge displays of exceptional skill. Flukes are simply revelations of unrecognised opportunities. They balance out over time, so it serves no purpose to take too much notice of them. After games, the graceful losers should congratulate the modest winners. They should avoid making excuses for their lack of success on the day a topic of conversation.

Bowlers should fairly share the task of kicking bowls after completion of an end. Bowlers should give the skip their loyal support and comply with directions. If the skip's bowl remains in the ditch from the previous end, teammates should dust it and place it handily near the mat before changing ends.

Opposing leads should facilitate play by courteously handing the mat and jack to each other, as convenient. Bowlers can similarly hand bowls to one another when convenient. The enjoyment of a game of bowls is diminished if either team indulges in gamesmanship. Inconsiderate distractions such as loud noises or conversation, visible movement of players objects or shadows, impact of kicked bowls, etc should be avoided while a bowler is on the mat preparing for delivery. Bowlers should avoid delaying play by leaving the rink without consent. They should avoid asking to leave the green unless there is a reasonable necessity. They should avoid interfering with the head until the result of the end has been agreed. If an opponent has obviously not counted all the bowls the team is entitled to count, good sportsmanship should prevail.

Bowlers should shake hands at the end of a game. After games, players should sit with their opponents. Home team players should offer visitors refreshment. After domestic games, winners are normally the first to offer drinks. After singles matches, markers should be included in the invitation. Considerate thought and common sense are the keys to acceptable standards. Courteous losers normally reciprocate in turn.

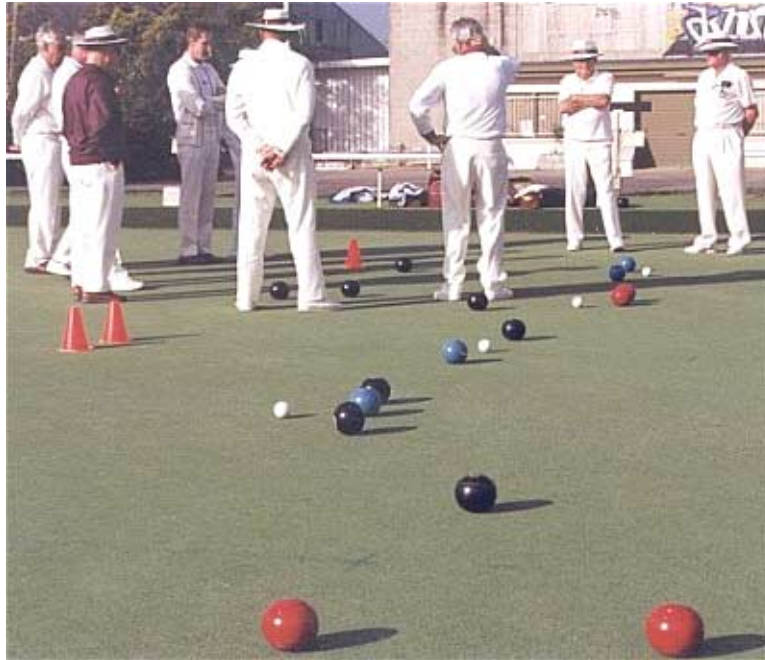
In changing ends, bowlers should avoid straying on to neighbouring rinks or otherwise distracting play on them. Borrowed personal items such as tape measures should be returned to their owners with thanks. Mats and jacks should be collected and returned to the usual distribution point. Bowlers should treat one another, the way they expect to be treated by others.

Tactical Practice

Practice Head Reading



A useful method of teaching and practicing head reading and shot selecting skills is through the setting of heads that illustrate tactical problems or challenges. The method works better if bowlers are available in groups for studying and discussing among themselves the tactical options available and their own choices of the percentage shot. Some method of distinguishing bowls of one's 'own team' from those of the 'opposing team' is useful.



Game theory or common logic might persuade one to feel that some rules could be developed for comprehensively analysing the lie of a head and for selecting of the percentage shot to play in the immediate circumstances. For providing practice in these skills, coaches commonly set hypothetical heads for analysis by their client group. Surprisingly, even skips of state and national teams often read heads and identify the tactical opportunities they offer quite differently. Therefore, they often have wide differences in their choices of the percentage shot, yet are able to offer well-argued and convincing explanations in support of their choice. However, even bowlers of this calibre could sometimes greatly misjudge the degree of difficulty of selected shots, and there might well be scope for greater development of structure in the art of head reading and shot selection. Some basic approaches appear under the 'shot selecting' heading.

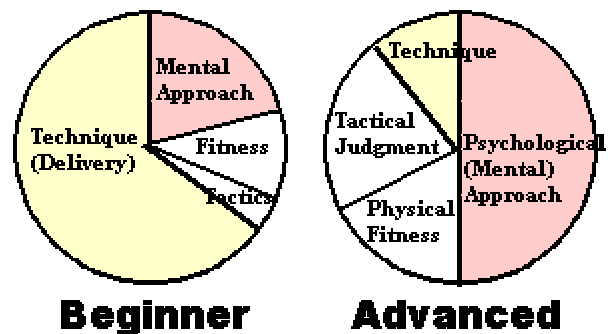
Psychology In Lawn Bowls

Mental Factors

Elements of Bowling Skill

The main skill areas of lawn bowling are delivery technique, game tactics, physical fitness, and psychological approach. Delivery technique, as the name implies, simply means the body movements involved in delivering jacks and bowls. Game tactics include game planning, head reading and shot selection. Physical fitness and good health are minimal requirements for success in any sport. The concepts of the two T's (technique and tactics) are highly sport specific. On the other hand, the concepts of the two P's (psychological and physical) are not particularly sport specific and apply to most other areas of daily life.

When lawn bowling champions quote the causes of their successes, they typically give most of the credit to their mental approach. Such beliefs are well founded and sincere. To some extent, this weighting somewhat negates the obsessive attention that many club bowlers (and some coaches) give to the mere mechanics of the delivery movement. It puts the importance of a sound mental approach in better perspective. The adjacent diagram indicates how the technical component of performance (i.e. technique) requires decreasing attention as bowlers acquire grooved and automated delivery actions. It correspondingly indicates how higher levels of competition faced by developing bowlers challenges their mental component of their performing skill.



Bowlers who experience performance problems during games (e.g. short bowling) should try to correct them immediately. For short bowling, the correction might be a longer arm swing to develop a greater bowl release speed. If the correction is successful, one might imagine that the problem has been solved. The correction was technical, i.e. a change in technique. However, the problem might be persistent and its cause might not be technical in nature. It might be the result of always trying too hard to deliver delicate 'resting-touchers' when wiser play would suggest bowls half a metre beyond the jack (tactical). It might be the result of imperfect vision or ill health (physical). It might be the result of faulty judgement of distances or lack of self-confidence (psychological). The point is that a sustainable solution to the problem relies on accurate diagnosis and remedies from within the same performance area. In other words, a sustainable solution to (for example) a psychological limitation must itself be psychological in nature. (Drills to improve perceptions of distances are easy to develop. They typically involve practice in skilfully estimating the extent to which a coach might have moved bowls or other objects while the client's attention is temporarily directed elsewhere).

Mental Attributes

A good psychological approach to sport is one that provides the ability to excel in performances under pressure. It does not imply gamesmanship or forms of mind games aimed at unsettling an opponent. However, an unruffled performance under pressure can sometimes in itself unsettle an opponent.

Mental attributes are the qualities that define who we are and what we stand for. They include our aims in life, beliefs and attitudes, keenness for bowling, attitude to winning and losing, self-image, propensity for anxiety, social needs, etc. Motivation is the need, desire or stimulus for action and success. Self worth is the image or opinion of one's worth as a person and competence as a bowler. Self-confidence is the motive to be successful accompanied by realistic expectations of success. Self-awareness is the awareness of one's thoughts, emotions and sensory feelings, and of how one's behaviour tends to shape the responses of others.

Mental Skills

Mental skills are the tools with which bowlers can redirect or fine-tune their mental approaches on the desired path to performing excellence. Several mental skills are important in lawn bowling. Attention, or concentration is the ability to focus on relevant matters in competition or other distracting situations. Arousal is the energising of the body in readiness for bowling activity. Goal setting is a process that maps out the attainment of a specific standard of task proficiency within a specified time. Imagery, visualisation, and mental rehearsal have similar meanings and are

processes of using all the senses to create or recreate an experience in the mind. Stress management includes a range of techniques. These include relaxation skills, thought stopping, centring, and refocusing.

Learning Mental Skills

Most past and present champions probably learned their mental toughness the hard way - that is by unassisted trial and error. Perhaps most future champions also will acquire sound mental approaches by hit or miss methods. However, the learning process need not always be that way. Competent coaches should not only teach sport psychological concepts, but also guide practice in related techniques. Only regular and purposeful practice over time will produce control and predictability in the mental approach. There are no quick fixes or instant miracles.

Bowlers use mental skills at early stages of lawn bowling. They mentally rehearse in 'feeling' or 'sensing' the pace of the green, the weight of their bowls, and the kinaesthetic feeling in their arms when propelling their bowls the desired distance. They visualise or imagine the curve of their bowl's track when selecting their aiming line. They control their breathing to avoid any feelings of anxiety. They concentrate on achieving a consistent delivery routine, and in excluding distractions to focus narrowly on their aiming point. They adopt motivation and goal setting at least in preferring either social or competitive bowling. So mastery of mental skills involves learning more about them and practising and extending the practical ability to use them.

Bowlers should retain responsibility for their progress with mental skills mastery. They should have reasonable expectations of success and be industrious and patient. There is no general answer to a question of whether third parties could usefully help with process of mastering of mental skills. Obviously, it depends on whether coaches or other third parties have sufficient sport psychology knowledge, and experience in using and fostering mental skills. They must have the trust and confidence of the bowlers they serve. They must also have a warm interest in the progress of their clients and to take responsibility for any mentoring role they accept.

Motivation

Motivation is the attribute that reflects values, wants, and needs for lawn bowling and other pursuits in life. It derives from the prospect of fun and enjoyment that characterise its recreational and social activities. Lawn bowling also offers personal development through mastery of playing skills, and the excitement that typifies competitive games. Motivation mobilises and directs efforts towards achievement of aims.

There are two main types of motivation. There is task-involved motivation where the focus is on the process or performance, and there is ego-involved motivation where the focus is on outcome or result. Task involved behaviour derives from desires to learn from errors and master new skills, to achieve efficacy based on effort, to extend personal bests, and to feel rewarded by performing well. Ego involved behaviour derives from desires to demonstrate superior ability and rises in competitive ranking, to win wherever possible, and to focus strongly on scores achieved and public acknowledgement. The orientation of a bowler may contain a mixture of task and ego involvement. All task-involved (but only a small minority of ego-involved) bowlers can be consistently successful. Task orientation is greatly affected by coaching styles, and the nature of coaches' responses to competitive performances.

People sometimes wrongly use the word 'motivation' to describe energization or arousal. A cartoonists' cliché shows a drawing of a coach giving a pep talk to a team of players with a propensity to under-perform. Pep talks can arouse some players, and that arousal can persist for the next several minutes of competition. However, motivation is not a short-term quality capable of induction by sanctions or arousing techniques. On the other hand, underlying motivation is a different and more enduring quality. Pep talks can be detrimental to motivation if they conflict with personal beliefs or values. They commonly follow a predictable track that soon becomes obvious to players, who usually tune out.

Some bowlers have stronger motivation to participate than others. The frequency of participation could indicate this factor. Efficacious effort, concentration, persistence etc characterise motivated behaviour.

Some bowlers have interests in different sectors of the sport. Preferences towards social play, competition, or club administration, etc are indicators of this factor.

Some commentators suggest that motivation can also be negative. They suggest that preferences to avoid certain acts are examples. For example, a person may be disinclined to consume certain foods because of their tendency to increase body weight. However matters expressed in negative terms are usually redefinable in positive terms (eg to maintain a particular body weight range), so the concept of negative motivation does not have compelling validity.

Bowlers should temper their drives or desires with realism. Bowlers who equate winning with success and losing with failure have a motivational problem. Winning is never certain, nor even a controllable aspect of performance. In a large competition, there can ultimately be only one winner. The other competitors are not axiomatically either unsuccessful or failures. Many of them may have surpassed their individual performance goals, so were successful in those terms. Players who intend making a career out of bowls need a rather calculating approach to the game, because when they don't win prizes, they don't get paid. However, bowlers looking at a career in another line of work can play bowls for enjoyment, and can afford to be less concerned about winning at all costs.

Bowlers should also distinguish between process and outcome. Process is primarily the delivering of their bowls. The quality of their actions or movements is largely within their control. However, they should avoid expectations of achieving one personal best after another throughout their careers. Outcome is the result of a game. Among other factors, outcome depends on how well opponents perform, which is beyond even vicarious control.

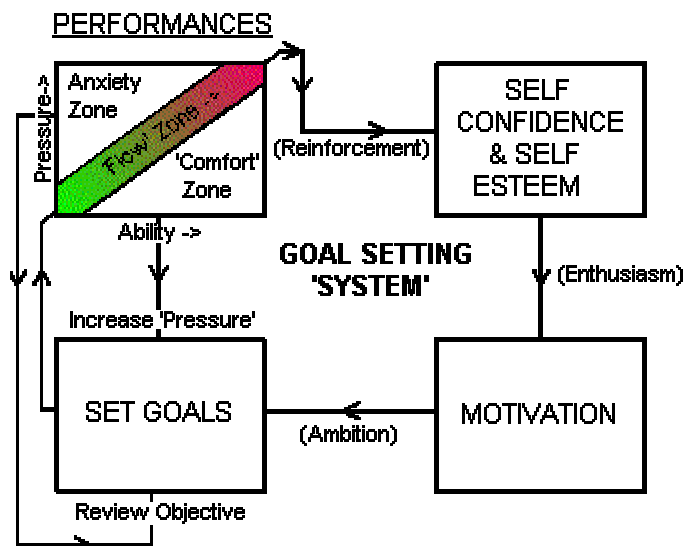
Goal Setting

Nature and Benefits

Goal setting is primarily the practice of defining and prioritising objectives according to the intensity, direction and priority of desires or ambitions. Goals mobilize, direct, and sustain effort. They are the action plan, or blueprint for an appropriate action strategy, and define the desired outcome of particular aims and the courses of action for mastering skills. Goal setting offers time efficiencies and a sense of control. Where no goals exist, sportsmen tend to create goals spontaneously for particular courses of action calculated to achieve desired objectives.

