Show Jumping Transfer of Training and Exercise Specificity: Insights from the Bondarchuk Method

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This article aims to provide guidance, informed by research on elite human athletes and expert opinion, on what exercises provide the most benefit when developing athletes (in this case jumping horses). Two key interrelated concepts (the transfer of training to competition performance and exercise specificity) are discussed.

Sports training can be defined as the systematic application of training methods to achieve the highest levels of performance possible while expending the least amount of energy. Applied training stimuli disrupt homeostasis within the body (due to energy depletion, the accumulation of microdamage in structures, oxygen stress, etc), and in response the body seeks to remodel various structures and processes to both restore normal function as well as to better prepare it for future stresses.

For anyone involved in the development of athletes, we need to be sure that we are applying exercises that will lead to improved performance while at the same time limiting injury risk. There are an almost infinite number of exercise permutations when you factor in movement mechanics, rate of force application, duration, intensity, recovery, environment, and so on. This creates a high level of complexity when determining optimal training programs.

To address this challenge, it is logical to classify exercises based on similar characteristics and anticipated outcomes. Numerous classification systems exist, but one I have found highly valuable in my own work is adapted from famous track and field athlete, coach, and researcher, Dr. Anatoliy Bondarchuk. He grouped exercises into four categories based on exercise specificity and how improvement in one exercise impacts performance in competition (termed transfer of training). A main advantage of this approach is that it can be applied to any sport, including equestrian disciplines. Below I will briefly cover some of the key considerations and provide examples.

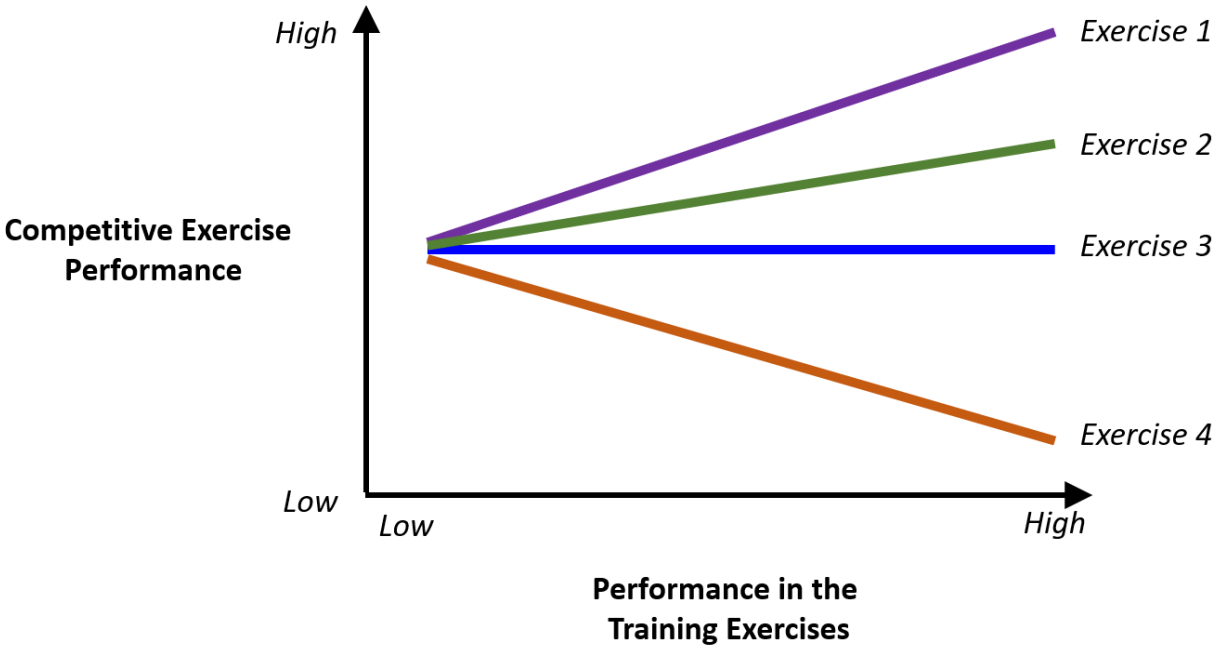
Dr. Anatoliy Bondarchuk

Much of the foundational work on this topic was completed by Dr. Bondarchuk (1940- 2025), who was an Olympic Gold Medalist (Hammer Throw), obtained a PhD in pedagogical sciences, and was one of the most successful track and field coaches of all time. His research on the transfer of training (how the performance of different exercises impacts the competitive performance) is widely cited across all sports (not just track and field). His writing is fascinating and I encourage everyone with an interest in training theory to seek out his publications.

