



***Technology facilitates advanced understanding of how high-level movement happens and traits likely to be found in a successful dressage athlete.***

*article & photos by Kim F. Miller*

Dr. Hilary Clayton's biomechanical perspective on the dressage training scale was a Health Fair highlight during the California Dressage Society's annual meeting in Southern California this past January. "I've been trying to make it out to the CDS meeting for many years and I'm glad I finally could," said the renowned veterinarian and equine biomechanics expert. Attendees were even happier about her appearance.

The demands of basic and high-level movements and the conformation and gait characteristics that enable the horse to execute them provided a fascinating context in which to think about training development and techniques.

The use of "force plates" at Dr. Clayton's unique sporthorse performance lab at Michigan State University was instrumental in analyzing gaits far beyond what the human eye can see. Embedded under a special runway, the force plates quantify how the hoof pushes against the ground to generate movement.

Infrared light reflectors placed on joints and other parts of the horse's body send signals back to

a computer. The collected data is translated into real-time stick figures that depict precise details of how and when each body part moves, and how it relates to movement elsewhere in the body.

Such sophisticated tools are needed to fulfill Dr. Clayton's goal of measuring "gaits, performance and movements of the modern-day dressage horse." The goal is to update, rather than replace, "the good information from the old masters," she emphasized. The ongoing research and findings are relevant for the ever-improving quality of today's horses, as well as today's higher quality riding and competition standards.

Most importantly, "We want to determine what qualities in a horse can help or hinder it becoming a good athlete," she stated. "And what are the qualities that won't stand up to the training needed to make a top athlete."

Correlating the findings to the Dressage Training Scale, Dr. Clayton began at its base: rhythm, which she defined as "regularity and tempo," and with an emphasis on the diagonal gait, the trot.

### **Diagonal Coordination**

The first issue she addressed was purity of the gaits and how this should be evaluated. Measuring diagonal coordination was the first point of focus. "Are the footfalls of the diagonal pairs (i.e, left hind, right front) occurring at the same time?" she asked as attendees studied two still pictures. One showed dramatic front leg extension: the other, less dramatic extension and the hoof lower to the ground. She drew attention to how the diagonal limbs swing forward in relation to each other and whether the footfalls of the diagonal hooves are synchronous.

In a more trained, typically older horse, the hind hoof usually hits the ground first. This is also the typical footfall sequence in the modern dressage horses bred for naturally uphill conformation and movement, she noted. "Modern horses are bred with uphill conformation and dressage training enhances that."

Studying the degree of limb rotation was the next step in this phase of gait analysis. "How is the leg protracting and retracting relative to the horse's body?"

Is there a big change in the angle of the leg between maximum protraction and retraction?" The ideal is that the leg is fairly vertical at the time of impact, as the horse's body begins to roll forward over the front leg. "You want the horse to be able to push up and off before that leg gets too far under the body. A more vertical forelimb supports the withers in a higher position."

As the degree of collection increases, the range of motion between protracting and retracting decreases. Elevated trotting in place, piaffe, for example, requires a combination of the haunches sinking down to carry and the foreleg pushing upward to elevate the forehand. "Maximum elevation of the forehand is possible when the foreleg is vertical," she explained.

Looking for parallel diagonal limb movement came next. "Compare the hind cannon bone to the front leg forearm, because the lower front leg is swung forward from the elbow," she explained. Here's where the major fault of slowness in the hind end can be detected. She showed examples and made comparisons between horses that were too slow with the hind leg versus horses that had a good hind leg with excessive elevation of the foreleg. "I often hear people say that they want a more expressive front leg, but I want a really quick hind end," said Dr. Clayton, who studies dressage from the ground and the saddle.

Dr. Clayton described this research as being in fact-finding, not answer providing, mode, as far as what gait characteristics are most important. "My own question is which element -- synchronous footfalls or synchronous swing of the fore and hind limbs -- is a better indicator of purity of gait?"

More research is planned to elicit those answers. Meantime, she'd made some conclusions: "Hind hoof first disassociation of the limbs is desirable, in my opinion, because it indicates that the horse is working in an uphill posture and is in self-carriage. And it may be that parallelism and synchrony of the forward swing of the fore and hind limbs is a more useful indicator of gait purity in trot than the synchronicity of diagonal hoof contacts with the ground."

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