

ROUND TABLE: HORIZONTAL JUMPS

With Craig Hilliard, Dan Pfaff, John Boas and Gary Bourne

Coordinated by Craig Hilliard of the Australian Institute of Sport (AIS), four experienced coaches of the long jump were asked several questions relating to the coaching of the event. Their insightful answers provide an in depth understanding of the requirements of the long jump and useful ideas for developing jumping ability. Re-printed with permission from Modern Athlete and Coach.

Craig Hilliard (AIS) is arguably Australia's most successful coach in recent times. He has coached numerous international athletes and has specialized in long jump, hurdles multi-events and the walks. In the long jump, he has coached Sydney Olympic silver medalist Jai Taurima and Olympic finalist Nicole Boegman among others.

Dan Pfaff (University of Texas, Austin, USA) is internationally regarded as one of the most talented and successful coaches in track and field. He has coached tens of international athletes, many of them Olympic medalists and finalists over the last decade in both track and field events.

Dr. John Boas has coached two of Australia's most successful long jumpers, Gary Honey (silver medalist in Los Angeles) and David Culbert (Olympic finalist in Seoul). He has combined his extensive understanding of science with the art of coaching to great effect.

Gary Bourne has worked successfully with secondary school athletes across a range of disciplines within track and field for many years. He is a Level 3 coach in long jump and coached Australia's first female 7.00m long jumper, Bronwyn Thompson.

Describe the most important physical qualities to be developed in horizontal jumpers and in what priority?

Hilliard:

Acceleration speed coupled with optimal approach speed, rhythm, coordination, technique, power and elastic strength.

Pfaff:

I feel that this sort of athlete needs to be a sound mechanical sprinter with excellent ballistic qualities. They need to possess above average eccentric strength values and have high motor educability. I find that many of today's athletes have little skill at amortization movements which, in turn, affects "stiffness" indices that are so critical to take off factors... so this area is one you look for but seldom find...

Boas:

The most important is take-off ability. That is, the ability to convert forward speed to vertical lift, or the ability to use explosive power at high horizontal speeds and convert to vertical lift. Speed and strength can be developed from this. A triple jumper requires a sense of the even rhythm of the event.

Bourne:

Foundation physical qualities:

- Core stability (strength & endurance; evidenced by the capacity to hold stable static prone, supine and lateral exercise positions for 60 seconds each).
- Static and dynamic flexibility (capability to attain established static stretch ranges of movement in hip flexion and extension and ankle dorsiflexion).
- Energy systems - Anaerobic alactic power and capacities (capability to complete 10 x 100m sprints at 95% speed on 4 minute recoveries).
- Anthropometric measures — body weight and skinfolds, (body fat skinfold levels for males of <50mm and females <80mm).

Specific physical qualities:

- Development of an effective arhythmical take off (U) and techniques for hopping/hop-stepping/bounding/ step-jumping (Ti)
- Sprinting speed
- Run up rhythm
- Reactive muscular strength
- Maximum muscular strength.

What field tests do you employ on a regular basis and which tests do you find most beneficial as expressions of jumping preparedness?

Hilliard:

Overhead throw, caber toss, 10 bounds, 20m hopping, 5 stride run in 4 bounds and jump, standing triple jump, vertical jump, 40cm bench-step-step-jump and hop-step-jump and velocity tests over 40m and 60m. As an indication of jumping preparedness, I prefer 4 steps and a jump, overhead and caber toss as good explosive measures, a variety of bench depth jump activities and 10-14 stride approach competitions. There are number of field tests available, but it is critical that you establish a battery of tests that are performed under similar conditions and strictness, and accurately reflect/measure what you set out to achieve in that particular phase of training.

Pfaff:

I use a variety of short end jump tests along with Bosco-like vertical jump inventories. I also do a fair bit of throwing tests as I believe that one must know how to project things in a general sense before they understand projecting themselves.

Boas:

Regular field tests include:

- Standing long jump
- 30m and 60m from first footfall and timed last 10m of the run up
- 4 hops and a jump (both legs)
- 2 hops, 2 steps and a jump from 1 step (a particularly good indicator for triple jump).

Indicators of jumping preparedness

- Long or triple jumps from 7, 9 or 11 running strides
- Timed 5 fast squats
- Full run up jumps in training (for mature athletes)
- A selection of exercises from the field tests listed above.

Bourne:

I use a regular battery of field tests throughout the specific physical conditioning of my jumpers. Testing is carried out at the end of each 3 week training cycle and the results utilized to monitor the progress of the athlete in training.

