Proceedings

12th International Equitation Science Conference

Understanding horses to improve training and performance

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International Society for Equitation Science
With the collaboration of the French Institute for Horses and Riding

Presents

12th International Equitation Science Conference

23rd to 25th June 2016

French National Riding School, Saumur

Understanding horses to improve training and performance

Incorporating ethological methods to optimize rider-horse communication

First published, 2016

Editors: Marion Cressent, Marion Renault, Hayley Randle, Alexandria Bailey

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Welcome to the French National Riding School

Welcome to Saumur and the 12th annual International Equitation Science conference.

The entire conference (academic part and practical day) is hosted by the French Institute for Horse and Riding (Ifce) within the French National Riding School. The Ifce is the French public operator which aims at promoting the professionalization of the French horse industry.

The French National Riding School of Saumur is home to the well-known “Cadre Noir de Saumur” and is the custodian of the French tradition of horse riding, recognized as intangible heritage by UNESCO.

The theme “Understanding horses to improve training and performance” means that all the scientific results which have already been published, need to be applied by as many riders as possible, to improve the performance of the horses through looking after both their health and their welfare. Because the performance results from both the horse and its rider, we wanted to focus one session on the health and safety of both athletes. Other sessions focus on the various means available to improve training efficiency and performance by a better understanding of how the horses learn or by taking into account the individual temperament and the cognitive abilities of each horse. As a technical institute, it is also very important for us to deal with the communication of equitation science to practitioners.

The practical day is divided in two very different parts. The first one presents some examples of practitioners already using the equitation science principles. The second focuses on scientific topics, devices and tests.

We hope you will enjoy this exciting program, sharing science from all over the world, and meeting both new scientists with whom to develop even more interesting projects, and horse practitioners to disseminate equitation science.

We hope you have some time to enjoy the special visit to the National Riding School, exploring the beautiful city of Saumur, tasting our typical Loire wines and food, attending the social evening at the Abbaye Royale de Fontevraud, and discovering the beautiful “Pays de la Loire” region.

M. Jean-Marc Lapierre,
director of the French National Riding School

Jean-Marc Lapierre

With the collaboration of the local organizing committee: Marion Cressent, Laetitia Marnay, Marion Renault, Céline Saillet and Alice Victor

With additional help from: Sophie Biau, Françoise Clément, Laurent Coiffard, Nathalie Mull, Jean-Michel Pinel and Patrick Teisserenc.

ISES president's welcome

Welcome to beautiful Saumur, France for the 12th conference of the International Society for Equitation Science (ISES).

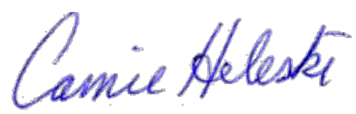
Ten years ago, I was relatively new to this field of study (though with a lifelong interest in horse behaviour and welfare), and I attended the 2nd International Equitation Science Symposium in Milan, Italy. Eureka! I had found my scientific home! And suddenly I had found over 100 international colleagues with many of the same viewpoints as me. If you are new to ISES and this is your first conference with us, I hope you feel the same way during this conference. Every one of your Council members and every one of the Local Organizing Committee members has a passion for understanding horse behaviour, enhancing equine welfare and improving horse-human interactions. We like to think of ourselves as a friendly, welcoming Society, so please don't hesitate to talk with anyone who is here in attendance.

If you have not already read up on it, I strongly urge you to learn a little about the history of the French National Riding School and the Cadre Noir http://www.ifce.fr/en/cadre-noir/ . For me, this is my first real visit to France (since I don't really count sitting in the Charles de Gaulle Airport waiting for connecting flights). I am looking forward to enjoying some of the area tourist attractions.

As your time allows, please look over the Training Principles document contained in these Proceedings, also the Glossary of Terms. There is nothing "magical" about these documents or about Equitation Science or about Learning Theory. However, the careful application of evidence-based training methods has every opportunity to improve horse welfare and help us to be safer in our interactions around these magnificent animals. Most of us in ISES recognize that we walk a fine line between working on the *science* of ISES while not diminishing the *art* that will always be inherent to the equestrian discipline.

I would encourage every one of us to open our minds to really hear and appreciate everyone's perspective. One of my highest priority goals for this conference is to have a fruitful cross-pollination of ideas from stakeholders from different disciplines of the equine industry, different countries around the world, scientists with access to different methodologies, and practitioners with varied experiences.

Enjoy the conference!



Honorary President, ISES

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Principles of learning theory in equitation

The following 10 training principles are presented as 'First Principles' for all horse training interactions. As first Principles, these stand as non-negotiable obligations for trainers to maintain optimal welfare in trained horses as well as optimal training efficiency. These Principles are presented as further refinements of the original 8 Principles on the ISES website and in peer-reviewed literature (McGreevy and McLean, 2006).

ISES
International Society for Equitation Science

Training Principle 1 – Take into account the horse's ethology and cognition

DOES YOUR TRAINING DEMONSTRATE: recognition of Ethology and Cognition?

Ethology is the study of animal behaviour that provides information on how animals have evolved to live. It helps to explain natural equine social structures and behavioural needs. Since horses need the company of their own species and readily form attachment bonds, isolation is detrimental. They have evolved to walk and graze for about 16 hours per day.

Cognition refers to the ways animals process information about the world. Compared to humans, horses' prefrontal cortex is relatively small, so they may not experience events as we do. They excel at memorising and recognising stimuli that trigger certain responses, particularly those that keep them safe. We must be careful not to overestimate equine intelligence and to say things like "he knows what he did wrong", especially when trying to justify punishment. Equally, we should not underestimate cognitive abilities by supposing that horses do not have emotions.

WELFARE IMPLICATIONS: Isolation and restricted locomotion and foraging have negative impact on horse welfare. Similarly over- or under- estimating horses' intelligence also can have negative welfare implications.

Training Principle 2 - Use learning theory appropriately

DOES YOUR TRAINING DEMONSTRATE: the appropriate use of Habituation, Sensitisation, Operant conditioning, Shaping and Classical conditioning?

Habituation refers to the process of response reduction, which can occur after repeated exposure to a particular event or stimulus. Horses are innately fearful of new/unfamiliar things (i.e. they are neophobic) and may react to various stimulus characteristics, such as size/magnitude, novelty, proximity, and sudden appearance or occurrence. Objects that are moving, especially if erratic and/or coming towards them, may be hard for them to identify, even when familiar.

A range of desensitisation techniques can be used to achieve habituation. Systematic desensitisation, approach conditioning, overshadowing, counter-conditioning, and stimulus blending are some methods of desensitisation. (See Table 1 for further explanation and practical examples.)

Sensitisation is when the responses made by an individual increase, i.e. become more intense. If an individual experiences a series of arousing attractive or aversive stimuli, sensitisation describes the likelihood that it will respond more quickly or with more intensity to these stimuli in the future. This increased response may generalise to a whole class of stimuli.
Operant conditioning describes training using rewards and punishment. There are 4 subsets (see Table 2 for practical examples):

1. **Positive reinforcement**: is the addition of something the horse values to increase the occurrence of a desired behaviour. *Primary positive reinforcers* are resources that horses naturally value such as food and gentle touch. Training becomes more efficient if the reinforcement is given immediately at the onset of the correct response. *Secondary*

positive reinforcers can also be used but have to be reliably linked to primary reinforcers. These often take the form of auditory stimuli, such as a clicker or a consistent vocalised sound made when the desired response is performed by the horse.

2. **Negative reinforcement** is the removal of something the horse wants to avoid to increase the occurrence of a desired behaviour. Negative reinforcement in horse training often relies on the use of pressure and it should ultimately be very subtle. Pressure motivates horses but the release of that pressure is what trains them. Applying pressure for inter-gait and intra-gait transitions relies on the trainer beginning with a light pressure cue followed by the maintenance, repetition or increase of the pressure and then the release at the onset of the desired reaction.
3. **Positive punishment** is the adding of something aversive after an undesired behaviour has been performed in order to decrease the likelihood of that behaviour occurring in the future. Positive punishment can have negative welfare implications and should be avoided. If used, it should be carefully timed to coincide with the occurrence of the undesired behaviour.
4. **Negative punishment** is the removal of something the horse values after an undesired behaviour has been performed in order to decrease the likelihood of the occurrence of that behaviour in the future. Negative punishment is rarely used except for prompt removal of attention or food to suppress a behaviour.

Timing is important for all types of operant conditioning: the reinforcing or punishing stimulus must occur in connections with the targeted behaviour.

Classical conditioning is the process by which an association is made between two stimuli. For example, the animal is presented with a neutral stimulus (e.g. a visual signal that does not *per se* elicit a response from the horse) and this is followed by a biologically relevant stimulus (e.g. an aversive stimulus such as pain or a pleasant stimulus such as food or freedom) and the animal links them together. In the future the neutral stimulus is responded to by the horse. In equitation, classical conditioning describes situations where horses respond to light cues or signals given by the rider or handler. When first used, these must be carefully paired with the signal known to already elicit the response for the initial association to occur. For example, a verbal command can be used to slow/stop the horse if the command is paired with a rein signal to which the horse has already learned to slow/stop. After the association has been created the verbal command can be used without the rein signal to stop/slow the horse.

WELFARE IMPLICATIONS: The misuse of pressure/discomfort has the potential for serious welfare implications.

Training Principle 3 - Train easy-to-discriminate cues

DOES YOUR TRAINING DEMONSTRATE that operant and classically conditioned signals are easily discriminated?

Because of the large number of responses required in horse training, (especially under-saddle), it is important that all signals are as clear and as different as possible to enable the horse to discriminate them. This is important in order to avoid confusing the horse, which can result in undesired behaviours and stress.

WELFARE IMPLICATIONS: Not using clear and separate signals can lead to confusion and stress and consequently horse responses that compromise performance and rider safety.

Training Principle 4 - Shape responses and movements

DOES YOUR TRAINING DEMONSTRATE: that, for any trained behaviour, training begins by reinforcing basic attempts at the target behaviour and then gradually improving approximations of that behaviour?

It is important to have a plan when training a horse to perform a new response. The horse's initial responses should be rewarded. As training progresses the horse should only be rewarded for responses that become more and more similar to the ultimate goal.

WELFARE IMPLICATIONS: Poor use of shaping can lead to confusion and responses that compromise equine understanding and performance.

Training Principle 5 - Elicit responses one-at-a-time

DOES YOUR TRAINING DEMONSTRATE: that individual cues/signals are separated in time from each other?

Giving the horse multiple signals at the same time can result in a reduction in responding of any required behaviour. This is because the horse is unable to process two or more signals concurrently as both compete for the horse's attention. Especially the use of opposite signals (such as acceleration and deceleration) at the same time should be avoided. In the early stages of training, signals should be well separated however eventually they can be given closer together.

WELFARE IMPLICATIONS: The use of opposite signals at the same time can confuse the horse, through weakening the trained link between signal and behaviour/response, and quickly lead to stress and consequently responses that compromise horse performance and welfare, and rider safety.

Training Principle 6 - Train only one response per signal

DOES YOUR TRAINING DEMONSTRATE: that each signal elicits a single response?

While each response may be elicited by a variety of signals (i.e. rein cue or lead rope) it is most important that each signal elicits only one response. If the same signal is used to elicit more than one response, confusion begins to set in as predictability decreases.

WELFARE IMPLICATIONS: The use of ambiguous rein and leg signals lead to confusion, stress and responses that compromise performance and rider safety.

Training Principle 7 - Form consistent habits

DOES YOUR TRAINING DEMONSTRATE: consistency?

When training new responses it is important that the same signals are used on the same part of the horse's body, or in the same location relative to the horse's body and that all contextual aspects such as place, equipment and person are kept constant. This is because during the acquisition of new responses, all contextual information is initially included in the array of stimuli associated with the particular response, and maintaining consistency promotes efficient uptake of the associated cue and avoids excessive stress of prolonged training. Once each response is reliably given in response to the signal used, contextual aspects can be gradually removed.

Similarly when training inter-gait and intra-gait transitions, consistency in both the delivery of associated signals and the timeframe in which the responses are elicited and reinforced is essential to promote efficient learning and to avoid confusion.

WELFARE IMPLICATIONS: Inconsistent training can lead to dull responses that compromise understanding and clarity and therefore result in stress and confusion and/or lead the rider to use stronger rather than lighter cues.

Training Principle 8 - Train persistence of responses (self-carriage)

DOES YOUR TRAINING DEMONSTRATE: the continuation of locomotory responses so that the horse learns to 'keep going' in speed, line and posture to avoid any need for constant rein or leg signalling and reduce the risk of the horse stopping responding to the signals.

This outcome is an important goal in shaping of equitation responses.

WELFARE IMPLICATIONS: The consequences of a lack of self-carriage range from dull responses to hyper-reactive responses that compromise welfare, performance, and rider safety.

Training Principle 9 - Avoid and dissociate flight responses

DOES YOUR TRAINING DEMONSTRATE: an absence of flight responses?

Flight responses have unique characteristics. They tend to be difficult or even impossible to remove, and may reappear spontaneously. Training processes that involves systematic/deliberate triggering of fear responses should be avoided because fear inhibits learning and reduces equine welfare.

Flight response behaviours are often accompanied by:

- Increased HPA-axis activity (raised catecholamine (e.g. adrenaline) and glucocorticoid (e.g. cortisol) levels)
- Increased muscle tone – preparedness for flight/escape
- Aggression related behaviour
- Displacement behaviours *and*
- Behaviours arising from confusion and stress

A horse that frequently shows flight responses tends to be stressed. Frequent and/or chronic stress can lead to one or more of the following:

- Learning and memory deficits
- Compromised immunity
- Digestive disturbances
- Redirected aggression
- Ritualisation of the original behaviours indicative of stress (possibly developing into stereotypies)

WELFARE IMPLICATIONS: Horse training should not result in flight responses. Stress results in problem behaviours (including escape and aggression). Both acute and chronic stress have a negative impact on horse welfare.

Training Principle 10 - Demonstrate minimum levels of arousal sufficient for training

DOES YOUR TRAINING DEMONSTRATE: appropriate relaxation?

Trainers should be able to show that the horse is as relaxed as possible during training. Whilst it is widely agreed that certain levels of physical and mental arousal (e.g. muscle tone and attentiveness) are necessary for learning to take place, it is important these levels are not exceeded resulting in a negative impact on learning, training and horse welfare.

WELFARE IMPLICATIONS: Whilst insufficient arousal may lead to lack of motivation for learning, excessive arousal may compromise welfare and be related to stress (acute and/or chronic) with associated behaviours such as aggression, flight or learned helplessness).

Table 1. Examples of desensitisation techniques

Technique	Description and example
Systematic desensitisation	The term refers to a gradual habituation to an arousing stimulus. Systematic desensitisation is a commonly used behaviour modification technique for the alleviation of behaviour problems caused by inappropriate arousal. In a controlled situation, the animal is exposed to low levels of the arousing stimulus according to an increasing gradient, and rewarded when it remains relaxed or shows an appropriate response. An increase in the level of the stimulus is not made until the animal reliably fails to react to the previous level. In this way the technique aims to raise the threshold for a response. ***Example**: The horse is fearful of aerosols. As a first step a handler brings an aerosol close to the horse and strokes it on the body with the bottle (no spraying). This is to habituate the horse to the visual characteristics of the aversive stimulus. When the horse shows no avoidance responses, a next step is to stand some meters from the horse and spray in the opposite direction, preferably with water, i.e. a fluid with no smell. This is to gradually habituate the horse to the aural characteristics of the aversive stimulus. The handler gradually steps closer to the horse, and when the horse shows no responses to the handler standing next to it and spraying in the other direction, the handler can gradually spray closer to the horse. Before spraying directly on the horse's coat, the handler should stroke the horse with a hand and spray gently on the hand. At all stages, it is important to ensure that the horse is only rewarded for appropriate responses, i.e. the aerosol should be removed or spraying terminated when the horse stands still. Positive reinforcement (e.g. food, wither scratching) can be used as an additional reinforcer for appropriate behaviour.*
Counter-conditioning	To "condition" means to train, and "counter" means opposite. Counter-conditioning refers to training an animal to show a behaviour (e.g. eating) which is counter to the one that the trainer wishes to eliminate (e.g. flight), i.e. producing an incompatible response to a stimulus that is expressed in preference to the undesired response. This can be done by forming an association between the feared stimulus and a pleasant stimulus so that the fear-eliciting stimulus comes to predict something good to the horse. As soon as the horse observes or encounters the fear-eliciting stimulus, we introduce something that produces a pleasant emotional reaction (e.g. food). Over many repetitions, the animal learns that whenever the fear-eliciting stimulus appears, something pleasant happens. Eventually, the process produces a neutral or positive emotional reaction to the sight of the previously feared or disliked event, person, place or object. This technique is widely used in combination with systematic desensitisation. By ensuring that the preferred behaviour is more rewarding, the animal learns to perform the new behaviour when exposed to the problematic stimulus. ***Example**: A horse becomes anxious when it hears the bell before the competition, which compromises good performance. Through counter-conditioning, positive outcomes such as a food reward or termination of work are associated with the sound of the bell so that it becomes a*

	predictor of a positive event. Once the horse shows a neutral or positive emotional state at the sound of the bell, it will no longer be tense before a competition.
Overshadowing	Overshadowing describes the phenomenon whereby habituation to the least salient stimulus takes place when two or more competing stimuli are presented concurrently. In the practical setting of horse training, overshadowing provides an effective method of desensitising horses to aversive stimuli such as clippers, needles or other invasive procedures. These aversive and invasive procedures frequently elicit a withdrawal response in the horse. Similarly, when a horse learns to respond to lead rein signals of forward or reverse, they are initially acquired because they too produce a withdrawal response, which through the refinement of further training, diminish to light lead rein cues. Therefore outcompeting the withdrawal response elicited by the clippers through the use of the lead rein cues of forward and reverse can be a useful overshadowing protocol. The horse must therefore be reliably trained to step forward and back from lead rein cues via operant conditioning. Overshadowing differs from systematic desensitisation and counter-conditioning principally because of the use of the lead rein mobility responses. ***Example****: The horse is needle–shy and when it sees the person approaching with the syringe it becomes hyper-reactive and pulls against the handler's lead rein pressures in its attempts to escape. The needle pricking the horse's skin also induces a severe flight response. The solution in terms of overshadowing involves the horse being trained to step back and forward from lead rein pressure so that the horse's reaction is elicited from the lightest of lead rein cues. Next the person with the syringe approaches the horse with the syringe and as soon as the horse displays even the smallest of fear responses, the person with the syringe stops and remains immobile so that the distance between the horse and the syringe stays constant. The horse is then signalled to step back one step and perhaps then forward a step. Initially the horse is delayed and its reaction to light pressure is ignored because his attentional mechanisms are overshadowed by the syringe so the handler then increases the motivational pressure of the lead rein so that in a few repetitions the horse is now responding to light signals of the lead rein. The horse's fear reaction to the syringe has, at this distance, decreased. The syringe is now brought closer to the horse and as soon as the horse shows the slightest fear reaction, the process is repeated. This process continues until the horse's response to the syringe has diminished. Positive reinforcement at each increment enhances the acquisition of the lowered arousal. These lead rein signals and their associated mobility responses soon achieve stimulus control of the horse's locomotion and thus overtake the syringe or clippers for salience. The less salient stimulus either no longer elicits or greatly diminishes withdrawal from the original, more salient stimulus. The procedure however is most successful if the process is begun at the lowest levels of arousal.*
Approach conditioning	This method exploits the natural tendency of horses to explore and approach unknown objects, in combination with systematic desensitisation. The horse is stimulated by the rider or handler to approach the object of its fear, which is retreating as the horse approaches. The horse may then be signaled to stop before it reaches its fear threshold, so that the object retreats even further. The horse is then signaled to catch up. As soon as the horse slows its approach it is deliberately stopped and this is repeated until the horse becomes as close

	as possible to the object. The method has been successfully applied to horses that are afraid of tractors and diggers, motorbikes and trams. ***Example***: *the horse is fearful of tractors, motor bikes or trams and attempts to escape, in order to lower its fear. However if the process is reversed whereby the horse approaches the retreating machine, this can have the opposite effect: its fear is lowered because the machine itself escapes. This technique has been used in training police horses. In best practice, when the horse closes in on the machine it is stopped, thus allowing the machine to increase its distance from the horse. The horse is then stimulated to approach again and each time it draws closer to the machine before it is stopped. Stopping the horse apparently increases its motivation to approach. This is continued until the horse actually makes contact with and investigates the machine.*
Stimulus blending	The method uses a stimulus to which the horse has already habituated to systematically desensitise the horse to the original fear-inducing stimulus. The fear-inducing stimulus is applied gradually at the lowest threshold of fear simultaneously as the known, non-fear-inducing stimulus is applied, and then systematically increased in intensity. For example a horse may be afraid of aerosol sprays but unafraid of being hosed. The aural and tactile characteristics of the aversive stimulus (e.g. aerosol) are gradually mixed with the habituated one (e.g. the hose) making identification of the formerly aversive one difficult and perceptually different. The old benign stimulus can then be diminished and finally terminated after which the horse will show habituation also to the new stimulus. ***Example***: *the horse is fearful of aerosols. In this technique, a stimulus to which the horse has already habituated is used to blend with the problem stimulus. If the horse is used to hosing on its body, the aerosol is introduced during hosing and on the hosed patches of skin. The sound and feeling of the usual water on the horse's body will blend with the novel sound and tactile feeling of the aerosol, making it less distinct. The hosing can then be terminated while the spraying continues.*

Adapted from From McLean & Christensen, 2016. The application of learning theory in horse training. Appl. Anim. Behav. Sci. (in press)

Table 2. The quadrants of reinforcement and punishment

	Reinforcement *Increasing the likelihood or intensity of a behaviour*	**Punishment** *Decreasing the likelihood or intensity of a behaviour*
Negative (Subtraction)	The removal of an aversive stimulus to reward a desired response ***Example:*** Rein tension is applied until the horse stops and the removal of the tension rewards the correct response.	The removal of a desired stimulus to punish an undesired response ***Example:*** The horse paws and so food is withheld.
Positive (Addition)	The addition of a pleasant stimulus to reward a desired response ***Example:*** The horse approaches when called for and receives a carrot to reward the response.	The addition of an aversive stimulus to punish an undesired response ***Example:*** The horse bites and receives a slap on the muzzle.

Conference schedule

Only the affiliations of the presenting author are mentioned.
Please refer to the abstracts for further information.

