

# Biomechanics of the Gaits

USDF "L" program teachings. Second of three parts.

BY J. ASHTON MOORE

**L**AST MONTH, I OUTLINED THE USDF "L" program's approach to the teaching of equine biomechanics. I discussed several basic biomechanical principles and their application to the judging of dressage. This month, I'll take a look at how and why "L" candidates learn to evaluate the biomechanics of the three basic gaits.

## The Most Elemental Aspect of Dressage

"L" candidates learn more than the average dressage rider about the biomechanics of the walk, the trot, and the canter. The "L" program aims to hone candidates' observation and evaluative skills as well as their methodology so that they learn how to incorporate the gait issues into the formulation of final scores for both the individual movements and the collective marks.

The gaits are a major consideration in evaluating almost every movement in the test. One of the collective marks (the overall scores given at the end of each dressage test) is for the gaits. This collective mark addresses the gaits in terms of *regularity* and *freedom*, both of which pertain to biomechanics and basics.

The concept of regularity includes purity (correct sequence and timing of phases and footfalls) and soundness (evenness and levelness of steps; even weight-bearing). It is not about steadiness of tempo.

Freedom includes issues of quality: reach, amplitude, scope, elasticity, springiness, articulation, trajectory, and so on.

In order to integrate the evaluation of the gaits into the methodology of arriving at the preliminary score (task + biomechanics/basics) and the final score (task + biomechanics/basics +/- modifiers in the execution), therefore, a judge needs

to understand the biomechanics of the gaits. Let's take a closer look.

## Purity

Above all, the gaits must be pure. Purity is evaluated in terms of four criteria:

- Beats
- Footfalls
- Phases
- Timing.

**Beat** can mean two things: a *footfall within a gait* or an *emphasized beat*, as in music. A footfall occurs when a hoof or pair of hooves strikes the ground, in the latter case virtually simultaneously. By this definition, the walk has four beats, the trot has two beats, and the canter has three beats.

The emphasized beat of a gait is the one the rider feels most prominently: two in the walk, two in the trot, and one in the canter.

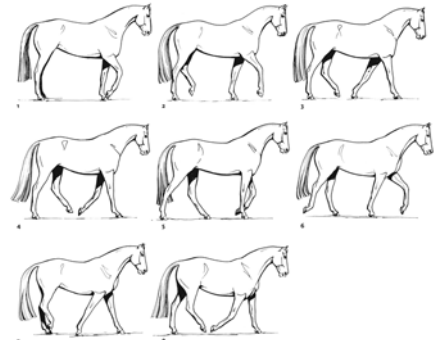
A **phase** is part of a stride—the placement and attitude of the horse's leg and hoof as it contacts the ground, lifts off the ground and moves through space, and contacts the ground again. A stride has a *stance phase* (ground contact) and a *swing phase* (moving or airborne time). Some strides also have an *aerial phase*—a moment of suspension during which all four limbs are airborne.

**Timing** addresses temporal and spatial considerations: duration, length, and relationship of the phases and footfalls of each gait.

## The Three Basic Gaits

Each gait, including each *pace* (working, collected, medium, extended) of each gait, has a set of distinguishing characteristics.

**Walk:** Four footfalls, eight phases, and two emphasized beats per stride. The walk has no aerial phase (moment of sus-



**PHASES OF THE WALK STRIDE:** The horse is supported alternately by two and then three legs. There is no moment of suspension: Feet are always touching the ground. The first illustration in the series depicts the move-off from halt to walk.

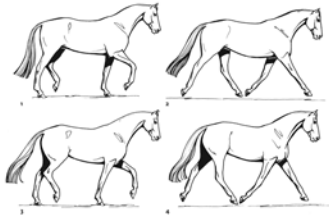
pension). It is characterized by a rhythmic oscillation of the neck.

**Trot:** Two footfalls, four phases, and two emphasized beats per stride. The trot has two aerial phases.

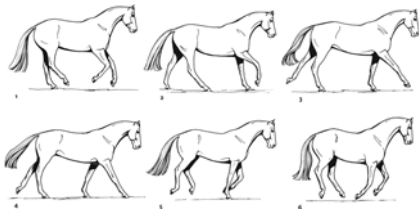
**Canter:** Three footfalls, six phases, and one emphasized beat per stride. The canter has one aerial phase. It is characterized by a rocking, asymmetrical, non-reciprocating motion: In the other two gaits, one leg of the left-right pair moves forward while the other leg of the left-right pair moves back. In canter, the two legs of the left-right pair move forward (partly, not absolutely simultaneously) at the same time.