My test battery consists of the following:

Jump tests:

- Hop-hop-step-step-jump off a 6 stride run-up
- 4 Bounds and a jump off a 6 stride run-up
- Long jump off a 10 stride run-up
- 5 spring jumps (2 spring jumps in competition phase)

Sprint tests:

- 120m sprint time (from horizontal jump run up starting position)
- Max velocity test (maximum runway velocity in competition phase).

Strength Tests:

Maximum weight clean from floor (not in competition phase). Maximum weight 2 squats to parallel (not in competition phase).

Anthropometric tests:

- Body weight
- Sum of skinfolds (Body fat).

How do you view the importance of biomechanics and technological aids as a coaching tool. Specifically, what measures do you utilize to assist in the coaching process and the athlete's understanding of their event?

Hilliard:

Providing the biomechanical filming analysis performed and the information gleaned is user friendly, the impact it will have on the desired technical changes you are trying to make, as well as the athletes understanding of the event is significant. There are many useful systems on the market in particular Dartfish

and Swinger. Such systems can provide instant feedback to athlete and coach, which can only enhance learning.

Critically, a data bank of jumps from training and competition can be overlaid with past and present models to clearly reflect what is changing. Effective patterns can be established as to what facilitates or contributes to sound technique and effective jumping. Laser gun velocities are also used and matched with competitions and specific run up/jumping sessions. Other parameters measured (but less frequently) include take-off angle, horizontal and vertical velocity and centre of gravity displacement during the penultimate and take-off strides. Most of our analysis at training and at National Grand Prix is centered on stride lengths, stride frequency and run up velocities.

Pfaff:

Specifically, what measures do you utilise to assist in the coaching process and the athlete's understanding of their event? I think that trying to coach without a foundation in biomechanics is like trying to sail without a compass. On the other hand we need a lot more common sense and practical info from our researches as they sometimes take liberties with their studies and/or reporting of data. I use film to develop common denominator models for athletes with a unique set of biomotor qualities. We use film also to compare inter and intra jump series.., of the same athlete. I like some of the software that measures ground contact times, flight times between strides, measures parabolic angles, and so on...

Boas:

One must distinguish, for both athlete and coach, between what's nice to know and what must be known. The coach must have a good understanding of the biomechanics of the event, in order to relate their observations to why the athlete is making particular movements. The athlete needs to be able to relate what they feel to what actually they did, and understand the event well enough to be able to work out for themselves what is going wrong and how to fix it. Biomechanical analysis, other than by simple use of a tape and stopwatch, can be overdone. There is no substitute for the 'coach's eye' and ability to observe, analyze movements and suggest solutions for technical problems, although some video analysis can be useful for the athlete to see what they are doing. The athlete usually doesn't have access to videotape during a competition. The scientifically minded athlete may want to know the biomechanical details out of interest, but beware of athletes over-analyzing their performance.

Bourne:

I believe that my knowledge and understanding of biomechanics helps me immensely in understanding and analyzing key aspects of horizontal jumping performance and in determining the relevance of various training activities.

The most useful information for me is the digital film record of the athlete's performances in competition and training. This film record is a most valuable coaching and teaching resource and I use it frequently both in competition and in training. My use of film extends to weight training sessions, bounding sessions, running sessions and competitions. I believe that this form of feedback is invaluable to the athlete who is all the time trying to match what they feel they are doing (kinaesthetic feedback) with the "picture" or technical model they have in their mind of what they are supposed to be doing. The regular use of film can only speed up the merging process between 'perceived performance' and 'actual performance' of a skill for athletes at all levels.

I also use velocity data whenever I can access it, as it provides valuable quantitative information as the most important factor determining performance in horizontal jumping. I discuss these results with the athletes to ensure they have a clear understanding of what we are working towards. Biomechanical data on stride lengths on the runway provides a useful insight into any steering that the athlete may be doing and we use this when necessary in the training process associated with refining run up rhythm.

Briefly describe your philosophy on weight training and its relative merit in the training process. List examples of the types of special strength exercises you would utilize to augment the various phases of training.

Hilliard:

Weight training is an important adjunct to the overall program and will vary in stimulus, frequency, intensity and loading depending on the level of athlete and the phase of training. However, it should never preoccupy the program at the expense of technique, running rhythm, specific jumping and plyometric activities. Weight training should compliment not dominate. Unfortunately, too many athletes become obsessed with improving their maximum squat, clean or snatch and fail to address the major technical issues.