	Wednesday June 22nd 2016 **Welcome & registration at "le dome du theatre"** *Place de la Bilange, 49400 Saumur*
6.00 pm	Registration open
6.00 pm	Welcome Reception
8.00 pm	End of registration

	Thursday June 23rd 2016 **Academic day at the French National Riding School** *Terrefort, 49400 Saumur* *Manège « Valat »*
7.00 am	Registration open
7.00 am	Poster board set up in the poster area and oral presentation preparation in the conference area
8.15 am	Welcome – Day 1: Scientific day
8.30 am	**Introductory presentation -** Thoughts on the first of the ISES First Principle: train according to the horse's ethology and cognition ***Sue McDonnell -*** *University of Pennsylvania*
	Understanding horse's ethology, learning and cognitive abilities to improve training *Chair : Léa Lansade, French Institute for Horse and Riding, France*
9.00 am	**Plenary 1 -** Memory systems in animals and human ***Ludovic Calandreau -*** *Inra, France*
9.45 am	Oral 1 - Stress affects instrumental learning based on positive or negative reinforcement in interaction with personality in domestic horses ***Mathilde Valenchon****, F. Lévy, C. Moussu and L. Lansade - Inra, France*
10.00 am	Public presentation of the "Cadre Noir de Saumur"
12.00 pm	Oral 2 - Positively reinforcing an operant task using tactile stimulation and food - a comparison in horses using clicker training ***Sian Ellis*** *and L. Greening - Hartpury University Centre, UK*
12.15 pm	Oral 3 - Presenting a methodology for continuous and automated monitoring of mental state in horses using wearable technology ***Deborah Piette****, V. Exadaktylos and D. Berckmans - KU Leuven, Belgium*
12.30 pm	Oral 4 - Fearfulness and learning ability in young horses ***Janne Winther Christensen*** *and L. Peerstrup Ahrendt - Aarhus University, Denmark*
12.45 pm	Lunch

Improving performance through acknowledgment of the horse's temperament, learning abilities and ethology *Chair : Nathalie Waran, University of Edinburgh, UK*	
1.45 pm	**Plenary 2 -** Personality tests in horses: reliability, heritability and relationship with rideability ***Léa Lansade*** *- French institute for horses and riding, France*
2.30 pm	Oral 5 - When training young thoroughbred foals, are there differing rates of learning efficiency due to sex or sire? ***Leigh Wills****, A.N. Mclean, R.B. Stratton, S.P. Wills and S.M. King - Equus Education, New-Zealand*
2.45 pm	Oral 6 - Effects of rein tension on the behaviour and physiology of horses during a standardised learning task *K. Fenner, H. Webb, M. Starling, R. Freire, P. Buckley and* **Paul McGreevy** *- University of Sydney, Australia*
3.00 pm	Oral 7 - Assessment of Franches-Montagnes (FM) horse personality by standardized tests: a first step towards the identification of behavioural trait genes ***Alice Ruet****, S. Briefer-Freymond, C. Le Mével, M. Gelin, D. Bardou, L. Lansade, M. Vidament and I. Bachmann - Agroscope, Swiss national stud farm, Switzerland*
3.15 pm	Afternoon refreshments / Posters
Communication of equitation science to practitioners *Chair: Mathias Hébert, French Equestrian Federation, France and Camie Heleski, Michigan State University, USA*	
4.00 pm	Oral 8 - Testing theoretical and empirical knowledge of learning theory by surveying equestrian riders ***Angelo Telatin****, P. Baragli, B. Greene, O. Gardner and A. Bienas - Delaware Valley University, USA*
4.15 pm	Oral 9 - Riders' perceptions, understanding and theoretical application of learning theory ***Tanja Bornmann*** *- University of Edinburgh, UK*
4.30 pm	Oral 10 - Equitation pedagogic practice: use of a ridden horse ethogram to effect change ***Alison Abbey*** *and H. Randle - Duchy College, UK*
4.45 pm	Oral 11 - Feasibility of a grading system for horses used for leisure riding in the UK ***Rachel Lawson*** *and C. Brigden - Myerscough College, UK*
5.00 pm	Close - day 1
5.30 pm	Special visit to the National Riding School

Friday June 24th 2016 **Practical day at the French National Riding School** *Terrefort, 49400 Saumur* *«Grand Manège»*	
8.30 am	Welcome – Day 2: Practical day
Everyday use of equitation science *Chair : Angelo Telatin, Delaware Valley University, USA*	
8.40 am	Applied learning theory and the basic responses: ground work and ridden work ***Andy Booth***
9.30 am	The story of managing horse welfare in a riding school ***Jill Carey**, Festina Lente*
10.10 am	Morning refreshments / posters in Manège Valat
10.55 am	Teaching airs above ground at the French National Riding School ***Colonel Patrick Teisserenc** and **Fabien Godelle**, French Institute for Horses and Riding*
11.35 am	Intrinsic biomechanics for riders: the inside story ***Lindsay Wilcox-Reid**, Equipilates*
12.15 am	Improve the athletic training of the horse ***Manuel Godin**, Haras de la Cense*
12.55 am	Lunch
Science in practice *Chair Andrew McLean, University of Sidney, Australia*	
2.00 pm	Associating work, health and performance in riding and horse-management ***Nicolas Sanson** and **Emily Freeland**, French Institute for Horses and Riding*
2.40 pm	Simplified personality tests for young show jumping horses and ponies during breeding shows in France ***Marianne Vidament** and **Léa Lansade**, French Institute for Horses and Riding*
3.20 pm	Afternoon refreshments / Posters in Manège Valat
4.00 pm	An ambulatory electroencephalography system for free moving horses: an innovating approach ***Hugo Cousillas**, University of Rennes 1*
4.30 pm	Close - Day 2
7.30 pm	Social evening at Abbaye Royale de Fontevraud

Saturday June 25th 2016
Academic day at the French National Riding School
Terrefort, 49400 Saumur
«Manège Valat»

8.30 am	Welcome - Day 3: Scientific day
	Health and safety of horses and riders during training and breeding *Chair: Paul McGreevy, University of Sydney, Australia*
9.00 am	**Plenary 3 -** Biomechanical effects of training surfaces on the locomotor system – Impact on the horse's health ***Nathalie Crevier-Denoix*** *- Veterinary school of Alfort, France*
9.45 am	Oral 12 - Relationships between health problems and husbandry, use and management of horses: an analysis based on health insured horses ***Uta König von Borstel,*** *C. Erdmann, M. Maier and F. Garlipp - University of Goettingen, Germany*
10.00 am	Oral 13 - Classical music reduces acute stress of domestic horses ***Claire Neveux****, M. Ferard, L. Dickel, V. Bouet, O. Petit and M. Valenchon – Ethonova, France*
10.15 am	Oral 14 - The effect of breast support on vertical breast displacement and breast pain in female riders across equine simulator gaits *J. Burbage,* ***Lorna Cameron*** *and F. Goater- Sparsholt College, UK*
10.30 am	Morning refreshments / Posters
	Equitation science *Chair: Hayley Randle, Duchy College, UK*
11.30 am	Oral 15 - Contribution of sensory information in horse-rider coupling according to the skill of the rider ***Agnès Olivier****, J. Jeuvrey, C. Teulier and B. Isableu – University of Paris Sud, France*
11.45 am	Oral 16 - Influence of the riders position on the movement symmetry of sound horses in straight line trot ***Emma Persson Sjödin****, E. Hernlund, A. Egenvall and M. Rhodin - Swedish University of Agricultural Sciences, Sweden*
12.00 pm	Oral 17 - The effect that a saddle positioned laterally to the equine vertebrae has on rider biomechanics whilst cantering *R. Guire, M. Fisher, T. Pfau, H. Mathie and* ***Lorna Cameron****- Sparsholt College, UK*
12.15 pm	Oral 18 - A comparison of rein tension with methods to determine equine laterality ***Sandra Kuhnke*** *and U. König von Borstel - University of Kassel, Germany*
12.30 pm	Lunch

Understanding, measuring and improving working horses' welfare *Chair: Janne Winther-Christensen, Aarhus University, Denmark*	
1.30 pm	**Plenary 4** - Favouring positive working conditions to ensure horse welfare and rider safety ***Clémence Lesimple*** *- University of Rennes 1, France*
2.15 pm	Oral 19 - Exploring the relationship between heart rate variability and behaviour – Social isolation in horses *A. Badr Ali, K. Gutwein and* ***Camie Heleski*** *- Michigan State University, USA*
2.30 pm	Oral 20 - An investigation into noseband tightness levels on competition horses ***Orla Doherty,*** *V. Casey, P. McGreevy and S. Arkins - University of Limerick, Ireland*
2.45 pm	Oral 21 - The effect of noseband tightening on horses' behaviour, eye temperature and cardiac responses *K. Fenner, S. Yoon, P. White, M. Starling and* ***Paul McGreevy*** *- University of Sydney, Australia*
3.00 pm	Afternoon refreshments / Posters
3.45 pm	Oral 22 - Crib-biting behaviour of horses: stress and learning ***Sabrina Briefer-Freymond****, S. Beuret, E.F. Briefer, K. Zuberbühler, R. Bshary and I. Bachmann - Agroscope, Swiss national stud farm, Switzerland*
4.00 pm	Oral 23 - Monitoring equine (acute) pain: validation of two composite pain scales for general pain expression and facial expression of pain ***Machteld van Dierendonck*** *and T. van Loon - Utrecht University, Netherlands*
4.15 pm	Oral 24 - Effects of Ridden Exercise on Night-time Resting Behaviour of Individually Housed Horses *T. Jones,* ***Kym Griffin,*** *C. Hall and A. Stevenson - Nottingham Trent University, UK*
4.30 pm	Oral 25 - The 'social box' offers stallions the possibility to have increased social interactions ***Anja Zollinger****, C. Wyss, D. Bardou, A. Ramseyer and I. Bachmann - Agroscope, Swiss national stud farm, Switzerland*
4.45 pm	Close – Day 3 Student prizes ISES 2017 Australia - short presentation by organisers Close conference
5.30 pm	ISES Annual General Meeting (AGM)

Posters list

Only the affiliation of the presenting author is mentioned.
Please refer to the abstracts for further information.

Understanding horse's ethology, learning and cognitive abilities to improve training

1. Association of foals' behaviours at weaning with pre-weaning social interactions
   ***Camille Hilliere**, S. Durand and J. Cadwell-Smith - Faculté des Sciences Fondamentales et Appliquées de Poitiers, France*
2. Effects of foal sex on neonatal adaptation in the horse
   ***Manuela Wulf**, C. Aurich and J. Aurich - Graf-Lehndorff-Institut für Pferdewissenschaften, Germany*
3. What makes a good leader? How domestic horses perceive, assess and trust group members
   ***Mathilde Valenchon** and O. Petit - University of Strasbourg, France*
4. Factors affecting seller assigned temperament scores of horses on an internet sales site
   *B. Rice and **Colleen Brady** - Purdue University, USA*
5. A preliminary investigation which indicates the use of fore limb data has limitations in accurately determining laterality in horses
   ***Linda Greening**, L. Palmer and T. Bye - Hartpury University Centre, UK*
6. Short-term spatial memory or food cues; which do horses use to locate preferred food patches?
   ***Mariette van den Berg**, V. Giagos and C. Lee - University of New England, Australia*
7. Secondary reinforcement did not slow down extinction in an unrelated learned task in horses
   ***Léa Lansade** and L. Calandreau – French Institute for Horses and Riding, France*
8. A comparison of methods to determine equine laterality in thoroughbreds
   ***Sandra Kuhnke** and U. König von Borstel - University of Kassel, Germany*

Improving performance through acknowledgment of the horse's temperament, learning abilities and ethology

9. Evaluation of the effectiveness of three non-confrontational handling techniques on the behaviour of horses during a simulated mildly aversive veterinary procedure
   ***Jackie Watson** and S. McDonnell - University of Pennsylvania*
10. The laterality of the gallop gait of Thoroughbred racehorses
    Withdrawn at author's request
11. Attention and performance in sport horses
    ***Céline Rochais**, S. Henry, M. Sébilleau and M. Hausberger – University of Rennes 1, France*
12. Training for a safer leisure horse: a pilot study investigating differences in heart rate between exposures to unknown stimuli
    ***Karolina Marta Drewek** and R. M. Scofield - Oxford Brookes University, UK*
13. A review of sleep deprivation in horses and its association with performance, safety and welfare: potential for future research
    ***Kym Griffin,** S. Redgate, K. Yarnell and C. Hall - Nottingham Trent University, UK*
14. Safely introducing horses to novel objects – a pilot investigation into presentation techniques
    *S. Cliffe and **Rose M. Scofield** - Oxford Brookes University, UK*

15. Possibilities of linear personality trait evaluation during foal-shows: a pilot-study in American Quarter Horses
__Uta König von Borstel__, B. Goldstein and S. Kuhnke - University of Goettingen, Germany
16. Relationship between rideability and tactile sensitivity assessed via algometer and von-Frey filaments
K. Krauskopf and __Uta König von Borstel__ - University of Goettingen, Germany

Communication of equitation science to practitioners

17. Evaluating a natural horsemanship program in relation to the ISES First Principles of Horse Training
S. North, __Ann Hemingway__, A. McLean, H. Laurie and C. Ellis-Hill - Bournemouth University, UK
18. A realistic simulation model of the interacting rider and horse behaviour
__Ola Benderius__, M. Karlsteen, M. Sundin, K. Morgan, M. Rhodin and L. Roepstorff - Chalmers University of Technology, Sweden
19. Reaching equestrians through an on-line academy to implement a new thought process for humane bitting using applied physics
__Caroline C. Benoist__ and G.H. Cross - Neue Schule Ltd, UK
20. Factors impacting student interest in an online module on equine learning theory
__Elise A. Lofgren__, C. Brady and J. Lewandowski - Purdue University, USA
21. Taking the reins: communication strategies to prompt change in riders' training practices
__Lucy Dumbell__ and V. L. Lewis - Hartpury University Centre, UK
22. A pilot study on the application of an objective scoring system
__Michael Guerini__, C. Ramsey, J. Johnson and A. McLean - Dun Movin Ranch & North American Western Dressage,USA

Health and safety of horses and riders during training and breeding

23. Physiological response to training and competition in 1-star to 4-star eventing horses
__Katharina Kirsch__, M. Düe, H. Holzhausen, S. Horstmann, M. Scharmann and C.Sandersen - University of Liège, Belgium
24. Twitching in veterinary procedures: how does this technique subdue horses?
__Benjamin Flakoll__ – Brown university, USA
25. Assessing muscle mitochondrial function to improve training, performance and to early detect exertional myopathies in sport horses
__Dominique.-M. Votion__, C. Leleu, C. Robert and D. Serteyn – University of Liège, Belgium
26. Closure times of the physis in high performance Mangalarga Marchador Gaited Horses - Preliminary data
__Kate Moura da Costa Barcelos__, A.Souza Carneiro de Rezende, R. Weller, A. M. Quintão Lana and R. Resende Faleiros - Federal University of Minas Gerais, Brazil
27. Effect of a nucleotides based preparation on body composition, growth and performance in trotters and racing Thoroughbreds
__Florence Barbé__, A. Sacy, P. Bonhommet, A.S. Vallet, J. Potier and M. Castex
28. A preliminary study to investigate the prevalence and progression of pelvic axial rotations among neonate foals
__Rebecca Stroud__, J. Ellis, A. Hunisett and C. Cunliffe - McTimoney College of Chiropractic, UK
29. An investigation into the limb phasing characteristics and stride duration of fully shod, partially shod and unshod horses on a twenty metre circle in walk and trot gait
M. Bouwman, J. Berry, __Jenny Paddison__ and D. Richmond - Hadlow College, UK

30. What methods are commonly used during weaning (mare removal) and why? A pilot study
***Catherine Williams** and H. Randle - Duchy College, UK*
31. Prevalence of back pain and its risk factors in professional horse riders
***Sophie Biau**, N. Fouquet, R. Mouster and R. Brunet – French Institute for Horses and Riding, France*
32. Effects of osteopathic manipulation in horse riders: a pilot study
***Sophie Biau** and C. Bouloc – French Institute for Horses and Riding, France*
33. Effects of osteopathic treatment in sport horses
*I. Burgaud and **Sophie Biau -** French Institute for Horses and Riding, France*
34. A preliminary study into elite event riders who compete with pain
***Victoria Lewis**, K. Baldwin and L. Dumbell - Hartpury University Centre, UK*
35. Horse and rider safety on the United Kingdom (UK) road system: pilot evaluation of an alternative conspicuity measure
***Rose M. Scofield**, H. Savin and H. Randle - Oxford Brookes University*

Equitation science

36. Statics of neck and head in horses in relation to rein tension - a model calculation
***Kathrin Kienapfel** and H. Preuschoft - Ruhr Universität Bochum, Germany*
37. The development of an innovative and comprehensive protocol to better understand the horse-saddle-rider interaction
***Pauline Martin**, L. Cheze and H. Chateau – CWD, France*
38. Determinant factors of efficiency of the horse-rider coupling during frequency changes
*A. Olivier, **Florie Bonneau**, J. Jeuvrey and B. Isableu – University of Paris Sud, France*
39. Rein tension peaks within canter
***Agneta Egenvall**, M. Rhodin, L. Roepstorff, M. Eisersiö and H. M. Clayton - Swedish University of Agricultural Sciences, Sweden*
40. The impact of bitted and bitless bridles on the Therapeutic Riding Horse
***Clodagh Carey**, S. H. Moriarty and R. Brennan - Festina Lente Foundation, UK*
41. Influence of rider's actiontype profile on rein tension
***Imke Leemans**, M.E. Willemsen, B. Douwes, M.Y. Steenbergen, S. van Iwaarden and A. Retting - University of Applied Sciences, The Netherlands*
42. The symmetry of rein tension in English and Western riding and the impact of human and equine laterality
***Sandra Kuhnke** and U. König von Borstel - University of Göttingen, Germany*
43. The relationship between approach behaviour and jump clearance in show-jumping
***Carol Hall** and R. Barlow - Nottingham Trent University, UK*
44. Assessment of poll pressure induced by a baucher/hanging cheek snaffle
***Caroline C. Benoist** and G.H. Cross - Neue Schule Ltd, UK*
45. Interaction between human voice and horse gait transitions in longeing training
***Keita Nishiyama**, M. Ohkita, K. Samejima and K. Sawa - Teikyo University of Science, Japan*
46. Measurements performance of a horse rider – a case study on contribution of the stirrup forces
***Sophie Biau** and J. F. Debril – French Institute for Horses and Riding, France*
47. A preliminary investigation to compare the pressure exerted by a conventional square saddle pad and a novel wing saddle pad behind the saddle
***Victoria Lewis**, L. Dumbell and P. Stallard - Hartpury University Centre, UK*

Understanding, measuring and improving working horses' welfare

48. Practice and attitudes regarding trimming of equine vibrissae (sensory whiskers) in the UK and Germany
__Lauren Emerson__, K. Griffin and A. Stevenson - Nottingham Trent University, UK
49. To Eat or not to Eat: A review of feeding practices in relation to prevention and treatment of equine behavioural problems
__Machteld van Dierendonck__ - Utrecht University, The Netherlands
50. Physiological stress responses of mares to gynaecological examination in veterinary medicine
__Natasha Ille__, J. Aurich and C. Aurich – University of Vienna, Austria
51. Relationships between owner-reported behaviour problems and husbandry, use and management of horses
__Uta König von Borstel__, C. Erdmann, M. Maier and F. Garlipp - University of Goettingen, Germany
52. An objective measure of noseband tightness in horses: a novel tightness gauge
__Vincent Casey__, T. Conway, O. Doherty and R. Conway - University of Limerick, Ireland
53. Welfare of the hospitalized horse in veterinary clinics: assessment and impact of environmental enrichment
Withdrawn at author's request
54. A preliminary study on the effects of head and neck position during feeding on the alignment of the cervical vertebrae in horses
__Eulalia Speaight__, N. Routledge, S. Charlton and C. Cunliffe - McTimoney College of Chiropractic, UK
55. Acute physiological response of male and female horses to different short-term stressors
__Saori Ishizaka__, C. Aurich, N.Ille, J. Aurich and C. Nagel - University of Veterinary Sciences, Austria
56. Do stabled horses show more undesirable behaviours during handling than field-kept ones?
Z. Losonci, J. Berry and __Jenny Paddison__ - Hadlow College, UK
57. Food anticipation in domestic horses – anticipating something good or frustrated with waiting for a desired resource?
__Katelyn Gutwein__, A. Ahmed Badr and C. Heleski - Michigan State University, USA
58. 24h-time-budget of sport horses housed in box
J. Berthier, L. Lansade, M. Faustin and __Marion Cressent__ – French Institute for horse and riding, France
59. Evaluation of physiological parameters of barrel racers in the home and competitive environment
B. C. Harris and __Petra B. Collyer__ – Texas A&M University-Commerce, USA
60. Does a commercial pheromone application reduce separation anxiety in separated horse pairs?
H.S. Wilson and __Petra B. Collyer__ – Texas A&M University-Commerce, USA
61. Accuracy of horse workload perception by owners when compared to published workload parameters
C. Hale, A. Hemmings and __Hayley Randle__ - Duchy College, UK

Social studies

62. Longitudinal survey of turnout in show-jumping horses in four European countries in 2009/2010
C. Lonnell, C. Bitschnau, E. Hernlund, R. C. Murray, A. Oomen, L. Roepstorff, C. A. Tranquille, R. van Weeren, M.A. Weishaupt and ***Agneta. Egenvall*** *- Swedish University of Agricultural Sciences, Sweden*
63. An industry view of perception and practice of equine management in Canada
Emilie Derisoud*, L. Nakonechny and K. Merkies - University of Guelph, Canada*
64. Horse-riding techniques as an interspecies communication tool
Patrice Régnier *and S. Héas – University of Rennes 2 - France*
65. Equines as tools vs partners: a critical look at the uses and beliefs surrounding horses in equine therapies and argument for mechanical horses
Emily Kieson *and C. Abramson - Oklahoma State University, USA*
66. Straight from the Horse's Mouth: Understanding experiences of Professional Event riders' techniques in mental preparation for maximising self-confidence
Sally McGinn *- UK*
67. Visual appeal of horses may be linked to human personality
Emily Zakrajsek *and K. Merkies - University of Guelph, Canada*
68. Exploring human horse relationships in Australian thoroughbred jumps racing
Karen Ruse*, K. Bridle and A. Davison - University of Tasmania, Australia*
69. The influence of equine popular art forms in the invention of a contemporary human-horse relationship based on an alter ego paradigm
Sylvine Pickel-Chevalier *- Université d'Angers, France*

Biographies of the plenary speakers

Sue McDonnell: Sue McDonnell, PhD, Cert Applied Animal Behaviourist, is the founding head of the Equine Behaviour Program at the University of Pennsylvania's School of Veterinary Medicine, where her work involves research, teaching, and clinical service. In addition to scientific research publications, she has authored two introductory level books on horse behaviour, as well as a book and DVD entitled *The Equid Ethogram: A practical field guide to horse behaviour,* cataloging behaviour of horses under both domestic and natural conditions. Along with Dr. Daniel Mills she co-edited *The Domestic Horse*. She writes a regularly for *The Horse* and contributes to other equine industry magazines in North America and Europe.

Ludovic Calandreau: Ludovic Calandreau is a researcher, leader of a team specialized on the study of animal behaviour and cognition in birds, sheep and horses at the Institute of Physiology and Reproduction, Nouzilly France. He has done extensive research on learning and memory capacities in mammals and birds as well as on their neurobiological bases. His current work is about the relationships between stress, learning and memory strategies and neurogenesis, an important mechanism of brain plasticity. He gives lectures on this topic is different university formations, belongs to national groups of research engaged in the study of animal learning and memory capacities, is involved in a French expertise about animal consciousness. More information about his research can be found at http://www6.val-de-loire.inra.fr/umrprc-ethologie-neurobiologie.

Léa Lansade: Léa Lansade works for the French Institute of Horses and Riding. She belongs to the “behaviour, neurobiology and adaptation” group of the National Institute for Agricultural Research, located in the Loire Valley in France. Léa has studied the personality of horses for 15 years. One of her goals has been to develop some reliable tests, aimed at measuring personality in the field as well in laboratory conditions. She has also worked on determining the relationships between personality and rideability. Other interests include the relationship between personality, learning abilities and stress in horses. Finally, she has worked on horse welfare. In addition to scientific papers, she has written a book for horse riders to help them to understand and apply learning theories and she has conducted some courses on this aspects. During her free time, Léa enjoys caring for and riding her horses.

Nathalie Crevier-Denoix: Nathalie Crevier-Denoix is a 1989 graduate from the Veterinary School of Alfort (France). Agrégée in Veterinary Anatomy (1993), she defended her PhD in Biomechanics (1996) and became Professor in Anatomy (1999). Since 2003 she is the head of a research unit devoted to Biomechanics and clinical research in equine locomotor pathology in Alfort. After a thesis of Veterinary Doctorate on the radiographic images of the foal limbs during growth (1991), her research activities have first been focused on equine tendon biomechanics. Since 2006, she supervises an extensive research program on the biomechanical effects of track surfaces on the equine locomotor system. She has published 40 peer-reviewed articles and about 150 conference abstracts including about 45 as invited speaker.

Clémence Lesimple: Clémence Lesimple is researcher in ethology, specialized in horses’ welfare. Her early research activities related to perinatal experiences and their positive or negative impact on the later life. This questioning led to a growing interest for welfare, and in 2012, she defended a PhD on horses’ welfare in the “Human and animal ethology” research unit of the University of Rennes (France). Her work aims to identify positive ‘global’ management (including housing, social, feeding and working conditions) in regard to horses’ welfare, with a particular emphasis on the impact of teaching and riding practices on horses’ back ‘health’. She is involved in educational programmes for vets (Lyon University’s degree) and animal osteopaths. She is has published 9 international scientific peer-reviewed publications and about 30 presentations in conferences on the subject since 2008.

Abstracts of oral presentations

Introductory presentation

Thoughts on the first of the ISES FIRST PRINCIPLE: train according to the horse's ethology and cognition

S. McDonnell

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From its very start, ISES has promoted a set of fundamental principles of horse training and management, known as FIRST PRINCIPLES.(1) ISES considers these to be "non-negotiable obligations for trainers to maintain optimal welfare in trained horses as well as optimal training efficiency." The first of these 10 FIRST PRINCIPLES is to **train according to the horse's ethology and cognition**. This presentation will review this 1st and overriding principle, with examples given by ISES Council members and Founders, who were recently asked to cite their own personal favourites. Ethology is the scientific study of the natural behaviour and related biology of animals. For any given domestic species, certain biological and behavioural characteristics, such as social organization, reproductive strategies, foraging patterns, perceptual capacities and other cognitive abilities along with related physiology that favoured survival to reproduce over many thousands of generations before domestication, linger as core innate characteristics. Applied ethology is the application of this species-specific knowledge to the management, handling and training, of domestic animals. There remain enormous opportunities for managers and trainers of domestic animals to apply what is known about the ethology of animals to enhance the overall quality of the human-animal relationship, including health and welfare, training and management efficiency, human and animal safety, and productivity. This is certainly the case for horses.

Equine ethology in general

The favourite examples provided by ISES Founders and Council members for training according to the horse's ethology and cognition all relate to the fact that horses evolved as primarily an open-plains grazing prey herd species. For prey species that must spend most of the time foraging out in the open, the "safety in numbers" rule is paramount. These animals seek the company of others, particularly their own species, and act instantaneously in concert particularly when threatened. This results in individuals within a band and bands within a herd forming long lasting strong relationships. They appear to gain comfort from proximity to trusted cohorts, and appear stressed when separated. Complex dominance relationships support harmony within and between sub-groups of large herds. In wide open environments, distance is the primary indictor of submission. This all requires clear and efficient ongoing communication of presence or absence of threats. Communication signals tend to be quiet and subtle, with instantaneous reaction to threats. In addition to communication among a herd, prey species are particularly perceptive and reactive to communication signals and emotional states, both negative and positive, of other species in the environment. Any activities that may reduce vigilance and/or increase risk of predation, such as breeding, parturition, or rest, all tend to be relatively brief, quiet, and buried within the herd as opposed to off alone, and so relatively inconspicuous to predators. When resting, band members conspicuously alternate shifts of one or more individuals remaining more alert as a sentinel for the less vigilant of the group who are dozing while standing or recumbent. These are all reasons why stable and compatible equine companionship is considered a basic need for horses.

There are dozens of other opportunities to accommodate and take best advantage of these characteristics to improve the welfare and efficiency of management and training domestic animals that evolved as open-plains grazing prey herd species. Husbandry that supports the natural trickle feeding and natural continuous movement while foraging has obvious benefits for most horses, in terms of physical and mental health that directly affect training as well. Incorporating trusted social support during training in the form of an already-trained, relaxed stable companion can be quite beneficial, especially in the early phases of training or in new

environments and training conditions. Because horses perceive and respond to our emotional states, relaxed confident non-confrontational handlers and trainers are typically most effective.
Prey species are thought of as genetically programmed for “hard memory” of panic-related features and events, so it is best to avoid panic situations at all cost. Carefully considering and minimizing potential environmental pressures is recommended to raise the threshold for fear and startle, hopefully avoiding panic. An example of an often-overlooked pressure is restraint and confinement that tack or training enclosures represent to horse. Just introducing new tasks in a quiet open area with minimal tack, and with a calm companion horse or two if possible, can often reduce the risk of panic for many horses.