The Goal Setting System

Goal setting practices are closely related to motivation and several other mental attributes. The adjacent diagram implies that these attributes form a 'closed-loop system' whereby motivated desires lead to the setting of courses of action to improve performances, which reinforces feelings of efficacy and self-confidence, which then stimulates the desire to achieve 'bigger and better' objectives. The box labelled 'Performances' simulates a graph with pressure (challenge or degree of difficulty) as the vertical axis, and level of ability as the horizontal axis. When task difficulty and ability match one another, bowlers perform in the 'flow' zone. When there is a mismatch, the task is too easy or too hard and goals should be reviewed and possibly varied. The attributes identified in the diagram tend to have enduring characteristics that are not greatly affected by temporary circumstances. However, system is not the simple closed loop depicted. The attributes involved are really part of a more complex network of relationships connecting other mental capacities.



Scope of Goals

Goal setting is primarily the process of defining and prioritising objectives according to the intensity, direction and priority of individual desires or ambitions. Goals mobilize, direct, and sustain effort. They offer time efficiencies and a sense of control. They form an action plan, or blueprint, and should be based on a sound development strategy.

In the context of a planned development program, performance goals should reflect the culmination of desired improvements during the development period. The scope of goals should extend to each area of performing skill, i.e. technique, game tactics, fitness, mental approach, and preparation for competition. Process goals are a sequence of shorter-term steps that lead to major, longer-term goals.

The time scales relevant to mental skills may range from less than a second (eg a response to a stimulus) to more than a year (eg a career milestone). In defining a goal's criteria, the concept of long and short-term goals arises. Shorter-term goals can stand alone, and may sometimes be adopted during practice or competition. Perhaps because of exuberance, there is a common tendency to overestimate what is achievable in the shorter term. Perhaps because of insufficient

appreciation of the cumulative gains of process goal achievement, there is a common tendency to underestimate what is achievable in the longer term. Most people, including bowlers, plan their holidays better than they plan the rest of their lives. The anticipation of holidays is highly motivating, and the prospect is easy to visualise.

Here, the term 'goal setting' refers primarily to participation in lawn bowling. However, bowlers have a range of personal, family, and other commitments outside of sport. All their worthwhile objectives should receive appropriate time and attention from bowlers to achieve balance in life. Bowlers should consider setting goals for all aspects of their lives to reflect their talents, interests and values.

Only individuals really have goals. Teams and other corporate bodies do not have goals so much as a shared purpose. The individual goals of team members need not mesh perfectly with group objectives but do need to be compatible with them. Compatible team members will demonstrate cohesiveness, cooperation, and mutual respect & consideration.

Setting Performance Goals

The following worksheet sets out a logical sequence of steps for defining performance goals, and contains some specimen entries to illustrate the method:

List at least five performance-related and achievable goals reflecting, your needs, wants & interests.

Improve performances in 40-bowl test
Get at least half of deliveries into a 'scoring zone'
Reduce margin for error (bowl scatter)
Increase driving accuracy rate
Improve self confidence in competition
Improve stability & consistency of technique
Improve concentration

List and prioritise at least three timely performance goals.

(A long-term goal is specialising in lead position)
Improve accuracy so that at least half of all deliveries finish in the 'scoring zone'
Improve stability & consistency of technique
Improve performances in 40-bowl tests
Improve concentration

List at least three of those goals in order of descending priority.

1. Improve stability & consistency of technique
2. Improve accuracy so that at least half of all deliveries finish in the 'scoring zone'
3. Improve concentration

Redefine the goals, as necessary so that skills specifically targeted are realistic yet challenging.

1. Avoid loss of balance, mistiming and premature recovery from delivery position
2. Spend part of each practice delivering at least 2 of every 4 bowls into marked 'scoring zones'
3. Develop a delivery procedure ritual; and learn and practice centring in practice & competition.

Refine the goals, as necessary, so that they are positively expressed and contain assessment criteria. Indicate the reasons that justify the inclusion and attainment of each listed goal.

1. Perfect my delivery movement to produce optimal stability, timing and smoothness and 'hold' my follow through; monitoring progress with my camcorder.	Justifying reasons	My accuracy and consistency as leader depends on flawless delivery technique
2. Practice delivering at least 2 of every 4 deliveries into a scoring zone positioned at 21, 27 and 34 metres, irrespective of green speed.	Justifying reasons	My prospect of my maintaining position as team leader depends on my reliability in getting my bowls in good position close to the jack so that my team mates can build heads in our favour.
3. Develop, practice, perfect and memorise an all-purpose delivery ritual whereby I am always perfectly set up for delivery, and I will always "say the shot", "see the shot", and "feel the shot". Learn, practice, and deliberately use centring technique at least every second end until I sense when my concentration is drifting, and I use centring intuitively.	Justifying reasons	My delivery preparation lacks 100% consistency, I sometimes make deliveries without confidence.

and I study the scoreboard too often in competitions.
4.
Justifying reasons
5.
Justifying reasons

Defining Goals

Three elements represented by words beginning with 'C': commitment, criteria, and conditions, constitute the essential elements of goals. The commitment is the specific aim or achievable result, and should reflect the principle of progressive overloading. Goals that are insufficiently challenging are unlikely to extend existing skills, and little development is likely to result. Although some imprecision in defining long-term or 'career' goals is understandable, bowlers should avoid vagueness such as "to become a better player". Such vague expressions do not really commit bowlers to particular courses of action. There should be no vagueness in short-term goal definitions. The criteria define when achievement is due and the measurable criteria for success or completion. The conditions define any requirements or exclusions as to time, place, methods, etc. A goal's conditions normally provide the latitude for engineering task challenge or difficulty so that it matches the individual's developing ability.

Recording

Unlike other mental skills, and principally because of the duration of typical objectives, goal setting is easier with aid of a computer or pencil and paper. Written goals attract a stronger and more enduring commitment. Bowlers may commit to performance goals better if they set them in consultation with a respected mentor. The process should begin by listing all possible goals. The next step is reducing goals to a manageable number and listing them in descending priority. The next step is validating the reasons for inclusion of each of the goals. The final step is defining the goals, as necessary, so that they reflect the 'commitment, criteria, and conditions' guidelines. Bowlers should regularly review goals achieved, goals in process, and new goals worthy of introduction. A sheet in the following form lends itself to monitoring of set goals...

Goal Setting and Achievement Log

Goals	Motivational Focus	Shorter Term or Process Goal #1		Shorter Term or Process Goal #n		Longer Term Goals	
		Goal Definition	Target Date	Goal Definition	Target Date	Goal Definition	Target Date
Bowling	Technical	1... 2... 3...etc	1... 2... 3...etc				
	Tactical	1... 2... 3...etc	1... 2... 3...etc				
	Psychological						
	Physical						
Non Bowling	Family						
	Finance						
	Educ/Training						
	Employment						
	Social						

Achievement of proficiency in goal setting requires practice.

Self Esteem and Self Confidence

Self-esteem is a positive self-image or feelings of self worth. Achievement of goals stimulates self-esteem and encourages the setting of further goals.

Self-confidence is equivalent to realistic expectations of success, or self-belief. It is an optimum state between under-confidence and overconfidence.

Self-esteem and self-confidence generate motivating enthusiasm. They encourage self-control and self-fulfilling expectations of performance improvements.

Validating Performance Goals

Skills rarely improve at a uniform rate, so a levelling out in performance could be a temporary effect that is ultimately self-correcting. If performing tasks have insufficient challenge, skill improvement could taper off, or even decline into a 'comfort zone'. On the other hand, task challenge may be frustratingly unrealistic or even unachievable. Recurring experience of failure could eventually undermine a bowler's self-esteem, self-confidence, and enjoyment of the sport. When there is a mismatch between challenge and ability, particularly when there is insufficient challenge, bowlers should adjust their goals so that they perform in the 'flow' zone. Positive feedback has the capacity to stimulate motivation and sustain the process of setting and achieving goals.

Post Competition Analysis

Post competition analysis broadly encompasses two areas - external events and internal experiences.

External events affecting performance are typically observable and assessable or measurable. They include weather and other conditions at the venue, quality of the opposition, the game plan and its effectiveness (shot selection, game turning points, etc), team cohesiveness, personal performance (strengths and weaknesses), scores or outcome, positive and negative feedback from others, etc.

Internal experiences include:

- sensations - sights, sounds, feelings (incl. kinaesthetic, fatigue, hydration, injury, etc)
- thoughts - helpful or negative, focused, etc
- feelings and emotions - flat, fluent, excited, anxious, positive, etc
- lessons learned and experience gained.

The conclusions that the analysis reveals should be noted for future reference. Improvements in performing skill typically require a tailored training program and a repertoire of supportive methods and learning aids. A training diary that includes summaries of the analysis of performances can be an invaluable aid. Bowlers who do not maintain a training diary are lacking an aid to improvement.

Training Diary

A useful training diary may be of almost any convenient format. It may be electronic or on paper. The size, layout, binding method, and number of pages are also matters of personal preference. A specimen page layout is appended on page 124. Diaries could also conveniently include space for goals, personal contacts, checklists, etc. Pages for data about each performance could have significant factors listed in a convenient and consistent sequence with adjacent spaces for brief notes. The factors selected for inclusion might include many of the following:

Event/Activity	Performance	Movement	Body	Mind	Tactics	Next training & practice goals
Date	Goal achieved?	Timing?	Flexibility?	Level of motivation?	Suitability &	1
Practice/Competition	Personal	Stability?	Strain or	Negative thought	effectiveness?	2
Calibre of opposition	accuracy?	Control?	injury	stopping	Game plan	3
Purpose of practice	Enjoyment &		(reason)?	(effectiveness)?	departures?	4
Wind & weather	satisfaction?		Fatigue	Self-confidence	Tactical	
Score, or outcome	Personal rating?		(reason)?	recovery	innovations?	
			Stiffness	(effectiveness)?	Turning points	
			(reason)?	Anxiety or over-	of games?	
				arousal intervention		
				(effectiveness)?		
				Maintenance of		
				concentration		
				(effectiveness)?		
				Team harmony?		

Bowlers should update their diaries daily while their recollections of events and feelings are fresh. Thereby, their post-competition analysis is available when planning the next practise session.

Bowlers gain little by recording data that is unlikely to have future value for them. Initially, they might find it useful to imagine they have been maintaining a training diary for some time. They could then imagine themselves reviewing their analysis of past performances. They can then best decide what types of information would have most value in preparing for practice and competitions. This is the information that they should enter in their diaries, using simple words consistently and concisely to simplify future reference. They might do well to consider how much of the relevant detail they would have remembered without the aid of a diary.

Elite athletes in most sports privately maintain a training diary or logbook. Athletes in masters and veterans sports seem less inclined to do so. Athletes who maintain training diaries review them from time to time, and typically feel proud of their accomplishments.

A Method of Fours Team Play Analysis

Assessing Fours Team Performances

Club selectors have a need for data on individual performances in trial and pennant fixture games. Coaches also could make effective use of such data. One of the problems in collecting it, especially considering that the performance of a side is the aggregate of four separate games, is that it is so time and labour-intensive.

One form of feedback that provides data are the official scorecards of each game. Scorecards do not indicate who played well, but at least they indicate whether a team got away to a good start, and whether they faded, or sustained their effort to the end. Another form of feedback that selectors can seek is the subjective opinion of managers and players as to who played well and who did not. This form of feedback gives also some indication of team motivation and cohesion. Selectors should crosscheck subjective opinions to minimise mistaken observations or personal bias. They should collect this type of feedback as soon after the completion of a game as possible while details are fresh in the minds of the observers.

Lead's Scorecard

A form of feedback worth considering is a lead's scorecard:

End	We				They			
	Lead	2 nd	3rd	Skip	Lead	2nd	3 rd	Skip
1	-	-	-	-	1	1	1	2
2	2	3	4	4	-	-	-	-
3	-	-	-	-	2	2	3	1
4	-	1	1	2	1	-	-	-
5	1	2	1	1	-	-	-	-
6	-	-	-	1	1	1	2	-
7	2	-	1	2	-	1	-	-
8	-	-	-	-	2	1	2	3
9	-	-	-	-	2	3	4	5
10	2	4	2	3	-	-	-	-
11	2	2	2	-	-	-	-	1
12	1	1	1	-	-	-	-	1
13	2	2	1	1	-	-	-	-
14	2	2	-	-	-	-	1	1
15	2	3	3	4	-	-	-	-
16	2	3	4	2	-	-	-	-
17	-	1	-	1	2	-	3	-
18	-	-	-	-	2	4	4	3
19	-	-	-	-	2	4	4	3
20	1	-	-	-	-	1	1	1
21	2	4	6	6	-	-	-	-
22	-	-	-	1	2	2	3	-
23	-	2	2	3	1	-	-	-
24	-	1	-	1	2	-	2	-
25	-	-	1	1	2	2	-	-
Adds	21	31	29	33	22	22	30	21
Lead	S.White				V.Black			

2nd	V. Large	A.Small
3rd	A. Driver	A.Bowler
Skip	K.Jack	B.Pegg

This is so-called because the lead is the only player with enough time to maintain it without detriment to other playing responsibilities. In the example below, the focus of interest is the "We" team comprising White (lead), Large (2nd), Driver (3rd), and Jack (skip). If the game were an intra-club pennant trial, interest would also focus on the individuals in the "They" team.

On the first end, the "We" team was down a shot after leads had played. It remained one shot down after both second and third players had played. It was down two shots after skips had played and the result of the end determined accordingly. White recorded all this on line 1 of the card. On the second end, The "We" team was up two shots after White had played. It was three shots up after Large had played. It was four shots up after Driver had played. It was still four shots up after the skips had played, and the result of the second end determined accordingly. White recorded all this on line 2 of the card, and used the same routine to record subsequent ends. Where the measured result of an end disclosed an error in recorded interim scores, White correspondingly altered them. The skip (Jack) helped White's task by signalling the interim score after each player in turn had played both bowls.