Transfer of Training

Transfer of training describes how the results obtained for one exercise (for example weight lifted while squatting for humans or time taken to gallop 600m in horses) 'transfers' to performance in the main competition event (for example a human running the 100m sprint or a horse jumping a 5* grand prix). If you have enough high-quality data, you can study the relationship between any exercise and competition performance to identify three general responses to training:

1) *Positive Transfer of Training* – improvements in an exercise directly relate to improvements in competition. For most jumping horses, exercises such as jumping shortened courses at home, technique jumps and performing gallops (assuming a balanced stride) will have positive transfer of training.
2) *Negative Transfer of Training* – improvements in an exercise cause worse competition performance. For jumping horses, intense flatwork at slower velocities can alter muscle fiber composition and tendon stiffness, which could reduce peak power production in the competition ring.
3) *Neutral Transfer of Training* – improvements in an exercise have neither an improving or reducing effect on competition performance. For high-level jumping horses, exercises like walking on a dry treadmill for 15 minutes may have general wellness benefits but will likely not impact performance in the ring.



This figure demonstrates hypothetical relationships between performance on four different training exercises (1-4) and the competitive exercise (i.e. the sport we are training for). If you collect data on the performance of each exercise over time you could graph the results in that exercise compared to competition performance and end up with something like this (although the lines may not be linear). *Exercise 1* would be classified as having positive transfer of training - as the performance on this training exercise increases so too does the competitive performance. *Exercise 2* would also be classified as positive transfer of training, although the impact of improvement on the training exercise has a lesser effect on competition performance. *Exercise 3*

would be neutral transfer of training - whether you have a low or high performance on this exercise does not affect the competition performance. Lastly, *Exercise 4* would be an exercise you want to avoid, as getting better at this exercise correlates with reduced performance in competition.

It is important to appreciate that with young horses, or horses that are behind on their training, almost all exercises will have positive transfer of training (assuming the rider is not introducing bad habits in the process). This is because almost any activity will be viewed by the body as relatively novel and produce a stress response significant enough to cause positive adaptations in the body. Further, for unfit horses, any exercise that develops some level of athleticism will likely allow them to perform their specific sport at a higher level.

However, as an athlete develops toward elite status, the number of exercises that can stimulate the body to positively adapt will become fewer and fewer. This is because as the body becomes highly specialized and trained, many of the common exercise-induced changes to the body (e.g. muscle fiber composition changes, exercise-induced cardiac remodeling, body composition changes, neural changes, etc) have been achieved with the already applied training methods. This phenomenon is what you may hear referred to as a 'training plateau'. To push the athlete's body further and to experience continued growth in results, positive transfer of training requires very specific and targeted loading, which requires careful monitoring to ensure overreaching and overtraining do not occur. At the elite level, it is about being creative and looking under every rock to find new ways to stimulate the body to 'unlock' an additional 1% or 2% of performance.

Specificity of Training

To further explore why certain exercises cause either positive, neutral, or negative transfer of training, it is helpful to consider the role that specificity (performing movements similar to the target movement) plays.

We know that the body (both equine and human) responds in a specific manner to work, such that the application of 30 minutes of moderate intensity flatwork will produce very different effects as compared to 2 minutes of galloping at 90% of maximal velocity. The exercise-induced changes in strength, speed, endurance, and flexibility that trainers observe in their horses are the result of acute responses and chronic alterations (such as changes to gene expression) throughout the body due to the oxidative stress, energy depletion, mechanical loading, and so on that exercise produces. Trainers select exercises to generate biochemical and mechanical signals sensed by cells in the body, which trigger various molecular cascades and result in the desired changes to the body.

Similarly, being able to accurately perceive information from the surrounding environment, selecting the correct movement strategy, and executing this strategy (while updating information throughout) underlies the neural processing component of sports. This is a learned skill that is developed over time through the methodical application of exercises. The trainer must select exercises that are relevant to the sport, teach the athlete how to correctly interpret information and produce an adequate solution, all while maintaining confidence and enthusiasm for performing. Of note, many coaches report that exercise intensity needs to be in the range of 85-92% of maximal to be strong enough to mimic competition performance, while at the same time providing athletes with opportunities to refine technique.