Another favourite example in this regard is that horses like many prey species have evolved to have only subtle and inconspicuous signs of fear, anxiety, confusion, or physical discomfort. This is no doubt the cause of considerable unintentional poor welfare of domestic horses. The most effective trainers are those who instantaneously recognize the subtle signs of fear, anxiety, or confusion and to instantaneously adjust the pressure and pace of training to maintain a relatively relaxed state. Similarly, pain-related changes in behaviour in otherwise well-trained horses is frequently misinterpreted, even by healthcare professionals, as misbehaviour. For many people, recognition of the subtle signs of these emotional states is not intuitive, but it is a skill well worth learning.

Equine cognition in particular
Cognition, a specialized sub-discipline of ethology, refers to perceptual and the mental abilities and processes, including behaviour changes as a result of experience (i.e. learning). Just as with the other species-specific ethological characteristics, cognition of our horses evolved to favour survival for an open plains grazing prey animal, so grazing most of the time and continuously alert to potential threats. The sensory capacities and characteristics of horses have long been understood as well adapted for the best nearly 360o detection of potential threats when grazing.

In terms of learning ability, there is an abundant scientific literature on the laws of learning and various learning and behaviour modification phenomena. Most of the early scientific studies of learning used animas models. There is no doubt that all that early learning science is directly applicable to horses. In fact, graduate students who did this early laboratory work on learning often took side jobs as animal trainers for circuses and roadside shows. A major concern in training domestic animals is that mistakes are easily made by over- or under-estimating their cognitive ability. Because behaviour modification principles generally apply to all species, the risk of making those mistakes is greatly reduced.

The top favourite examples of training according to the horse’s cognition cited by ISES leaders are a) reinforcement of incremental steps, b) use of simple, unambiguous, consistent cueing, c) appropriate timing of reinforcement, and d) the relative effectiveness of reinforcement vs punishment in training (2). My own favourite example concerns how quick horses are to associate cues with experiences, positive or negative. Among animals, horses’ ability to discriminate subtle differences in stimuli is quite extraordinary. One could argue that, in analogous non-verbal learning situations, most horses do better than most people. Again, this all makes ethological sense. When moving from place to place, finding forage and water while avoiding predators, fine stimulus discrimination and continuous modification of behaviour as a result of experience afford obvious survival advantage.

References:
1. http://www.equitationscience.com/learning-theory-in-equitation
2. http://avsabonline.org/uploads/position_statements/Combined_Punishment_Statements.pdf

Lay person message: For any domestic species, best welfare and training efficiency can be expected when husbandry and training are designed to take greatest advantage of species-specific biological needs and behavioural characteristics, including perceptual and cognitive ability in light of general learning theory and behaviour modification principles.

Keywords: horse, ethology, cognition, welfare, species-appropriate training.

Plenary 1

Memory systems in animals and humans?

L. Calandreau

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Memory is a complex and dynamic cognitive function that allows an individual to acquire, store and recall information and events. It is now well accepted that memory is not a unitary function. Indeed, since the pioneering work by Scoville and Millner in 1957, with the study of the patient H.M, many studies in neuropsychology provided solid evidence that different memory systems co-exist in human. These systems are characterized by the cognitive processes engaged, from simple and non-conscious associative forms of memory to more complex and conscious forms of memory. These memory systems have been classified as non-declarative vs. declarative forms of memory. Importantly, memory systems are also characterized by their underlying neurobiological substrates. It is now well considered that most of memory systems described in human are also observed in animal (with the exception of components related to language and consciousness). Forms of declarative memory such as spatial or more recently relational memory have been largely described in non-human animals. Interestingly, these forms of memory involve similar cognitive processes and share the same neurobiological substrates than those already reported in human. For instance, the hippocampus, a brain area critically required in human in declarative memory, is also involved in declarative like memory in animals. Studies conducted in animals indicate thus that memory systems are relatively conserved across species. They also highlight that a memory performance does not automatically inform us what memory system is engaged in a training task. This is of importance because the use of some memory systems allows the animal to give flexible responses whereas others do not. Moreover, these studies highlighted that factors such as stress level, age of the individual strongly influence the memory system that will be involved in a task.

Lay person message: Studies conducted in human and animals indicate that memory is not a unitary function. They are different memory systems relatively conserved across species. These systems allow the processing and storage of information or events more or less complex, permit or not the animal to give flexible responses. They also highlighted that factors such as stress level, age of the individual strongly influence the memory system that will be involved in a task.

Keywords: declarative memory, non-declarative memory, memory system.

Oral presentation 1

Stress affects instrumental learning based on positive or negative reinforcement in interaction with personality in domestic horses

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Learning abilities of horses are constantly challenged, from the early handling of the foals to the high-level dressage of sport horses. Many trainers notice that learning performance can be improved, or on the contrary inhibited, by stress according to horse's personality, but the complex relationship between stress, learning performance and personality remains poorly understood. Yet, improving training requires identification of which factors are favourable to learning performance according to each horse's personality. The present study investigated how stress affects instrumental learning performance in horses depending on the type of reinforcement used and horses' personality. We assigned horses to four groups (N=4 x 15) and each group received training with positive (PR) or negative reinforcement (NR) in the presence or absence of extrinsic stressors (unrelated to the learning task). The learning task consisted of the horse entering one of two compartments at the appearance of a visual signal given by an experimenter to obtain food reward (PR) or to avoid unpleasant tactile stimulation (NR). In the absence of extrinsic stressors, learning performance did not differ between NR and PR (Dunn test, df=3, $p>0.05$). The presence of extrinsic stressors (exposure to novel and sudden stimuli prior performing the task) impaired learning performance, with a greater extent when PR was used. Indeed, stressed horses required more trials than non-stressed horses to complete the criterion (5 consecutive successful trials) in the PR task (Dunn test, df=3, $p<0.05$), whereas stressed horses only tended to perform worse in the NR task (Dunn test, df=3, $p=0.06$). The negative reinforcement, considered as an intrinsic stressor, could have counterbalanced the impact of the extrinsic stressor by focusing attention toward the learning task. Prior learning experiment, 5 personality dimensions were assessed for each horse using validated behavioural tests. Personality appeared to influence learning performance depending on the presence of stressors and the type of reinforcement. When NR is used, the most fearful horses were the best performers in the absence of stressors (correlation performance x fearfulness variable: $r_s=-0.57$, $p<0.05$) but the worst with stressors ($r_s=0.54$, $p<0.05$). On the contrary, when PR is used, the most fearful horses appear to be consistently the worst performers, with ($r_s=-0.51$, $p<0.05$) and without extrinsic stressors ($r_s=-0.57$, $p<0.05$). This study is the first to demonstrate that stress affects equine learning differentially according to the type of reinforcement in interaction with personality. It provides fundamental and applied perspectives to the understanding of the relationships between personality and training abilities.

Lay person message: This study shows that stress is a powerful modulator of learning performance in horses. Acute stress impaired learning performance in both positively and negatively reinforced tasks, but to a greater extent with positive reinforcement. Influence of stress also differed according to personality. This provides insightful knowledge on how training can be optimized for each horse depending on its personality.

Keywords: learning, cognition, reinforcement, temperament, training, emotion.

Oral presentation 2

Positively reinforcing an operant task using tactile stimulation and food - a comparison in horses using clicker training

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Positive reinforcement is a frequently employed method of horse training, commonly utilising food as a biologically significant stimulus to reward a desired behaviour. Whilst the replication of allogrooming behaviours with a human has been shown to lower equine heart rate, little quantitative evidence exists to describe the effectiveness of this type of tactile stimulation as a reinforcer. The current study aimed to compare the reinforcing properties of food against tactile stimulation on the withers, measuring latency to completion of an operant task. Fifteen horses (6 mares, 9 geldings; mean age 17.8±8 years) from mixed backgrounds (retired and rescue) were randomly assigned to one of three groups; group A (n=5) received food as a primary reinforcer (3g of carrot), group B (n=5) received a scratch on the withers for 5 seconds, and group C (n=5) acted as a control (no reward). During days 1 and 2 of the study (the conditioning phase) each horse was simultaneously exposed to a secondary reinforcer (a clicker) followed by a primary reinforcer dependant on their group (group C received nothing). On days 3, 4 and 5 (the experimental phase) horses were shaped to touch a target (a 94cm orange traffic cone). On each day, horses were given 30 consecutive opportunities (trials) to touch the cone following both a visual and auditory cue (pointing to the top of the cone and saying "touch"). If horses did not touch the cone within 10 seconds of the cue, the trial was recorded as a fail. Learning criteria was set at 80%. One-way ANOVA (independent samples) was used to compare latency times between the three groups. Overall, there was a significant difference ($F_{2,11}$=6.978, $p<0.05$) between groups for mean latency to touch the target. Tukey's HSD post-hoc test highlighted a significant difference ($p<0.01$) between the latency for group A (0.65 seconds) compared with group B (13.36 seconds) but with no differences between any other groups. Chi-squared test indicated a significant difference (Chi^2=151.97, df=2, $p<0.001$) between groups for the total number of touches on the target. Group A was the closest to achieving learning criterion (75.6%), compared with group B (39.6%) and group C (26.4%). On the fifth day, 3 horses (all from Group A) achieved learning criteria; two reached 96.67% and one 100%. Learning criteria for horses in groups B and C did not exceed 40%. These results suggest that food is more effective at increasing the likelihood of a desired behaviour compared to wither scratching. This has implications for horse training both in-hand and under saddle as scratching may not reinforce a behaviour enough for it to be repeated at the required rate. Scratching of the withers may be reinforcing only for some individuals.

Lay person message: riders and handlers are often observed to scratch their horse on the withers following successful completion of a desired behaviour, however the results of this study suggest that this does not necessarily translate across to a training scenario. Food appears to be a more effective reward than a scratch on the withers for horses.

Keywords: equine, reinforcement, wither scratching, food, behaviour, learning.

Oral presentation 3

Presenting a methodology for continuous and automated monitoring of mental state in horses using wearable technology

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Monitoring the mental state of horses is essential to the evaluation of their welfare and performance. The most common approach to evaluate mental state in horses is assessment of behaviour, with or without an equine ethogram. The drawbacks of this method are the subjectivity and the time needed. In this study a methodology is presented to monitor the mental state of horses in an automated way using wearable technology. For this purpose, 9 horses (3 mares, 6 geldings, 4-15 years) were monitored in 4 experiments (68 measurements), approved by the Animal Ethics Committee of KU Leuven. The presented methodology is based on the principle that a horse's heart rate can be divided in 3 parts: basic metabolism, activity and mental state or stress. In this study, activity of the horses was quantified by measuring physical activity directly on the horse. Metabolism was assumed constant during the short experiments and was not taken into further account. Using the measured activity of the horse, a simulated heart rate was calculated that only reflected changes in heart rate resulting from changes in activity. This was done by applying an autoregressive model with exogenous outputs with 2 a- and 2 b- parameters and a time delay of 1 second to the measured activity. Since the measured heart rate relates both to mental state and activity, it was hypothesised that the positive difference between the measured and simulated heart rate is a measure for the horse's mental state or stress. By computing the 20 second moving average of the horse's mental state followed by normalisation, the relative stress in percentage was obtained. The gold standard for stress in horses, behaviour, was obtained using an equine ethogram. Using the video recordings of the horses and a labelling tool developed by M3-BIORES, the occurrence of 13 types of negative behaviour was stored for each second of the experiment. This resulted in continuous equine behaviour data with the same sampling rate as the measured heart rate and activity, which enables validation of the mental state detection method. The same window averaging and normalisation procedure as for the simulated heart rate was applied to the labelled behaviour to obtain relative negative behaviour in percentage. For validation, the relative stress was compared with the relative negative behaviour. A peak detection algorithm was applied to both time series (min. peak distance=50 seconds, min. peak height=10%). Positive peaks were matched between stress and behaviour in a range of ±50 seconds. Applying this validation procedure to all measurements resulted in a sensitivity of 77% and a precision of 78%. In conclusion, the presented method provides a reliable, automated and objective way to evaluate mental state.

Lay person message: The mental state of horses provides essential information on their welfare and performance. The most common approach to evaluating mental state in horses is visual assessment of their behaviour, which is subjective and time consuming. This work presents a methodology to monitor the mental state of horses in an objective, continuous and automated way using wearable technology.

Keywords: equine, behaviour, wearable technology, automated, monitoring, welfare.

Oral presentation 4

Fearfulness and learning ability in young horses

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Fear reactions in horses are relevant for both human safety and animal welfare. In addition, fearfulness may interfere with learning due to frequent or prolonged glucocorticoid secretion as well as attention deficits during training. This experiment was part of a larger project on the development of fearfulness and learning ability in foals and the potential influence of variations in maternal care. The aim of this subpart of the project was to investigate whether individual performance correlated in a range of learning tests, targeting both positive and negative reinforcement modalities, and similarly whether fear reactions correlated between fear tests, indicating consistent temperamental traits. We further aimed to explore the association between learning and fearfulness and the ability to habituate to frightening stimuli. Forty-four young horses (male: 28, female: 16) from one stud were kept in mixed sex group boxes and tested at 10-12 months of age in four learning tests (visual discrimination; spatial reversal, clicker training and a tactile negative reinforcement test), and at 12-14 months of age in two standardised fear tests (novel object tests; NOT1 and NOT2) and a habituation test in which the horses habituated to walking across plastic to reach a feed container in a gradual, voluntary set-up. Performance was recorded as the number of test sessions required to meet the habituation criterion. In the fear tests, behaviour (e.g. latency to pass the objects) and heart rate (HR) were measured. Performance in the learning tests was evaluated as the number of correct choices, or the number of sessions required to reach a pre-set learning criterion. There were strong positive correlations between the two fear tests in both behavioural (latency to pass objects, $r_s=0.6$, $p<0.001$) and heart rate reactions (HR mean: $r_s=0.9$, $p<0.001$; HR max, $r_s=0.7$, $p<0.001$), i.e. horses that showed strong reactions in one fear test showed similar reactions in the other test. Similarly, the number of required habituation sessions correlated significantly with latencies in the fear tests (NOT1: $r_s=0.5$, $p=0.001$ and NOT2: $r_s=0.6$, $p<0.001$). There was a tendency towards colts passing the habituation test quicker than fillies (median [25; 75%] number of required training sessions, Mann-Whitney U test, colts: 2 [0.3;7] vs. fillies: 7 [2;15], $p=0.054$). Performance in the learning tests did not correlate ($p>0.05$ for all test combinations) and there was no effect of foal sex on performance. The link between fear reactions and learning performance remains to be explored.

Lay person message: Our results suggest that fearfulness can be considered a temperamental trait whereas learning ability is related to the actual task, which is in accordance with earlier studies. Fearfulness appears to be consistent across a range of different situations, but learning abilities should be evaluated within the context (discipline) that a horse is expected to be trained in.

Keywords: fearfulness, habituation, learning ability, temperamental traits.

Plenary 2

Personality tests in horses: reliability, heritability and relationship with rideability

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Personality, the term used here as a synonym for temperament, can be defined as a set of behavioural tendencies called traits or dimensions which are present early in life and are relatively stable across various situations and over the course of time. These dimensions are mutually independent. Currently, there are an increasing number of studies on personality because it is a major factor influencing the life of an animal from different perspectives. For example, personality dimensions such as fearfulness have an impact on welfare and adaptation to rearing conditions of captive wild and domestic animals. Dimensions such as fearfulness or boldness are reported to have a strong influence on learning performance in many species including horses. Personality is also an important factor to consider when domestic animals are trained by humans. For example, in working dogs, the boldness dimension is positively correlated with performance during working dog trials. Personality is also a key element to be taken into account in the breeding and riding of horses. An Australian study found that personality was cited as the first selection criteria for riding schools, before morphology or price. A large-scale survey of competitive or leisure riders, and horse professionals and breeders conducted in 13 countries reported that it was the most important criterion to be considered. Furthermore, attempts to evaluate personality are already included in different selection programmes for sports horses, but these evaluations are often subjective and non-standardized. Nevertheless, a large number of personality tests have been developed over recent years to evaluate traits in horses, such as fearfulness, confidence, boldness, extraversion, reactivity towards humans, locomotor activity, social motivation, gregariousness or tactile sensitivity. We propose in this talk to present these different personality tests, in particular the tests we have developed in France (the “complete personality tests” and the “simplified personality tests”), with their advantages and limitations. We will focus on their reliability in determining whether or not they meet all the criteria required, in particular, stability across situations and over time and independence of the traits measured. Then we will show how they can be easily implemented to test large numbers of horses in the field. Moreover, for these tests to be useful in selection programs, it is necessary to calculate the heritability of these personality measures. We will present our recent study demonstrating that heritability values of the “simplified personality tests” were elevated (h^2>=0.50) for fearfulness measures (suddenness test and novel surface test) and moderate (h^2=0.35) for tactile sensitivity measures. Geneticists consider these values to be high enough to allow genetic selection of horses according to these dimensions. Finally, before considering selection of horses according to their personality, we have to figure out which temperament profiles are appropriate for the intended use (sport, leisure, as a pet, etc.). For this, we will review the studies which have identified relationships between personality and rideability. Most of this research has shown that fearful horses or at least those which are more reactive (with a high level of arousal, including behaviour relating both to fearfulness and gregariousness), are the most complicated to ride and express more avoidance behaviours such as evasion or shying. However, some recent results also show that the most fearful horses are in general appreciated by the most experienced riders, and in certain cases could be the highest performers in show jumping competitions. This demonstrates that there is not a “suitable” or “unsuitable” personality, but rather that each horse presents advantages and drawbacks according to its intended use.

Lay person message: Personality tests are already implemented in the field in different countries. Some measures present enough heritability to allow genetic selection. Relationships between personality and rideability have been identified. Importantly, results show there is not a “suitable” or “unsuitable” personality, but rather that each horse presents advantages and drawbacks according to its intended use.

Keywords: temperament, fearfulness, training, selection, genetic, reactivity.

Oral presentation 5

When training young thoroughbred foals, are there differing rates of learning efficiency due to sex or sire?

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The New Zealand thoroughbred breeding industry demands expedient and effective foundation training for their young horses with minimal risk of injury. The behaviours are required to be elicited at differing levels of arousal and in various environments. Typically training is kept to a minimum and occurs pre weaning and post weaning for a set number of days. The aims of this study were to describe the learning efficiency in foals for three foundation behaviours and to understand if sex or sire altered these so that future stud training programs may be adjusted accordingly to minimise training time and costs. The effectiveness of a foal training programme run by Equus Education (NZ) Ltd on a commercial thoroughbred breeding farm was investigated. Approximately 2150 foals have been trained over the past thirteen years with a 100% success rate and zero injuries to any mares or foals. In this study foals were trained using the 10 ISES principles at three to six weeks of age during the socialisation phase. Training sessions were for 15-20 minutes allowing for the shorter concentration span in foals and conducted on no more than three consecutive days to allow for latent learning. The initial training area was minimised to inhibit the flight response and included protective padding. The number of repetitions and sessions required to achieve task acquisition in three behaviours for 56 previously untrained three to six week old thoroughbred foals was recorded along with sex and sire details. The behaviours were (1) stand still to be approached by a human; (2) balance, pick up a foot and hold for five seconds and (3) respond to light pressure for the stop and go signal. All foals achieved task acquisition in a mean of 6.2 (SD 1.4) sessions, with no injuries over the 349 sessions. Foals took a mean of 5.0 (SD 1.5, range 1-8) sessions for human approach, 6.1 (SD 1.2, range 4-9) sessions for having a foot picked up and 5.7 (SD 1.3, range 4-9) sessions to lead. Of the 20 fillies and 36 colts in the study there was no significant difference in learning efficiency based on sex (t_{54}=0.46, p>0.05) or sire ($F_{6,47}$=2.07, p>0.05). The method of training based on the 10 ISES principles was effective. Results of this study may be used to inform breeders of the variation that exists in the amount of training each individual foal requires. Further research could be warranted to investigate determinants of this variation and how these can be applied to minimise the amount and range of sessions for foals to be competent in the three foundation behaviours.

Lay person message: Training using the 10 ISES training principles was successful for all foals. At three to six weeks old thoroughbred foals already showed differences in their rate of learning to be approached, pick up their feet and lead. These differences were not shown to be based on sex or sire.

Keywords: learning efficiency, foal, training, foundation, behaviour, thoroughbred.

Oral presentation 6

Effects of rein tension on the behaviour and physiology of horses during a standardised learning task

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Rein tension is used to apply pressure to control both ridden and unridden horses. The pressure is delivered by equipment such as the bit, which may restrict voluntary movement and cause changes in behaviour and physiology. Managing the effects of such pressure on arousal level and behavioural indicators will optimise horse training outcomes. This study examined the effect of training horses to turn away from bit pressure on cardiac variables and behaviour (including responsiveness) over the course of eight trials in a standardised learning task. The experimental procedure consisted of a resting phase, treatment/control phase, standardised learning trials requiring the horses (n=68) to step backwards in response to bit pressure and a recovery phase. As expected, heart rate increased (GLM, $F_{1,66}$=5.01, p<0.05) and heart rate variability decreased (GLM, $F_{1,66}$=7.3, p<0.01) when the handler applied rein tension during the treatment phase. The amount of rein tension required to elicit a response during treatment was higher on the left than the right rein (*t*-test: t_{30}=2.775, p<0.01). Total rein tension required for the subsequent trials reduced (REML, $F_{6,462}$=6.10, p<0.001) sequentially, as did time taken (REML, $F_{1,41.7}$=41.67, p<0.001) and steps taken (REML, $F_{6,462}$=10.65, p<0.001). The probability of head tossing also decreased ($F_{11,730}$=2.16, p<0.05) with the progression of the trials and was higher ($F_{1,72}$=5.86, p<0.05) for the control horses than the treated horses. These results suggest that preparing the horses for the lesson and slightly raising their arousal levels, improved learning outcomes.

Lay person message: The results of this study suggest that preparing horses by moderately raising their arousal levels before lessons, could improve training. Horses in this study showed increases in arousal (indicated by moderate cardiac changes), followed by an immediate return to resting rates after the lesson. We propose that, in the future, this technique could be referred to as bringing horses into the engagement zone.

Keywords: behaviour, horse, physiology, rein, tension, welfare.

Oral presentation 7

Assessment of Franches-Montagnes (FM) horse personality by standardized tests: a first step towards the identification of behavioural trait genes

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Personality is defined as reactions towards environmental stimuli that are expressed by behavioural patterns and remain relatively stable across time and situations. It results from the interaction between certain genes and the environment. A better knowledge of the link between genes and personality could allow better selection of horses. An international project aims to create a database of the personality of different breeds in order to identify behavioural trait genes. In France, two tests named “Tests de Tempérament Simplifiés (TTS)” have been developed to assess tactile sensitivity and fearfulness, two dimensions linked to the horse’s rideability and performance. These tests met the validity criteria of a personality assessment method: independence of dimensions and temporal and situational stability. In this study, 184 FM horses (53 % mares, 33 % stallions and 14 % geldings), aged 3 to 23 years with diverse genetic origins, were tested with TTS in 18 horse stables, in accordance with Swiss law. All horses were already handled, ridden and driven. For the tactile sensitivity test, 4 Von Frey filaments (0.008g, 0.02g, 1g and 300g) were applied on the withers and muscle quivering (yes/no) was recorded. The fearfulness test consists in opening a dark umbrella in front of the horse and observing the intensity of reaction (“no reaction” to “strong reaction”). Results were analysed with linear mixed effect models. The FM horse tactile sensitivity was medium (47% quivering with 1g) but with variation between less sensitive (9% no quivering) and more sensitive horses (13% quivering with 0.008g). Most FM horses had low levels of fearfulness (86% included between “no reaction” and “medium reaction”). Taking into account individual characteristics, location, date and weather, it seems that fearfulness increased with an increasing level of admixture with Warmblood horses (LR Chi^2=8.6, df=1, $p<0.01$ but decreased with age (LR Chi^2=5.8, df=1, $p<0.05$). We also compared our results to those of a French sport horse breed (N=110) and a French draft horse breed (N=61) which were tested with the same tests in 2014. The FM breed’s tactile sensitivity is ranked between the draft horse (Chi^2=964, df=1, $p<0.001$) and the sport horse (Chi^2=1160, df=1, $p<0.01$). Fearfulness is significantly higher in the FM breed than in the draft breed (LR Chi^2=9.4, df=1, $p<0.01$) but does not differ from the sport breed. Although temporal stability is still heavily discussed especially regarding fearfulness, larger sample sizes should reduce environmental noise within the data, so that the tested dimensions remain relevant for the identification of personality genes.

Lay person message: In this study, we found differences between breeds based on the two studied dimensions. The FM breed, as a light draft breed, lies between the heavy draft breed and the sport horse breed for tactile sensitivity and shows more fearfulness than the heavy draft breed. These results are promising for the research into the genes influencing horse personality.

Keywords: equine, sensitivity, fearfulness, breed, personality, genes.