Analysing the Score Card

Leads or selectors insert column totals for the "We" team in Line 1 of the following analysis, and for the "They" team in Line 2. They complete Line 3 by subtracting each total in Line 2 from the corresponding total in Line 1. This produces an unadjusted value for each player's contribution. Line 4 is simply the accumulated surplus or deficiency inherited from the previous player which when added to Line 3 produces in Line 5 the adjusted contribution of each player.

Analysis For "WE" Team

Line		Lead	Second	Third	Skip
1	Scores for, after turn	21	31	29	33
2	Scores against, after turn	22	22	30	21
3	Net scores, after turn	-1	+9	-1	+12
4	Less net score before turn	n/a	-1	+9	-1
5	Contribution to team score	-1	+10	-10	+13

The analysis for the "We" team indicates that the skip and the second scored well, the third player did not, and the leads were evenly matched. However, such conclusions may be somewhat misleading. For example, the second player or skip may have encountered a particularly weak or 'out of form' opponent. The third player may have contributed to the good result of the skip, by playing many position bowls that did not directly contribute to the score. Over the course of several games however, aberrations tend to disappear. If Black kept a corresponding card for the "They" team, periodic cross checking should disclose any recording errors.

Concentration or Attention

The Elements of Concentration or Attention

'The championship bowler must condition mind and body. During play, he must exclude thoughts on any subject not vital to his game. This is crucial if he is to develop the unflagging concentration so necessary for success.' (Dobbie, 1983)

Externally-directed concentration is an awareness of stimuli from the five senses. Psychologists commonly use the terms concentration and attention interchangeably. They are the outcome more of ignoring unhelpful self-talk or other distraction than of any forcing of the mind to concentrate. The direction of concentration is external when a bowler selectively scans features of the performing environment. It is internal when a bowler attends to thought processes and neuro-muscular sensations.

Also, the span of concentration may be broad or narrow. It is broad when a bowler is considering several factors and correlating them. It is narrow when a bowler gives undivided attention to a critical aspect of performance. During delivery of a bowl, the span and direction of a bowler's concentration should shift sequentially through several combinations of these phases. Concentration skill involves selecting the immediately important stimulus, shifting attention from one stimulus to another when appropriate, and sustaining focus when necessary.

There are limits to and individual differences in span of concentration. All bowlers tend to concentrate better when engaged in absorbing activity. Stress, pain and fatigue have the capacity to distract concentration. Performance below expectations because of uncontrollable factors also tends to distract concentration.

Bowlers approach the mat with at least two bowls at their disposal. Some bowlers over-emphasise the reliance on the second of their deliveries to correct any error made with the first. Champion bowlers concentrate on achieving the tactical aim with the first of their deliveries. In that way their second bowl often becomes a bonus delivery that they can then play under less pressure. Selective concentration can be developed through competition-like practice. The 'grooving' or automating of the delivery movement relieves any need to give it attention when delivering bowls.

Learning to Concentrate

Concentration training involves increasing the ability to narrow and sustain focus of attention and the ability to exclude environmental distractions. Training may include simulations of event pressures and distractions. The simplest form is probably selective awareness training. It lends itself to adaptation and scheduling by coaches or bowlers to suit individual requirements. The following script is for an exercise in selective awareness training. Participants should begin by making themselves relaxed and comfortable and working through the following steps:

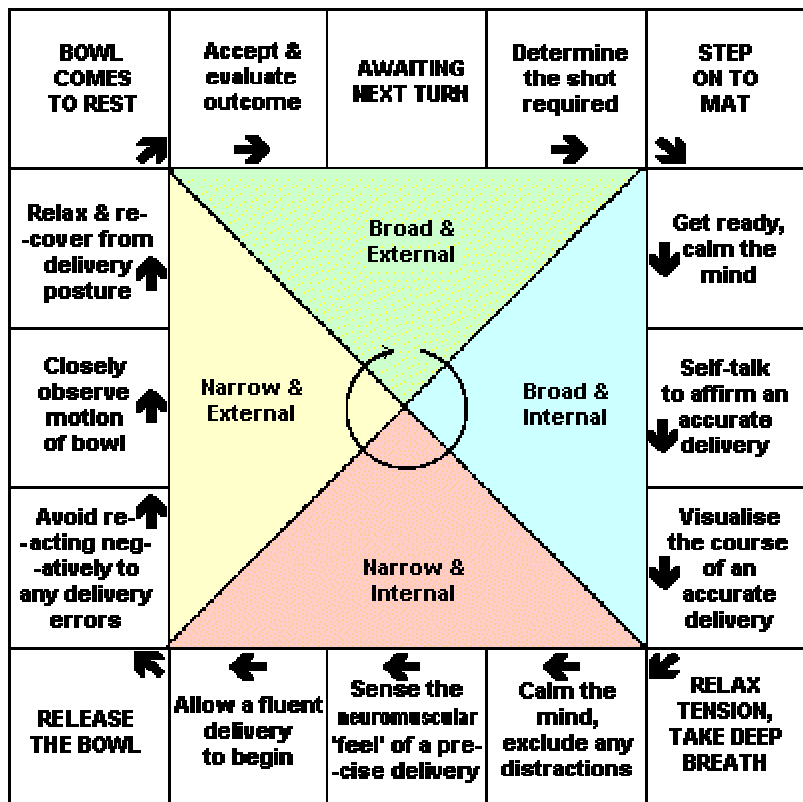
Focus	Sensation	Direction
(Coach): "Close your eyes for a minute or two.	-	-
Focus on your breathing rhythm Inhale deeply every third breath.	Breathing	Internal
Now focus on your thoughts and how you feel about them Calm your mind, then empty it of any thoughts	Thoughts, Feelings	Internal
Now focus on audible sounds. Decide what is causing them and where they are coming from.	Sound	External
Now focus on the contact your hands are making. Then on the contact of your body with your chair. Then on the contact of your feet on the floor.	Touch	External
Now open your eyes and focus on an object across the room. Narrow your focus to shut out objects near your cone of vision. Now broaden your focus so that the original object and other peripheral objects all come into view."	Sight	External

Notice that this simple routine involves both internally and externally-directed concentration, and involves three of the five senses.

Delivery Routine

A routine is an individualised sequence of steps for performing a particular task. It is like a pilot's cockpit drill. It can ensure that all essential elements of a performance receive proper attention. Mistakes such as deliveries on the wrong bias should not occur. Personalised drills or routines are an excellent way of ensuring performing consistency. Expertise in lawn bowling depends on consistent and automatic repetition of sound technique.

A delivery routine enables a bowler to concentrate on the essential variables, namely delivery line and bowl release speed, and confidently rely on that well-practised routine for ensuring that other aspects of preparation fall into place. Reduction in demands on attention results in less anxiety. A well-conceived delivery



routine should cycle through broad-narrow-broad and external-internal-external shifts in concentration as follows:

A delivery routine that follows the foregoing pattern, and which bowlers could modify to suit personal preferences, is as follows:-

Delivery Stage	Concentration or Attention	Routine, or Action Steps
Stage 1 Complete previous delivery Prepare for next delivery	Broad & External	Systematically monitor any environmental cues, e.g. wind changes, etc. Stay relaxed but avoid widening attention to the extent that unhelpful distractions intrude. <i>(Wait for next turn)</i> Pick up the bowl Obtain instructions Step on to the mat Select the appropriate delivery line Settle in the ready position
Stage 2 Preparing and rehearsing the delivery	Broad & Internal	Tune out distractions Calm the mind by a deep breath or other means. Be convinced the bowl will do exactly as required; use positive self-talk. Visualize the bowl performing exactly as required
Stage 3 Executing the Delivery	Narrow & Internal	Take a deep breath and narrow the inward focus even more While observing the delivery line, sense the neuro muscular activation of the delivery arm and body; imagine the feel of the ideal delivery Focus on the aiming point, and let the arm swing and the delivery flow, exactly as rehearsed
Stage 4 Recover and relax.	Narrow & External	Avoid any negative reaction to a delivery that misses the mark. Watch the run of the bowl and estimate any correction warranted. Breathe deeply and relax both mind and body.

Imagery

Imagery (or Visualization)

Many people, even some psychologists, occasionally use the terms imagery, visualisation and mental rehearsal interchangeably. Imagery involves creating or recreating an experience in the mind. A common application is visualising the likely path of a bowl to determine the delivery line and speed required to achieve a particular result. The more senses (sight, sound, touch, smell, taste) that bowlers can use in imagery, the more powerful is its effect.

Mastery of imagery should proceed through each of the following stages:

1. Establishing realistic expectations in the rate and amount of individual progress in mastering the technique.
2. Stimulating responsiveness of all the senses during imagery
3. Enhancing its vividness
4. Establishing the controllability of imagery at will.

Lack of experience of the look and feel of a particular bowls skill when it is well executed may limit the effectiveness of imagery in early stages of skill learning. Therefore, imagery is typically less helpful for learning new skills than for refining learned skills. The higher the stage of learning, the more beneficial does imagery become.

Anxious bowlers may use imagery to practise relaxation in visualised anxiety-provoking situations. Psychologists use the term stress inoculation to describe such desensitising techniques.

Mental Rehearsal

'Before your shot, visualise yourself playing the perfect bowl - draw, drive or controlled shot - whatever is called for. Imagine it as vividly as you can, then step onto the mat.' (Snell, 1982)

Mental rehearsal is a more descriptive term for imagined executions of balanced, fluent, and accurate deliveries of bowls. It generates the neuro-muscular activation that occurs when actually bowling. It can provide skill practise when bowlers are fatigued or injured, and at a pace that they can control.

Internal imagery includes kinaesthetic (performing) experience. External imagery involves an outside perspective of a performance.

Imagery that includes bowling successfully and that is intrinsically rewarding can reinforce motivation.

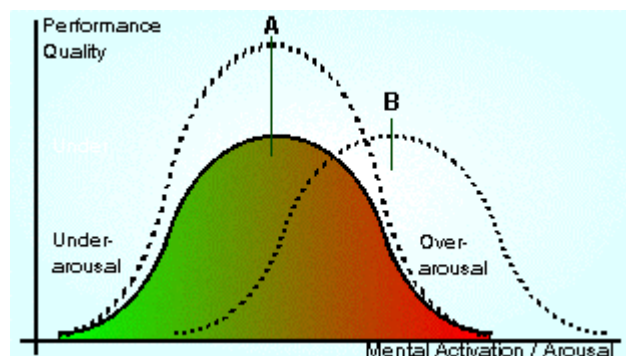
Skill in use of imagery improves with regular practice.

Arousal & Anxiety

Arousal

Arousal is a state of activation, stimulation or excitement that has a physical component, and usually has also a psychological element. The cause of arousal may be a natural response to a situation perceived as threatening. It is then a 'fight or flight' response. Other popular terms used to describe the physical effects of arousal include 'adrenalin rush' and 'fired up'. Arousal typically elevates heart rate. Over-aroused bowlers typically exhibit hurried performances. A popular term used to describe the psychological component of arousal is 'psyched up'. Arousal tends to increase in the period leading up to competition, but taper off somewhat once it begins. This reaction to competition is not inherently negative.

The graphical relationship between performance and arousal takes the form of a bell or inverted 'U' curve, as the adjacent diagram shows. A short vertical line indicates the top of curve A. The top of the curve corresponds with the peak level of performance. The base line point below the top of the curve indicates the level of arousal that corresponds with peak performance. Small variations in optimal arousal cause only slight reduction in performance quality. Optimal arousal and psychic activation is a controlled, focussed 'flow' zone centred between the 'comfort' zone (green area) and the zone of over-excitement or over-stimulation (red). Larger departures from optimal arousal produce may cause significantly sub-optimal levels of performance.



The dotted bell curve (A) represents a different level of performance for the same level of arousal. Two bowlers can have the same optimal level of arousal but one of them may perform better (the higher curve) because of greater experience and skill. However as the other bowler improves, the difference between their capabilities tends to diminish.

The dotted curve B reflects a different level of arousal that produces the same level of performance. For fine or complex motor skills that commonly have only small latitude for error (eg accurate bowling on fast greens over short distances), low levels of arousal (curve A) are better. For gross motor skills (eg driving at a large cluster of bowls), higher levels of arousal (curve B) are better.

Some bowlers, particularly junior boys, have a passion for driving. They will drive even when tactical risks are high and potential rewards (particularly in comparison with the tactical alternatives) are low. Worse still, they typically approach the task in an over-aroused state, and tend to sacrifice accuracy for speed. This further reduces their prospects of success. Over-arousal is also common within a team towards the end of a game if it is well ahead on the scorecard.

Dotted curve B also serves as a reminder that there are individual differences in the optimal level of arousal among bowlers. Pep talks or urging, that exhorts bowlers to 'lift their game', can have the effect of lifting some of them from their comfort zone to their optimal level of arousal. However, pep talks can further arouse any bowlers who are already optimally aroused. In other words, the exhortations can 'backfire' and produce worse performances. Worse, they can generate anxiety that may further worsen performances.

Successful self-management of both arousal and anxiety, which is described in the following section, depends significantly on disciplined thought processes. Arousal management techniques appear in the next section.

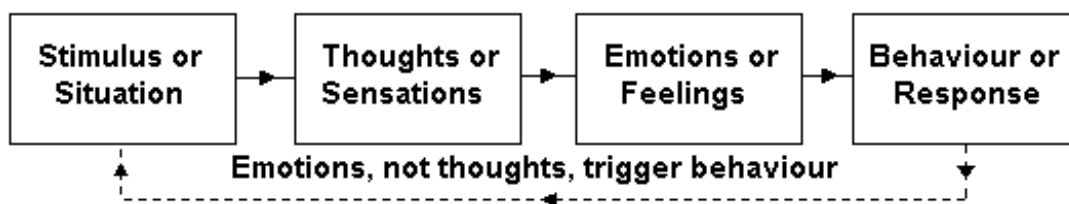
Anxiety and Stress

Nature of Anxiety

Anxiety may occur when bowlers perceive an imbalance between what is demanded of them and what they are capable of doing, and the outcome is important to them. Anxiety is a psychological condition associated with feelings of apprehension or tension. It is not uncommonly accompanied by over-arousal. Stress is a heightened condition of anxiety. Stress may be observable because of the physiological and behavioural symptoms that accompany it. Symptoms of stress may be psychological (such as distraction or worry), physiological (such as elevated heart rate or shallow breathing), or behavioural (such as nail biting or fidgeting).