All prescribed exercises target motor control training, whereby we look to pair an athlete's physical potential for movement with neural control (i.e. electrical signals sent throughout the body) to enable efficient, goal-directed actions. Training needs to focus on developing both the structural component and neural component in synchrony. It is of little use to work on developing technique (i.e. the neural component) when the athlete is too weak or lacks energy for the proper execution of movement. In this situation, the effective coordination of muscle action will not be achieved, leading to a host of secondary issues. Similarly, gains made in strength, speed, endurance, and so on are of little use if they are not paired with neural control strategies that can be employed by athletes in competition.

If an exercise can induce molecular changes within the body that will enhance strength, speed, or endurance capabilities, while also reinforcing the proper coordination of different muscles and systems, it is likely to have positive transfer of training. This exercise would be considered specific to the sport in question. Conversely, if a trainer is hoping to develop more power in their horse, but select an exercise that involves slow muscle contractions and low force output in the middle gluteal muscle, you will see negative transfer of training because the epigenetic changes will prioritize oxidative capacity in this muscle, causing a shift away from high force generating capacity required for vertical propulsion at jumps.

Naturally, the question is why trainers do not only use a small number of very specific exercises to train horses (i.e. jump horses 3 or 4 times per week). The reason is that the loading would be too extreme on horses and injury would certainly result. Further, a variety of exercises are required to stimulate other bodily systems, the horse's mind, etc. Thus, it is a balance, and experience plays a tremendous role in knowing what exercises to apply and when.

Categorizing Exercises

In equestrian sports we can consider grouping exercises by i) the muscle groups active during the completion of the exercise, ii) the physiological systems activated to enable the movements, iii) the biomechanics underlying the movement, iv) the environments the exercises are performed in, v) the exercise-induced molecular changes, and vi) the impact of the work on mental and emotional states.

Category 1: General Preparatory Exercises (GE)

These exercises do not mimic the actions of the competitive event in full or in their separate parts. With these exercises, the movement of the body (e.g. range of motion of joints, velocity of movement, forces applied to the ground, etc) and physiological systems activated (e.g. energy systems, neuromuscular control, stress responses, etc) will be different from what is seen when the athlete jumps a course in competition. These exercises have value as a means of developing general athletic abilities in an athlete, increase the amount of work the athlete can tolerate, as well as enhance their coordination. Additionally, this group of exercises can be valuable during warm-ups, cool-downs, and for active recovery.

Key points

- The movement does not resemble the competitive movement in either its whole or component parts.
- Develop general physical qualities, work capacity and coordination.
- Useful for warming up, cooling down, and restoration.

-Walker
-Relaxed walk & trot U/S
-Trail rides
-Treadmill
-Water treadmill (water depth dependent)
-Flatwork (> 120 consecutive seconds)
-Road work
-Relaxed longeing
-Turnout

Category 2: Special Preparatory Exercises (SPE)

While these exercises do not look like the competitive exercise, they do utilize similar muscles and physiological systems. These exercises are employed to develop the muscles and bodily systems that will allow for the athlete to achieve greater speed, power, coordination, and so on when completing competitive movements.

Key points

- Exercises do not follow the competitive movement patterns, but similar muscle groups take part in their performance.
- These exercises stimulate activity in those physiological system functions that provide for improvements in the competitive exercises.
- ***Whether these exercises are SPE or GE depends on the duration. If performed for longer than 90 seconds continuously different physiological systems begin to be engaged, and they transition to being considered GE.

-Longeing @ canter
-Transitions U/S
-Walking or trotting up / down hills
-Longeing @ trot with side reins
-Water treadmill (water depth dependent)
-Leg-yield, Half pass, Shoulder-in, Shoulder-out…
-Flatwork (< 120 consecutive seconds)
-Riding over poles on the ground

Category 3: Special Developmental Exercises (SDE)

Special Development Exercises repeat the competitive exercise(s), but in individual components that allow the coach/trainer to target specific movement pieces or physiological systems. Importantly, these are the exercises often employed to exceed some component of the competitive exercise, selectively enhancing performance in the process. By ‘breaking down’ the competitive exercise into component pieces, trainers can systematically target one or two weaknesses with SDEs, and improvements here then contribute to improved sports form in the CE.

Key points

- Exercises follow the competitive movement in its separate component parts.
- The same muscle groups (or their significant parts) participate in their performance, and similar physiological systems are activated.