Oral presentation 8

Testing theoretical and empirical knowledge of learning theory by surveying equestrian riders

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In order to improve the safety and competence of equestrians and the welfare of their mounts, it is necessary to identify and address disconnects between rider knowledge and application under saddle. A 23 question survey was designed to assess theoretical and empirical knowledge of learning theory by definition questions, followed by application to specific scenarios. Of 376 respondents 94% were female, ranged in age (below 20: 17%, 20-29: 46%, 30-39: 14%, 40-49: 9%, and 50+: 14%). Over half (51%) self-identified as advanced or professional riders, with 79% of respondents participating in English discipline. Of the 376 respondents 34% correctly answered negative reinforcement definitions, however when asked in an empirical form in regards to the use of the whip, leg and bit, 41% knew how to use the whip in a correct negative reinforcement sequence, 39% knew how to use the leg properly and 78% knew how to use the bit. However, when asked a more generic question about the bit during collection requiring application of the knowledge, only 43% of responses were correct. The percentage of participants with correct theoretical knowledge is similar to those with correct practical knowledge for all variables, except one: the use of the bit. A potential contributor to the skewed bit response could be the 293,000+ views of the top seven YouTube videos search results for "on the bit". When presented with situational questions requiring application of learning theory, respondents did not excel (i.e. low % of correct responses: needle shy horses - 25%, bucking behaviour in response to whip - 37%, correction of whip-related/bucking behaviour - 48% and cause of horse halting - 51%). Survey results demonstrate the necessity to educate horse owners in effective application of learning theory for improved rider safety and equine welfare.

Lay person message: Our survey results indicate that participating riders had limited knowledge about learning theory; therefore potentially compromising their safety and the horse welfare. There is much work yet to be done to educate equestrians on putting the learning theories to practice.

Keywords: survey, horses, learning, theory, rider, knowledge.

Oral presentation 9

Riders' perceptions, understanding and theoretical application of learning theory

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This study aimed to explore and investigate riders' perceptions, understanding and theoretical application of learning theory (LT) in horse training focussing on positive reinforcement (PR), negative reinforcement (NR) and punishment (P). Further, riders' perceptions of the most successful reward in horse training, common training models (natural horsemanship vs. conventional training), and unwanted ridden horse behaviours as a possible consequence of incorrectly applied LT were investigated. The results were compared between different groups (e.g. nationality, education) and previous findings investigating professional coaches' understanding of LT. An anonymous survey, comprising 21 questions, was distributed via social media and horse-related organisations. The participants (n=1028) were voluntary, English-speaking riders over 18 years and non-licensed coaches. Chi-square test was performed to analyse the data and post hoc testing via multiple regression approach was executed using SPSS software. Initial Pearson chi-square values were adjusted according to the Bonferroni-method. 85.41% of all respondents believed that PR is the most successful horse training method ($Chi^2=13.3$, df=4, $p<0.001$). In contrast, 82.49% of all respondents thought that "releasing the aid/pressure" (NR) would be the most effective reward, and those respondents significantly more often selected the incorrect definition of NR ($Chi^2=24.6$, df=4, $p<0.001$). Similar findings were also obtained in other studies involving licensed coaches, where 79.5% and 81.2% rated PR as most helpful in horse training, and, conversely, 82.3% considered "releasing the aid/pressure" as the most effective way to reward. 95.82% of all participants indicated that they know how their horses learn certain behaviours. Yet, significantly less knew how NR impacts horse behaviour ($Chi^2=21.9$, df=4, $p<0.001$) and confused the definition of NR with PR ($Chi^2=15.9$, df=4, $p<0.001$). Only 25.88% provided a correct/partly correct example of NR and significantly ($Chi^2=14.5$, df=2, $p<0.005$) more riders (28.61%) with tertiary education. The majority (88.68%) of those who regarded "releasing the aid/pressure" most effective (82.49%) considered PR the most successful horse training method ($Chi^2=35.9$, df=4, $p<0.001$). Although the majority of respondents believed that PR is the most successful horse training method, only few chose the correct definition of PR ($Chi^2=36.1$, df=4, $p<0.001$). These findings suggest that riders may be lacking in their knowledge and application of LT, which may have welfare implications on their equine partners and jeopardise rider safety. It is strongly suggested to 1) include LT in coaching syllabi; 2) identify channels to reach all involved in training/riding horses to educate them about LT; 3) improve riders'/trainers' knowledge of LT through an international educational campaign.

Lay person message: The principles of learning theory govern the way horses learn. Many riders and trainers, particularly professional coaches, who should possess correct expert knowledge in this field, lack the correct understanding of learning theory in horse training. Educating riders and coaches alike about the correct application of LT could reduce unwanted equine behaviours, improve horse welfare and improve safety.

Keywords: learning theory, horse, training, rider, welfare, safety.

Oral presentation 10

Equitation pedagogic practice: use of a ridden horse ethogram to effect change

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A vast number of horses work in educational institutions worldwide. These horses are ridden by numerous riders who not only vary in equitation ability but also in their understanding of the horse and his/her physical and mental capabilities. Many riders receive instruction and coaching using teaching systems that focus solely on achieving outcomes that are curriculum or competition driven which do not provide the rider with an understanding of the horse. The aim of this study was to determine the effect of providing riders with an understanding of the horse using objective measurements of horse behaviour when ridden. Eighteen students aged 16-20 years studying an equestrian diploma course at Duchy College, U.K. rode an individual horse autonomously for 2 periods of 18 minutes incorporating walk, trot, canter and changes in direction, in a 40x60m indoor school. All horses were accustomed to being ridden by a range of students and were familiar with the test environment. Riding took place in three groups of 6 horse-rider pairs. Twenty one ridden behaviours considered to be indicative of stress by an experienced equitation scientist exhibited by each horse were recorded using scan-sampling with each horse observed for a series of 30 second intervals over a period of 18 minutes. As part of a mixed-methods investigation riders also completed a questionnaire prior to riding to ascertain their perception of the horses place in equitation pedagogy. An intervention talk lasting three minutes was then delivered to the 18 riders immediately after the first 18 minutes of riding (whilst still mounted) in which concepts of horse sentience and the working space between horse and rider were introduced. Riders then continued to ride the same horses in the same environment and group immediately after the intervention talk and the recording of ridden behaviours continued. Immediately after riding rider's views on schooling, horse training and their understanding of the horse were obtained via a post-trial focus group. Horse behaviour data were non parametric (Anderson Darling; all $p<0.05$) and Wilcoxon tests were used to compare pre-and post- intervention talk behaviour. Occurrences of tail swishing, jaw tense, flare nostril and ears back all decreased significantly post intervention talk ($W=340$, 510, 890 and 2160 respectively, all $p<0.001$), as did jaw open and wrinkle nostril ($W=245$ and 192.5, both $p<0.01$) and ears fixed forward, roll eyes and eye wrinkle ($W=856.5$, 127 and 28 respectively, all $p<0.05$). Both ears neutral and ears forward-and-back both increased significantly post intervention talk ($W=1519$ and 531 respectively, $p<0.05$). The focus group data confirmed that riders had an increased awareness of the horse as a sentient being and subsequently more realistic expectations of the horses' capabilities following the intervention talk. The focus group emphasized the need for the horse to be part of the pedagogic experience, not be subjected to it, suggesting that there may be shortcomings in how horse and rider pedagogy is facilitated within equestrian educational centres.

Lay person message: Horses are used for educational purposes all over the world. Comparison of the behaviour of ridden horses before and after riders had been made aware of sentience in horses, showed significant changes in positive ridden horses. There is a need to review equitation education in order to improve ridden horse welfare.

Keywords: horse, sentience, ridden, ethogram, welfare, educational facility.

Oral presentation 11

Feasibility of a grading system for horses used for leisure riding in the UK

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The UK has a vast equine leisure industry, with many sub-industries also focusing on leisure horse use. The demand for suitable leisure horses is great, yet there are no standardised methods of identifying desirable traits of these horses, unlike the competition horse. Previous studies validate a demand for an inexpensive and reliable horse assessment method. The purpose of this study was to explore the demand for, and feasibility of, a leisure horse grading system. A self-administered online questionnaire was completed by leisure horse owners (n=157). Mostly closed and ranking/scaling questions were used to gauge general understanding of performance horse grading within the UK and opinions regarding a leisure horse specific grading. The remaining questions were open ended to allow free expression of opinions. Interviews were conducted with a representative from the British Equestrian Federation, responsible for competition horse grading, and with a member of an equine charity. These were carried out to gain experiential knowledge from the success of the competition grading system and to explore potential benefits or limitations of the system within the general industry. Focus groups (n=9) were used in which participants assessed a simulated leisure horse grading, which allowed participants to identify which aspects work effectively or poorly within a leisure horse grading, identifying feasibility of the concept. Results showed that 60.7% of respondents were entirely positive about the grading concept, with a further 29.0% of respondents unsure but open to the idea. 81.8% of respondents believed the concept would be met with interest within the equine industry. The most influential reason for potentially using a grading was to improve the matching process of horse to rider. Kruskal-Wallis identified significant differences in the perceived importance of different components of the grading ($H=193.52$, $df=6$, $p<0.001$), personality and ridden behaviour rated the highest with medians of 2 and 3 (where 1=most important, 7=least important). Paces were considered least important (median score=6). Interview and focus group responses are currently being analysed using thematic analysis. This research suggests that horse owners would have an interest in leisure horse grading and specifically the inclusion of personality testing, and riding performance and behaviour. This could aid in the matching of horses to riders, potentially reducing equine wastage and improving equine welfare and rider safety.

Lay person message: A proposed grading system for UK leisure horses was met with strong interest from owners. Assessment of horse personality and ridden behaviour were deemed most important, which could help to better match horses and riders. The implementation of this process may reduce welfare concerns by helping lower wastage attributed to poor horse and rider relationships.

Keywords: leisure, horse, personality, grading, behaviour, welfare.

Plenary 3

Biomechanical effects of training surfaces on the locomotor system - Impact on the horse's health

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During stance, the horse's hooves come in contact with the surface, slide and sink more or less into it, then compress it differently according to the limb, to the gait and speed (i.e. activity), and to the surface properties. The different phases of stance are affected by the surface's properties. The amplitude and orientation of the 'ground reaction force' vector, which varies during stance, condition the biomechanical stresses applied to the limb. A study performed in trotters, thanks to the Ifce, has established the link between the hardness of a track and the lesions induced at training on this track.

1. Effects of equestrian surfaces during stance

1.1. Landing

Under training conditions, the hoof generally lands on the lateral quarter or heel. The hoof's horizontal velocity at landing is most often not significantly influenced by the surface's properties. On the contrary, the vertical velocity is always larger on a soft surface than on a hard one. This is due to the relative duration of the swing phase, shorter on soft surfaces (the horse has then less time to bring back his limb at the end of swing), which also implies a reduction in the limb-surface angle (limb more inclined to horizontal) at landing.

1.2. Impact shock

The contact of the rest of the hoof with the surface induces a sudden deceleration known as the "impact shock". The latter can be measured with an accelerometer fixed on the hoof wall; it is expressed in $m.s^{-2}$ ($9.81\ m.s^{-2} = 1$ G). The impact produces vibrations generally proportional in intensity to the deceleration itself. The impact shock is the biomechanical variable the most sensitive to the superficial hardness of the surface. Measured values largely vary according to surfaces and activities: from about $-300\ m.s^{-2}$ at landing after a jump (1.2 m) on a harrowed sand & fibre mix, to $-6000\ m.s^{-2}$ in a trotter (40 km/h) on a hard track. The impact shock is particularly sensitive to the surface's preparation: it is divided by 2 on a harrowed sand & fibre mix (at canter and jump), compared to the same surface after compaction. Besides, the impact shock is significantly increased when the superficial layer's thickness (of a micro-sand with fibres arena) is decreased from 13 to 7 cm; conversely, the shock reduction is not significant when the thickness is increased from 13 to 20 cm. In other terms, beyond 13 cm, the increase in the superficial layer's thickness has no more significant effect on the impact shock. The impact only concerns the distal extremity of the limb (hoof and pastern). Besides the induced vibrations are hardly detectable proximally to the fetlock (bone measurements). Nevertheless, there may be a relationship between the very high decelerations measured in trotters and the high frequency of third phalanx fractures in these horses, as well as between the vibrations induced by the impact shock and the occurrence of some tendinopathies.

1.3. Braking

After landing, the hoof slides more or less 'on the surface', or sink while moving forward in the surface, depending on the surface's properties. The forward motion of the horse's trunk, which involves the proximal part of the limb, induces an increase of the vertical component of the force (Fz) applied to the limb. Above a certain Fz threshold, the hoof's advance is stopped, and the longitudinal component of the force (Fx), which kept increasing until then, starts to decrease. The maximal braking force (Fx max), which generally amounts to 1500 to 3000 N (9.81 N = 1 kg), is lower and is reached later on soft surfaces (reflecting a larger displacement of the hoof in the surface). The longitudinal loading rate (slope of the Fx-time curve) is therefore reduced. For instance, it is divided by 1.6 on a sand & fibre mix after harrowing vs. after compaction.

1.4. Vertical loading of the limb

Once the hoof's longitudinal displacement has stopped, the fetlock goes down and the centre of pressure (point of application of the ground reaction force) moves back, which tends to induce heels' compression. Fetlock motion also induces tension in the superficial digital flexor tendon (SDFT) and suspensory ligament. The proximal interphalangeal joint extension, in relation with the SDFT tension, starts during this phase. The distal interphalangeal joint extension starts several milliseconds later. All these events are more sudden on a firm surface. On compliant surfaces, sinking of the heels in the surface due to fetlock drop not only reduces heels compression but also the SDFT tension, and the interphalangeal extension is delayed. At the time the vertical component of the force reaches its maximum (Fz max; about 1.5 time body weight under training conditions), the reaction force is still oriented backward (load-absorbing phase) on the forelimbs, while it is oriented forward (propulsion phase) on the hind limbs. The vertical loading rate (slope of the Fz-time curve), even more sensitive to the surface properties than Fz max, reflects the ability of the surface (including its deeper layers) to vertically deform, or on the contrary, its tendency to compacting. Fz max is reached all the most late (lower slope) that the surface is more compliant. In terms of severe injury risk (e.g. long bones' fractures), the vertical loading rate, and *a fortiori* the Fz max, are key variables.

1.5. Propulsion phase, heel raising then take-off

During this phase, the longitudinal force measured under the hoof becomes negative (propulsive), and reaches an extremum (Fx min) at the time of maximal extension of the elbow and stifle. A high absolute value reflects a surface that provides a good support; it should be recalled that this surface has been compacted by the previous phases of stance. A deep surface induces a lower Fx min, reached later, and an increased relative duration of stance, especially in hind limbs. Heel raising, at about 95% of stance, produces a force peak measurable on firm surfaces that allow no, or very little, forward rotation of the hoof, as well as on very deep surfaces. This peak, which is produced by the deep digital flexor tendon, is much more subtle on soft surfaces, which offer little resistance to the tendon's action.

2. Injury risk in relation with a hard track in trotters

A group of 12 young trotters, trained during 4 months according to the same protocol (same distances and speeds, anticlockwise) but for half of the group, only on a soft track, and for the other half, only on a hard track, were followed up clinically and by imaging at CIRALE. The lesions observed were graded according to their severity. 50% of the group trained on the hard track developed bilateral moderate to severe fore SDFT tendinopathy at the end of the training period. Metatarsal condyles (hind fetlocks) of the hard track group were significantly more often and severely affected than those of the soft track group. Generally, moderate to severe lesions were significantly more frequent in the hard track group, and the most severe lesions were observed only on left limbs.

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Lay person message: Track or arena surfaces used for training or competing not only affect hoof's motion at the onset of stance. They can also increase or decrease the stresses to the limb's bones, joints and tendons throughout stance, and modify locomotion. The beginning of stance is highly sensitive to the surface's properties. Support and propulsion are affected by the properties of the compacted surface. In trotters, injury risk in relation with training has revealed significantly higher on a hard track compared with a soft one.

Keywords: force, hoof, impact, lesion, load-absorbing phase, surface.

Oral presentation 12

Relationships between health problems and husbandry, use and management of horses: an analysis based on health insured horses

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The present study was based on a data set of 5158 health-insured horses from Germany and their records, if applicable, for surgeries or sutures incurred over a period of 3 years. Using an online-questionnaire sent to the horse owners, information regarding husbandry conditions, management and use of horses was gathered from a total of 1562 respondents (response rate = 30.3%). Generalized linear mixed models were used to assess the probability of the occurrence of health problems in dependency of husbandry conditions, management and use of the horses. The annual probability for a surgery to be required was highest for the digestive system (9.2%), followed by the locomotor system (7.1%), the skin (6.2%) and the eyes (1.2%). For the remaining organ systems (e.g. cardiovascular system, reproductive system, respiratory system), the probability of a surgery was each lower than 1%, likely reflecting the difficulties and/or lack of necessity of conducting surgeries in these systems. There was no significant difference in the probability for a surgery in general or regarding a particular organ system to be required between group-housed or individually housed horses, horses kept in groups of a particular or mixed gender, or between different frequencies of pasture turnout or riding (all $p>0.1$). However, dressage horses ($F_{1,1254}=9.39$, $p<0.05$) and shod horses ($F_{1,1182}=9.50$, $p<0.05$) were at a higher risk of disorders of the locomotor system compared to horses used for other disciplines (e.g. hacking, show-jumping, Western riding) or compared to barefoot horses, respectively. Horses ridden in Western rather than other riding styles, were at a higher risk of suffering from splint bone fracture ($F_{1,1254}=3.87$, $p<0.05$). Horses kept on facilities managed by persons with a relevant professional qualification (e.g. certified groom, farmer) rather than an unskilled owner/manager were at a lower risk of suffering from a health problem ($F_{1,1002}=4.95$, $p<0.05$). Horses participating in more 30 events such as shows or competitions per year were at a higher risk of requiring surgery of the digestive system, compared to horses travelling to fewer or no such events ($F_{2,1243}=6.84$, $p<0.05$). Perhaps due to locomotor rebound effects in horses deprived of free exercise for longer periods of time, horses receiving paddock-turnout for a couple of hours daily during summer only, were at a higher risk of requiring a suture, compared to horses that received daily turnout all year round ($F_{3,1299}=2.78$, $p<0.05$). Overall, the present study revealed a number of interesting links between husbandry, management and use of horses and their risk of requiring surgery. These links provide starting points for future studies, to investigate causes of these relationships and to ultimately improve health and welfare of horses.

Lay person message: The present study revealed a number of factors related to horses' risk of requiring surgeries or sutures. For example, dressage horses are at a higher risk of health problems related to the locomotor system compared to horses of other disciplines. Future studies need to look into the mechanisms causing these effects, to ultimately enable changes improving horses' health and welfare.

Keywords: health, surgery, horse shoes, turnout, group-housing, riding discipline.

Oral presentation 13

Classical music reduces acute stress of domestic horses

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Domestic horses are regularly subjected to stressful situations due to management practices, such as social isolation, transport and farriery or, in general due to exposure to new/sudden stimuli. These situations may eventually be harmful to the horses' welfare, possibly altering their relationships with humans and increasing the risk of safety hazards for horse and people. In this context, our goal was to develop a simple procedure that may reduce animal stress when subjected to such acute stressors. The procedure consisted in providing classical music to horses. Indeed, music has been proven to possess relaxing effects on various animal species. In horses, it has been shown that the diffusion of classical music regulates heart rate and reduce violent behavioural reactions when played in the horse's environment during long-term stressful situations. We tested the effect of classical music (Forest Gump theme) played with an in-ear device on the intensity of stress reaction when horses were exposed to two stressful situations: short-term transport (±21 min) and farriery. The study was carried out at a French National Stud (Haras du Pin, France) on 48 saddle horses divided into 2 groups: Transport (N=24) and Farriery (N=24). Each horse was subjected to a stress episode (Transport or Farriery) in three different conditions: "music" (classical music played via an in-ear device), "sound attenuation" (with earplugs) and "control". During transport, the diffusion of classical music decreased several stress indicators (*e.g.* ears backward, Wilcoxon, control: z_1=-2.74; sound attenuation z_2=-3,533, $p<0.05$) and induced a faster post-stress heart rate recovery (t-test: control: t_{20}=3.827, $p<0.05$; sound attenuation: t_{22}=3.01, $p<0.05$; music: t_{21}=-0.559, $p>0.05$). During farriery, the effects on behaviour were not significant but music showed a trend to accelerate the post-stress heart rate recovery (t-test: music: t_{20}=1.921, $p>0.05$). Playing music with the in-ear device did not induce any sign of discomfort or stress during the whole experiment (Wilcoxon, NS). When comparing the two types of stressors, transport was more stressful than farriery (e.g. heart rate, Mann-Whitney: control: U=92, $p<0.05$; sound attenuation: U=158.5, $p<0.05$; music: U=107, $p<0.05$). From a physiological and behavioural point of view, classical music appears to reduce the intensity of stress responses to these common management practices, which can have several applications. Less stressed horses are less likely to exhibit dangerous behaviours, such as fleeing or kicking, which reduces the risk for humans moving around them. Also, repeated acute stress can lead to chronic stress which is detrimental to horse welfare (becoming manifest as health and behavioural consequences). Reducing the impact of acute stress will also prevent the onset of chronic stress and contribute to this fundamental component of welfare that is the absence of fear and distress.

Lay person message: Domestic horses are regularly subjected to stressors (e.g. transport or farriery). We tested the effect of classical music during such stress episodes. We found that playing music reduced stress during transport, which could lead to safer management practices and better welfare.

Keywords: equine, music, stress, transport, farriery, welfare.

Oral presentation 14

The effect of breast support on vertical breast displacement and breast pain in female riders across equine simulator gaits

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The female breast has limited intrinsic support and repeated loading on the delicate supporting structures due to excessive breast motion can result in breast pain. Recently it has been reported that female horse riders describe exercise-induced breast pain whilst horse riding, constituting an important barrier to participation. This may result in a negative impact on rider-horse interactions through the application of inadvertent pain-induced cues. Despite previous research in non-equestrian sports advocating the use of a sports bra to reduce breast motion and pain in athletes, research suggests sports bra use in this population is low. There has been no research detailing breast biomechanics in female horse riders where, unlike other sports, body movements are dictated in response to large excursions of the horse in various gaits, which may cause breast motion unique to female riders. To improve understanding of breast motion and pain during horse riding, twelve female horse riders fitted as a UK bra size 32DD or 34DD performed a 1 minute walk, medium trot (sitting) and canter on a dressage simulator (Racewood, UK) in three breast support conditions: (a) no bra, (b) daily bra and (c) sports bra. After calibration, each participant was filmed with a 50 Hz camera (Panasonic SDR-H85, Japan) placed directly in front of the simulator at rider height; markers placed on the sternal notch and left and right nipple (or on the bra over the nipple) enabled relative vertical breast displacement data (mm) to be calculated in Quintic software. Participants rated breast pain after each support condition and pace on a 10 cm Visual Analogue Scale. All data were checked for normality using Anderson-Darling tests and displacement data analysed using a repeated measures analysis of variance ($p<0.05$). Vertical breast displacement was significantly different across paces ($F_{2, 11}=16.62$, $p<0.001$) and support conditions ($F_{2, 11}=12.70$, $p<0.001$). Mean (± SD) unsupported vertical breast displacement was highest during medium trot (45 ± 12); *post-hoc* analysis ($p<0.05$) revealed vertical breast displacement was significantly reduced in a sports bra compared to the daily bra ($T=-3.71$, $p<0.01$) at this pace. Wilcoxon signed-ranks tests found breast pain to be significantly reduced in a sports bra compared to the daily bra during the canter ($Z=-2.950$, df=11, $p<0.01$) and trot ($Z=-2.814$, df=11, $p<0.01$). Results from this study may be used to develop bras specific to equestrian sports and to educate female riders on appropriate breast support. Breast pain caused by wearing inappropriate breast support may prove to be detrimental to horse-rider interaction, causing inadvertent cues to be applied to the horse and warrants further investigation.

Lay person message: Excessive breast motion impacts female athletes by increasing exercise-induced breast pain. Breast pain may not only be a barrier to rider participation, but also impact horse-rider interactions resulting in conflicting cues to the horse. This is the first study to quantify breast motion and breast pain in female riders, both being significantly reduced when appropriate breast support is used.

Keywords: horse, rider, breast, biomechanics, pain, motion.

Oral presentation 15

Contribution of sensory information in horse-rider coupling according to the skill of the rider

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In horse riding, balance is a paramount constraint for the rider and is based on the interaction of sensorimotor systems. The contribution of sensory systems in the control of intersegmental coordination evolves with athletic expertise, and it is known that skilled horse riders relying more heavily on proprioceptive information. The aim of this study is to identify the contribution of sensory information on horse and rider interaction according to the level of expertise. In this study, 14 skilled riders and 12 novices rode an equestrian simulator under different conditions of sensory disturbance: obscured vision, without audition and disrupted proprioception. Optoelectronic cameras were used to record rider's and simulator's displacements. Relative phase (RP) between ten human segments and simulator motion around the vertical axis of displacement were analyzed. Three ANOVAs were conducted on head-trunk, upper arm and lower limb segments with five factors: Expertise × Segment × Audition × Proprioception × Vision. The results showed a significant Vision × Expertise interaction on upper arm ($F_{1,24}$=8.82, $p<0.01$) and Proprioception × Expertise on lower limb ($F_{1,24}$=5.36, $p<0.05$). Furthermore, analysis of head-trunk segment showed a main effect of Segment ($F_{1,72}$=63.66, $p<0.001$) but not in Expertise and all sensory conditions. These findings suggest that obscured vision condition improved the synchronization (i.e. reduce the phase lag) between the simulator and the wrist displacements in novice riders. Moreover, the result indicated that the mean RP of novice was higher than in skilled in disrupted proprioceptive condition. The coupling ability observed in these riders was linked to a better proprioceptive anticipation of horse movement. In addition, no significant effect of the without audition condition was found on riders/simulator coupling. Auditory rhythmic cues from simulator did not provide significant benefits on coupling. Regarding the head-trunk coordination, the results showed that the head exhibited a phase lag whereas the trunk anticipated the equestrian simulator motion. Trunk likely plays a key role in damping vertical horse displacements. In conclusion, skilled riders did not change their mode of coordination and always remain more synchronized with the simulator even in degraded sensory conditions unlike novices. The skilled riders would detect the sources of uncertainty more quickly. They adapt their postural coordination because they detect reliable sensory inputs (proprioceptive information) than novices.