Causes of Anxiety

There are individual differences in propensity for stress. Negative emotions typically induce stress. Bowlers with result-oriented goals are more prone to stress than those with performance-related goals. The following diagram illustrates how circumstances lead to thoughts, how thoughts induce emotions or feelings, how emotions shape behavioural responses.



An important relationship evident in the diagram is that the performance or other behaviour tends not to be the direct outcome of thoughts. Typically, behaviour is influenced much more by the emotional inferences or feelings that a bowler makes from those thoughts. The dotted path completes a loop indicates how responses could modify the original situation, or even create a new situation.

'Negative self-talk' is commonly the outcome of worrying about inherently uncontrollable factors of a competition. If the impulses flowing in a circular pattern are negative in character, an anxiety spiral, or stress develops. Anxiety or stress arises not from bowlers' perceptions of a situation but from the feelings generated by self-talk.

Bowlers who lose matches after having been well ahead in progressive scores either witness their opponents recovering from a slump, or they fall into one themselves. It is not possible to control the calibre of an opponent's game, but bowlers are able to control their own performances. To have accumulated a large margin, they must have been 'in the groove'. They had probably focused on line and length, delivery after delivery, and the jack must have seemed as large as a football. Then something distracts them. Perhaps their opponents win an end by a couple of shots. Even weak opponents will occasionally win ends. They begin thinking about how much more of their margin they might lose, about how the rest of the match might unfold, and what the final score might be. They start to get anxious and allow their concentration to switch away from immaculate line and length and they begin speculating about match outcomes. Their accuracy starts to unravel, and they start to get annoyed with themselves, the opponent, the marker, and anyone else in their neighbourhood. That is often how big margins vanish.

Effects of Anxiety on performance

When bowlers experience stress, the hyperactivity in the analytical left side of the brain tends to generate paralysis of the right side's motor skills. Negative self-talk is in many instances a temporary, or short-term effect. However, it can greatly influence performance throughout or in part of a match. An isolated episode of either a positive or negative character is unlikely to affect the more enduring mental attributes, such as motivation and self-confidence.

Avoiding over-arousal or anxiety

The ability to cope with pressure is a very important quality of a champion. There are individual differences in the ability to keep self-talk positive. Bowlers can make competition stressful by imagining problems that might never occur. There is really no such thing as a stressful situation. The self-talk that should continually occupy the minds of bowlers during competition, centres on accurate aiming lines and bowl delivery speeds. If it is positive, self-talk has the capacity not only to inhibit negative thoughts but also to augment confidence and self-image.

Competitive bowling inevitably imposes a degree of pressure. Bowlers can avoid some of the effects of pressure, i.e. over-arousal, distraction, and anxiety in several ways. Constructive self-talk can isolate any emotion from thinking

processes. Engineered exposure to the usual elements of competition can desensitise bowlers to their effects. Observance of competition preparation routines can ensure that no essential matters are forgotten, and which otherwise could become causes for concern.

A pre-competition routine offers bowlers the benefits of predictability and control and the avoidance of worrying problems during the lead up to important events. It ensures all necessary preparations receive proper attention. It is a checklist of preparatory steps not unlike an aircraft pilot's cockpit drill. A pre-competition routine has some parallels with a delivery routine. The form and content of routines are a matter of individual preference, and individual bowlers must sometimes prepare differently for different events. Subjective matters that typically deserve inclusion in a pre-competition routine include the following:

- becoming familiar with the published conditions of play,
- obtaining satisfactory answers to worrying questions about the event,
- visualising the ambience of the venue on competition day, and
- keeping prospects of winning or losing in perspective.

Matters that typically deserve inclusion in pre-competition checklists include the following:

Before competition day:	Competition day:
Competition preparation	Bland meals
Relaxation practice	Punctuality
Personal goals regarding the competition	Team meetings
Personal equipment clean & practice complete	Relaxation & concentration
Packing list	Game plan
Travelling & competition time-table	Warm up
Competition eve sleep	UV protection
	Hydration

Controlling over-arousal or stress

Despite comprehensive preparations, pressure inevitably arises during competition. Irrespective of whether that pressure manifests itself as over-arousal, distraction, or anxiety, effective methods of containing its effects are similar. Typically, bowlers must stop any negative thinking and empty their minds so that positive self-talk can take effect. Bowlers with their composure disturbed by over-arousal or anxiety normally find that remedies synchronized with body rhythms are very helpful. A notable example is controlled breathing, which is an aspect of centring technique - useful for regaining composure and control during competition.

Centring employs deep breathing, a body rhythm, and muscular relaxation to induce mental relaxation. This simple exercise is quick, and need not attract the notice of team mates and opponents: -

- Balance body weight evenly and comfortably between the feet. Relax, take a deep breath, and exhale slowly.
- Displace any negative thought that comes into mind with a positive thought. (Negative thought stopping)
- Concentrate on a factor that is relevant to success.
- Say one or two favourite keywords of proven effectiveness in past performances.
- Focus on producing a smooth, rhythmic delivery. (Affirmation, positive self talk)
- Form a mental image of a successful delivery.

Bowlers may vary the procedure to suit individual requirements, but it needs practice, just like any other skill.

Uncontrolled stress typically causes negative behaviour, which tends to reinforce a spiral of negativity within conscious mental processes. It typically undermines the capacity to perform effectively. Negative thought stopping and positive self-talk are typically the most productive ways of dissipating a negative cycle. Positive self-talk tends to induce positive feelings or emotions and to enhance performance. An improvement in performance constitutes a new and positive situation or trigger. Positive self talk also has the capacity to be self-reinforcing.

Learning to Relax

Bowlers could reduce their propensity for stress by practicing relaxation techniques in their training routines. Relaxation training should begin with a controlled breathing routine. Bowlers can use controlled breathing as a relaxation technique or as a preparation for other relaxation techniques. Breathing is an automatic and easily monitored body rhythm on which bowlers can redirect any distracted thoughts.

Controlled breathing is an example of 'muscle to mind' relaxation technique. Such techniques involve systematic relaxation of muscles to induce calming of the mind. They are in wide use, simple to learn, and highly effective for stress intervention. Progressive relaxation technique involves conscious release of tension from a sequence of major muscle groups. If using active progressive relaxation, bowlers tension, pause, then release tension in the major muscle groups around their bodies. If using passive progressive relaxation, they simply locate parts of the body where tension is present, and consciously induce the tension to flow away. 'Mind to muscle' relaxation techniques are also effective for management of arousal. Such techniques involve calming of the mind to induce release of tension around the body. Examples of such techniques include meditation, imagery, and autogenic training. Autogenous technique invites attention to how parts of the body feel rather than how relaxed they are. Such feelings include heaviness or lightness, warmth or coolness, etc. Bowlers can reinforce effectiveness of the technique by repeating such statements that affirm a feeling of complete relaxation.

Memory and Performance

If a bowler's first delivery nearly succeeds in realising a desirable tactical outcome, and if the next delivery by the opposing team has not materially affected the situation, the skipper's call for the second delivery is likely to be along the lines of: "Still drawing to here. How's your memory? Same line. Same weight, don't change a thing!" Should the second delivery also miss the objective, the skip's comment is likely to be along the lines of: "You changed it, I wanted the same bowl!"

The bowler may have experienced a little extra pressure for the second attempt and this may have contributed to the outcome. However, bowlers' kinaesthetic memories are shorter than is commonly realised. Short-term memory endures reasonably well for about 25 seconds in most individuals, after which it declines very rapidly. After the first attempt, the opposing team will have possession of the rink for around a minute during which their player chooses a bowl, prepares and executes its delivery, and observes its run until it comes to rest. Thus, a minute or more may elapse before a bowler is able to prepare for a second attempt. Because of the amount of elapsed time, many bowlers are unable to remember enough of a prior delivery to duplicate the movement. Consequently, they are obliged to re-program the second delivery from scratch, re-estimating required delivery speed and line. Recollection of personal data such as telephone and PIN numbers becomes possible through reinforcing techniques whereby it transfers into long-term memory. Some individuals may retain enough vestigial traces of a previous delivery to help them fine-tune their motor program for the subsequent delivery.

Bowls is a mechanically simple sport. The limited duration of short-term memory is one of several aspects of bowls that make the game so mentally challenging. Archers and shooters are not usually obliged to wait so long between scoring attempts. They are able to retain a more vivid imprint of the previous movement as a model for their next.

Use of Scripts

Notes on Scripts

A common mental skill training technique involves spoken positive suggestions that induce beneficial thought patterns in listeners. The term 'scripts' applies to both written and spoken versions of the commentary. Effective presentation requires an unhurried, firm and steady voice. Effective media includes audiotapes, typically each of 10-20 minutes' duration. Users should hear them daily, possibly for several months, to imprint their benefits.

Mental skill training requires a distraction-free environment. Different mental skills require different training scripts. A session might well begin with a relaxation script. Some scripts may have motivational value. However, they constitute neither pep talks nor hypnotism. Users may shorten and re-record scripts themselves as their responsiveness to related mental skills develops. They can sometimes recall memorised segments of scripts to advantage during competition.

Specimen scripts appended are

- Imagery (page 128)
 - Mental Rehearsal (page 128)
 - Thought Stopping & Positive Self Talk (page 129)
 - Deep Breathing (page 130)
 - Progressive Relaxation (page 130).
-

Physical Fitness For Lawn Bowling

General Fitness and Health

Lawn bowls imposes lower physical demands than many other sports impose on players. The general physiological requirements of lawn bowls are good general health and a well-functioning cardio-vascular system. Playing of several competitive games on each of several consecutive days would clearly make greater physical demands on bowlers than one social game per day.

Elements of physical fitness of most benefit are endurance and limb flexibility. Any training undertaken does not necessitate high intensity work. Partly because of their average age, few bowlers undertake fitness training. Those bowlers who do undertake fitness training, need to be aware of the recommended maximum heart rate for their age. It is $208 - 0.7 \times \text{age}$ (in years). So a 60-year-old bowler should avoid activities that could cause heart rate to rise above $208 - 42 = 166$ beats per minute. In general, bowlers of or above middle age should aim for a heart rate about $2/3$ rd of the maximum for their age during training.

Because the sport does not require a high degree of physical conditioning, some bowlers mistakenly believe either that physical fitness does not provide a competitive advantage, or that unfitness is not a disadvantage. In games between bowlers of similar competence but differing fitness levels, the fitter bowler tends to have a competitive edge.

Adverse lifestyle habits that affect physical capacity for competitive bowling include:

- smoking,
- alcohol,
- obesity,
- insufficient sleep, and
- non-prescribed pharmaceuticals.

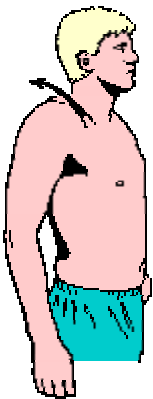
Bowlers should appreciate the effects of these, even though they might be reluctant to avoid adverse indulgences. Excess body weight is a condition that commonly affects performance, fitness and health. The Body Mass Index (BMI) of an individual takes into account height and body weight. The BMI is the weight expressed in kilograms divided by the height (in metres) squared. In short, $\text{BMI} = W \div H^2$. The table appended on page 132 shows BMIs according to the column that corresponds with height, and the row that corresponds with body weight. (Weights expressed in pounds need to be divided by 2.2 to convert them to kilograms).

The ideal range for BMI is between 20 and 25. Bowlers with BMIs between 25 and 30 are generally overweight. Bowlers with BMIs exceeding 30 are generally obese and should consider losing weight. Bowlers with BMIs between 18 and 20 are generally underweight. Bowlers with BMIs under 18 should consider gaining enough weight to enter the ideal range.

Warm Up & Stretching

Warm Up

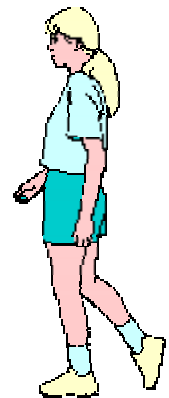
Trial ends, though useful, are inadequate as a warm up for bowlers. As a result, bowlers tend to be less effective until they have warmed up and acquired full joint flexibility. Warm up is the process of physiologically preparing for bowling. Warming up for bowls requires brief gentle exercise (e.g. walking) to stimulate the circulation rate and warm joints and muscles. The muscular-skeletal system thereby functions more efficiently and has less likelihood of sustaining injury.



Warming up dissipates any stiffness. It prepares a bowler's body for controlled and accurate movements from the outset. It also tends to induce a relaxed and ready state of mind.

Stretching

A slow start is not a good way to begin a competition. Pre-game static stretching is the solution to this problem. Stretching exercises should be effective, quick, simple, and reasonably unobtrusive



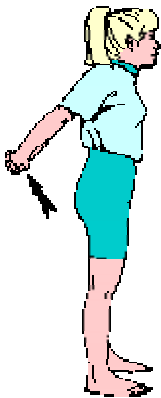
It takes only a couple of minutes to stretch all muscles important for bowling. Static stretching involves flexing or extending each major muscle group in turn and holding it at the limit of its normal range of movement for about six seconds before allowing it to relax. Stretching should avoid discomfort and any ballistic movements. Bowlers should breathe deeply while stretching.

The Australian bowls coaches' manual details a range of stretches for the major muscles of the legs, back, arms and neck. The stretching process for bowls should include gentle working of major muscle groups. A good choice of stretches would not require any equipment, nor result in soiling of bowling attire.