Both of the gaits that have a phase of suspension (trot and canter) also have a "diagonal" phase (two per stride in trot, one per stride in canter) in which a diagonal pair of limbs contacts the ground. If one hoof of a diagonal pair meets the ground before or after the other during a diagonal phase, the phenomenon—as described by biomechanics expert Dr.

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**PHASES OF THE TROT STRIDE:** The trot is a two-beat gait in which the horse's legs move in diagonal pairs, with a moment of suspension in between (2) during which all four limbs are off the ground.



**PHASES OF THE CANTER STRIDE** (right lead): Left hind (1); left hind, right hind, and left fore together (2); right hind and left fore (diagonal pair) (3); right hind and left fore, plus right fore (leading leg) (4); right fore only (5); moment of suspension (6).

Hilary Clayton—is known as *positive* or *negative dissociation*, also referred to as positive or negative diagonal advanced placement (DAP). Positive dissociation occurs when the hind leg of the diagonal pair strikes the ground first. Negative dissociation occurs when the foreleg of the diagonal pair strikes the ground first.

In general, positive dissociation is a good thing, and negative dissociation is a bad thing. Positive dissociation normally occurs in very collected (“school”) canter, canter pirouette, and racing gallop. Positive dissociation is a negative if it happens as a result of earthbound laziness or inactivity (a Western-pleasure lope, in some instances). In such cases, it is not an issue of extreme collection.

“L” program participants also learn to identify common gait-related faults, some of which you may have encountered on your dressage test sheets. For example, the canter or the walk may have the wrong sequence of footfalls (“four-beat canter,” “pacing walk”). The walk and the canter may have the correct sequence of footfalls, but if the timing is faulty, the

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## THE JUDGE'S BOX

judge might comment, “walk nearly pacing,” “lateral walk,” or “lateral canter.”

### Quality

Quality of the gaits is evaluated using more-subjective terminology: freedom and reach, elasticity and springiness, and trajectory.

**Freedom** includes amplitude, range of motion, and scope of the limb movements. All of these terms overlap or are nearly synonymous.

**Elasticity** includes springiness (in trot and canter), fluency (in all gaits), and articulation of the joints and condition of the musculature, the latter of which overlap.

**Trajectory** is the line or path of travel of each limb or hoof, using both aerial and profile views. In profile, the trajectory should be an even arc from liftoff to touchdown of the hoof. An aerial view of the trajectory will reveal any faulty lateral deviation, such as winging and paddling (which are not of interest to dressage judges); or any abduction or adduction.

Abduction and adduction are crucial in dressage judging but usually are related more to training, way of going, or balance than to the natural gaits themselves.

At the walk, freedom refers mostly to reach, flat-footedness (as opposed to an undesirably “bouncy,” tense walk), and articulation of the joints. At the trot, amplitude refers mostly to reach and roundness (trajectory), articulation, and springiness. At the canter, amplitude refers mostly to reach and roundness, forward reach of the outer legs, and articulation.

### Common Faults

Common faults as they pertain to desired qualities in the basic gaits include:

*Fault:* lack of freedom. *Symptom:* lack of reach.

*Fault:* lack of elasticity. *Symptoms:* “boinging” up and down at the expense of reach and ground-covering; sprawling (even if reaching); rolling over the front legs (lacking push against the ground to produce upward spring in trot and can-

ter; lack of involvement of the sling muscles); “earthbound” trot and canter; rigidity and constraint and tightness (sustained contraction) in the musculature.

*Fault:* incorrect trajectory. *Symptoms:* incorrect direction of reach or thrust (aerial view); toe-flicking; “snatchy” knees and hocks (“trappy” action, like the movement of a Hackney) at the expense of reach; “daisy cutting,” “cake walking,” other forms of exaggerated or artificial movement (profile view).

*Fault:* test movements forced or performed incorrectly. *Symptom:* deleterious effect on the gaits.

### Gaits and Scoring

The “L” program teaches judge candidates to apply a standard methodology to the scoring of gaits: If all three gaits are pure, quality notwithstanding, the basic score is generally a 5. Upward adjustment of the score is based on quality (known in judging parlance as a modifier). A score lower than 5 generally indicates problems with purity, soundness, or both.

In the “L” program, we cultivate the use of a common language and an understanding of simple biomechanics in order to improve the understanding of the realities of the gaits as well as communication among judges, trainers, and competitors. This knowledge protects us from being overly influenced by artificial flashiness and “fashion versus function,” and it helps to improve the lot of the horses and the task of the trainers.

*Next month:* Our biomechanics series concludes with a discussion of their application to the movements and the judging process. ▲

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