Lay person message: The results of this study suggest that it is interesting to develop and train proprioception in order to improve the performance and the interaction with the horse by using equestrian simulator for example. This factor should be taken into account when considering horse welfare.

Keywords: horse-rider, interaction, expertise, sensory information, welfare.

Oral presentation 16

Influence of the riders position on the movement symmetry of sound horses in straight line trot

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The knowledge of how different riding positions influence the movement symmetry of sound horses in over-ground locomotion, is important for both when training of horses and evaluating horses ridden during lameness exams. In an earlier study of horses trotting on a treadmill it was shown that the movement of the rider in rising trot induces an uneven biphasic load on the horse. This load causes an asymmetry of comparable magnitude to mild hind limb lameness. The aim of this study was to investigate the influence of the riders' position on the movement symmetry of horses when trotting in a straight line trot. Thirteen warmblood riding horses were included in the study, all considered healthy by their owner and in full training within their discipline (dressage or show jumping at novice to intermediate level). The horses were trotted in-hand and ridden back and forth in a straight line of approximately 60m in length, in an indoor arena, by one experienced rider performing four different positions in a randomized order; sitting trot with short reins, ridden with a light seat and long reins, rising trot with short reins on left (sitting on the left fore- right hindlimb diagonal) and right diagonals respectively. Vertical movement of the horses head and pelvis were measured for all five conditions using uniaxial accelerometers. The mean difference between the two diagonals for the two displacement minima and maxima of the head (HDmin, HDmax) and pelvis (PDmin, PDmax) were calculated for each horse and exercise condition (21-34 strides). Differences of mean values for HDmin, HDmax, PDmin, and PDmax for the unridden, light seat and rising trot on left and right diagonal were compared with the sitting trot condition using the paired Wilcoxon signed rank test. Increased asymmetry was found for the rising trot on both the left and the right diagonal compared to the sitting trot condition for PDmin (mean±SD mm) (rising trot left: $p<0.001$, $z=2.9$; -3.7±2.9, rising trot right: $p<0.05$, $z=-2.903$; 1.3±3.7, sitting -0.6±3.1) and PDmax (rising trot left: $p<0.01$, $z=-2.97$; 3.1±4.4, rising trot right: $p>0.05$, $z=2.589$;-4.0±3.9, sitting: -0.5±3.7). For the head, HDmax for rising trot on the right diagonal ($p<0.01$, $z=2.589$;-5.8 +6.5) and light seat: ($p<0.05$, $z=-1.992$; 3.5±6.2) was significantly different from the sitting trot (-0.6±5.6). No significant differences were found when comparing sitting trot to the unridden condition. The conclusion of this study is that the uneven load induced by the rider in rising trot significantly increases the movement asymmetry of the hind limbs compared to sitting trot. The degree of asymmetry is comparable to mild lameness. The practice of alternating sitting diagonal in rising trot is supported by this study.

Lay person message: The uneven load of the rider rising up and sitting down in rising trot will increase the asymmetry in the movement of the hind limbs in horses to a degree comparable to mild lameness. The traditional practice of alternating sitting diagonal in rising trot, to put equal strain on both hind limbs, is supported by this study.

Keywords: rider, horse, movement, symmetry, trot, lameness.

Oral presentation 17

The effect that a saddle positioned laterally to the equine vertebrae has on rider biomechanics whilst cantering

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With subtle aids, the rider's pelvis can influence the horse positively. Increased flexion of one hip or pelvic shift are common movement asymmetries seen in riders. As a result, mixed signals between horse and rider are received, creating potential for undesirable behaviour. In training, little consideration is given to the effect that saddle position has on the rider's position and resultant equine behaviour. The aim of this study is to objectively evaluate the effect of a saddle positioned laterally to the vertebrae (LATERAL) on rider biomechanics compared to a correctly centrally positioned saddle (CENTRAL). Seven horses, displaying LATERAL saddle position, were assessed for lameness by a veterinarian. Seven sound horses (1.63-1.80m; 6-12 years) and riders (6 female and 1 male) took part. Saddle fit and LATERAL positioning was subjectively graded independently using a 0–5 scale by 3 Society of Master Saddlers Qualified Saddle Fitters. Markers were positioned on the mid-line of the cantle, between the two tubera sacrale and caudal aspect of the croup. Riders wearing a posture jacket (Visualise^{TM}), with lines positioned horizontally across the upper scapula and down the spine. A high speed camera (240 Hz), positioned caudally capturing straight line locomotion on both left and right rein. Horses were warmed up following a standard 20-minute protocol. Data were collected with LATERAL positioned saddles, then saddles were adjusted/rebalanced made CENTRAL using Prolite shims. Using Quintic Biomechanics, 2D video analysis, left and right hip flexion and angle of a line between left and right foot relative to the horizontal were quantified. Informed client consent was obtained for all animals used in the study. A mean of 3 repeated canter strides with a paired T-test used to determine significance between CENTRAL and LATERAL. All stirrup leathers were assessed for symmetry and were found to be symmetrical. It was found that lateral saddle grade was significantly smaller for CENTRAL (mean 0.78±0.49) versus LATERAL (mean 3.32±0.69), (t_6=0.01, $p<0.05$). Saddle positioned LATERALLY left, more noticeable on the right rein showed a significant increase in rider's right hip flexion right hip flexion (t_9=0.02, $p<0.05$) (Left Hip 153.27°±7.26 Right Hip 141.93°±3.36). When CENTRAL, the right hip was significantly less flexed (t_9=0.01, $p<0.05$) resulting in improved symmetry with no significant difference (t_9=0.16, $p>0.05$) between left and right hip flexion (Left Hip 149.27°±10.68 Right Hip 148.60°±2.24). In addition, the rider's left foot was significantly (t_9=0.02, $p<0.05$) lower than the right foot, (Left Rein 1.67°±1.22 Right Rein 6.25°±2.21). When CENTRAL the right foot in relation to the left foot showed (t_9=0.007, $p<0.05$) improved symmetry with no significant difference between left and right foot position. This study found significant differences in rider's hip flexion and foot position with saddle which was LATERALLY positioned left.

Lay person message: The influence of saddle position must be considered in order to improve rider balance and performance and optimise horse welfare. The findings of this study suggest that terms such as 'collapsing of the right hip' or the need to adjust one stirrup to 'feel straight 'may be as a result of saddle positioning as opposed to rider mechanics.

Keywords: saddle, rider, kinematics, position, symmetry, performance.

Oral presentation 18

A comparison of rein tension with methods to determine equine laterality

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The study compared agreement between results of different methods to determine equine laterality and rein tension in 12 warmbloods (age 7 – 23 years) with 10 right-handed riders. The direction of equine laterality was classified according to the horse's preferred advanced foreleg (a) during grazing (scan sampling at 30 or 60 second intervals for 2 hours) and (b) eating from a bucket, (c) visual laterality during confrontation with 3 novel objects, (d) lateral displacement of their hindquarters in relation to the median plane, (e) degree of lateral displacement (angle of deviation from perpendicular through the withers) and (f) laterality (preferred side for dressage tasks) estimated by the riders. Rein tension data were collected at walk, rising and sitting trot and canter in both directions on straight lines and circles. Based on mixed-model analysis (F test throughout), no relation between the results of test methods a, b, c, e and rein tension was found (all $F<1.0$; $p>0.1$). The mean rein tension of the dominant right hand was higher overall (14.2±1.5 N R vs 13±1.5 N L, $F_{1,351}=5.93$, $p<0.05$), even though the riders applied more tension to the outside rein in both directions. Mean rein tension applied to the left-lateral horses (LL) was higher than in right-lateral horses (RL) (mean of both reins: 17.6±2.5 N LL vs 9.5±1.5 N RL, $F_{1,10.2}=7.69$; $p<0.01$). The difference between tension in the left and right rein was higher in the direction of the non-dominant hand, but was more stable in direction of the dominant hand in LL horses (LL: 4.9 N vs 3.6±0.9 N, df=2, $p< 0.01$). A low mean difference in rein tension of left and right reins correlated with a low mean tension and standard deviation ($r=0.6$ and $r=0.65$, $p<0.05$). Equine and human laterality had an impact on rein tension. Horse-rider-combinations with the same direction of laterality seemed to be better coordinated and kept rein contact more stable. Laterality test results obtained on the ground do not appear to predict laterality during riding. Only the rider's assessment of their horse's laterality agreed significantly with the laterality detected in rein tension. Matching horses and riders according to their laterality might be beneficial for the stability of rein tension and improve training and welfare.

Lay person message: Equine and human laterality as well as the rider's skill level had an impact on rein tension. Rein tension in horse-rider-combinations with the same direction of laterality was more stable, which might be beneficial for the stability of rein tension and therefore improve training. Riders are able to determine horse's direction of laterality, but laterality test results obtained on the ground do not match the horse's laterality during riding.

Keywords: rein, tension, equine, laterality, human, handedness.

Plenary 4

Favouring positive working conditions to improve horses' welfare and human safety.

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From early on in the domestication history of horses, their relationship to humans has been largely centred on a working relationship through harnessing and riding. Archaeological studies trying to evaluate when horse riding first occurred are largely based on examination of the animal's teeth and spine, both showing traces of bit actions and rider's weight on the back respectively. Thus, work does affect the horse's body but the question remains of whether this is so that horses' welfare may be altered both during the working sessions and/or in a more chronic way with consequences outside work. Here we will review the existing evidence of the potential effect of work on the overall welfare state of horses and try and identify the behavioural indicators of discomfort at work as well as the indicators of work related problems outside the working situation. We will end with positive practices that may favour the horse's good perception of working time and thus enhance human security.

Work as a source of physical problems:
Working conditions may be source of physical impairments. In particular, the use of unfitting equipment is recognized as a primary source of body lesion, going from simple hair removal to real wounds under particularly extreme conditions. However, in addition of such highly visible physical marks, deeper lesions may not be that easy to identify. Anatomical as well as physical examinations, imagery or electrophysiological studies all converge to reveal a high prevalence of back disorders in riding horses, which could explain for some part some of these welfare problems. Thus, musculoskeletal disorders at the back level have been identified in the past as one of the main reasons for culling horses, with working conditions identified as amongst the primary causes of such disorders. Veterinary studies were the first to explore the impact of working conditions on horses' skeleton and biomechanics, highlighting that the prevalence, type and localization of spine disorders differed according to the type of work performed by the horse. However, even if recognized as a major source of welfare impairment for working horses, these disorders remain strongly under-identified by owners and caretakers and horses often keep being used despite the discomfort or pain.

Work as a source of behavioural problems
In addition to physical stress, there is a growing evidence that psychological and emotional stress may be associated with work in this species, in particular in the case of improper riding techniques or due to some disciplines' specificities. Show horses, and especially dressage horses, were shown to exhibit higher emotional levels during experimental tests than unbroken or leisure horses. More recently, it was shown that the type and prevalence of abnormal behaviours performed in the box differed according to the type of work.

Work as a source of postural problems
Working conditions may also have strong consequences on the horses' posture outside working time. Recent studies comparing riding school and leisure horses revealed that constraining working practices led to a global "flatness" of the horses. When diving deeper into this postural study, the difference was particularly important at the level of the horses' neck, with riding school horses presenting a hollow neck, whereas leisure horses had a round neck. In some extreme cases, riding school horses were even too stiff to obtain a regular neck flexion.

Potential causes of welfare impairment
One of the first causes of welfare impairment for working equines is the equipment used. Thus, unfitted or un-adapted equipment may lead to body lesions (mouth, girth, withers) or damaging

peaks of pressure at the level of the back. Extreme neck and head positions that are sometimes (more or less voluntarily) imposed to the horses when ridden may be, to a great extent, responsible of welfare impairment. In the first steps of riding learning, the riders' hand actions and seat balance are often uncontrolled. The direct actions on the horses' mouth (through the reins and bit) and back are likely to lead to harm the horse's welfare. However, beginner riders are not the only one to put pressure on their horses' musculoskeletal system: hyperflexion, sometimes used in show horses, also impacts horses biomechanics and lead to discomfort: when ridden with an extremely flexed neck, horses tried to avoid the pressure and display more conflict and defence behaviours than when they are ridden in a natural head-neck position. In addition to physical constraints, extremely bended postures lead to an increased emotionality, with more startles and unwanted behaviours. Riding techniques do affect horse's head and neck position and hence muscular tensions over the whole spine and in particular the thoracolumbar area. If riding techniques are inappropriate, they may therefore repeatedly affect the thoracolumbar system and lead to potential chronic back disorders. When taken into account, working conditions appear amongst the three main reasons of welfare impairment.

Indicators
As most horses are used in working contexts, it seem urgent to clearly identify reliable indicators of good or less good practices in terms of horses' welfare. During working session, flight, fight and defence behaviours (e.g. opening the mouth, shaking the head, tail swishing, crabbing, abnormal oral behaviours…) indicate some sort of discomfort. In addition, working conditions may also have a strong impact on horses' welfare at rest. Studies converge to show that increased emotionality, behavioural disorders and aggressiveness outside work may result from the type of work the horses are used for or the way it is performed. The neck shape as well the level of attention towards the environment outside working time, turn out to be useful to identify the presence and prevalence of back disorders.

Towards positive practices
Horses are in contact with humans from earliest age and from this proximity, they will develop a perception of humans, associated to positive or negative emotions. From the beginning of breaking, it is possible to facilitate the setup of a positive perception of humans, and, by association, of the work related context. Thus, promoting the use of positive reinforcement since the first step of a young horse education to the later learning tasks, not only improves the learning process, but also the human-horse relation. When being mounted, it is also crucial to take into account the horse's signals of welfare impairment: recent studies showed that, when allowed to, horses clearly avoid the tension applied in their mouth through the bit or extreme postures (e.g. rollkür). Making the right choices, in terms of life conditions, working conditions, behavioural knowledge and choice of horses is the first step of horses' welfare and human security improvement.

Lay person message: Working conditions are more and more pointed out as a main source of welfare impairment in horses, leading to an increased risk of aggressiveness and dangerous behaviours. Promoting positive educational techniques and, most importantly, being attentive to the horse's behaviours and postures as only reliable signals of its welfare state will lead to a positive perception of both human and work and thus increase both horse's welfare and human's safety at work.

Keywords: horse welfare, back disorders, working conditions, behaviour, posture, management.

Oral presentation 19

Exploring the relationship between heart rate variability and behaviour – Social isolation in horses

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As part of our research into the relationship between HRV measures and behaviour we examined social isolation (SI) as a potential stressor in 8 Arabian horses (4 mares, 4 geldings, mean age=2.75±1.04 years). We hypothesized that horses displaying the strongest indication of behavioural distress would show HRV indicators of distress also. All horses were fitted with a Polar heart rate monitor; 5 min of baseline HR, HRV and behavioural data were collected while horses were at rest in a box stall near other horses. Individually, horses were led to a round pen housed inside an indoor arena. No other horses were in either area. The subject was released into the round pen and the human observers moved to the far side of the arena to minimize impact. Five min of social isolation data were collected for HR, HRV and behaviour, which was videotaped for later review. Post testing, an ethogram was developed. Behaviours deemed to indicate a level of distress (DB), such as vocalizing, defecating, pawing, bucking and snorting were counted as frequencies; behavioural states such as trotting or cantering were recorded as duration. Combined DB for the 5 min of social isolation varied from 1 – 16. Heart rata data were analysed with Kubios HRV software, version 2.2. HRV values were highly correlated (Pearson test) to combined behavioural scores (Mean HR, r=0.99; SDRR, r=-0.99; RMSSD, r=-0.99; LF, r=0.98; HF, r=-0.98; LF/HF ratio, r=0.95) (all p<0.001). ANOVA was used to compare between groups, all analyses were performed using SPSS17.1. Though not all horses appeared equally distressed by the SI, the group average of baseline HR and HRV as compared to social isolation values still differed significantly. The basal mean HR = 42.71 ± 6.89 bpm, whereas the SI average = 120.11±15.88 bpm ($F_{1,14}$=45.02, p<0.05). LF/HF ratio (representing sympatho-vagal balance) was 1.49±0.15 for the basal average and 11.25±3.58 for the SI average ($F_{1,14}$=55.02, p<0.05). It was noticeable that the 2 horses who exhibited the most trotting/cantering during SI (225, 153 sec), recorded the highest LF (135.25, 122.85) and LF/HF ratio (22.52, 16.89). In an ad hoc experiment, those horses were subjected to trot/canter exercise on a longe for the same duration as in SI to assess the influence of physical exercise without SI impact. The results showed considerably lower LF/HF ratios during longeing as compared to social isolation (Horse 1=3.56 vs 22.52; Horse 2=4.25 vs 16.89).

Lay person message: Heart rate variability measures were strongly correlated with behavioural indicators of distress in this study. Horses who seemed the most upset about the social isolation also showed the strongest HRV measures of distress. As yet, it remains challenging to interpret some HRV data when significant physical exertion has taken place.

Keywords: social isolation, horse, HRV, behaviour, stress, exercise.

Oral presentation 20

An investigation into noseband tightness levels on competition horses

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Nosebands are used by riders to prevent the horse from opening its mouth, increase control and, in some cases, to comply with the rules of competition. Compared with standard cavesson nosebands, the crank noseband provides a mechanical advantage of 2, i.e. it doubles the tension for a given force used to tighten it. Possible negative consequences such as discomfort, pain or tissue damage are of concern to equine scientists and the public. The current study sought to identify the level of noseband tightness applied to competition horses. Using the ISES taper gauge, noseband tightness data were collected from 750 horses competing in national and international competitions in eventing (n=354), dressage (n=334) and performance hunter (n=62) competitions in Ireland, England and Belgium. Data were collected immediately before or after the performance. Using the taper gauge as a guide, results were classified according to the number of 'fingers' that could fit under the noseband at the nasal planum, and assigned to five groups: 2 fingers; 1.5 fingers; 1 finger; 0.5 fingers or zero fingers. Kolmogorov-Smirnov tests revealed the data were not normally distributed, so Kruskall-Wallis and Mann-Whitney tests were applied to compare noseband tightness levels between disciplines and horse age. Seven per cent of nosebands were fitted to the recommended 2-finger noseband tightness level while the remainder had nosebands fastened tighter, with 44% fastening it too tight for even the tip of the taper gauge to be inserted beneath the noseband (zero fingers). Twenty-three per cent of nosebands were at 1 finger tightness and 19% at 1.5 fingers. Significant differences emerged between disciplines (H_2=31.62, p<0.001), with the highest levels of noseband tightness being among eventers (Median=0.00, p<0.01/Mean=0.56, SE=0.35), followed by dressage competitors (Median=1.00, p<0.001 / Mean=0.75, SE=0.04) with performance hunter classes (Median=1.00, p<0.05/ Mean=1.04, SE=0.10) being lowest. Horse ages ranged from 4 to 19 years. Noseband tightness did not differ significantly with age (U=9.35, p>0.05). Comparison of noseband tightness levels between four year old horses (n=80) and five year old horses (n=59) found slightly higher levels of noseband tightness in the five year old horses, but the difference was not significant (U=2064, p>0.05). The prevalence of such tight nosebands aligns with the ISES position statement calling for the resumption of noseband checking and should trigger further research into the behavioural and physiological implications of tight noseband usage for horses. The current lack of guidelines and regulations regarding permitted noseband tightness levels permit the use of noseband tightness levels that may be detrimental to horse welfare.

Lay person message: Noseband tightness was measured in 750 horses competing in dressage, eventing and performance hunter classes internationally. Forty four per cent of nosebands were extremely tight. Only 7% were fitted to the recommended tightness level of the equivalent of two fingers. Tight nosebands may cause uncomfortable levels of pressure and pain in horses and are difficult to justify on welfare grounds.

Keywords: noseband, tightness, competition, horse, gauge, welfare.

Oral presentation 21

The effect of noseband tightening on horses' behaviour, eye temperature and cardiac responses

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Nosebands are becoming tighter in equestrian sport, especially in elite dressage, possibly because they mask unwelcome behaviours that attract penalties. This is concerning, as recent evidence suggests that very tight nosebands can cause a physiological stress response, and may compromise welfare. The objective of this study was to investigate the relationship that noseband tightness has with oral behaviour and with physiological changes that may indicate distress such as increases in eye temperature (measured with infrared thermography) and heart rate and decreases in heart rate variability (HRV). Horses (n=12) naïve to a double bridle and crank noseband were randomly assigned to four ten-minute treatments: unfastened noseband (UN), conventional area under noseband (CAUN) with two fingers of space available under the noseband, half conventional area under noseband (HCAUN) with one finger of space under the noseband, and no area under the noseband (NAUN). They were not ridden but were observed while standing in a test bay. During the tightest treatment (NAUN), horse heart rate increased (s.e.d.=3.92; df=88, p<0.01), HRV decreased (s.e.d.=70.90; df=88, p<0.001) and eye temperature increased (s.e.d.=70.90; df=88, p<0.05) compared with baseline readings, indicating a physiological stress response. The behaviour data were all counts and were analysed using a generalised linear mixed model with a Poisson distribution, a logarithm link function and a split-plot ANOVA. The behavioural results suggest some effects from bits alone but the chief findings are the physiological readings that reflect responses to the nosebands at their tightest. Chewing decreased from baseline during the HCAUN ($F_{2,92}$=11.99, back-transformed means 21.41 versus 7.88, p<0.001) and NAUN (19.47 versus 3.61, p<0.001) treatments. Yawning rates were negligible in all treatments. Similarly, licking was eliminated by the NAUN treatment. Following the removal of the noseband and double bridle during the recovery session, yawning ($F_{2,93}$=83.04, back-transformed means 3.25 versus 1.08, p<0.05), swallowing ($F_{2,121}$=21.83, back transformed means 3.46 versus 1.42, p<0.01) and licking ($F_{2,96}$=111.81, back transformed means 17.25 versus 1.58, p<0.001) significantly increased compared with baseline, indicating a post-inhibitory rebound response. This suggests a rise in motivation to perform these behaviours and implies that their inhibition may place horses in a state of deprivation. It is evident that a very tight noseband can cause physiological stress responses and inhibit the expression of oral behaviours. The use of restrictive nosebands for a perceived advantage in sport may be difficult to defend on ethical grounds.

Lay person message: Horses naïve to nosebands and double bridles show significant shifts in heart rate, heart rate variability and eye temperature when nosebands are tight enough to compromise comfort behaviours such as chewing, licking, yawning and swallowing. On ethical grounds, using sustained pressure to eliminate behaviours because they may attract penalties in some competitions seems difficult to justify.

Keywords: horse, nosebands, post-inhibitory rebound, behaviour, welfare, thermography.

Oral presentation 22

Crib-biting behaviour of horses: stress and learning

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Crib-biting is a stereotypy in horses that is potentially linked to both chronic stress and genetic predisposition. Chronic stress can cause neurobiological changes such as alteration of the dopaminergic modulation of the basal ganglia, which could alter the learning profile of the horses. We tested 19 crib-biters and 18 non-crib-biting horses (controls) in five challenging spatial tests, in order to test if potential differences in dopaminergic modulation impair learning capacities. The tests were performed in two parts, separated by a break, in a small arena (8 x 10m) that was familiar to the horses. For each trial (phase 1: 21 trials; phase 2: 12 trials), the horses were led to the start zone in front of a solid fence (4m) and were then left alone in the arena. Their task was then to find a bucket containing food, which was situated at different locations around the fence, depending on the tests. The time to reach the food bucket (Time) and the trajectory taken by the horse (left or right side of the fence) were recorded continuously. Additionally, salivary cortisol was collected before the tests (baseline), after phase 1 and after phase 2. Crib-biters and controls behaved similarly during the learning tests. However, crib-biters that did crib-bite on the solid fence during the task (group A; 10 horses) behaved differently than crib-biters that did not crib-bite (group B; 9 horses) and controls (group C; 18 horses) for some of the tests (e.g. Time, Linear mixed model (LMM): Test 1, $F_{2,245}$=8.21, p<0.001; Test 3, $F_{2,140}$=9.07, p<0.001). These differences are likely explained by the time taken to crib-bite, more than by differences in impairment of the dopaminergic system. Indeed, the frequency of crib-biting affected Time for the tests where a group difference was found (e.g. LMM: Test 1, $F_{1,245}$=12.84, p<0.001; Test 3, $F_{1,140}$=13.54, p<0.001). We also found a difference in salivary cortisol after the phase 1, between groups A, B and C; the crib-biters that did not crib-bite had higher salivary cortisol values than all the other horses (mean±SD: A, 0.51±0.16ng/ml, B, 0.78±0.17ng/ml, C, 0.59±0.20ng/ml; LMM, $F_{2,17}$= 5.08, p<0.05). Our results suggest that crib-biting horses that did not crib-bite during the learning tests were more stressed than all other horses. This difference could be due to higher stress sensitivity in crib-biters, which could be reduced by the opportunity to crib-bite. Therefore, we suggest that letting the crib-biters crib-bite will improve their welfare.

Lay person message: Crib-biters and control horses generally behaved similarly during the learning tests, with the exception of some of the crib-biters that did crib-bite during the learning tests. Additionally, crib-biters that did not crib-bite during the learning tests were more stressed than all other horses. We suggest that the opportunity to crib-bite helped the crib-biters to reduce their stress and improved their welfare.

Keywords: stereotypy, equine, cortisol, crib-bite, arousal, welfare.