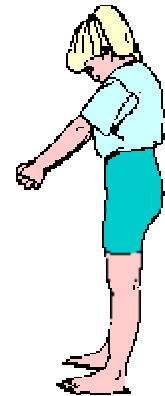
Even just before a competition, bowlers should find enough time to:

- circle the extended delivery arm forwards & backwards 8-10 times each way
- while standing, hug each knee towards the chest
- flex and loosen knees and ankles.

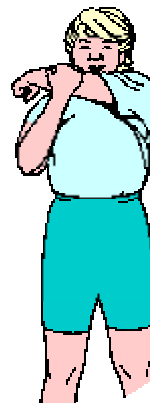
Before a practice session, bowlers should have ample time for stretching.



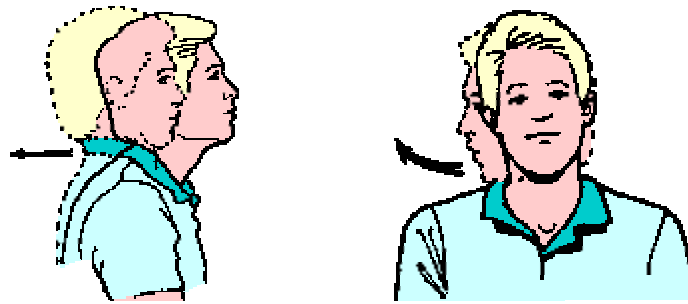
Two stretches for the arms follow. On the left, the bowler extends the arms behind the back and clasps hands. Raising of the arms stretches the muscles in the chest and upper arms. A similar stretch involves extending the arms forward with wrists crossed and palms clasped together. The bowler raises the arms to an overhead position and then returns them to the start position. On the right, the bowler has arms in the forward position. However, the exercise there comprises using the non-bowling hand as a resistance for flexing and extending the fingers and wrist of the bowling hand.



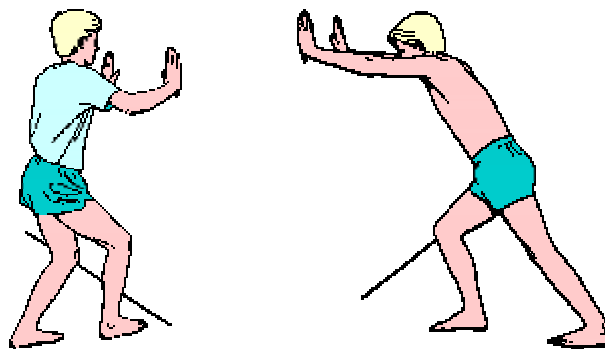
Two stretches for the upper arms and shoulders follow. On the left, the bowler demonstrates a latissimus dorsi stretch. This muscle provides much of the power for the back swing of a bowl. A bowler places the bowling hand (in this case, the left hand) behind the neck or extending down the back, and pulls on the elbow with the non-bowling hand. A bowler can enhance the value of the stretch by bending the trunk towards the non-bowling side. On the right, the bowler demonstrates a triceps stretch. The triceps and pectoral muscles provide much of the power for the forward swing of a bowl. A bowler rests the hand of the bowling arm on the opposite shoulder and pulls on the elbow with the non-bowling hand.



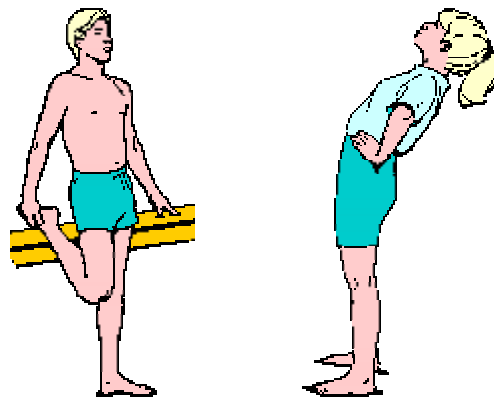
Stretches for the neck follow. On the left, the bowler demonstrates neck flexion and extension forward and back (nodding movement). On the right, the bowler demonstrates stretching by turning the head left and right (shaking movement). Not illustrated is tilting the head towards each shoulder (rocking movement). Neck exercises demand care. Exercise in more than one plane at a time (e.g. head rotation) should be avoided.



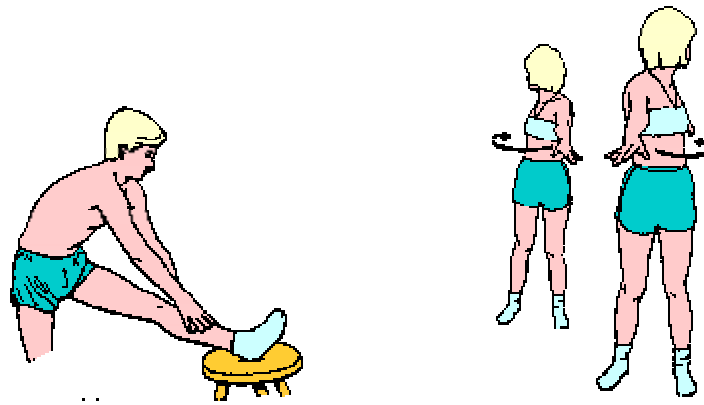
Standing stretches for the calf or lower leg follow. Using the usual method, bowlers position a pace away from a wall. They lean forward, placing outstretched arms against the wall and have both heels on the floor. In both cases, the back leg is the one being stretched. On the left, the bowler demonstrates the Achilles and soleus stretch. The soleus is the large flat muscle just above the Achilles tendon. Note that both knees are slightly flexed. On the right, the bowler demonstrates the gastrocnemius stretch. The gastrocnemius is the thick calf muscle just below the knee. Note that the back leg is straight.



In the left image below, the bowler demonstrates a standing quadriceps stretch. The quadriceps is the large thigh muscle. The leg under stretch is the bent one. The corresponding foot is pulled up toward the buttock. On the right, the bowler executes a simple form of back arch to stretch back muscles.



In the left image on the following page, the bowler demonstrates a hamstring stretch. To stretch a hamstring, a bowler supports the corresponding foot on an elevated surface. With outstretched arms for support, the bowler leans forward to stretch the hamstring. An alternative method involves placing the corresponding foot on a lower surface and flexing the knee. The bowler leans forward in a posture similar to that for delivering a bowl, taking the chest towards the knee, to stretch the hamstring. The bowler on the right is executing spinal twists. These movements are primarily a warming up exercise, but do produce some stretching of back and hip muscles.



Talent Identification (TID)

Identification versus 'Scouting'

At least until 1987, methods of talent identification (TID) in Australia were generally very rudimentary. Talent scouts with a 'good eye' observed trial games or competitions, to discover talented players. In lawn bowls and many other sports this process is still about the only method of 'talent identification' used. 'Talent scouting' is a term that might better describe this practice. Lawn bowling is not a skill that children can experience by improvisation in the schoolyard or playground. Today's talented bowlers represent those who have become successful in lawn bowling more typically by chance than through specific guidance.

Focus of TID

More systematic methods of TID have emerged since 1987. The Australian Institute of Sport (AIS) introduced TID in sports such as rowing, cycling, track and field, and canoeing. Sport scientists determine the physical and physiological demands of particular sports and make recommendations about the type of athletes suited to them. The Australian Sports Commission (ASC) introduced 'Sports Search', a program involving labour intensive anthropometric measuring and fitness testing of willing 12 to 16 year old subjects at participating schools. TID focuses on attributes that cannot readily change through training. For example, heredity is the primary influence on height and body shape. Training has little influence on such characteristics. A coach once said: "Training cannot put in what God left out".

Newer TID programs do not focus on players already skilled in sports being targeted. They focus on youthful athletes who have the physical attributes but perhaps no experience whatever in particular sports. Usage of the term 'Talent Identification' increasingly means these newer and more scientific programs.

TID for Lawn Bowls

Lawn bowls is not a sport warranting a rigorous TID program. Lawn bowling imposes only modest physical demands on players. However, even limited demands can sometimes challenge the quality of performances. The participation pyramid in lawn bowls has a broad base. Elite level bowling is a rather small apex of that pyramid. In addition, overall participation has been in decline for many years. Member recruitment programs appropriately focus more on numbers than on potential of new players. However, authorities could introduce TID procedure wherever an influx of youthful newcomers occurs, to identify those most likely to respond to specialised coaching and training.

Tests and Measurements

Australian Coaching Council (1991) *Better Coaching - Advanced Coach's Manual* (Ch 3), Frank S. Pyke (Ed) Australian Sports Commission, which is the prescribed textbook for Level 2 Coaching Principles' Courses in Australia, describes measurement methods. The syllabus of this course includes brief training in somatotyping and anthropometric measuring. Thus, Level 2 lawn bowls coaches should have had exposure to the methods involved. Coaches who work with school groups may have had the opportunity to apply simple TID programs. However, such work in lawn bowls would have little point in the absence of funding for developmental programs. Individuals within school groups would display wide variation in motivation and talent for lawn bowling. A primary aim of a TID program would be to identify the individuals with suitable attributes (i.e. 'talent') for the sport. The aim should encourage them to receive specialised coaching and training additional to the school group program. TID programs simplified for lawn bowls would exclude testing of factors more relevant to aerobic sports. This would probably include tests of power, speed, agility, oxygen uptake, etc. Talent factors relevant to bowls would probably include most of those listed in the appendix on page 133.

Lesson Plan Example

(NB: Consider teaching complex skills (eg delivering a bowl) in parts (eg grip, stance, delivery, and follow through). Use a separate plan for each part and an extra plan to describe the method of chaining learned parts into a composite skill)

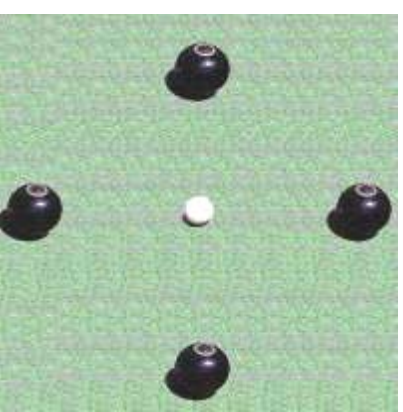
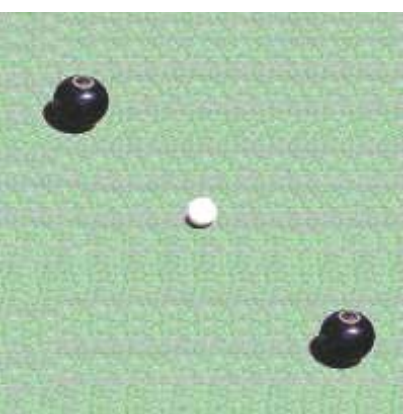
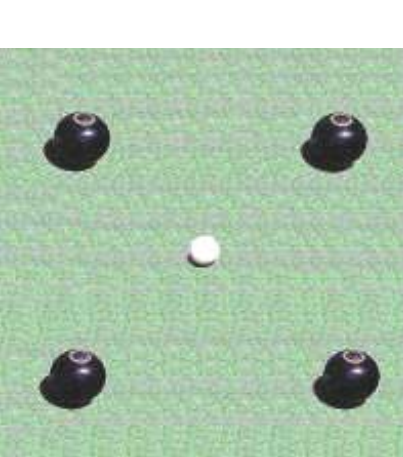
Skill:		<i>Laying the Mat (Simple Skill)</i>	
Purpose:		<i>Locates a common "base" for delivering the jack and bowls, whereby the green surface is protected from wear and tear by the back foot of bowlers during their deliveries. The front edge of the mat provides a line for measuring distances to bowls or to ditches.</i>	
Competency:		<i>Lay mat at permissible positions so that its longer mid line coincides with the centre alignment of the rink.</i>	
Equipment:		<i>Mat, Rink</i>	
Time Activity	Teaching	Method	Appraisal
	<i>Explanation of skill</i>	<p><i>Introduce skill & explain its purpose. Mention:</i></p> <ul style="list-style-type: none"> • <i>Tossing of coin</i> • <i>Who lays mat</i> • <i>Positioning for first end</i> • <i>Positioning options for subsequent ends</i> • <i>Wet weather can erase rink markings</i> • <i>Rink realignments can result in confusing multiple rink markings</i> 	<i>Test knowledge gained by questioning</i>
	<i>Demonstration of skill</i>	<ul style="list-style-type: none"> • <i>Pick up mat by corners of a short edge</i> • <i>Squarely face rink marker at rear ditch</i> • <i>Position mat after either crouching down or taking a forward pace and bending as in a delivery movement</i> • <i>Align mat with rink marker if centre line not visible</i> • <i>Align front edge two mat diagonals plus one mat length from ditch if 2m mark not visible</i> • <i>Resume an erect posture.</i> • <i>Straighten a dislodged mat</i> 	<i>Test learning by questioning about key points</i>
	<i>Practise of skill by client</i>	<ul style="list-style-type: none"> • <i>Correct (if necessary)</i> • <i>Frequent, informative, positive feedback</i> 	<i>Observe & Analyse</i>

Check List of Coaching Behaviours

Observed Coaching Behaviour (Mark appropriate column)	Competency Satisfactory	Modify Immediately	Modify Later	Modify Ultimately
Empathizing skill (eg. supportive, encouraging, rewarding)				
Reinforcing skill (eg Q & A about previous session, summing up at end of current session)				
Planning for video-taped session (eg prompts, subject sequencing, subject-to-subject transitions)				
Explaining skill (eg. clear, concise, correct and convincing)				
Mentioning of related basic tactical matters (eg. avoiding short bowling when shots down)				
Mentioning of mental states essential for competently performing the skill. (eg. focusing)				
Mentioning of adverse lifestyle indulgences (eg. Sunburn, insufficient fluid intake)				
Partitioning the teaching of complex skills (eg grip, stance, movement, follow through)				
Questioning skill (eg stimulate attention, test comprehension)				
Demonstrating skill (eg. visible, exemplary, frequent, critical cues)				
Maintaining momentum (eg preparedness, avoiding external distractions & interruptions)				
Maintaining interest (eg novelty, variety, avoiding inactivity)				
Observing skill (eg alertness, good positioning, technique v style)				
Diagnosing skill (eg perceptual v. movement errors, interrelated errors, cause v. effect)				
Socializing skill (eg easy courtesy, eye contact, personal space conventions re 'touching')				
Communicating skill (eg considerate, articulate, responsive, dispassionate, positive, informative)				
Training skill (eg practice drill suggestions, challenging variations)				

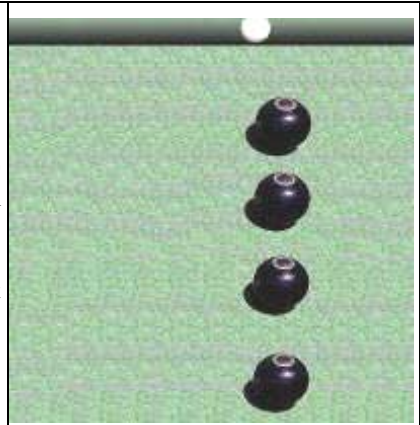
Practice Head Examples

A few examples of practice heads follow. Bowlers obliged to practise alone on a single rink can set similar practice heads, changing the task as required.