Generally, I will work from hypertrophy to maximum strength (neuromuscular coordination) followed by combination structures of strength plus elastic strength qualities. It is important that these phases of work are no longer than six weeks, preferably shorter, so that the body is constantly adapting. Specific strength exercises include all Olympic lifts and full squats, whilst special strength exercises involve step ups to varied height boxes, lunge squats, single leg squats and a multitude of core strength exercises and ankle complex drills. Closer to competition emphasis is on speed of movement, which is incorporated into most lifts and rebound exercises, coupled with elastic strength exercises.

Pfaff:

My program is hugely based in external load work. We do various Olympic lift movements, pressing movements, and a wide variety of leg exercises (e.g., step ups, lunge jumps, jump squats, lateral squats), where we place the load on the body. The sets, reps, rest periods, speed of movement, height of displacement, ancillary work, etc. are all dictated by the training age, health, phase of year, and other periodizational considerations...

Boas:

Weight training, as a part of strength development, is an essential part of the overall program for all horizontal jumpers after the age of about 14 for girls and 16 for boys. For a developing horizontal jumper, strength training, based on weight training, may comprise 25% to 30% of the program. I start young athletes off with a series of exercises using their body weight, with emphasis on core strength and general flexibility development but also including exercises such as step ups, push ups, dips, chins, exercises for hip flexors, hamstrings, ankle/foot strength and flexibility. Once the athlete is in the right age range and state of maturity, I introduce training with weights as the additional loading factor. Back squats are the fundamental exercise for developing leg power — the number of sets, repetitions, weight used, depth and speed are all variables, which depend on the progression of the athlete. For the older and more developed athletes I use power clean and snatch as general exercises and introduce front squats.

Bourne:

I am a strong advocate of weight training as part of the strength training program. My weight training programs for horizontal jumpers are focused on the development of the musculature of the hip, legs and back regions. My exercises include both double leg movements and single leg activities. My upper body program consists mainly of repetitive body weight exercises for upper body development along with a range of core strength exercises that work the hips, trunk, chest and arms. I deliberately avoid heavy upper body programs as I believe that the development of excessive muscle bulk in this region (and the associated additional mass that comes with it) is counter-productive to the athlete achieving the necessary high vertical impulse required at take off.

Whilst I use a varied range of exercises from time to time for strength stimulus purposes, my main exercises for development of maximum strength include double leg squats to parallel (usually, but depends on the lower back stability of the individual athlete), power clean from the floor or from the knees and single leg squat to 90 degrees knee angle. During competition I will again use a range, but mainly a single leg reactive squat, power clean from a drop from hip to knee and single leg cleans from a drop from hip to knee. Upper body exercises are

chins, dips and stability press ups plus the spin-off athletes receive from the core strength program.

Visual control during the final phase of the run up is paramount to successful jumping, how do you coach or influence the 'steering process' of the athlete. What strategies or practices do you employ in developing a consistent approach run?

Hilliard:

The steering process is a naturally acquired gift. However, there a number of drills and practices that will help develop a better feel. They include:

- Running to a specific mark on the track and changing the approach distance on each trial
- Have your athletes hurdle (both legs preferably) and utilise a variety of stride patterns, 3-5-6-7-8. This is very good for developing rhythm, spatial awareness and sighting.

Many athletes have considerable stride length changes over the first 8 steps, which will have a significant impact on what is happening at the board. Further, many athletes simply fail to sight the board and are looking up from as far out as half way through their run up making steering impossible. Check marks are useful for developing consistency, particularly early in the run up. From a coaching viewpoint a check mark opposite the fifth step from the board can assist in determining where potential run up problems are occurring.

Pfaff:

I spent the better part of two decades working with Dr. Jim Hay (internationally renowned sports biomechanist, who has worked extensively with US horizontal jumpers) on this problem. We identified many interesting variables from this work and concluded that it is a very complex area. I am firm, however, that one must 'see' the target. That implies seeing the board for a good part of the approach and maintaining at least peripheral eye contact through even the penultimate step... some can take a picture some two strides out, but these athletes are in the minority. I purposely use Rewson methods on approach work whereby I move the starting mark up and back throughout various workouts. The range for these maneuvers is between 30- 60cm. The athletes practice into wind and also with the wind. We make accuracy a big deal even in the early season short run jump sessions. I could never understand why pole vaulters, basketball players, soccer players, hurdlers and the like were allowed and encouraged to look at their target but for some reason a virus broke out where horizontal jumpers were taught to not look at the board. I think this virus has wiped out at least two generations of jumpers...