Oral presentation 23

Monitoring equine (acute) pain: validation of two composite pain scales for general pain expression and facial expression of pain

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The recognition and treatment of equine pain has been studied extensively over recent decades. However, there is still need for improvement in objective identification of acute pain in horses, especially for severe pain. This study assessed the validity and applicability of two Composite-Pain-Score systems: Equine Utrecht University Scale for COMposite Pain ASSessment (EQUUS-COMPASS) and EQUUS-Facial Assessment of Pain (EQUUS-FAP) in horses with acute pain. These EQUUS scales used together with several other scales. All control horses (visits for shoe change and Embryo Transfer, ET, mares) were checked at the hospital and declared free from lameness or other painful conditions. For both the scale construction and scale validation twice a cohort follow-up study of 50 adult horses (n=25 horses with acute colic and n=25 controls) was performed. In addition n=23 patients with acute head pain or pain induced by head surgery and 23 new control individuals (as earlier + MRI/CT patients) were assessed with EQUUS-FAP only. The scores were taken during five minutes (COMPASS) and one-minute (FAP) direct observation and by blinded video clips during extra validation sessions. Patients were assessed on arrival at the clinic; and on their first and second morning. Control horses were also assessed at arrival. Both scores showed high inter-observer reliability in all cases (construction: COMPASS ICC=0.98, FAP ICC=0.93, $p<0.001$). Internal validation by specificity and sensitivity for differentiating between control horses and colic patients (n=50) was good for both EQUUS-COMPASS (sensitivity 95.8%, specificity 84.0%) and EQUUS-FAP (sensitivity 87.5%, specificity 88.0%). Internal specificity and sensitivity differentiating between conservatively treated and surgically treated (or euthanized) colic patients (n=25) was good for EQUUS-COMPASS (sensitivity 80.0%, specificity 85.7%). External validation with new colic patients versus controls was satisfactory: (COMPASS sensitivity 87.1%, specificity 71.4%). Development of pain score over days after treatment for the conservatively treated horses (n=13) decreased significantly both for EQUUS-COMPASS EQUUS-COMPASS ($F_2=9.66$, $p<0.05$) and EQUUS-FAP ($F_2=10.42$, $p<0.05$). The EQUUS-FAP for the head patients versus controls showed that this scale is working in these patients as well (sensitivity 80.1%, specificity 78.3%; development over time: $p<0.001$). For patient/control comparison the most painful moment was used. There was no difference between any group in age, sex or breed.

Lay person message: This study assessed the validity, development over time and applicability of two Composite Pain Score systems for horses. The EQUUS scores improved objectivity of the assessment of severity of pain. Both scales are useful instruments when horses are examined for behavioural problems or equine welfare issues. Veterinary professionals as well as owners/handlers can use both scales.

Keywords: Composite Pain Scale (CPS), Facial Assessment of Pain Scale (FAP), acute, pain, validation, welfare.

Oral presentation 24

Effects of ridden exercise on night-time resting behaviour of individually housed horses

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Resting behaviour is frequently used as a welfare measure in horses; this indicator has been adopted from bovine research where it has been shown to alter with environment and management changes. However, unlike bovines, equine resting behaviour may also be influenced by the amount of ridden exercise the horse has performed through the day. If ridden exercise does have an effect, then the level of exercise should be considered when using resting behaviour as a measure of welfare. Resting behaviour includes rest standing (ST), sternal (SR) and lateral (LR) recumbency, which have been used in various studies to identify how comfortable a horse is with its surroundings. For horses to achieve paradoxical sleep (PS or REM sleep) they must be in the lateral position and if horses do not reach PS then welfare could be compromised. The aim of this study is to investigate whether ridden exercise has an effect on the horse's resting behaviour compared to non-ridden exercise in horses housed individually. Eight geldings, aged 7-16 with heights 152cm-172cm, were used. All horses were housed individually in American Barn style housing and were in full ridden work. CCTV cameras were used to monitor the horse from 6pm-6am for 5 nights each week. During the not-in-work week (NW), horses were turned out to graze from 8am-3pm. During the work week (WO), horses were stabled except when ridden in normal riding school sessions for around two, one-hour periods per day. The duration of ST, SR and LR behaviours were recorded and analysed using DVR365 software. A Friedman Test showed a statistically significant difference between total resting time of horses NW and WO ($Chi^2=10$, df=1, $p<0.01$), with NW showing more total time resting than WO. Post hoc analysis with Wilcoxon signed-rank tests (Bonferroni corrected) showed ST behaviours were significantly more frequent when NW ($Z=-5.05$, $p<0.001$) and SR behaviours were more frequent when WO ($Z=-2.46$, $p<0.05$). There was no significant difference of LR behaviour between NW and WO. The results suggest that horses in work spend less time overall resting but spend more time SR than those not it work which spend more time ST. This suggests horses' alter their resting pattern when in work, therefore this needs to be considered when using rest as a measure of welfare. As this was a pilot study it is possible that these results could reflect an alteration to the horse's 24 hour resting time budget with horses in NW being SR more during day (which was not measured here) compared to night. However, these preliminary results suggest that level of exercise should be taken into account when using rest behaviour as a welfare measure. Further research into how various environmental factors influence horse rest patterns are due to be carried out.

Lay person message: Resting/lying behaviour is used as a parameter to assess equine welfare. The night-time resting/lying patterns of stabled horses in ridden work and not in work were measured. Horses in work spend less time resting overall but spent more time lying in sternal positions than horses not in work. Therefore, work level should be considered when using rest/lying behaviour as a measure of welfare.

Keywords: equine, sleep, ridden, exercise, behaviour, welfare.

Oral presentation 25

The 'social box' offers stallions the possibility to have increased social interactions

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In order to give individually housed stallions the opportunity to have more social interactions, the Swiss national stud farm investigated a separation wall called the 'social box'. Sixteen adult Franches-Montagnes breeding stallions were housed for 3 weeks in conventional boxes (CB) and for 3 weeks in social boxes (SB). The separation wall of the SB consisted of one part with vertical metal bars (2.55 m high) spaced at 30 cm allowing the horses to pass the head, the neck and the legs into one of the adjacent boxes. The separation wall of the CB consisted of a lower solid wooden part (1.40 m high) and an upper part (another 1.15 m high) with vertical metal bars spaced at 5 cm strongly limiting tactile contact. The stallions participating in this study all grew up with conspecifics, as prescribed by law in Switzerland. They were individually housed in a CB since they arrived at the stud as 3 year olds. During the whole experiment, there were no mares present in the nearby area. Boxes were assigned randomly. After 3 weeks of habituation, the social interactions of the horses were video recorded for 24h in both CB and SB and analysed. The valence of every social interaction phase was assessed (positive; negative; indeterminate). Injuries were recorded weekly. Statistical analyses were conducted in R using linear mixed-effects. A Bonferroni correction was applied for the post hoc tests. The stallions had longer social interactions in the SB than in the CB ($F_{1,22}$=78.63, p<0.0001). The mean total duration of the social interactions per day was 51 min in SB vs. 5 min in CB. The mean total duration of positive social interactions was higher in SB than in CB ($F_{1,7}$=62.39, p<0.0001) with 37 min in the SB vs. 4 min in the CB. The mean duration of negative social interaction was higher in SB than in CB ($F_{1,7}$=59.94, p<0.0001) with 6 min in the SB vs. 1 min in the CB. The proportion of positive and negative social interactions was similar in both CB and SB (positive interactions: 13% in SB vs. 14% in CB; negative interactions: 71% in SB vs. 72% in CB). No grievous injuries were recorded. Skin damage was mainly situated above the eyes. Damage was not directly caused by the neighbouring horse, but rather when the horses bumped their head against the metal bars during social interactions. The stallions were able to have increased physical contact without expressing potentially dangerous aggressive behaviours. Nonetheless, a solution must be found to pad the metal bars of the SB with a suitable material to limit the skin damage. It can be concluded that the implementation of SB will improve housing conditions of individually housed horses.

Lay person message: Stallions are usually housed individually. The 'social box' offers them the opportunity to experience increased physical contact with another horse. In the social boxes, the stallions spent about 50 min a day interacting with their neighbour without expressing dangerous aggressive behaviours. No grievous injuries were recorded.

Keywords: Equine, behaviour, housing, social interaction, stallions, welfare.

Abstracts of poster presentations

Poster n°1

Association of foals' behaviours at weaning with pre-weaning social interactions

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In equine production, foals are commonly weaned at 5 or 6 months of age, although it does not take place until 8 months or older in nature. While many studies concur that weaning is stressful behaviourally and/or physiologically, the ideal way to wean a foal is not clearly indicated. To improve welfare, this study determined if behaviours during weaning can be predicted by pre-weaning mare-foal interactions, and if, on the other hand, the independence of foals, characterized by nursing times and distances between mares and their foals, could be linked with the degree of stress during the weaning. This study involved 17 mare-foal pairs (10 standardbred and 7 stud). Foals were divided in two groups treated in the same way with fillies and colts combined. Different types of interactions before weaning were recorded by over 12 days: aggression (head threat, bite, chase, kick…), affiliation (mutual grooming, play, friendly contact), submission (head turn, avoid, retreat…), time of nursing and also the distances between mares and foals. Stress related behaviours (neighing, passage, tail raised, defecation…) exhibited by foals at the time of weaning were also included in the ethogram containing 38 behaviours, and recorded. To determine the degree of stress for each foal, behaviours during weaning were categorized and allocated a score from 1 (mild stress) to 5 (severe stress). Results represent 69 hours of video analysis and 15520 recorded behaviours. On average 3 interactions/minute were observed during pre-weaning compared to 150 interactions/minute at the time of weaning. Using generalized linear models (GLM), results show that submission before weaning is correlated with the submission during weaning (df=15, $p<0.05$) and affiliation before weaning is correlated with aggression at the time of weaning (df=15, $p<0.01$) toward any individual. Nursing time was positively correlated with the aggression of the young during weaning (df=15, $p<0.01$). In addition, the weaning stress rates were correlated with the affiliation of the mare toward any member before weaning (df=15, $p<0.05$), the nursing time and the average distance mare-foal (df=14, $p<0.05$ for both). Both age and group had an impact on foals' behaviours during weaning. Additionally stress during weaning seems to increase when the foal shows an independence regarding its mother. This is surprising and has not been described to date. Pre-weaning social stress could be due to the lack of maternal protection from mares in independent foals, which could be considered as a chronic stressor, which then causes a greater acute stress related activity than in dependent foals. In summary, this study showed that the behaviour of the foal before weaning could be indicative of his/her reaction at the time of weaning.

Lay person message: The findings of this study could contribute to the identification of equine management systems that allow foals behaviours at weaning to be predicted from pre-weaning behaviour. This could be used to avoid stress related behaviour and associated coping strategies that impact negatively on digestive, metabolic and orthopaedic systems, and therefore welfare. Use of pre-weaning behaviour could allow more careful management of the individual foal at weaning and so avoid damaging long term effects.

Keywords: Equine, weaning, behaviour, stress, ethogram, welfare.

Poster n°2

Effects of foal sex on neonatal adaptation in the horse

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In equestrian sports, many riders and trainers prefer either male or female horses because of the sex-specific characteristics. The preference for riding a horse of a specific sex differs considerably between equestrian disciplines with preferences for male horses in dressage and mares in polo sports. Many sex-related differences do not depend on gonadal activity but are suggested to be established much earlier in life. Readiness for birth depends on timely maturation of the foetus which is necessary to contend with the challenges of extra-uterine life. We hypothesized that horse foals show sex-related differences during neonatal adaptation. Foaling itself, behaviour of the foals after birth, salivary cortisol concentration and heart rate variability (RMSSD, root mean square of successive beat-to-beat differences) were investigated in healthy Warmblood foals (male n=29, female n=35) born at the Brandenburg State Stud at Neustadt (Dosse), Germany. Duration of stage II of labour and times from delivery to first attempt of the foal to rise, first standing and first suckling were analysed by Kaplan-Meier analysis with foal sex as factor. Changes in cortisol concentration, heart rate and RMSSD were analysed by GLM-ANOVA for repeated measures with foal sex as between subject and time as within subject factor (statistics program SPSS 22). Data given are mean ± SEM. Duration of stage II of parturition (rupture of the allantoic membrane to birth of the foal) was not affected by sex of the foal (male 13.6±1.3, female 13.4±1.5 min). In female foals, the interval from birth to the first attempt to stand (14.2±1.2 min) and first standing (42.7±2.7 min) was shorter than in male foals (first attempt to stand 18.9±1.8 min, Chi^2=4.0, df=1, p<0.01 first standing 51.2±3.3 min, Chi^2=4.0, df=1, p<0.05). Male and female foals did not differ significantly with regard to the time of first suckling after birth (male 119.1±8.1, female 106.7±7.8 min). Concentration of cortisol in saliva increased for one hour after birth of the foal and decreased thereafter (F_8=27.0, p<0.001) but did not differ significantly between groups. Heart rate increased in male and female foals within 30 min after birth and decreased continuously thereafter (F_9=22.2, p<0.001) while the heart rate variability parameter RMSSD decreased until one hour after birth and increased thereafter (F_9=6.1, p<0.001). Neither heart rate nor RMSSD differed significantly between male and female foals. All foals had IgG concentrations of >800 g/dl at 24h after birth. In conclusion, behavioural traits of horse foals during neonatal adaptation are affected by sex. Despite a longer gestation length of males, adaptation to the extra-uterine environment is slightly but significantly delayed in this sex.

Lay person message: The behaviour of horses, their riding ability and suitability for specific tasks are influenced by their sex, but it is not yet known when these differences begin to develop. We have investigated if male and female foals already show differences with regard to neonatal adaptation to the extra-uterine environment during their first hours of life. Even though the gestation length in male foals is longer, female foals are faster in their adaptation to the new challenges following birth.

Keywords: equine, foal, birth, sex, neonatal adaptation.

Poster n°3

What makes a good leader? How domestic horses perceive, assess and trust group members

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Domestic horses living in social groups have to make collective decisions in order to maintain group cohesiveness. Such a goal requires that group members move together, while maintaining a number of activities. Understanding how horses perceive each other, communicate and behave to succeed in making such collective decisions may really help to determine more general cognitive abilities. In a social context 'leadership' means that a particular horse takes the decision to move and is successfully followed by its group mates. In horses, it has been proved that several individuals can be at the origin of the collective movement, discrediting the 'unique leader' myth. However, some horses appear to have a greater social influence, *i.e.* are more successfully followed by others. To understand what makes an initiator highly reliable for its group, an experimental approach based on learning/extinction procedures applied to a social context was developed. Three established groups of 6 Dartmoor, Shetland and Haflinger female horses (aged 1 to 23 years) were tested to evaluate their ability to be a leader in provoked movement initiations. An initiation is a clear movement of an initiator moving outside of the group, whereas the rest of the group is motionless. The group's reaction to these provoked initiations was recorded to determine an average success level/initiator (*e.g.* number of followers). During the training phase, induced initiations were provoked with a protocol where only the tested horse was informed of the location of hidden food (5 initiations/horse). During this training phase, the whole group immediately followed the initiator regardless of its identity and had access to the food (no inter-individual variability: always 4 or 5 followers), suggesting that in an optimal controlled context, every initiator was successful. Then, in the next step, the same protocol was repeated, but for two initiators (highest social status *vs.* lowest social status), food reward was removed before they came back followed by the group. The objective of this extinction phase was to render these initiators unreliable for their conspecifics. Interestingly, the group immediately stopped following the initiator with the lowest social status (number of followers: training trials > extinction trials, one sample runs test, df=1, $p<0.05$) whereas they continued to follow the highest-social-status initiator despite the absence of food for both (number of followers: training trials = extinction trials, one sample runs test, df=1, $p>0.05$). These results suggest that some initiators appear to be more trusted than others based on their identity and may reveal the existence of a charismatic leadership. This innovative experimental approach opens up new approaches to the investigation of horses' socio-cognitive abilities particularly within a human-horse context.

Lay person message: Domestic horses living in groups have to make collective decisions in order to maintain social cohesiveness. Some horses appear to have a greater social influence in this context. An experiment to test the ability of each horse to lead a group showed that only the horse with a high social status continues to be trusted despite leading others to an empty location (*i.e.* violate food expectation).

Keywords: leadership, social, decision-making, collective, movement, extinction.

Poster n°4

Factors affecting seller assigned temperament scores of horses on an internet sales site

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Suitability is of major importance to a cooperative relationship between horse and rider. Previous studies have demonstrated that horse temperament is an important factor in building that cooperative relationship, and therefore, increasing horse welfare. The purpose of this study was to determine if there was a relationship between seller assigned temperament scores (SATS) of horses on a horse sales website, and colour, use, breed and sex. The database search was limited to horses between 5 and 15 years of age and riding breeds. Data were collected on horse age, temperament score (1= very calm to 10=very spirited), colour, breed, sex and use, and were analysed for frequencies, means, and differences between means using one way ANOVA and Independent T-tests in SPSS. Seventeen colour variations were reported, so colours were pooled as chestnut (n=196), bay (n=204), black (n=53) and grey (n=50) by base colour. Twenty-four breeds were represented in the sample, therefore, breeds were pooled as stock type (n=288), hunter type (n=63), saddle type (n=78), warmblood type (n=65) and grade (n=9). Thirty-nine uses were reported as the primary use, so uses were pooled into Sport horse (n=118), Western Competition (n=178), English Competition (n=38), Youth (n=50) and Non-competition (n=119). SATS ranged from 1-9, with 2 being the most frequent (n=125) and a mean SATS of 3.4. Analysis with ANOVA showed a difference by Colour (F_8=2.36, p<0.05), Breed (F_8=14.42, p<0.001), and Use (F_8=4.0, p<0.001). Chestnuts had the lowest mean SATS (3.2), while greys had the highest mean SATS (4.2). SATS between colours were compared using an independent T-test. Chestnuts had a lower score than greys (t_{244}=-3.95, p<0.001). Bays (t_{252}=-2.69, p<0.01) and blacks (t_{101}=-2.71, p<0.01) also had a lower temperament score than greys. Sport horses had higher SATS than Western Competition (t_{294}=9.48, p<0.001), English Competition (t_{154}=3.13, p<0.05), Youth horses (t_{166}=5.92, p<0.001), and Non-Competition horses (t_{235}=3.32, p<0.001). Warmblood type horses had higher SATS than Stock type (t_{351}=8.99, p<0.001) and Saddle type (t_{141}=2.23, p<0.05). Stock type had lower SATS than Hunter type (t_{364}=6.34, p<0.001), Saddle type (t_{364}=-6.32, p<0.001) and Grade (t_{295}=-2.94, p<0.01). This preliminary study revealed two important findings: 1) seller assigned temperament scores are concentrated on the 'calmer' portion of the scale, and 2), colour, use and breed may be factors SATS. With the use of SATS in promoting sale horses online, it is important to understand what these data mean, to assist purchasers in making selections that will increase the likelihood of a long and cooperative relationship between horse and rider.

Lay person message: Seller assigned temperament scores for horses are included on most internet sales sites. Potential purchasers use these descriptions for preliminary screening of potential horses. This study shows that the scores of a randomly selected group of horses are not broadly distributed across the temperament scale, and that factors such as colour, breed and use may be related to seller assigned scores. Understanding factors that may affect SATS will assist riders in using that information to help identify a suitable horse, and increase the likelihood of having a cooperative relationship between horse and rider.

Keywords: temperament, suitability, selection, horse-rider, relationship, welfare.

Poster n°5

A preliminary investigation which indicates the use of fore limb data has limitations in accurately determining laterality in horses

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Side preference is suggested to link with cognitive bias and the phenomenon of laterality is proven in a range of species, including the horse. Motor lateralisation refers to directional bias; in equine research this has been measured using the favoured fore limb during the initiation of movement or the advanced fore limb during grazing. However little research has been done to validate the links between forelimb observations and side preference, for example the hind limb in most cases initiates movement. Two preliminary studies were conducted; the first aimed to identify whether a correlation existed between fore and hind limb preference, the second aimed to consider whether kinematic measurements of the stabilising and mobilising limb correlate with the preferred limb which is used to indicate laterality. Statistical analysis in both pilot studies was not possible due to the small sample populations. In the first study, six horses (various breed/sex, mean age 10.3±5.5 years) were released ten consecutive times to navigate towards a feed bucket in an enclosed arena. Frequency data were collected from observations of the hind limb used to initiate movement and fore limb advancement; laterality index scores were calculated using McGreevy and Rogers (2005). The left hind limb was used to initiate movement during 43% of observations. Laterality index for hind limb indicated a right limb preference (13.33). The left forelimb was advanced whilst eating from the bucket for 51% of observations. Laterality index for forelimb indicated a slight left limb preference (-1.69), in opposition to the hind limb result. In the second study, horses were observed whilst eating a forage ration from the floor to establish limb preference using the laterality equation from the first study; these individuals then underwent a conformational assessment to discount participants with conformational asymmetries. Four horses (two mares, two geldings, mean age 18±2.8 years) were selected for kinematic analysis; skin markers were attached to correspond with the centres of rotation for the major joints of the appendicular skeleton and horses were then trotted in-hand past a Casio high speed video camera located 10m away from the plane of motion. Three passes in each direction were made for each individual. Measurements of mobilising and stabilising limb traits were averaged from the three runs on each side, but no clear links were recorded between these traits and the advanced forelimb used to determine laterality. Results from these preliminary studies suggest that hind limb preference is not matched by forelimb preference. Further study is required to determine links with lateralisation, where a better understanding of directional and cognitive bias might inform equine training.

Lay person message: Horses can display side preferences, however research has yet to validate an accurate method of profiling horses to determine left or right sidedness. More accurate data could enable better utilisation of laterality data which could help us better understand issues within equine performance and training.

Keywords: equine, laterality, sidedness, index, fore limb, hind limb.

Poster n°6

Short-term spatial memory or food cues; which do horses use to locate preferred food patches?

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Working (short-term; ST) memory in horses has been typically assessed by the ability to recall a food location using spatial cues. Yet, herbivores exploit preferred foods by means of spatial cues and/or sampling (pre- and post- ingestive feedback), which are influenced by the scale of the foraging hierarchy and variability of the environment. While this has been demonstrated in ruminants, less is known about the food searching strategies of horses, particular at the foraging scale of bite, station and patch where the heterogeneity increases. As part of a larger study, the ST spatial memory of horses was assessed using a patch model. Twelve adult mares were presented with a two-choice test that comprised of 10 min feeding intervals on 3 days where horses were introduced to a forage preference test (1 to 4). The tests were pair comparisons based on the nutritional profile, with one being Familiar (F) and the other forage Novel (N). These forages (2x400g) were presented in a randomised checkerboard design within a 144 m2 testing area divided in 16 zones/buckets. Results on intake, zone count, time spent foraging and latency have been published elsewhere and demonstrated neophobia to N forages. In this study ST spatial memory within the patch design was also assessed by examining movements from F-to-F (FF), N-to-N (NN), N-to-F (NF) and F-to-N (FN). The hypothesis tested was that if horses use ST spatial memory at patch level then greater movement counts to the preferred forage (i.e. FF and NF) would be observed. A Chi-square test showed dependence between the total counts for NN (394), FF (478), FN (1881) and NF (1896) (Chi2=1818, $p<0.001$). Further analyses using GLMM models showed that the mean total counts for FF significantly differed from NN ($p<0.01$) and NF and FN ($p<0.001$), but NF and FN did not significantly differ from each other. Similar patterns were observed for early (first 5 min) and late exposure. While FF counts were greater than NN they did not reach the same value as NF and along with the equal and higher counts for NF and FN it suggests that these horses used patch foraging behaviour and trial-and-error (sampling) and did not appear to use spatial cues to move to the next F forage (FF or NF). This was also confirmed by the zone count; an almost 50% split for visits to N and F zones. Overall, these findings suggest that associations between sensory cues (smell and taste) and foods are important in food searching/choice, which may be distinct from the associations between food (quality) and spatial cues. The flexibility of these memory circuits appears to be dependent on the variability of the environment and could have implications for equine studies investigating working memory in the context of training and highlights the need for further development of appropriate (non) food based tests.

Lay person message: Horses appear to use food cues (smell, taste and nutrients), over short-term spatial cues when locating preferred food patches in a variable environment. Horses may use distinct working memory circuits in food searching and this should be accounted for when studying working memory in the context of horse training using food based tests. Future studies investigating working memory circuits in horses could lead to better training protocols and enhance welfare by accounting for individual variation during task-solving situations.

Keywords: horse, short-term, spatial, memory, patch foraging model, food cues.

Poster n°7

Secondary reinforcement did not slow down extinction in an unrelated learned task in horses

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Secondary reinforcement, also called conditioned reinforcement, is widely used by animal trainers. It consists in associating a stimulus (e.g. a sound, word or a tactile contact) with a primary reinforcement, generally a food reward. After a certain number of Pavlovian associations between the stimulus and the primary reinforcement, it becomes a 'secondary stimulus' and could be theoretically used to reinforce a response by replacing the primary reinforcement (e.g. food reward). Surprisingly, while this technique is increasingly promoted in the horse industry, its efficiency to prolong the response in the absence of primary rewards has not been demonstrated yet. Previous studies have tested its efficiency in extinction, but demonstrable effect was not found. The question is whether a larger number of stimulus/reward associations than tested in these experiments could improve its efficiency. The aim of this study was to determine if an auditory signal, after being associated with a food reward a large number of times (288), could be used as a secondary reinforcement, and consequently could help to maintain an unrelated instrumental response in absence of primary rewards. Fourteen one-year old saddle horses were divided into two groups of 7: the No Reinforcement NR group and the Secondary Reinforcement SR group. All horses in both groups underwent nine sessions of Pavlovian conditioning during which an auditory stimulus (the word "Good") was associated with food that was delivered immediately after (32 associations/session). A total of 288 associations were performed for each horse. Independently, they underwent five sessions of instrumental conditioning (30 trials/session) during which the horse had to touch a cone that was signalled by an experimenter (two cones were present) to receive a reward (pellets). On the last day of the experiment, horses underwent one session of extinction of the instrumental response: the reward was not given, but the word "Good" was said each time a horse from the SR group touched the cone. Nothing was said when a horse form the NR group touched the cone. The number of correct trials fell significantly between the last acquisition session and the session of extinction in both groups (Wilcoxon test, NR: $V=34.87$, $p<0.05$; SR: $V=34.87$, $p<0.05$). Horses from the SR group did not achieve more correct trials in extinction than those from the NR group (mean±se in extinction, NR: 8.57±1.34; SR: 9.28±1.38; Mann-Whitney test $U=60.84$, $p>0.05$). These findings show that the secondary reinforcement did not help to maintain the response.