<p>Example 1</p> <p>Set bowls about 1.25 metres from the jack at 3, 6, 9 & 12 o'clock, as shown. The front bowl might partly or wholly obscure the jack. The player currently has four 'shots'. In these circumstances, overconfidence or anticipation of a large score can result in inattention or increased excitement or arousal and failure to make relatively easy shots. The objective is to avoid any distractions to draw a fifth shot. By way of variation, the player should imagine the opposition has the four shots. In those circumstances, nervousness about the tactical situation or fear of failure could produce an unsuccessful attempt at a relatively easy conversion. The objective is to avoid any distractions to draw into the centre of the head, converting the position from 4 down to 1 up.</p>	
<p>Example 2</p> <p>Set 2 bowls about 45° to the centre line and 20 - 50 cm from the jack. The player currently has two 'shots'. At such an early stage of head development, there are a variety of realistic options, including positioning a bowl to receive the jack, if moved. The objective is to evaluate different options at that stage (in singles, fours, etc). Nominate preferred option and play accordingly. By way of variation, the player should imagine the opposition has two 'shots'. Again, there are a variety of realistic options, including a draw into the head, converting 2 down to 1 up.</p>	
<p>Example 3</p> <p>Set 4 bowls about 45° to the centre line about 1.25 metres from the jack. The two front bowls partly block access into the head. The player currently has four 'shots'. As in example 1, the objective is avoiding any distractions to draw a fifth shot. By way of variation, the player should imagine the opposition has the four shots. In these circumstances, options may include not only drawing to convert, but also to attack, particularly if bowl spacing is such that the head constitutes a relatively easy target. The objective is then to evaluate different options, to nominate the preferred option and to play accordingly. Another variation might require the player to imagine that bowls on one diagonal belong to opponents and those on the other diagonal do not. Without measurement, the owner of the closest bowl is an uncertainty. The objective is again to evaluate the different options, nominate the preferred option and to play accordingly.</p>	

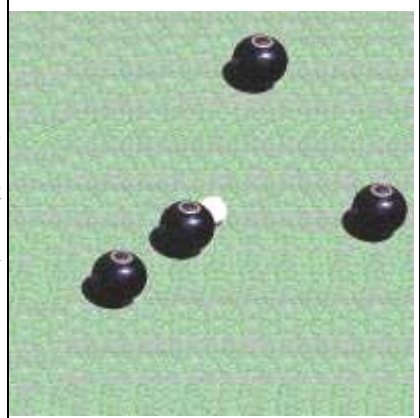
Example 4

The jack is in the ditch. Opposing bowls (in a right-angled line) are 60 cm (2 ft), 1.2 metres (4 ft), 1.8 metres (6 ft) and 2.4 metres (8 ft) from the ditch. The player is currently 4 shots down. Drawing to reduce the count may be safer than drawing for the shot. If the bowl runs into the ditch, there are no shots saved. The objective is to draw to the rearmost bowl to save shots and possibly convert to 1 shot up.



Example 5

An opposing bowl rests on the jack. Another opposing bowl is less than 0.5 metres in front of and wide of the resting bowl. The player has two nearby bowls on the opposite side of the head. A slight impact against the resting bowl could cause the jack to cannon away from the opposing bowls towards the player's bowls. The objective is to draw to an imaginary jack about a metre through the resting bowl. The resulting impact should have just enough force to move the jack across the head towards the two receiving bowls.



Players should clear any bowl that comes to rest in a position that changes the character or degree of difficulty of a particular exercise. They should normally reset a disturbed head.

Thirds and skips, in particular, can simulate realistic competition situations by setting heads with spare sets of bowls. Practice for play in a team should include all the shots that the relevant team position might require. Therefore practice heads for fours play should contain up to 3, 7, 11, or 15 bowls for leads, seconds, thirds and skips, respectively. For all shots, organized practice is the key to sustainable performance improvement.

Indoor Practice Ramp



The left view shows the ramp, which has a curved bed of 4 mm plywood overlaid with 12 mm foam. The foam is bevelled at the 42 cm wide mouth of the chute to remove any ridge at the edge. The image also shows the strip of 12 mm foam that cushions the top piece of the ramp housing. The maximum height of the ramp is 62 cm. The sides, top and swivelling leg assembly are of 18 mm plywood. The rear view on the right shows the 4 mm ply base of the ramp. It also shows the upper and lower rails that bridge the 47 cm-long legs. The top rail is of 18 mm ply, the bottom rail is 16 mm dowel. The 18 mm ply pieces are all about 55 mm wide. The final view shows the ramp when folded. The dip of about 95 mm at the centre of its 92 cm curved length is clearly visible.



Scoring Zone

The 'scoring zone' is a concept that Bowls Australia's present-day coaching director, Bob Middleton, used often when he played as leader for national World Bowls (1976 & 1984) teams, the Trans Tasman team (1984), and at other times in his career. It was the outcome of his long experience. He has been Bowls Australia's National Coaching Director since mid 1980s. Bob contributed the scoring zone concept as an article on Team Play (The Leader), published in *Bowls in Victoria* – February/March 1994.

The shaded area in the following diagram gives dimensions for a scoring zone for practice. The 1.2 m 'base' is the edge nearest the ditch, and the 'apex' points toward the mat. Some of the dimensions shown have the purpose of simplifying marking and cutting out of scoring zones for accuracy practice.

Tensioned thread anchored with small nails is a possible form for a scoring zone for practice. The chalked outline of a cardboard template (possibly hinged with packaging tape along the centre-line to allow folding for storage) is another satisfactory form. A template made of thin sponge rubber sheet would be a possibility.

Marking Out Ellipses

The following method envisages use of chalk as the marking medium. Where use of chalk is not acceptable, the method also serves to make an elliptical template, useful for marking or defining the scoring zone in some other way.

Method:

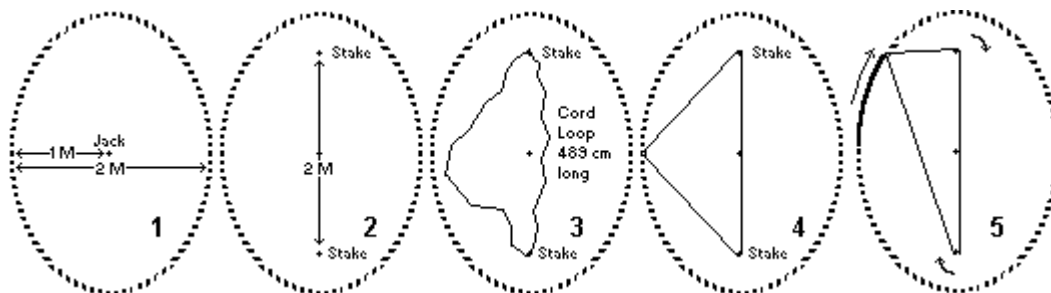
Decide a suitable size for the ellipse. Subtract about 20% from the average error of the bowler. Suppose the average error of the bowler is about 1.3 metres. 80% of 1.3 metres is 1.04 metres. The smallest (crosswise) radius of the ellipse should not normally exceed this length. Accordingly, the minimum diameter should not normally exceed double this distance, i.e. 2.08 metres. Suppose the chosen distances are 2 metres and 1 metre (minimum diameter and radius, respectively)

Fix the position of the proposed ellipse. Mark the alignment of the ellipse by inserting 2 spikes on the longest (lengthwise) axis, separated by a distance equal to the crosswise axis (i.e. 2 metres)

Make a loop. Make a cord loop of total length equal to twice the crosswise axis plus 20.7%. Twice the crosswise distance (2 m) is 400 cms, which when increased by 20.7% is 483 cms. (20.7% is $(\sqrt{2} - 1) \div 2$).

Prepare for marking. Drop the loop around the spikes and a marking device (eg. stick of chalk) and tension the loop by moving the marker outwards.

Draw the ellipse. Outline the ellipse by moving the marker around the circumference, allowing the tensioned loop to glide around the restraining spikes and the marking device.



40-Bowl Test Recording Sheet

Player Name:

End →							6 7 8 9 10							
Length→							M S M L M							
Mat→							C T E T C							
Hand ↓	Jack→	E	T	C	T	E	Row Totals	Hand ↓	E	I	C	T	E	Row Totals
Fore→	Bowl 1→						F ₁	Back→						B ₃
Fore→	Bowl 2→						F ₂	Back→						B ₄
Back→	Bowl 3→						B ₁	Fore→						F ₃
Back→	Bowl 4→						B ₂	Fore→						F ₄
Totals														6-10

C=Centred, 4 m from ditch, E=Centred, 6 m from ditch, I=Centred opp. 23 m mark,

L=Long, M=Medium, S=Short, T=2m mark

Player Name:

End →							6 7 8 9 10							
Length→							M S M L M							
Mat→							C T E T C							
Hand ↓	Jack→	E	T	C	T	E	Row Totals	Hand ↓	E	I	C	T	E	Row Totals
Fore→	Bowl 1→						F ₁	Back→						B ₃
Fore→	Bowl 2→						F ₂	Back→						B ₄
Back→	Bowl 3→						B ₁	Fore→						F ₃
Back→	Bowl 4→						B ₂	Fore→						F ₄
Totals														6-10

C=Centred, 4 m from ditch, E=Centred, 6 m from ditch, I=Centred opp 23 m mark,

L=Long, M=Medium, S=Short, T=2m mark

Player Name:

End →							6 7 8 9 10							
Length→							M S M L M							
Mat→							C T E T C							
Hand ↓	Jack→	E	T	C	T	E	Row Totals	Hand ↓	E	I	C	T	E	Row Totals
Fore→	Bowl 1→						F ₁	Back→						B ₃
Fore→	Bowl 2→						F ₂	Back→						B ₄
Back→	Bowl 3→						B ₁	Fore→						F ₃
Back→	Bowl 4→						B ₂	Fore→						F ₄
Totals														6-10

C=Centred, 4 m from ditch, E=Centred, 6 m from ditch, I=Centred opp23 m mark,

L=Long, M=Medium, S=Short, T=2m mark

Calculating Consistency

A measure of inconsistency is the calculated 'standard deviation' of measured errors. Bowlers with access to a calculator or a computer spreadsheet can readily calculate not only mean errors, but also standard deviations and relative consistency. Calculated standard deviation is normally expressed in the same units (eg centimetres) as the error measurements. A concept of consistency is based on the difference between the mean error and the standard deviation, expressed as a percentage of the mean error.

Note: The following example of the method of calculating consistency is illustrative and contains only 8 terms. A worksheet for calculating consistency of a different number of test deliveries (as in the 40-bowl test) would have a corresponding number of terms.

Example of method:

- Deliver 8 bowls towards a marked target position
- Measure the distance between the target and the actual stopping position of each bowl (column 1)
- Calculate average error. Deduct average error from each actual error (column 3)
- Square each error difference (column 4) and calculate the square root of the sum of the squares.
- Calculate consistency by completing the step that follows the table.

Measured distance between target and actual stopping position (m)	Average error	Actual error minus average error	Squares of variations
0.4	0.7	-0.3	0.09
1.1	0.7	0.4	0.16
0.8	0.7	0.1	0.01
0.0	0.7	-0.7	0.49
0.5	0.7	-0.2	0.04
1.3	0.7	0.6	0.36
0.6	0.7	-0.1	0.01
0.9	0.7	0.2	0.04
5.6			1.20

Average error
= $5.6 \div 8 = 0.7$ m
= 70 cms

Average square
= $1.2 \div 8 = 0.15$

Square root of average square ('Standard Deviation')
= $\sqrt{0.15} = 0.39$ m = 39 cms

Thus, the bowler has an average error of 70 cms, with a standard deviation, or dispersion zone 39 cms in width. This value (39 cms) reflects the extent of scatter, or *inconsistency*. Subtraction of this value (39 cms) from the average error (70 cms) produces a value (31 cms) that reflects the extent of *consistency*. A more meaningful expression of consistency is the square root of the consistency factor, thus:

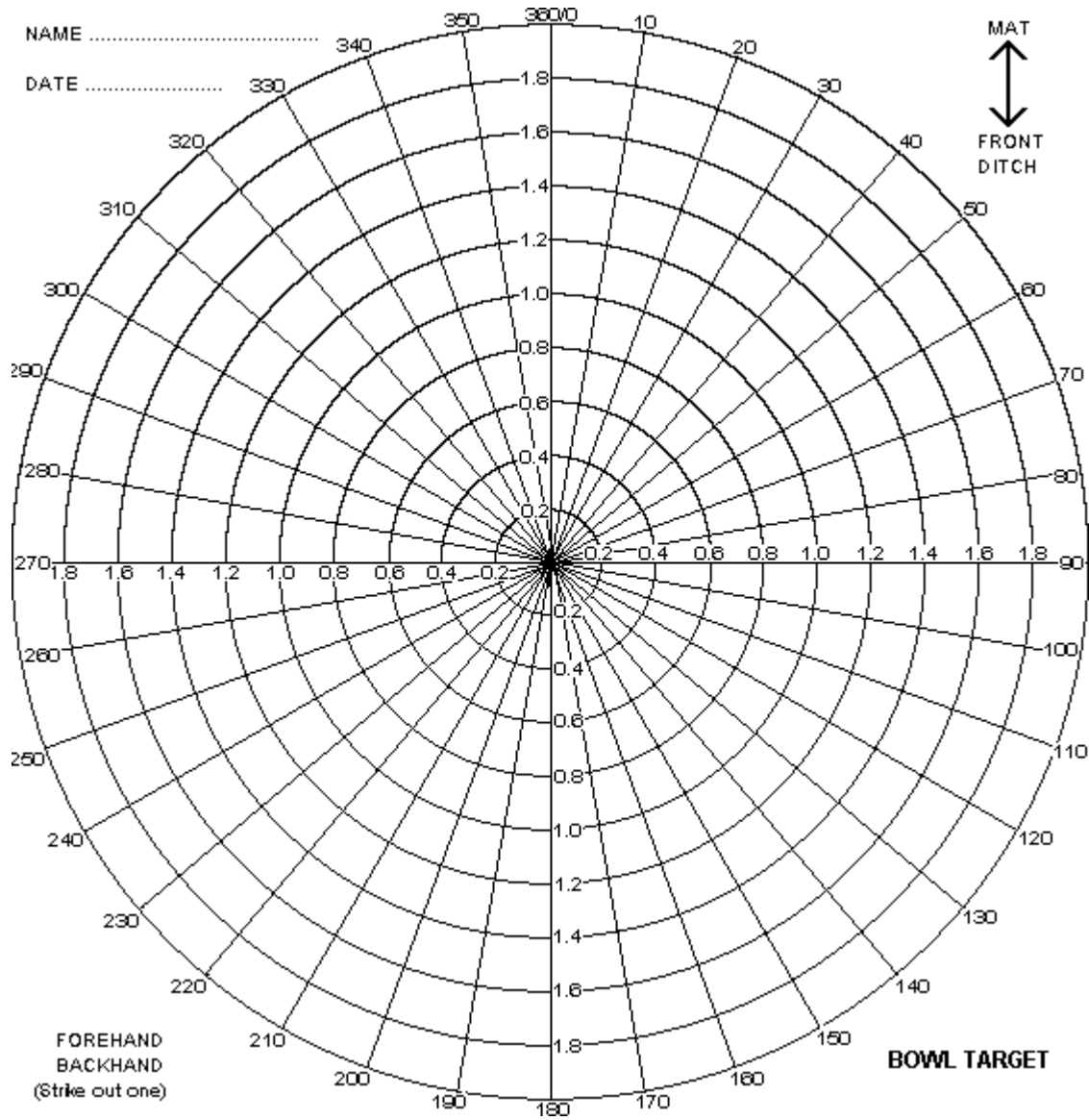
$$\sqrt{(31 \div 70)} = \sqrt{0.443} = 0.66 = 66\%.$$

Consistency tends to improve with accuracy over time. Therefore, the following suggested scale for assessing consistency is reasonably valid whatever the standard of the player being assessed:

Under 40%	some bad deliveries spoiling consistency?
40-60%	fair to good
61-70%	good to very good
Over 70%	Exceptionally good

As bowlers improve and reduce their mean errors, the standard deviation of their errors tends to reduce in similar proportion. Therefore, as mean error reduces (i.e. accuracy improves), the consistency percentage might not vary materially.

Target Bowling Marking Sheet Blank



Scores To Be Plotted

No	Direction°	m/cms	No	Direction°	m/cms	No	Direction°	m/cms	No	Direction°	m/cms
1			9			17			25		
2			10			18			26		
3			11			19			27		
4			12			20			28		
5			13			21			29		
6			14			22			30		
7			15			23			31		
8			16			24			32		

(Use separate sheets for forehands and for backhands)

Target Bowling Example - Resolution Of Vectors

1. List the magnitude and direction of each vector

<u>Direction</u>	<u>Magnitude</u>
349°	0.55 metres
70°	0.07 metres
155°	0.99 metres
235°	0.62 metres

2. Calculate the magnitude of the vertical and horizontal component of each vector as follows:
 a. Magnitude of vertical (N/S) component (y) = vector magnitude × cos(vector direction)
 b. Magnitude of horizontal (E/W) component (x) = vector magnitude × sin(vector direction)

<u>Direction</u>	<u>Magnitude</u>	<u>Vertical (y)</u>	<u>Horizontal (x)</u>
349°	0.55 metres	0.5399	-0.1049
70°	0.07 metres	0.0239	0.0658
155°	0.99 metres	-0.8972	0.4184
235°	0.62 metres	-0.3556	-0.5079

3. To assist later analysis (see 6), calculate the mean distance error

<u>Magnitude</u>
0.55 metres
0.07 metres
0.99 metres
0.62 metres

Total Average
2.23 metres 0.56 metres

... (1)

4. Obtain totals of both x components (T₁) and y components (T₂) (deducting any minus values).

	<u>Vertical (y)</u>	<u>Horizontal (x)</u>
	0.5399	-0.1049
	0.0239	0.0658
	-0.8972	0.4184
	-0.3556	-0.5079
T ₂ & T ₁ (resp)	-----	-----
	<u>-0.6890</u>	<u>-0.1286</u>

5. T₁ and T₂ are the y and x components of the resultant vector (R).

6. The magnitude (or length) of R is simply the square root of the sum of the squares of T₁ and T₂ (squaring a negative x or y results in a positive)

$$R = \sqrt{((-0.6890)^2 + (-0.1286)^2)} = \sqrt{(0.47472 + 0.016538)} = \sqrt{0.491258} = 0.7009 \text{ metres.}$$

The mean distance of the resultant vector error is R divided by the number of vectors (4) so, in this case:

$$0.7009 \div 4 = \mathbf{0.175 \text{ metres ... (2)}}$$

7. If a computer with Works, Excel, 123, etc is available; the direction of resultant R is the value of a cell containing the following formula:

$$"=\text{mod}(450-\text{atan2}(x,y)*180/\text{pi}(),360)" \quad (\text{where } x \text{ and } y \text{ are the values of the cells containing } T_1 \text{ and } T_2)$$

If a spreadsheet is not available, the direction of R may be derived by calculation as follow:

- a. Determine the quadrant in which R lies

If both T_1 and T_2 are positive, R is between 0 and 90 degrees.

If only T_1 is positive, R is between 90 and 180 degrees

If neither T_1 nor T_2 is positive, R is between 180 and 270 degrees

If only T_2 is positive, R is between 270 and 360 degrees

Both T_1 and T_2 are negative in this example, so **R must lie between 180° and 270° .**

b. Calculate R 's angle relative to the x or y axis:

Relative to Vertical Axis (y) (Option A)

R 's angle corresponds with the tangent (of absolute values) of T_1 divided by T_2 . ($=\text{atan}(\text{abs}(T_1)/\text{abs}(T_2))$).

$\text{abs}(-0.1286) \div \text{abs}(-0.6890) = 0.1286 \div 0.6890 = 0.1866$, which is the tangent of an **angle of 10.57°**

Therefore, **the direction of R is $180 + 10.57 = 190.57^\circ \dots$ (3)**

Relative to Horizontal axis (x) (Option B)

R 's angle corresponds with the tangent (of absolute values) of T_2 divided by T_1 . ($=\text{atan}(\text{abs}(T_2)/\text{abs}(T_1))$).

$\text{abs}(-0.6890) \div \text{abs}(-0.1286) = 0.6890 \div 0.1286 = 5.3577$, which is the tangent of an **angle of 79.43°**

Therefore, **the direction of R is $270 - 79.43 = 190.57^\circ \dots$ (3)**

8. Thus, **the mean magnitude of the resultant of the four deliveries is 0.175 metres (0.7009 metres total) in distance, and 190.57° in direction.**

Bowler's Training Log Book or Diary

Date.....

Event/Activity
Practice/Competition
Calibre of opposition
Purpose of practice
Wind & weather
Score, or outcome
Performance
Goal achieved?
Personal accuracy?
Enjoyment & satisfaction?
Personal rating?
Movement
Timing?
Stability?
Control?
Body
Flexibility?
Strain or injury (reason)?
Fatigue (reason)?
Stiffness (reason)?
Mind
Level of motivation?
Negative thought stopping (effectiveness)?
Self-confidence recovery (effectiveness)?
Anxiety or over-arousal intervention (effectiveness)?
Maintenance of concentration (effectiveness)?
Team harmony?
Tactics
Suitability & effectiveness?
Game plan departures?
Tactical innovations?
Game turning-points?
Next training & practice goals
1
2
3
4

Mental Approach to Lawn Bowls - Self Assessment

Self-assessment or self-reflection is a useful way of reviewing approaches to sport. A checklist for self-assessment follows. Comments for further reflection follow the checklist.

Method

1. Respond to each proposition by inserting a mark that best corresponds to your own approach.
2. Glance at the comments that follow that correspond with each question.
3. Adjust any of your original marks where you consider appropriate.
4. Identify any matters that you would like to discuss further with a suitably experienced counsellor (e.g. psychologist, sport agency, coach, etc).

Proposition	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I like playing bowls				
2. I use my imagination to enrich my bowling experiences				
3. I feel responsible if my team fails to win.				
4. I am disappointed when I don't win the game				
5. I enjoy my regular visits to the bowls club				
6. I enjoy playing in competitions.				
7. I like to feel in 'the groove' when I play bowls.				
8. I tend not to play as well in competition as in lead-up games.				
9. I continually fine-tune my technique, and practice regularly.				
10. Playing bowls has made me mentally sharper.				
11. I tend to get distracted by the scores in close games.				
12. I often feel anxious during competitive games.				
13. I concentrate on my body movements when I deliver a bowl				
14. I would like to achieve quick improvements in my skill.				
15. I have never turned a competition game around; i.e. I have never won a game once I got the feeling I was going to lose it.				
16. I enjoy playing as a member of a team.				
17. Playing bowls has helped my health and fitness				
18. I am more self confident about my game than I used to be.				
19. I enjoy the bowling at the club.				
20. I enjoy improving my bowling skills				
21. I like to win prizes in bowls events.				
22. I have lost many games, after having had an almost unbeatable lead.				
23. I like to play a drive when the opportunity presents itself.				
24. I tend to get distracted by the opposition during competition games.				
25. Bowling has made me feel a better person				
26. I believe that bowling requires a similar level of sportsmanship as other sports.				
27. I keep errors that occasionally creep into my game in perspective				
28. I would like to be a leading bowler				

Comments

1 Enjoyment of the game is the key to continuing participation

2 Imagination can be a powerful aid in development of bowling skills. Bowlers should imagine situations as they would normally experience them, and try to engage as many of the 5 senses as possible.

3 Success and winning mean different things, just as losing and failure mean different things. Success should be the outcome of matching or exceeding one's personal best. A successful performance may or may not be a winning performance.

4 Expectations of continual winning outcomes are unrealistic. Losses generally provide learning experiences that can help skill development, and should be accepted gracefully. A belief that 'Winners are grinners; losers can please themselves' is symptomatic of a degree of selfishness that is unworthy of the sport.

5 Bowls clubs offer fellowship, and the opportunity to chat about community issues

6 Competition provides new learning experiences - particularly about the progress of one's bowling skill development

7 When bowlers face challenges that match their skills, and they approach them in neither an under- or over-aroused state, their performances tend to 'flow' or follow 'a groove'.

8 For some bowlers, a competition environment induces apprehension or negativity, or has random noises and movements that distract them.

9 Persistent self-development usually yields improved performances.

10 The desire to play bowls, coupled with realistically achievable, personal expectations, should positively reinforce self-confidence and self esteem.

11 Bowl deliveries have a process (delivery) and an outcome (scoring effect). Optimal performance depends on concentrating on precise and fluent delivery processes. Scores should be left to look after themselves.

12 A moderate amount of stress can yield enhanced performances. However, uncontained stress can induce anxiety that normally and adversely affects performance. Stress is responsive to positive self-talk, or thought control interventions, and to relaxation techniques such as deep breathing.

13 Concentration should focus on required line & length: simultaneous body movements should be subconsciously automatic

14 A reduction in the rate of wasted deliveries is an obvious candidate in many cases. Bowlers generally overestimate what are achievable objectives in the short term. They 'set their bar too high'. Unachieved objectives usually translate into diminished self-confidence and loss of faith in the value of goal setting.

15 Once attention switches to game outcome, and negative self-talk is allowed free reign; pessimistic prophecies tend to become self-fulfilling. Focusing on process, positiveness, and relaxing breathing provides the best prospects of turning a game around.

16 Team play offers small-group bonding for a shared task.

17 A good diet, avoidance of tobacco, & moderation with alcohol should allow the fresh air and exercise to provide beneficial health and fitness.

18 Reinforcement of self-confidence and self-esteem is a normal outcome of positive experiences in playing bowls

19 Bowling activities offer companionship in the clubhouse and out on the green

20 Mastery of sporting skill is commonly highly motivating

21 Money, publicity, acknowledgement, etc are forms of extrinsic rewards. Personal satisfaction, and reinforcement of self-esteem and self-confidence are forms of intrinsic rewards. Intrinsic rewards tend to be more enduring and more beneficial in the long term.

22 Having had this experience before, players tend to be distracted by the thought that it might happen again. That it happens at all is commonly the result of concentrating on the scoreboard instead of on accurate line and length and consistently fluent technique.

23 A predilection for driving is commonly an expression of youthful exuberance, or over-arousal. Carelessness is often responsible for inaccurate and ineffective driving. Driving often occurs even when other shot options have better prospects of success.

24 Of all the factors present during competition, some are controllable by a player, and some are not. Factors that are uncontrollable, such as environmental conditions and how well opponents are playing, should be dismissed from the mind. Concentration should focus on only those factors that are controllable. These centre around a player's own performance.

25 Bowls has the capacity to help development of health & fitness, mental well being, and social interaction skills.

26 Nobody admires a cheat, or a player who violates the traditions or etiquette of lawn bowling

27 Occasional performing errors are natural learning experiences about skills to be mastered.

28 In the long run, anything is possible. Success can build upon success. However, 'failing to plan usually means planning to fail'. Without clear objectives, and a disciplined approach to development of skills, vague hopes are unlikely to be realised.

