

When a picture's worth a thousand words

Identifying asymmetries in a horse's way of going requires a stack of experience, but even the human eye has its limitations, which is why vets and industry experts are turning to technology to objectively assess abnormalities. Stephanie Bateman investigates



"Horslyx are a fantastic way of making veterinary care a more positive experience for the horse" **Gemma Pearson, MRCVS**



NO HUMAN IS perfectly symmetrical and nor is a horse. We all have a preferred side or a hand that we write with, and horses are no different. Therefore it follows that most horses are slightly asymmetrical. However, when these asymmetries go beyond certain parameters it could be a sign that something isn't quite right.

Until recently vets have assessed a horse's movement visually. Research has now shown, though, that the human eye is only capable of capturing images at a rate of 15 frames per second, which can be limiting in terms of making a consistent and objective evaluation of a horse that is walking or trotting in front of them.

This is where technology can really improve the picture in more ways than one.

Mark Georgetti, a vet at Three Counties Equine Hospital, has been using gait analysis software for the last few years, and he believes that it is a gamechanger in terms of offering objective data when assessing a horse's movement.

"They certainly have a place, and it's becoming ever more common for them to be based in equine hospitals and utilised as part of movement analysis and lameness work ups," he says. "Analysis software is useful in that it provides an objective assessment of the horse's gait. It is particularly useful when you've done a nerve block and you want to see if the horse has actually improved as the machine takes away the bias.

"Similarly, if you've got a client who isn't sure whether their horse looks better or feels better when they're riding them, the system gives you something objective to demonstrate the change."

There are currently a variety of systems available on the market, each one with its own way of working.

"Some systems require specialist interpretation and training to be able to fully understand the readings," explains Mark. "Some systems are easier to read and easier to interpret than others, but they certainly don't replace the expert actually looking at the horse, because ▶

Even though all horses are slightly asymmetrical, it is when this trait goes beyond certain parameters that something may be amiss

Hoofbeat's system can be used when the horse is on a hard or soft surface and is walking or trotting in a straight line



Left: The Hoofbeat system offers visual representations and 3D animation that can be played back at different speeds

horses show you other things, like behavioural signs of pain, that won't show up on a gait analysis, but they are nevertheless important factors to consider."

Gait analysis software can, however, also be used to help train vets in assessing lameness.

"You can make your own assessment first from watching the horse move, and then see what the gait analysis software shows so that you can compare the readings," adds Mark. "It can be useful to help new vets validate their findings and build confidence in their own ability."

Feet first

Some gait analysis systems are focused on the hoof. Master farrier Ben Benson uses such a system in his work.

"I was one of the first farriers to get a farriery gait analysis system. It arrived in Britain about two years ago," says Ben. "It is brilliant for telling you what is happening with the hoof, and it is fairly simple to use, although you still have to be able to interpret the results, which is what requires experience and an understanding of the system. I always look at the horse's conformation and the information from the system and marry the two up and then work out what is

achievable and what isn't. The skill is in the interpretation and not simply measuring."

One of the key benefits for Ben is the clear objectivity that the gait analysis offers.

"There's nothing worse than someone having an opinion that isn't correct, so this takes the subjectivity out of it," he says. "It takes away that element of human bias, because farriers often make changes to a horse's hoof and expect instant improvement. However, this quite often

"The human eye can see and record up to the equivalent of 15 frames a second, but when watching something with the equipment I'm able to see up to 1,500 frames a second"

flags up other changes, or sometimes even though we believe it has been a success as a big change has been made, there might only be a very limited marginal improvement.

"Sometimes it works the other way and the owner or rider can't see the changes and so rather than having to argue whether or not what you have done has worked, the farrier can show it with the 3D model, or by using the graph and chart measurements that give a report."

Ben uses the system to see how the horse's foot lands and breaks over in order to help him with the shoeing process.

"Think of the tracking on your car — the system helps me to measure if the horse's

tracking is correct," Ben explains. "It assists me in seeing if one foot is landing differently to the other, or in a lame horse it can show me in more minute detail if one hoof is slower to land or quicker than another and takes longer to break over. I can see the adaptation of a gait — this might include breakover time, landing time, time with the hoof flat on the floor, or time with the heels coming off before the foot takes off — and so if I need to alter a hoof or hooves, this gives me something measurable to be able to change. The human eye can see and record up to the equivalent of 15 frames

a second, but when watching something with the equipment I'm able to see up to 1,500 frames per second. All the foot's measurements are visible in fine detail and captured in milliseconds."

Ben doesn't just use gait analysis on pricey competition horses and racehorses, though.

"I use it in remedial work as a standard," he adds. "It's also important that farriers share the information from these analysis kits with the horse's care team, including the vet and the physio, because our aim is for the horse to stand and move as squarely and symmetrically as possible, and that involves the whole team."

The key devices at a glance

These days professionals have a veritable treasure trove of systems available to assist them in assessing gait abnormalities and asymmetries in horses, including...

A state-of-the-art solution

EquiGait, a UK-based company, provides state-of-the-art gait analysis solutions for vets and professionals. The system consists of a wireless inertial measurement unit (IMU) that is used either while the horse is in-hand, on the lunge, or being ridden. This offers unimpeded access to all the limbs as the sensors are attached to the upper body of the horse.

The system outputs numerical data and graphs to help inform the vet/professional who can then make a swift decision, either on the diagnosis of a lameness, or how a horse in rehabilitation is progressing. The system, which comes with three, five, six, or eight sensor set ups, offers comprehensive gait analysis based on the fundamentals of physics and equine biomechanics.