-Bounces
-Cantering hills
-Small jump work
-Cavalettis
-Technique jumps
-Single jumps
-Gymnastics

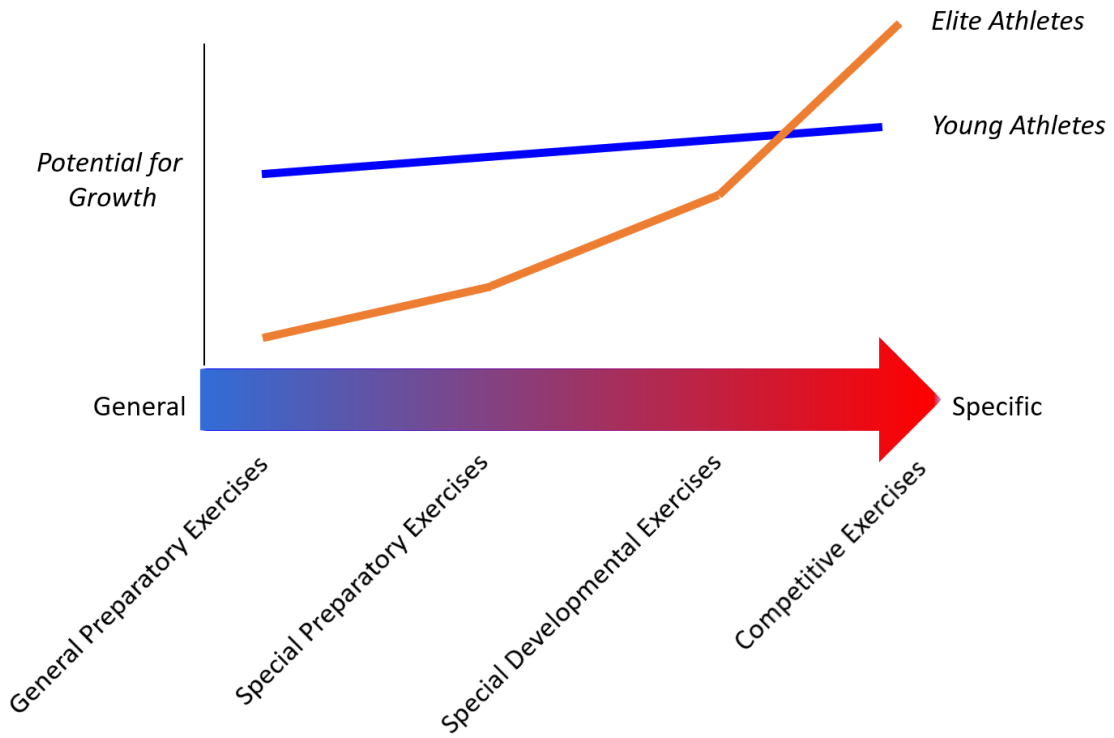
Category 4: Competitive Exercises (CE)

This is the competitive movement (i.e. jumping at 300m/min+). These exercises are executed in training OR modeled in a specific manner at home. In the latter situation, they repeat competitive conditions in easier conditions (e.g. to build a horse's confidence, to work on a specific aspect) or in more challenging (e.g. to build further strength/power/confidence, to develop new skills) conditions.

Key points

- Exercises that exactly replicate competitive movements and goals for the athlete.
- The exercises are executed in the process of competition as well as in training.

-Jumping full courses at home
-Competitions
-Jumping slightly shortened courses at home
-Jumping slightly longer courses at home
-Speed classes



This figure highlights how athletes at different levels will respond to exercises in the four categories. For young and novice athletes, exercises from each category all have the potential to stimulate growth and improvements in sporting performance. As an athlete ages, it will only be the most specific exercises that will have positive transfer of training. However, less specific exercises still play a role in developing specific physiological processes and reinforcing targeted technical points.

In closing, an understanding of which exercises are most likely to contribute to improved competition performance is critical for the design of efficient and safe training. While all roads lead to Rome, some routes are shorter or safer than others.

The considerations presented here can be used by trainers at any level (and in any sport) to help guide program design. In the future I will write an article discussing how to pull exercises from these four categories to build a training program.

Suggested Reading:

Bondarchuk AP (2007) Transfer of Training in Sports. Ultimate Athlete Concepts.

Bondarchuk AP (2011) Periodization of Training in Sports. New Training Concepts.

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