Psychological Skills Self-Training Scripts

(Refer to Notes on Scripts on page 106)

Imagery Script

"You'll continue by using the power of your imagination to consolidate your relaxed feelings...
Keep your eyes closed ...
Deeply breathe in ...
Slowly breathe out ...
Imagine yourself alone in a quiet valley ...
See how the sunlight touches the bush ...
Feel its warmth ...
See how it creates highlights and splashes of colour on the trees and grassy banks ...
See how the wind forces the slow march of scattered white clouds ...
Feel the wind against your cheek ...
Hear it pushing through the trees ...
Smell sometimes the scent of blossom, sometimes the tang of the decaying leaves of the damp understorey...
See the dancing highlights of a rippling creek ...
Hear it talking to granite rocks along its course or to the dragonflies hovering over its surface ...
See the darting birds ...
Hear their musical chatter ...
Hear the shrill buzz of hidden cicadas ...
This is a restful place. Let yourself relax and enjoy it...
You have made your imagery vivid by using all of your senses ...
Deeply breathe in ...
Slowly breathe out ...
(To continue) Remain nicely relaxed ...
(To discontinue) Now you can open your eyes and have a stretch and a yawn."

Mental Rehearsal Script

"While you are nicely relaxed you'll continue using imagery to mentally rehearse some fine bowling...
Keep your eyes closed ...
Remain nicely relaxed ...
Imagine yourself picking up one of your bowls in your non-bowling hand...
Hold the bowl comfortably to your waist ...
From behind the mat, give your attention to the head ...
Determine where your bowl needs to finish and which side of the rink to play ...
Decide what delivery line you need for your bowl to finish on the exact spot ...
Using self talk; tell yourself that your bowl will set out on that line; that it will begin curving in towards that spot as it begins to slow down ...
Tell yourself that it will curve more and more as it gets slower and slower; right on track ...
Tell yourself that your bowl will drift towards the spot and finish right on it ...
You feel confident ...
Remain nicely relaxed ...
Now you know what you are going to do ...
Step forward on to the mat with your anchor foot pointed along your delivery line ...
Bring your opposite foot comfortably alongside ...
Transfer the bowl to your bowling hand with a centred grip and on the correct bias ...
Flex your knees: and get your weight over the balls of your feet ...
You are nicely set up ...
Narrow your focus ...
Pause in the ready position ...
See your exact aiming point ...
See your bowl grassing sweetly and setting out right on line ...
See it curve at the shoulder of the green and begin closing on the head ...
See it slow down nicely as it drifts in to the right spot ...
See it finish its run right on target ...
You are perfectly focussed ...
Deeply breathe in ...

Slowly breathe out ...
 Remain nicely relaxed ...
 Still in the ready position, let your body feel that perfect delivery ...
 The nerves that control your muscles feel activated ...
 You can feel that perfect delivery ...
 Your mind feels right ...
 Your shoulder muscles feel right ...
 Your legs feel right ...
 Now go ahead and execute that perfect delivery ...
 As you do everything feels the same; everything feels right ...
 Even as the bowl leaves your hand, you know that it will finish very close to where you planned...
 See the bowl follow the right track and finish right where you wanted ...
 Congratulate yourself for that perfect performance ...
 You can relax a little before your next delivery ...
 You can check whether the wind might be shifting; or whether the green pace might be changing ...
 Forget about the position at the head, forget about the score, forget about your opponent, and forget about distractions among spectators...
 Keep your focus fairly narrow otherwise negative thoughts will intrude ...
 Remain nicely relaxed ...
 Deeply breathe in ...
 Slowly breathe out ...
 Now you can open your eyes and have a stretch and a yawn."

Thought Stopping & Positive Self Talk Script

To stop negative self talk or negative thought, bowlers must first recognise that it is occurring. If possible they should ascertain what caused it. Effective intervention for many bowlers may be as simple as saying the word "stop" silently, or even aloud. Bowlers should then replace negative thoughts with rational or motivational positive thoughts. Positive self-talk is self affirmation expressed in the present tense. For example "I am confident because...". This step will not only counteract stress but help concentration on the task at hand.

"Now that you are nicely relaxed you'll continue using your imagery skill for replacing any negative thoughts with positive ones....
 Keep your eyes closed....
 Remain nicely relaxed....
 Imagine you are a finalist in a major championship tomorrow....
 Tell yourself that's great. At last you have your opportunity in the big league....
 Remain nicely relaxed....
 Imagine that your opponent is a formidable bowler...
 Tell yourself that's great, too. It will bring out the best in you; and if you play well enough to win, the victory will be that much sweeter....
 Remain nicely relaxed....
 Imagine the venue is unfamiliar to you...
 Tell yourself that's fine. It's not your opponent's home club either, and it's just another bowling green....
 Remain nicely relaxed....
 Imagine that competition day has arrived and there is a strong wind....
 Tell yourself you have played well in strong winds many times....
 Visualise highlights of an important game that you won in strong wind...
 Deeply breathe in....
 Slowly breathe out....
 Remain nicely relaxed....
 Imagine that you have arrived at the venue and there is an unexpectedly large crowd there....
 Tell yourself that their presence will bring out the best in you....
 Imagine yourself walking over to briefly talk to one or two of them....
 Now tell yourself they are all your friends....
 They are all on your side....
 Remain nicely relaxed....
 Imagine the direction of play is into the sun in one direction....
 Tell yourself that you have played into the sun hundreds of times and it doesn't worry you....
 Remain nicely relaxed....
 Imagine the venue is beside a busy street, and there is distracting traffic noise outside...

Tell yourself that you will be concentrating so much on smooth, consistent bowling, that you'll let your opponent worry about distractions...

Deeply breathe in.....

Slowly breathe out.....

(To continue) Remain nicely relaxed....

(To discontinue) Now you can open your eyes and have a stretch and a yawn."

Deep Breathing Script

"Please begin by getting yourself squarely seated in a comfortable position. Feet together. Forearms comfortably extended along your thighs. Please close your eyes, everyone. I want you to keep your eyes closed, until I tell you to open them at the end of this session."

"You'll begin by using the muscles of your body to calm your mind.

You'll start with the muscles you use for breathing.

Concentrate on your breathing.

Deeply breathe in.....

Let your diaphragm push against your stomach.....

Slowly breathe out.....

Ten.....in.....

Nine.....out.....

Eight.....in.....

Seven.....out.....

Six.....deeply in.....

Five.....slowly out.....

Four.....in.....

Three.....out.....

Two.....in.....

One.....out.....

Keep your eyes closed.

Concentrate only on your breathing.....

Enjoy that relaxed feeling. Let the tension flow out of your body...

(To continue) Remain nicely relaxed....

(To discontinue) Now you can open your eyes and have a stretch and a yawn."

Progressive Relaxation Script

(Typically continues controlled breathing script)

You'll continue by using more muscles to consolidate your relaxed feelings...

You'll begin with what is called active progressive relaxation...

Deeply breathe in.....

Slowly breathe out.....

Become aware of your lower right leg.....

Tension the muscles in your lower right leg.....

Hold...

Now relax.

Let all that tension flow out of your leg....

Deeply breathe in.....

Slowly breathe out.....

Become aware of your lower left leg.....

Tension the muscles in your lower left leg.....

Hold...

Now relax.

Let all that tension flow out of your leg....

Deeply breathe in.....

Slowly breathe out.....

Become aware of both your thighs.....

Tension the muscles in both thighs.....

Hold...

Now relax.

Let all that tension flow out of your thighs....

Deeply breathe in.....

Slowly breathe out.....
Become aware of your lower right arm.....
Tension the muscles in your lower right arm.....
Hold...
Now relax.
Let all that tension flow out of your arm....
Deeply breathe in.....
Slowly breathe out.....
Become aware of your lower left arm.....
Tension the muscles in your lower left arm.....
Hold...
Now relax.
Let all that tension flow out of your arm....
Deeply breathe in.....
Slowly breathe out.....
Become aware of both upper arms.....
Tension the muscles in both upper arms.....
Hold...
Now relax.
Let all that tension flow out of your arms....
Deeply breathe in.....
Slowly breathe out.....
Let your awareness drift from your limbs up your body.....
Become aware of your head and neck.....
Mentally search for symptoms of tension there.....
Use your head and neck muscles to increase any tension....
Hold...
Now relax.
Let all that tension flow out of your body....
Deeply breathe in.....
Slowly breathe out.....
(Pause for any repetitions)

We'll now switch to passive progressive relaxation technique.
Become aware of your shoulders and body.....
Mentally scan them for any tension.....
Let that tension just flow away.....
Let it flow right out of your system.....
Deeply breathe in.....
Slowly breathe out.....
(Pause for any repetitions)
(To continue) Remain nicely relaxed....
(To discontinue) Now you can open your eyes and have a stretch and a yawn."

Body Mass Index (BMI) Table

	Height										
(Metres)	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00
(Inches)	59	61	63	65	67	69	71	73	75	77	79
Wt (kg)	Body Mass Index (BMI)										
40	18	17	16	15	14	13	12	12	11	11	10
42	19	17	16	15	15	14	13	12	12	11	11
44	20	18	17	16	15	14	14	13	12	12	11
46	20	19	18	17	16	15	14	13	13	12	12
48	21	20	19	18	17	16	15	14	13	13	12
50	22	21	20	18	17	16	15	15	14	13	13
52	23	22	20	19	18	17	16	15	14	14	13
54	24	22	21	20	19	18	17	16	15	14	14
56	25	23	22	21	19	18	17	16	16	15	14
58	26	24	23	21	20	19	18	17	16	15	15
60	27	25	23	22	21	20	19	18	17	16	15
62	28	26	24	23	21	20	19	18	17	16	16
64	28	27	25	24	22	21	20	19	18	17	16
66	29	27	26	24	23	22	20	19	18	17	17
68	30	28	27	25	24	22	21	20	19	18	17
70	31	29	27	26	24	23	22	20	19	18	18
72	32	30	28	26	25	24	22	21	20	19	18
74	33	31	29	27	26	24	23	22	20	19	19
76	34	32	30	28	26	25	23	22	21	20	19
78	35	32	30	29	27	25	24	23	22	21	20
80	36	33	31	29	28	26	25	23	22	21	20
82	36	34	32	30	28	27	25	24	23	22	21
84	37	35	33	31	29	27	26	25	23	22	21
86	38	36	34	32	30	28	27	25	24	23	22
88	39	37	34	32	30	29	27	26	24	23	22
90	40	37	35	33	31	29	28	26	25	24	23
92	41	38	36	34	32	30	28	27	25	24	23
94	42	39	37	35	33	31	29	27	26	25	24
96	43	40	38	35	33	31	30	28	27	25	24
98	44	41	38	36	34	32	30	29	27	26	25
100	44	42	39	37	35	33	31	29	28	26	25
102	45	42	40	37	35	33	31	30	28	27	26
104	46	43	41	38	36	34	32	30	29	27	26
106	47	44	41	39	37	35	33	31	29	28	27
108	48	45	42	40	37	35	33	32	30	28	27
110	49	46	43	40	38	36	34	32	30	29	28
112	50	47	44	41	39	37	35	33	31	29	28
114	51	47	45	42	39	37	35	33	32	30	29
116	52	48	45	43	40	38	36	34	32	31	29
118	52	49	46	43	41	39	36	34	33	31	30
120	53	50	47	44	42	39	37	35	33	32	30

<u>BMI Range</u>	<u>Weight Range</u>
Under 18	Very underweight
18-20	Underweight
20-25	Normal
25-30	Overweight
Over 30	Obese

Talent Identification for Lawn Bowls

Suggested Tests and Measurements, with the underlying rationale.

Test/Measurement	General Considerations	Bowling Considerations
Age (If child)	Relates to height, weight	Capacity for bowling influenced by stage of growth and physical development
Height	Height of older siblings, parents	Is delivery at the green surface easier for short bowlers, who do not have to bend as far as tall bowlers? Do bowlers well under average height greatly outnumber bowlers well above average height? Do tall people prefer basketball, netball, football, etc where their height is an advantage? Do many tall people take up lawn bowling and progress to elite performer levels? Are shorter bowls champions much more common, over the years? Should heights of a statistical sample of elite bowlers be benchmarked?
Weight	Over/underweight Body Mass Index (BMI) = Weight (kg) ÷ Height ² (m) Somatotype of parents: 'Mesomorph'=muscular, well-developed chest, shoulders, upper arms 'Endomorph'=overweight, well-developed hips, thighs 'Ectomorph'=thin and tallish	Is a newcomer with obese parents or older siblings likely to develop differently? Is obesity a disadvantage to performance? Above what BMI value (norm 20-25) does excess weight influence bowling performance? Should BMIs of elite bowlers be benchmarked? What somatotype mix suits bowling ability? Would, say, 38% mesomorphism, 34% endomorphism, and 28% ectomorphism be close to ideal? Should somatotypes of a sample of elite bowlers be charted?
Skin fold Measurement (Skin fold callipers)	Body fat. Correlate with BMI. Check diet	Does over or underweight significantly affect performance? What performance factors are most affected: endurance, fitness, flexibility, etc? Do family characteristics in each case indicate that bodyweight factors are congenital or are controllable through programs?
Grip Strength (Calibrated dynamometer)	Firm grip	Strength to hold a bowl of appropriate size with the fingertips on fast greens and to grasp a bowl firmly for quicker deliveries or on slower greens.
Sit Ups (Number/min - feet held)	Abdominal & hip strength Endurance, Resistance to muscular fatigue.	Resistance to fatigue of lower trunk during long games in tournaments.
Push Ups (Number/min)	Arm & shoulder girdle strength Fine movement control Resistance to muscular fatigue	Strength to deliver fast bowls on very slow greens or in attacking play.
Sit and Reach (cms)	Trunk flexion Hamstring soundness Lower back strength Freedom from lower back pain.	Resistance to fatigue of hip and large leg muscles during long games in tournaments.
Hip Range of Motion (Goniometric measurement - degrees)	Hip flexibility	Consistent and comfortable movement into and recovery from a stable delivery stance