Xsens DOT sensors can be controlled from a standard iOS or android device and because data can be stored on the sensors for later, this method is particularly useful for long-term follow up, for example during training, rehab and for research projects where immediate feedback isn't the priority. You simply attach the sensors to the horse, start logging the data via bluetooth, record the horse's movement, and then download the data on a Windows tablet and the analysis can begin.

Good things come in threes

The Equinosis Q with Lameness Locator is a field-based body-mounted inertial sensor-based system that has been developed specifically for use by vets for the measuring of equine lameness.

The system consists of three sensors applied to the horse, long-range bluetooth connectivity for live data collection and transmission, and a PC with software that analyses the data within seconds. This allows objective measurements to be obtained through each step of a vet's evaluation of the moving horse.



An EquiGait sensor is placed on the horse

The three sensors are applied to the head, the pelvis and the right forelimb. The head and pelvis sensors include an accelerometer and they measure the up and down movement of the head and pelvis.

If a horse has pain when coming down on a limb, he will accelerate down on that limb less than he does on the opposite one. The same is true if he experiences pain pushing off on a limb. These movement asymmetries between the two halves of a stride determine the magnitude of the lameness.

The right front sensor, meanwhile, uses a gyroscope to detect when the right forelimb is on the ground versus in the air. The program can infer where the other three legs are in space during the trot and the side of the lameness (right or left) can then be determined as well as if the peak pain is occurring on impact, mid stance or on push off.

Seeing the unseen

Hoofbeat's system measures all four legs while the horse is on both hard and soft surfaces and is walking or trotting in a straight line. According to the company, it is the first gait mapping system that

can distinguish landing, stance and break over in time and movement.

High-precision sensors make the horse's movement visible to the machine — movements which can't be seen by the naked eye. The information is then converted into visual representations and 3D animation which can be played back at different speeds.

The system therefore offers mapping of the gait — a measurement takes approximately one minute, which includes data interpretation, after which the professional receives a clear picture of the results within five minutes; quantifying and comparison of the data to a previous measurement on the same horse; and a measurement report that can be easily shared via an email link.

Let's get into our stride

EquiMoves' technology consists of wireless inertial sensors that are placed at the head, withers, sacrum and cannon bones of the horse. The subsequent data is streamed to a computer. Having a wireless and mobile system means that assessments are easy.

The EquiMoves' motion processing software then computes the relevant parameters and analyses the horse's gait for lameness and performance assessment.

The system also provides stride-related information, enabling the capturing of a movement that is probably near impossible to detect with the naked eye.

EquiMoves' software generates a report of the gaits, and horses can be assessed in hand, ridden or driven.



Attaching a Hoofbeat device to a horse's hoof

Spot on for symmetry

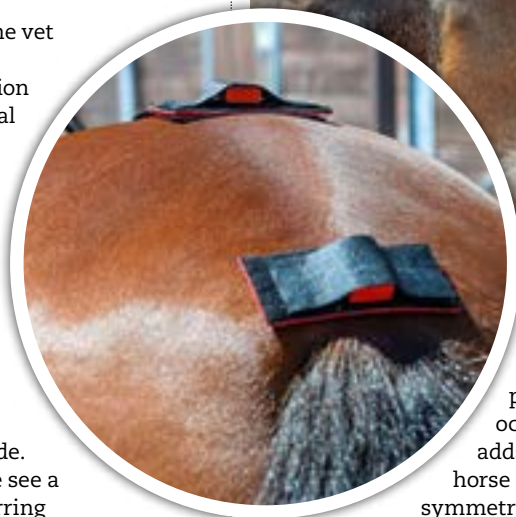
Biomechanist Russell Mackechnie-Guire uses an analysis system extensively in research and alongside vets and paraprofessionals to help support clinical judgement when assessing a horse's symmetry and gait.

"I use it alongside the vet to provide them with quantitative information to support their clinical judgement and assess how a horse moves," he says. Such systems can also define where asymmetry within the stride occurs — as there can be asymmetry in the weight-bearing phase and in the push-off component of the stride.

"In our research, we see a lot of saddle slip occurring during the push-off component of the stride, as opposed to the weight-bearing component," says Russell. "As we progress with our research, we will soon be able to distinguish between asymmetry in the weight-bearing and push-off component of the stride in relation to saddle slip."

Learning what a horse's baseline symmetry looks like is essential and advantageous in managing horses.

"Measuring a horse's natural symmetry when there is no lameness becomes your



EquiGait's system comes with three, five, six, or eight sensor set ups
Inset left: All EquiGait sensors are attached to the horse's body, offering unimpeded access to all the limbs

baseline for the times a loss of performance occurs," Russell adds. "No one horse is perfectly symmetrical and we

have thresholds we apply, appreciating that every horse is different, hence the importance of collecting baseline data when the horse is 'sound'. These are normal variations. If we know what a horse's natural symmetry is, we can identify when things are starting to become more asymmetrical."

Movement asymmetries of around 20% have the potential to go undetected by the human eye, and so these gait measuring systems are helping to fill in the gaps. One

of the advantages is that the system can be used when the horse is working in straight lines and on circles, and while ridden and non-ridden over a variety of surfaces. There remain some limitations, however, which is why it is still vital to look at the whole horse.

"There are so many complex areas when it comes to assessing horses, and this is just one part that assists in the decision making and helps to advance our research," says Russell. "Gait analysis systems also enable us to take data in the horse's own environment instead of just being lab based, which is really beneficial. It is, however, essential that the individual is suitably trained at collecting reliable and robust data and making accurate and correct interpretations of it." 🐾

"Measuring a horse's natural symmetry when there is no lameness becomes your baseline for the times a loss of performance occurs"



A horse is lunged while wearing EquiGait sensors