Lay person message: Despite a high number of associations between the stimulus (a vocal signal) and food reward (288) we failed to demonstrate the efficiency of secondary reinforcement in prolonging the response when the reward was removed. This experiment questions the usefulness of secondary reinforcement and its application in horse training.

Keywords: equine, training, instrumental conditioning, secondary reinforcement, pavlovian.

Poster n°8

A comparison of methods to determine equine laterality in thoroughbreds

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The study aimed to compare agreement between results of different methods to determine equine laterality. 61 thoroughbreds (age 0.003–19 years) were classified according to their preferred advanced foreleg during grazing (scan sampling at 30 (SC30) or 60 (SC60) second intervals for 2 hours), lateral displacement of the parallel hind limbs at stance in relation to the median plane, visual laterality (during a novel object test), direction of facial hair whorls and mane, the preferred canter lead and displacement of the hindquarters during flat racing. Cross-tabulations of two characteristics with 2-6 values were investigated for random distribution using chi-square tests, phi and Cramer's-V in SPSS. In a 30 second scan sampling, stallions (n=24) were mostly lateralized (z-value >+/-1.96; 33.3% left, 25% right), however, the majority of mares (n=37) showed no significant preference (56.8%, Chi²=12.046, df=2, $p<0.05$). With both sampling intervals, the majority of horses showed no leg preference (49.1% SC30 and 42.6% SC60). Most lateralized horses preferred their left foreleg (34% (SC30) and 33.3% (SC60), Chi²=88.839, df=5, $p<0.0001$). Direction and degree of laterality remained constant in most cases between both sampling intervals (Chi²=88.839, df=5, $p<0.0001$). 40.5% of the horses had their hindquarters displaced to the left and 59.5% to the right. However, there was no relationship with other methods. During frontal approach with novel objects (plastic bag, toy, ball), most horses showed no eye preference (53.7-59.3%). In 37-40.7% of the sample a sensory bias to the left was detected. For one object, visual laterality correlated with age (Pearson,r=-0.326, n=61, $p<0.05$). Young horses were more likely to show a biased reaction than older horses. The direction of facial hair whorls was randomly distributed and did not relate to any other method. Most horses in this sample were full- or half- siblings, however, there was no relation between the results of the mares, stallion and their offspring. Laterality seems to be influenced by age and gender, but not parental behaviour in this group of thoroughbreds. The majority of horses in each method were not lateralized. If lateralized behaviour occurred, there seemed to be a left-bias. However, the results of the different methods were hardly related. Attention should be paid to the desired information when selecting methods for assessment of laterality. Considering equine laterality in horse training might improve horse's performance and reduce risk of injury.

Lay person message: Equine laterality is influenced by age and gender. However, it seems not to be related to the parent's laterality. The majority of thoroughbreds were not lateralized. Most methods to determine equine laterality showed limited or no agreement with each other. Considering equine laterality in horse training might improve horse's performance and reduce risk of injury.

Keywords: equine, laterality, methods, thoroughbreds, genetic, age.

Poster n°9

Evaluation of the effectiveness of three non-confrontational handling techniques on the behaviour of horses during a simulated mildly aversive veterinary procedure

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During mildly aversive healthcare procedures, horses often exhibit behaviours (e.g. escape or avoidance movements, pawing, stamping, head tossing, tail swishing) that may interrupt or prolong the procedure. Handler response often includes increased physical restraint and/or positive punishment. These interventions are in many instances ineffective, and often counterproductive. One of the goals of our veterinary school-based applied equine behaviour program is to critically evaluate the effectiveness of less confrontational handling techniques anecdotally purported to effectively distract and/or comfort horses when restrained during mildly aversive healthcare procedures. The purpose of this study was to compare the effectiveness of 3 such handling techniques (scratching the WITHERS, gently rubbing the face and EYES, or FEEDing grain vs. no intervention CONtrol) in a simulated mildly aversive veterinary procedure scenario. In a between-subjects design, 48 horse (29) and pony (19) mares (43) and geldings (5) were randomly assigned to each of the 4 conditions (12 per condition). The scenario included confinement in an examination stocks or cross-ties in a novel clinical environment away from herd mates, along with a 3-minute exposure to a noxious auditory stimulus (electric sheep shears at 3 m from horse, 85db). Sessions were video recorded for subsequent detailed quantitative evaluation of behaviour during the 3-minute auditory challenge. Additionally, heart rate (HR) was telemetrically recorded at 5-second intervals during the 3-minute auditory challenge (Polar ProTrainer 5 Equine). Endpoints compared included avoidance/stress response frequency, average HR and ending HR. Mean (se) avoidance/stress response frequency was 13.7 (3.2) for FEED, 26.9 (2.7) for EYES, 30.4 (5.2) for WITHERS, and 44.2 (5.3) for CON. FEED, EYES and WITHERS each significantly differed from CON (1-way ANOVA, $F_{3,44}=8.72$, $p<0.0001$, Dunnett's, $p<0.05$, Dunnett's 2-sided follow-up multiple comparisons with control, with $p<0.05$). Mean (se) average HR and ending HR, respectively, were 73.7 (4.8) and 68.8 (5.7) for EYES, 75.3 (5.4) and 71.7 (5.9) for FEED, 84.7 (9.2) and 80.3 (10.2) for CON, and 92.5 (8.1) and 80.8 (10.1) for WITHERS. Differences were non significant (1-way ANOVA, $F_{3,44}=1.73$ and 0.51, $p>0.10$). We conclude that each of these 3 non-confrontational handling techniques meant to distract or comfort was effective in reducing problematic avoidance/stress responses in this simulated veterinary care scenario. Our impression of particular individual response to these techniques suggests that for any given horse and specific situation, a best technique may be identified empirically. Further work is planned to evaluate these and other techniques within individual horses for various specific types of procedures.

Lay person message: Horse handlers are often slow to use positive non-confrontational techniques for reducing avoidance and stress responses during aversive procedures. Evidence-based recommendations can now be made for alternatives to punishment or increased restraint during aversive healthcare, grooming, farrier, transport, or other procedures. Their use will likely improve horse and handler welfare and safety.

Keywords: equine, veterinary, low-stress, handling, distraction, non-confrontational.

Poster n°10

The laterality of the gallop gait of Thoroughbred racehorses

(Withdrawn at author's request)

Poster n°11

Attention and performance in sport horses

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In humans and animals, attention is considered to underlie a variety of cognitive processes, such as learning or memory. Attention is usually described as the ability to process selectively one aspect of the environment over others and in relationship with higher performances in human daily tasks (*e.g.* at school). Studies on animal attention are limited because the paradigms used were adapted from human attention studies; they involve extensive training and a laboratory context that is not adaptable to field studies. The present study aims to characterize horses' attention by designing a novel visual attention test (VAT) that does not require extensive training and that is easy to apply in the field. This test was inspired by an ethological approach based on spontaneous attention behaviour towards a visual moving stimulus without involving operant conditioning: it consisted in projecting for 5 minutes a green light from a laser pointer on the stall door of the horse (with repeated circular clockwise and 50-cm long vertical and horizontal movements). The study was conducted on seventeen horses, including 7 females and 10 geldings, aged from 7 to 12 years ($\overline{X}$ ±ES = 8.1±1.6), from French Saddlebred (n=13) and Anglo-Arabian (n=4) breeds and were ridden for either jumping (n=10) or eventing (n=7) competitions. Each horse was tested with the VAT once a day for two consecutive days (*i.e.* day 1 and day 2) and its competition performance index was collected. By measuring all horses' gazes towards the stimulus, VAT revealed different patterns of attention that can indicate a horse's attention level: overall visual attention when the horse merely gazed at the stimulus, and "fixed" attention characterized by fixity and orientation of at least the visual and auditory organs towards the stimulus. Results also revealed that the sequences of attention were very short (3.7 seconds on average) and fragmented, suggesting frequent refocusing of attention. Overall, the more horses' attention was fragmented, the higher the index of performance (Spearman's correlation test, n=17, rs=0.47, $p<0.05$) in particular for eventing horses (Spearman's correlation test, n=7, rs=0.73, $p<0.05$). This novel test seems to be a promising tool for studying attentional characteristics and skills in horses. Horses' attention characteristics such as attention fragmentation during the VAT can be predictive of equine performances in competition.

Lay person message: Previous studies have shown that horses in a poor welfare state display altered attention towards environment stimuli. This novel attention test could help to better identify factors that cause variation in attention, including intrinsic (*e.g.* welfare state and age) and environmental factors (*e.g.* riding practices). The results of this test could ultimately help understand how to promote attention in horses.

Keywords: equine, cognition, attention, novel test, performance, riding.

Poster n°12

Training for a safer leisure horse: a pilot study investigating differences in heart rate between exposures to unknown stimuli

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It has been reported that the heart rate (HR) of horses increases when they are exposed to an unknown stimulus and a behavioural response such as 'shying' (fast movement from a novel object) may occur. These responses can vary in intensity and may lead to dangerous situations for both horse and rider. Research has been carried out to identify how horses respond to differing stimuli, although the majority of studies have been performed on naïve stallions or sport and Thoroughbred horses. Therefore in order to identify closer with the type of horse that may be used more frequently by leisure riders a pilot study was designed to discover if different types of stimuli had the potential to cause changes in HR as an indicator of possible undesirable behavioural responses. A small cohort of mature riding school horses of differing crossbreeds between the ages of 14 and 21 were recruited from the same yard (n=5). The horses wore head collars and were exposed to the stimuli whilst inside their usual stable and always approached by a handler known to them. HR was measured in the first instance with a handheld Polar HR monitor by the handler walking into the stable and attaching a lead rope tied to a ring to the head collar of each respective horse. The same procedure was followed after exposure to either a visual (umbrella) or auditory (whistle) stimulus within 5 seconds of the experience. The data were collected in the morning (between 0800 and 0930 hours) before the horses were let out into their field and fed. Auditory and visual stimuli were collected on separate but consecutive days, and the choice of which to use first was implemented with a random crossover design. A Wilcoxon signed-rank test determined that there was a statistically significant median difference in HR when subjects were exposed to the aural stimulus (median=108, range 94-136) compared to the visual stimulus (median=74, range 57-93; $W=15$, $p<0.05$). These preliminary findings indicate that horses trained or retrained for use by leisure riders may benefit from more exposure to auditory stimuli coupled with visual stimuli often used in conventional training methods. The inclusion of exposure to differing auditory stimuli in training may reduce the incidence of undesirable behaviours such as shying in horses used by leisure riders.

Lay person message: It is suggested that trainers of horses for leisure riders may like to expose them to new noises and sounds to a greater degree than they do already when undertaking their training and retraining. This has the potential to produce a safer horse and is therefore likely to decrease the possibility of accidents happening.

Keywords: equine, stimulus, training, leisure, behaviour, safety.

Poster n°13

A review of sleep deprivation in horses and its association with performance, safety and welfare: potential for future research

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Although the specific physiological functions of sleep in mammals are still debated among scientists, there is an agreement that sleep is essential for good health and performance. Horses display polyphasic sleeping patterns, meaning they sleep multiple times within a 24 hours window. Early studies using Electroencephalography (EEG) to investigate equine sleeping patterns identified 4 stages of vigilance: wakefulness, drowsiness, slow wave sleep (SWS) and paradoxical sleep (PS is also called REM sleep). Horses require approximately 3-4 hours of sleep a day with as little as 30 minutes dedicated to REM sleep, despite it being crucial for learning and memory consolidation. Moreover, horses are able to achieve SWS while standing, yet if they are in a familiar environment they are more inclined to lie down in sternal recumbency (lying asymmetrically with forelegs bent underneath the thorax) for SWS. The majority of critical REM sleep occurs in lateral recumbency (lying on side). Horses are usually reluctant to lie down unless they are completely at ease with their environment, this is because they are a prey species and lying down makes them vulnerable to predators. For this reason it may take days, or possibly weeks depending on the temperament of the horse, to be sufficiently habituated to their environment before lying down, this lack of REM sleep has the potential to impact on both health and performance. Beyond the early work on horse sleep, the potential causes and consequences of sleep deprivation in horses has not received much attention. Most recent studies on sleep in horses are based on behavioural observations alone, providing a coarse measure of total time resting. However, without more detailed measures of sleep phase, crucial information may be missed. The use of EEG and behavioural data collection methods such as accelerometry and video analysis, may shed new light on the quantity and quality of sleep horses' are receiving whilst in work. Here we aim to perform an in-depth examination of the impact of environmental factors on horse sleep patterns using direct behavioural, accelerometer and EEG observations. The focus will not only be on total time spent sleeping but also time spent in each phase of sleep and how this is influenced by individual behaviour and environmental factors. Once a baseline of regular sleep pattern has been established we can examine how this is altered in a novel environment to determine if sleep deprivation is occurring. Additionally, measures of learning and cognition will be used to indicate if performance is affected by sleep deprivation. This work could have far reaching implications on performance, and the safety and welfare of competition and leisure horses alike.

Lay person message: Horses can doze standing up but, to perform at their best they still require a period of deep sleep which can only be achieved when they feel secure enough to lie down. This review identified different phases of sleep in the horse, how they are affected in novel environments, and questions whether this impacts their ability to perform successfully and safely at a high level competition.

Keywords: equine, sleep, EEG, Performance, welfare, safety.

Poster n°14

Safely introducing horses to novel objects – a pilot investigation into presentation techniques

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Research into the many aspects of the horse-human dyad has demonstrated how vital it is to maintain a safe environment for horses and their handlers. There are a number of studies investigating novel object testing to assess various factors of welfare and handling of horses. In many training programmes novel objects are introduced to the horse at various stages, though the safest way to present these objects has not been investigated to date. A pilot study was created to discover if there were any significant differences between behaviours shown when the novel object was presented to the cohort (n=4) in four varying measures. The object chosen was a plastic inflatable beach ball 30cm x 40cm printed black and white with coloured writing. A cohort of 4 privately owned ridden leisure horses of mixed breeds and ages was sourced for the pilot study. These were all kept in the same livery yard and in similar environments. The object was presented to the cohort using four separate measures by a handler well known to all the animals and in an enclosed sanded area inside a building where the entire cohort had spent time previously for exercise. The order of measures used was determined beforehand using a using a random crossover design. The horse was asked to stand by another familiar handler using a head collar and lead rope. The handler then walked towards the horse holding the object and introduced the object by either holding it no closer than 1 m away from its muzzle (OM), placing the object 1m away from its hooves on the floor (OF), holding the object no closer than 30cm away from the horse's muzzle (OMT), or placing it no closer than 30cm from the horse's hooves (OFT). An independent observer using a previously created ethogram recorded observations of behaviour, while horse interactions were also videoed by another familiar handler. These data were entered onto a MS Excel datasheet and were transferred to Minitab v17 for analysis. Chi-Square goodness-of-fit tests were carried out to determine the responses of the horses to the different measures. Horses were found to back away from the object more than approach it across all tests and conditions (OM, OF, OMT and OFT) ($Chi^2=43.8$, df=3, $p<0.001$). Horses were also found to approach the object more readily if held by the handler (OM, OMT) ($Chi^2=12.5$, df=1, $p<0.0001$). This suggests that if a handler is involved horses tend to approach novel objects more readily than if they are presented on the floor. This may reinforce the idea that the safest method to introduce novel objects to horses is by using a familiar handler. Further investigation is warranted to discover if the results are replicated under different test conditions.

Lay person message: When training horses novel objects can be presented to horses in varying ways. For safety reasons it may be more appropriate for a familiar handler to present these objects in order to avoid behaviours being exhibited by the horse that may place the horse and/or handler in a dangerous situation.

Keywords: equine, safety, novel, object, behaviour, handling.

Poster n°15

Possibilities of linear personality trait evaluation during foal-shows: a pilot-study in American Quarter Horses

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Personality traits are of major importance to riders, but currently, suitable assessment methods for evaluation for breeding purposes are scarce. Therefore, accurate genetic selection for personality traits in horses is impeded. Specific temperament tests provide one possibility for improved evaluation of certain aspects of personality, but they are time-consuming to conduct, not always reflect real-life situations, and test outcomes from procedures such as novel object tests can be influenced by prior habituation training. Therefore, breeding associations are interested in personality assessment methods that allow evaluation of large numbers of animals in a short period of time while yielding information on traits relevant to practitioners. The aim of the present study was to screen various behaviour traits assessable during foal shows for their suitability for incorporation into breeding horse evaluations. For this purpose, 138 American Quarter Horse foals were observed during free-running, catching and halter-leading as part of their participation in foal shows. The mares' behaviour was likewise observed. Observed traits included ease of catching, distance to dam, reaction to applause, aspects of posture and tension in gaits, which were evaluated using a linear 5-point scale. In addition, behaviour traits such as rearing, bucking, biting, relaxation or attention were assessed qualitatively (i.e. present or absent). The linearly evaluated traits all exhibited near-normal distributions and thus considerable variation among horses (e.g., distance to dam during free-running: sd=1.4 scores; reaction to applause: sd=0.9 scores), indicating that all the traits allow to differentiate between foals. In general, there were no sex differences observed (F-test: all $p>0.1$), and the majority of personality traits did not correlate with foals' evaluation of performance traits (all $p>0.1$). However, foals carrying their tails lower received higher leg conformation ($r_{128}=0.22$; $p<0.05$), movement and overall performance scores (both $r_{128}=0.27$, $p<0.05$), and foals reacting stronger to applause tended to receive lower scores for breed type ($r_{128}=0.17$, $p=0.05$). Also, correlations between different behaviour traits indicate that some traits may be used to categorize horses into specific personality types. For example, the higher the tail carriage during free-running the easier it was to touch the foals' head ($r_{138}=-0.21$, $p<0.05$), perhaps because foals that presented with tucked tails were more nervous in general. The correlations between different behaviour traits also indicate that in future studies as well as in practice, the number of behaviour traits could be reduced to include only traits of particular relevance to practice and/or that are particularly easy to assess and correlate highly with relevant traits. Interestingly, with regard to body tension, mares' behaviour opposed foals' behaviour ($r_{115}=-0.24$, $p<0.05$). Although earlier studies showed acceptable repeatability and inter-observer reliability for the same or very similar behaviour traits, these aspects still need to be validated for the novel traits of the present data.

Lay person message: Linear trait scoring for behaviour traits during the regular procedures taking place at foal shows may be a suitable, time-efficient method to evaluate certain aspects of personality without the need for a specialised temperament test.

Keywords: personality, human-horse interaction, foal, breeding shows.

Poster n°16

Relationship between rideability and tactile sensitivity assessed via algometer and von-Frey filaments

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Rideability describes the ease and comfort with which a horse can be ridden, and it is one of the most important traits in riding horses. However, rideability is assessed subjectively via grades assigned by judges, and earlier research revealed a critical degree of disagreement between judges when evaluating horses' rideability. The aim of the present study was to assess horses' tactile sensitivity as a potential indicator of some aspects of rideability. For this purpose, 66 warmblood riding horses were ridden by a professional rider according to each horse's standard training procedure, and evaluated, using grades from 0 (absence of trait) to 10 (excellent performance), with regard to the following, individual aspects generally included in the compound trait rideability: quality of rein contact, chewing the bit, relaxation, reaction to rider's aids, learning ability, and comfort of sitting. The rider also evaluated if the horse was lateralized such that the horse was more supple when working on one rein than the other. In addition, horses were tested with an algometer for the minimum pressure required to elicit a reaction as well as the intensity of reaction (scored 0-4) to three different von-Frey filaments each applied once at the girth, flank and back on both left and right sides. Reactions to stimulation by the von-Frey filaments varied considerably between horses, and reaction intensity to the different von-Frey filaments at the same or different body parts correlated highly with each other (r_{66} =0.46-0.95; $p<0.05$). Minimum pressure required to elicit a response likewise correlated between different body parts (r_{66}=0.32–0.88; all $p<0.05$) as well as with reactions to the 3 von-Frey filaments (e.g. r_{66}=-0.56-0.66 for means of all measurement sites; all $p<0.05$), indicating that reactions to touch of various intensities constitute a distinct behaviour trait. Based on a mixed-model analysis, stallions were less sensitive (i.e. reacted to higher pressures; mean of all body sites: 1552 ± 226.7 N/ cm²) compared to geldings (841 ± 98.6) and mares (808 ± 137; $F_{2,57}$=5.24, $p<0.05$). However, there were no significant relationships between any of the rideability aspects and any of the measures of tactile sensitivity (all $p>0.1$). Interestingly, however, horses that were perceived to be less subtle as evaluated by the rider when riding on the right hand, were less sensitive in the back compared to horses that were not strongly lateralized or that were lateralized into the opposite direction (e.g., for the left side of the back: 1504 ± 241.0 vs. 812 ± 125.2 and 749 ± 286.4 N / cm², respectively; $F_{2,57}$=4.46, $p<0.05$). Results were similar for the right side of the back ($F_{2,57}$=4.02, $p<0.05$), but no differences were found for the sensitivity in the area of the girth or the flanks ($F_{2,57}$<1.4, all $p>0.1$).

Lay person message: Sensitivity to light or medium touch did not relate to different aspects of rideability. However, sensitivity to touch differs considerably between horses, suggesting that pressures acceptable to one horse may cause discomfort to another horse. Training should thus consider horses' individual sensitivity levels to safeguard their welfare.

Keywords: tactile sensitivity, rideability, pressure, von-Frey filament, personality.

Poster n°17

Evaluating a natural horsemanship program in relation to the ISES First Principles of Horse Training

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The ISES training principles provide an excellent starting point for professionals and horse owners. Currently, there does not seem to be an accepted protocol for evaluating horse training programs against the ISES principles. We suggest an approach to this, using Parelli Natural Horsemanship as our subject for evaluation. This initial pilot study (single-subject / n=1), trials two analytical methods, as applied to the current, video-based teaching materials from Parelli (latest DVD set, published and commercially available from 2015, supplied by Parelli for use in this study). The two methods used were: (i) ethology-based video observation / logging and (ii) discourse analysis of the language used to teach. The ethology-based approach uses an ethogram, which lists the behavioural characteristics of a human trainer adhering to the ISES principles. Computer-based 'continuous sampling' of Parelli video clips was used to log the frequencies of ISES principles. Inter Observer Reliability of the analysis to date was assessed using a two-way, mixed, absolute agreement, average-measures ICC (Intra Class Correlation). This evaluated observer agreement in the frequency count ratings for the ISES principles. Discourse analysis is a qualitative research methodology, applied across many domains including politics and health. Discourse analysis allows us to study transcripts of horse training materials, codifying the words, phrases and linguistic structures. Understanding the context within which training language is used, and its meaning to both the speaker and audience, makes it possible to evaluate compatibility with the ISES principles. Results for the ethology-based observations found all ISES principles present (1-10). High frequency counts for principles 2 & 10. Low counts for principles 5 & 7. Inter Observer Reliability (2 observers) was in the 'excellent' range (ICC=0.79). The high ICC value suggests that a minimal amount of measurement error was introduced by the independent observers, and therefore statistical power is not substantially reduced. At this stage (without an ICC value closer to 1.0 or further calibrating observers), increasing the evidence against random effects would require more extensive trials (p=0.16). The interim results from the discourse analysis shows consistent congruence between the Parelli materials and the ISES principles, particularly in the areas of: training according to the horse's ethology and cognition, using learning theory appropriately, forming consistent habits, avoiding flight responses and ensuring that the horse should always be as calm as possible (1, 2, 7, 9 and 10).

Lay person message: This pilot study compares the training of Parelli Natural Horsemanship (represented by their latest educational DVDs) with the ISES training principles. Two analytical methods were used: ethology-based and discourse analysis. The Parelli video materials were found to be congruent with ISES training principles. Other horse training systems could be analysed and compared, using this methodology.

Keywords: discourse analysis, ethogram, ethology, ISES training principles, Parelli, evaluation.

Poster n°18

A realistic simulation model of the interacting rider and horse behaviour

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Recently, much new knowledge has been acquired in the field of driver modelling, in which the human control of a vehicle (e.g. car or motorcycle) is studied and mathematically modelled. From this knowledge, which includes studies both on perception and motor control, one can predict (1) what stimuli are used to evoke control actions and (2) how the control is carried out by the body (i.e. nervous system). Driver modelling is a mature research field originating from the 1940s which has been used to, for example, improve vehicle controllability and as a way to better understand vehicle safety. The work presented here is a first step to transfer knowledge from what is known from driver modelling into the Equitation Science. Also, it is hypothesized that at least some of the perception and motor control patterns as used by man is also relevant for horses, which is a unique addition to this type of research since it involves the will of two individual, but interacting, biological systems. In order to test this hypothesis, a computer simulation in which a virtual rider controls a virtual horse was developed. The virtual horse and rider demonstrate a trot on a circle, and the stimulus used is the angle between the direction of movement and an aim-point (i.e. the visual fixation point) for both the horse and the rider, as well as leg aids for the horse. The control actions of the virtual horse include forward locomotion and bend, and the control actions of the virtual rider includes leg and rein aids. Note that the rein aid does not here directly result in a bend, but does so indirectly by shifting the aim-point of the horse. The combined behaviour of the virtual rider and horse models was manually tuned so that it resembled the behaviour of a live rider and a horse, as observed in a simple experiment. In the experiment a rider was instructed to steer her horse through one of two gates, either to the left or to the right, at a headway of about 10m. The procedure was repeated 31 times in trot and walk, and was recorded using a marker-based motion capture system, as well as video. The purpose of this type of research is to better understand the delicate interaction between rider and horse, and to allow this knowledge to be applied in practical settings. For example, in this initial study it is suggested that the behaviour of a live rider and a horse in fact can be modelled by using basic, and previously well-studied, concepts. In future work, in order to make the presented model useful, it will be tuned to a large number of different riders and horses to capture representative behaviours. By then varying the perception and control behaviour of either the virtual horse or rider, different types of interaction can be studied.