Boas:

Visual control on the runway is the ability to judge space in an open skilled situation. Most jumpers have a capability to judge where they are on the runway. They also need to improve the accuracy and consistency of their judgments and to automatically make the correct decisions. The athletes learn to make the automatic adjustments to their stride pattern and the coach's job is to minimize the disruption to the ideal pattern. The coach must give accurate feedback. Importantly, fouls do not count in training, which is consistent with the rules of competition, and are in essence opportunities wasted. Like every other aspect of skill, plenty of perfect practice prevents pathetic performances. Ideally, I approach the problem as follows. First, the athlete must develop good running technique and an understanding of the changes in rhythm and body positioning required during a run up. Secondly, the athlete needs to be able to reproduce this pattern (at least) 9 times out of 10 in a closed situation — independent of the board (off the runway). Thirdly, transfer training to the runway and get the athlete to hit the board consistently.

Fourthly, get the athlete to perform full run up jumps (or triple jump hop take offs) under conditions with simulated competition where only valid jumps are measured and fouls do not count. Finally, practice under all types of conditions - sometimes I shift the athlete's marker forward or back (up to 30 cm or so) without their knowledge until after the session. Irrespective of anything else, many practice run ups are required in training right throughout the year.

Bourne:

I develop the runway rhythm firstly on the track. With a technical focus on running technique I aim to have the athlete feel confident, comfortable and fast. In this way I feel I am presenting no barriers to speed or the desired sprinting technique and I measure and compare speed here against standing start sprint measures. When it is consolidated at this level I will take it to the runway. My coaching focus is always to get the athlete to run to the rhythm that they have learned and repeatedly practiced.

To help ensure consistency on the runway I strongly encourage a standing start. To help develop this I insist on a run up start for almost all running activities in training. As most gross errors on the runway occur either during entry or acceleration, I also use an invisible (to the athlete) 12 stride marker to check consistency at this level of the run in. I look to have the athlete complete 6-8 repeated run ups with an error margin of only ± 10 cm at 12 strides. Surprisingly to some, (including me at first) this is achievable. I have found that any errors appearing at 12 strides are mirrored at the board. If not, at least I have identified the degree to which the athlete is steering in the latter stages of their run up.

With speed at take off being clearly the most important factor in determining distance in horizontal jumping, run up rhythm and the development of ultimate run up speed are all important in horizontal jumping events. Accordingly, run ups are given regular attention in my training program, being practiced year around and 3-4 times per week during the competition period.

Despite the physical differences that exist between male and female triple jumpers, do you believe they can be trained the same way with regard to the types of training units and respective loadings?

Hilliard:

Essentially the training for male and female jumpers is similar in terms of loadings. However, women tend to take longer to recover from maximal strength training units. Female triple jumpers can make significant gains in performance quite rapidly. However, our greatest challenge is in retaining these athletes in the sport and enhancing their longevity. Too many athletes break down after only 1-2 years of serious competition / training, which unfortunately is an endemic problem facing our sport. The abysmal national fitness levels of our junior athletes can be attributed to a number of factors none the least being compounded by a computerized, 'X-Box', generation of athlete. We are inheriting our top junior athletes with a very poor level of basic conditioning.

Pfaff:

I train both genders very similarly. I think women can often load elastic strength levels a bit more than men but they do have some restrictions with absolute strength development. The running, bounding, technique work, etc., do not have to be modified that much in my opinion.

Boas:

In principle male and female triple jumpers can follow similar training programs. However, the coach of female triple jumpers needs to pay particular attention to correct technique to minimize the risk of stress injuries and to the adjustment of training volumes so that correct technique is maintained. For bounding training, the loads should be more gradually increased and more emphasis placed on the use of soft surfaces. Protection exercises (core strength) are vital. A particular area of concern with young, particularly female, triple jumpers are toe pointing rather than flat-footed landings. The coach needs to be aware of the possibilities of dietary/metabolic related stress fracture syndromes, such as has been noted for developing female distance runners.

Bourne:

It has been my experience in conditioning female and male athletes that there is never a need to compromise on training loads for the girls. I find the better girls just as tough and hard as the good male jumpers. In fact in my experience the girls work harder, are more diligent about what they do and complain less. I make no concessions with bounding or sprint loads or the quality I seek in these activities for female athletes.

Exercise selection for girls in the weight room needs some consideration, however, because the female jumpers are obviously smaller and have lower strength levels in the upper body. They therefore have greater difficulty with cleans. I overcome this by reducing the number of repetitions per set (to ensure they can maintain quality) and increasing the number of sets (to ensure they complete the required amount of work).