Lay person message: Motor car driver behaviour has been studied since the 1940s for research on, for example, vehicle safety, but the acquired knowledge has not been transferred to research on horse riding. This work demonstrates how a computer simulated virtual horse can be controlled in a realistic way by a virtual rider. The behaviour was also successfully tuned to fit the observed behaviour of a real live horse and rider.

Keywords: horse-rider interaction, behaviour, driver modelling, computer simulation.

Poster n°19

Reaching equestrians through an on-line academy to implement a new thought process for humane bitting using applied physics

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The Academy by Neue Schule was instituted to promote thought through awareness in regards to bitting within the equitation community. The Academy puts to rest common myths surrounding bits and encourages new thought processes among riders who acquire a thorough understanding of the various mechanical actions and applied forces of bits. The curriculum is informed by a thorough unbiased search of the scientific literature as well as novel studies undertaken by Neue Schule scientists. For example, tension meters inserted into a single rein and cheek piece of a bridle were used to determine the forces placed upon the horse by bits of different classes. The results of these studies, and application of physics principles to common bitting situations, are the foundation of knowledge used to educate riders of all levels. The Foundation course provides a global overview of the history of bitting, materials used, mouth anatomy, distribution of forces and action of bits. The Intermediate course delves deeper into the forces applied to the horse through the bit. First, we quantify how forces distribute between lips and tongue depending on the horse's head position, in relation to the rider's hands. Further, the extent to which bits rotate upon rein tension (Working Angle) is studied. Students submit a detailed analysis as an assessed case study. Using these principles students learn how they can determine what narrower features of the bit press onto the tongue once the bit has rotated. Students learn of the following surprising result: The flat plate of a Dr Bristol forms an angle of only 8° to the tongue and is nearly parallel to it whereas the plate of a French link sits at 123° and presses its thin edge into the tongue. Students learn that the horse's mouth provides a "floating" (rather than fixed) fulcrum for lever bits. Since the deformable corners of the mouth cannot act as a perfect fixed fulcrum, levered bits (and indeed all bits) are translated towards the poll thus countering any rotational lever poll force through a so-called 'poll relief' effect. The results of these analyses and other studies are the foundation of knowledge used to educate riders of all levels participating in The Academy, which further serves to promote critical thinking in regards to the mechanisms of action of bits and potential consequences for training issues and equine welfare.

Lay person message: The Academy by Neue Schule is a rigorous on-line course designed to communicate with equestrians of all levels about the various mechanisms of action of bits and their impact on the horse's body, as well as put to rest common misconceptions. The curriculum material for the Academy stems from searches of the scientific literature as well as in-house studies.

Keywords: academy, equine, physics, bitting, forces, working angle.

Poster n°20

Factors impacting student interest in an online module on equine learning theory

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The comprehension and application of equine learning theory is a cornerstone of safety for equine-human interactions. Therefore, education is a primary step in this mission. Adaptable e-learning techniques have been shown to improve learner experience. This study explored the factors impacting student interest in an on-line module about equine learning theory. Specifically, situational interest, or interest generated by specific conditions outside of personal disposition. The hypothesis that a choice driven, adaptive pathway would increase Situational Interest guided the research. Participants were undergraduates in an upper level horse management course (n=30). Approximately 75% of the students indicated an interest in pursuing veterinary medicine as a career. The class was divided in two groups, with half the class completing a choice driven adaptive design module (Group LP, n=15) and the remaining students completing a teacher driven, linear design module (Group LN, n=15). Students completed a 42 question Likert-Scale questionnaire measuring personal and situational interest. Situational Interest was divided into 5 subgroups: Class Interest, Teacher Interest, Group Work Interest, Online Learning Interest, and Learning Pathway interest. Personal interest was measured through Subject Matter Interest, or the students' pre-existing topic interest. Results were analysed using ANOVA. There was significant difference in Class Interest related to Personal Interest in both groups (LN, $F_7=7.44$, $p<0.01$; LP, $F_9=7.67$, $p<0.05$). There was also significant difference in Class Interest related to the students' confidence in horse management knowledge in the Group LP ($F_4=4.15$, $p<0.05$). Data were also analysed with Pearson's Correlation to determine relationships between interest and attitude towards online learning. Class Interest ($r=0.56$), Online Learning Interest ($r=0.712$) and Learning Pathway interest ($r=0.710$) were all correlated ($p<0.05$) with attitude toward online learning for students in the linear pathway. Overall, Group LN had higher significant differences in Situational Interest. This study revealed a multi-factorial impact on Situational interest in an online module on Equine Learning Theory, and that the learning pathway was of less impact than other interest factors. In conclusion, when considering teaching equine learning theory through online modules, there are many different factors to consider when designing and developing the curriculum for the audience, such as the students' self-efficacy in their knowledge and attitude toward the medium used. These findings can be used to inform future research in developing educational curriculum or programs on equine learning theory.

Lay person message: Promoting education on equine learning theory and its impact on horse-human interactions is a primary goal of ISES. This study explored two online module designs and their influence on student interest in a lesson on equine learning theory. Results revealed interest in an online lesson depends on many factors, such as student self-efficacy in topic knowledge and attitude towards online learning.

Keywords: education, on-line, learning, teaching, interest, theory.

Poster n°21

Taking the reins: communication strategies to prompt change in riders' training practices

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Education programmes have been shown to have immediate outcomes of learning, skill development and positive behaviour change and positive long-term effects. Much of this research centres upon people that have already committed to the training, either through necessity, interest or because of career requirements. If we are trying to effect change in people who are not already committed or who may perceive they have no requirement for this training then parallels are closer between consumer marketing research and practice. The current pilot study explored what communication strategy might encourage educated riders to try a new training practice. A pilot survey was conducted using semi-structured individual interviews of eight riders currently employed as higher education educators on equine-related topics. Interviews covered the communication format, the communicator's characteristics and the information approach that would encourage the participant to try a new training approach. Themes were identified from participants' responses using thematic content analysis without third-party verification. The communication format themes that emerged were: personal exposure and viewing the effects. Participants felt that they would be most likely to try a new approach within a self-initiated personal training situation. They were unlikely to try something where they had not viewed the effects, whether through personal experience or a demonstration (either live or video). As such written communication was unlikely to influence them. The themes around the communicator included: experience, previous exposure and trust. All participants valued obvious experience which had to involve practical experience, with publishing research less important. Whether this was by a successful personal competition career, training a range of equestrian athletes including high level, or from an evidence-based career of research publications and personal experience varied between participants. The communicator had to inspire trust in the participant. Previous exposure represents the idea that if participants already had prior positive knowledge of the communicator or indeed the information they would be more likely to consider trying a new training approach. The information had to embody themes of complementary, context and previous exposure. To be tried a training approach should be complementary to already held knowledge and experience and framed within a context of personal relevance, e.g. holding a problem's solution. These findings suggest a challenging strategy of personal and visual, resonant communication methods at a relevant moment is required if the ISES Principles of training are to be widely adopted.

Lay person message: For the educated rider to try a new training practice personal experience and repeated exposure is important. The communicator must have demonstrable practical experience inspiring trust and the information delivered in a context of personal relevance and be complementary to previous experiences. A strategy for increasing adoption of the ISES Principles of Training should consider these points.

Keywords: communication, equine, education, experience, training, principles.

Poster n°22

A pilot study on the application of an objective scoring system

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Western Dressage is a recent addition to the arena of equine competitive disciplines and shares roots between western horsemanship and classical dressage. Judging in dressage has long been considered subjective. This new discipline presents an opportunity to evaluate the application of an acceptance of a change from the normal traditional dressage scoring system to one that employs a more objective system such as the one developed by McLean (ISES, 2014). This pilot study evaluated the use acceptance (using a Likert scale of 1 to 5, 1 being 'not in favour' and 5 being 'would definitely use') of this system by judges with 20+ years of judging experience or those with 19 and less years of judging experience. The evaluation was completed using an online survey. The analysis evaluated the feedback from judges with respect to the guidance and rationale of giving a 4 (scale of 0 to 10, with 10 being highest/best) or lower when a horse was ridden behind the vertical for >30% of a movement. Additional qualitative data were collected via interview with judges by telephone regarding their willingness to participate in the implementation of an objective judge scoring system. These data from the online survey revealed that judges with 20 years or more of judging experience in the discipline of dressage were less accepting (One tail t-Test: t_{28}= 1.73, $p<0.05$) of the proposed use of an objective judge scoring system. Judges with 20 years or more judging experience responded in an interview that they were reluctant about the use of an objective scoring system. An online survey was conducted to question riders, coaches and trainers (n=170 across all categories) with regards to whether they would show under a judge that uses an objective scoring system. More than 85% of survey respondents indicated they would show under a judge who used an objective scoring system. The continued study and use of this objective judging criteria will further promote a balanced system that is objective, ethical, transparent, and more easily helps riders and trainers stay in alignment with training and showing that is based on the welfare of the equine and education of the horse and rider.

Lay person message: This study evaluated the use and perception of an objective scoring system. Judges with 20 years or more judging experience in dressage were less accepting of the proposed use of an objective judge scoring system. Most respondents would prefer the use of an objective scoring system. The continued study and use of objective judging criteria will promote ethical, transparent training and competing, being based on equine welfare and the education of the horse and rider.

Keywords: objective, scoring, dressage, western, judging, welfare.

Poster n°23

Physiological response to training and competition in 1-star to 4-star eventing horses

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To prepare horses for the requirements of international eventing competition and simultaneously maintain their health and welfare, appropriate training is mandatory. Specific training and competition management necessitates information about exercise intensities and fitness, which are usually assessed by standardized exercise tests. The purpose of this study was to identify parameters whose measurement can be largely integrated into the daily training and competition routine and which provide information on fitness and adequacy of training used. Training and competition intensities of eventing horses was examined using data from 187 horses competing at 1-star to 4-star level over a period of six years. Data were collected from 410 training sessions and 916 Cross Country rides, including distance covered and speed (GPS, Fidelak EquiPILOT), continuous heart rate (HR) (Polar T52H) and blood lactate concentrations (BLC; Dr Lange photometer). Characteristics of the track, altitude profile, ambient temperature and humidity were recorded at each session. The results of the one-way ANOVA indicated a significant effect of competition level on HR ($F_{3,373}$=23.29, p<0.001) and BLC ($F_{3,763}$=46.12, p<0.001). Under competition conditions, HR and BLC increased from 1-star to 3-star level (1-star: HR=194±9 bpm, BLC=7.7±5.6 mmol/l; 2-star: HR=198±9 bpm, BLC=9.6±6.2 mmol/l; 3-star: HR=205±10, BLC=15.6±9.8 mmol/l; 4-star: HR=207±2 bpm, BLC=12.4±9.3 mmol/l), while under training conditions, they decreased with increasing competition level (1-star: HR=184±29 bpm; BLC=18.9±11.1 mmol/l; 2-star: HR=182±19 bpm; BLC=12.1±9.0; 3-star: HR=174±25 bpm; BLC=6.9±7.1 mmol/l; 4-star: HR=161±24 bpm, BLC=4.0±5.6 mmol/l). On 1-/2-star level, BLCs after training exceeded those after competition. Reverse applied for 3-/4-star level. At 3-star level, the percentage of HRs above 200 bpm during Cross Country was considerably greater than on lower levels (1-star: 33%; 2-star: 54%; 3-star: 94%). The competition format (CCI/CIC) had no significant effect on the progress of HR. The altitude profile however, had a significant effect on HR ($F_{1,201}$=26.72,p<0.001) and BLC ($F_{1,89}$=25.56; p<0.001). Evaluation of physiological response to training and competition through implementation of measurement technology allows an assessment of the different impacts on exercise intensities and should be more commonly used to assess appropriateness of training and competition management in eventing horses. Thereby a valuable contribution to health maintenance and welfare of the horses could be made. It should be further investigated if the detected discrepancies in the response to training and competition between levels are a result of different fitness or varying training strategies.

Lay person message: To meet the demands of international Eventing competitions, a systematic training of horses is necessary. Close monitoring of physiological response to exercise during training and competition can help to improve training. Therefore it is an important contribution to the maintenance of the health and welfare of the horses.

Keywords: exercise physiology, training, eventing, heart rate, lactate, welfare.

Poster n°24

Twitching in veterinary procedures: how does this technique subdue horses?

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This study analyzed mechanisms by which two forms of restraint (lip twitch and ear twitch) subdue horses. Whilst prior research suggests that the lip twitch subdues horses through an analgesic effect; the mechanism of the ear twitch is not known. Two experiments were carried out. In the first, 18 male horses (10 stallions and 8 geldings) were divided into two groups (the first group received the lip twitch while the second group received the ear twitch). Heart rate (HR) and three heart rate variability (HRV) indices (the root mean square of successive differences (RMSSD), the standard deviation of all normal R-R intervals (SDRR), and the ratio of low frequency power to high frequency power (LF/HF) were measured in order to determine autonomic nervous system activity before and during application of the twitches. A behavioural analysis was also performed to ascertain the ease with which horses could be handled before and after being twitched. In the second experiment, 12 male horses (all geldings) were also divided into two groups, and in addition to measuring HR, HRV, and behaviour, salivary cortisol (SC) levels were analyzed to assess stress levels before and after application of the twitches. Sample size and all procedures involving animal handling and testing were approved by the Brown University IACUC (Institutional Animal Care and Use Committee). Changes in heart rate variables and salivary cortisol were analyzed using a repeated measures ANOVA. For all statistical comparisons, a p-value of <0.05 was considered significant (repeated measures ANOVA, 2, p<0.05). Results show that the lip twitch led to significantly decreased HR ($F_{2,10}$= 129.8, p<0.05) and LF/HF ($F_{2,10}$=38.9, p<0.05), and significantly increased RMSSD ($F_{2,10}$=74.8, p<0.05) and SDRR ($F_{2,10}$= 41.3, p<0.05) (increased parasympathetic activity), when applied for 5 minutes, but significantly increased HR ($F_{2,10}$=129.8, p<0.001) and LF/HF ($F_{2,10}$=38.9, p<0.01), and significantly decreased RMSSD ($F_{2,10}$=74.8, p<0.001) and SDRR ($F_{2,10}$=41.3, p<0.01) (increased sympathetic activity) when applied for a longer period; decreased SC levels ($F_{2,10}$=3.5, p>0.05); and had no effect on behaviour (14 out of 15 horses stayed in the same behavioural category between the pre and post-test). The ear twitch led to significantly increased HR ($F_{2,10}$=132.9, p<0.001) and LF/HF ($F_{2,10}$=57.5, p<0.01) and significantly decreased RMSSD ($F_{2,10}$=93.4, p<0.001) and SDRR ($F_{2,10}$=70.0, p<0.001) (increased sympathetic activity), regardless of the length of application; significantly increased SC levels ($F_{2,10}$=15.9, p<0.05); and made horses more difficult to handle (10 of 15 horses became more difficult to touch during the post-test). It was concluded that the lip twitch initially subdues horses through a calming, probably analgesic effect (which may be reduced or eliminated when the twitch is applied for an extended period of time), while the ear twitch subdues horses through a stressful, probably painful effect. Due to these stark differences, only the lip twitch should be considered a humane method for subduing horses, while use of the ear twitch should be actively discouraged among veterinarians and people involved in equine management.

Lay person message: Sometimes horses need to be subdued to avoid injury during veterinary procedures. One method used is twitching. The lip twitch appears to initially subdue horses through a calming, analgesic effect, while the ear twitch restrains through stress and possibly pain. It is therefore recommended that the use of the ear twitch should be actively discouraged.

Keywords: equine, twitch, stress, cortisol, heart rate, restraint.

Poster n°25

Assessing muscle mitochondrial function to improve training, performance and to early detect exertional myopathies in sport horses

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In working muscle, oxygen is consumed to produce energy within the mitochondria, an organelle considered as the powerhouse of the cell. All energetic substrates (i.e. glucose, fatty acids) will be in fine oxidized to CO_2 and H_2O with the concurrent production of energy by the mitochondrial oxidative phosphorylation (OXPHOS) system. OXPHOS provides energy for muscle contraction in aerobic conditions but also for muscle relaxation after anaerobic exercise. An optimal OXPHOS system is thus crucial for athletic performance. Searching for minimally invasive new investigation procedures, we have developed standardized protocols to measure OXPHOS capacity in muscle microbiopsy (~20 mg obtained from the triceps brachii muscle) with high-resolution respirometry (HRR). This new advanced technology provides a measure of the ability of the muscle cell to produce energy in the presence of oxygen by determining the amount of O_2 (in pmol) consumed per unit of time (per second) by 1 mg of muscle tissue. This study aimed to confirm the practical value of HRR applied to microbiopsies to determine the level of training, athletic ability and for the early detection of muscular dysfunction in two different disciplines requiring opposite stamina: endurance and Standardbred races. The protocol was first applied to a group of 32 healthy horses trained for different disciplines as well as to untrained animals. Level of fitness was based on history (i.e. working scheme and sport performance) and body condition scoring determined by evaluation of the mass of fat deposits in five specific body locations by palpation and visual assessment of seven anatomic sites. Comparison of OXPHOS capacities with a Wilcoxon rank-sum test indicated significant differences (with $p<0.05$) according to fitness level: OXPHOS capacity (in pmol $O_2.S^{-1}.mg^{-1}$) increased from 77±18 in overweight (n=3) to 103±18 in untrained (n=8), to 122±15 in trained horses (n=16) and, to the highest capacities found in top competitive endurance athletes (129±12; n=5). Then, muscle OXPHOS capacity was determined in 10 trained horses belonging to the national endurance team of France. One month later, all horses participated to a 160 km endurance race. All but one horse completed the ride and out of 47 participants, horses of the team reached the 1st, 2nd, 3rd, 4th, 7th, 9th, 11th, 16th and 19th place. Linear regression analyses indicated that OXPHOS capacities were significantly correlated to finishing place (the first horses had the highest OXPHOS capacities; $R^2=0.76$; $p<0.001$) and speed (the fastest horses had the highest OXPHOS capacities; $R^2=0.74$; $p<0.0001$). Also, OXPHOS was strongly predictive of the ranking for the four first places. The protocol was too applied on 8 French Standardbred racehorses in active training before the racing season. Reduced OXPHOS was found in two apparently healthy horses. During the racing season, these two horses suffered from several episodes of exercise-induced myopathy. This approach is proposed for the study of athletic capacities in sport horses, but also as new tool for trainers to maintain optimal welfare as it contributes to the early prediction of exercise-induced myopathy.

Lay person message: High-resolution respirometry is a new advanced technology that measures OXPHOS capacities, *i.e.* the ability of the muscle cell to produce energy in presence of oxygen. These studies demonstrated that OXPHOS capacities correlate with fitness level and racing performance. Furthermore, altered OXPHOS capacities indicate risk of developing exercise-induced myopathy thus contributing to maintain welfare by adapting training and management of the horse to this risk.

Keywords: training, performance, muscle, mitochondria, endurance, welfare.

Poster n°26

Closure times of the physis in high performance Mangalarga Marchador Gaited Horses - preliminary findings

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The closure of the physes of the long bones is commonly used as a parameter when training can be started in horses. Mangalarga Marchador (MM) is a gaited horse breed that start competing in hand at 15 months and being ridden at 39 months of age. This schedule requires intense training at very young age. To date the closure times of the physes in long bones and hence skeletal maturity in this breed is unknown. The aim of this study was to determine the closure times of the distal physis of the tibia and radius in MM horses with the ultimate aim to guide training programmes and promote animal welfare. Fifty-six sound MM horses that competed successfully in one type of gaited horse competition (Marcha Picada Gait (MPG) were included in this study. These animals were the first seven placed horses in four categories in the National Exhibition in 2014, categorised by type of competition, age and gender: category I: shown in hand, 7 females (19-29 months) and 7 males (18-21 months), category II: shown in hand and 7 females (30 to 34) and 7 males (22 to 34); category III: ridden, 7 females (41 to 45) and 7 males (41 to 53) and category IV: ridden, 7 females (54 to 56) and 7 males (53 to 58). Three radiographs were taken of each horse: a cranio-caudal radiograph centred on the left and right distal radius and the left distal tibia using a digital radiography system (Orange 90® x-ray generator in combination with a Claro X DR system) with a focus-film distance of 60 cm, kV between 70-73 and 3.2 mAs. The radiographs were graded for physis closure by a single observer (RW) into: open-A, partially closed-B and fully closed-C. Data distribution of groups and homoscedasticity variances were checked using Lilliefors tests and Cochran, and the data were analysed using descriptive statistics. The physis closure results for radius and tibia were are the same. The initial closing time, grade B, began in females (29%) in category I, and in males (43%) in category II. In all horses physes full closure occurred earlier in females in category III and later in males in category IV. This results suggests physis closure time begin to take place between 22-34 months and ends between 41-58 months. This wide variation may be related directly to the type of feeding and training management, and additionally the genetic breed variation. More studies are needed to compare these findings with horses in the same breed not subjected to intense exercise, under the same management and feeding thus evaluating the influence of exercise on the growth of these animals in order to better guide and improve MM horse training.

Lay person message: The MM Horse MPG begins participation in competitions at 15 months when the cartilage of long bones has not yet ossified. Ossification begins to take place between 22-34 months and ends between 41-58 months. This wide variation indicates that exercise, management and feeding of high performance horses may in combination influence mineralization.

Keywords: gaited horse, Marcha Picada, growth, physis, training, welfare.

Poster n°27

Effect of a nucleotides based preparation on body composition, growth and performance in trotters and racing Thoroughbreds

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Between 12 and 18 months, the weight of young horses attains 70% of adult weight. Then the growth and development slow down until adulthood, reached at 3.5 years old. Race horses are submitted to intense training very early, while they are still in a period of intense growth. Early life of race horses therefore requires high nutrient levels to meet the energy demands both for growth and training. Among nutrients, dietary nucleotides/nucleosides may become essential nutrients during periods of rapid growth, when metabolic demands exceed the capacity for *de novo* synthesis. The aim of the trial was therefore to study the effects of a nucleotides based preparation (NBP) on body composition, growth and performance in trotters and racing Thoroughbreds (TBs). The trial involved 26 trotters and 23 TBs aged 2 or 3 years old: 14 trotters and 11 TBs were supplemented for 4 and 8 weeks, respectively, with a combination of NBP (Laltide®) at 30 g/horse/day, organic selenium (Alkosel®), vitamins E, C and linseed oil (EXP group). Horses were fed with barley and oats in 2 meals per day (5 L/horse/day), mineral supplement and Crau hay. The other horses were considered as the control (CON) group. The following parameters were followed for 4 weeks (8 weeks for weight in TBs): weight, height, body mass index (BMI), body condition score (BCS), muscle weight (MUS) and total fat tissue weight (TFT), which are relevant indicators of the energy reserves of the horse. Horse performance (average earnings per race) and fibrinogen level as a non-specific marker of inflammation were also analyzed. Data were statistically analysed by non-parametric tests (Mann-Whitney and Kolmogorov-Smirnov). The start weight of horses was not significantly different between both groups and showed a tendency to be higher in the EXP group than in the CON group for trotters (at 3 weeks, $U=1.24$, $p<0.1$) and for TBs ($U=1.29$, $p<0.1$ and $U=1.25$, $p<0.1$ at 7 and 8 weeks, respectively), inducing at the end of the supplementation period a weight increase of 4% in the EXP group (vs 2.1% in the CON group) for trotters and 3.7% in the EXP group (vs -0.6% in CON group) for TBs. The EXP group also showed a trend for increased BMI after 4 weeks of supplementation compared to the CON group for trotters (+2% vs +0.6%, $t=2.57$, $p>0.05$) and for TBs (+1.4% vs -1.3%, $U=5.44$, $p<0.05$). Trotters supplemented with NBP also presented higher BCS (+35.3%), MUS (+10.2%) and TFT (77.1%) than the CON group (BCS:+30.7%, MUS:+8.9%, TFT:+63.8%) after 4 weeks of supplementation, while TBs in the control group had decreased BCS (-2.7%), MUS (-0.8%) and TFT (-5.1%) compared to EXP group (BCS:+1.5%, MUS:+0.5%, TFT:+0.9%). These morphological improvements in the EXP group were observed in parallel with better race performance (better ranking or increased frequency of first ranking) and decreased inflammatory status after 1 month of supplementation ($U=-1.92$, $p<0.1$).

Lay person message: The juvenile period of young race horses is challenging, due to intense training while horses are still growing. Young horses therefore require increased levels of nutrients, in which nucleotides/nucleosides should be supplied in sufficient amounts in the diets. This study showed beneficial effects of a nucleotides based preparation on different morphological traits, body composition, growth and inflammatory status in young racehorses.

Keywords: horse, body composition, inflammatory status, growth, training, nucleotides.

Poster n°28

A preliminary study to investigate the prevalence and progression of pelvic axial rotations among neonate foals

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The aim of this study was to identify the presence or absence of pelvic axial asymmetry in the neonate foal, and its progression during the first nine weeks of life, using quantitative data. The importance of symmetrical development and skeletal alignment in the adult equine athlete and its relationship with career longevity and injury is widely acknowledged. Musculoskeletal development from foal to adult requires equal consideration. It could be hypothesised that the act of parturition has the potential to have a subtle effect on the musculoskeletal system without the foal exhibiting external symptoms and thus impact ongoing musculoskeletal development. Triplicate measures of the left and right tuber coxae height were taken vertically from the dorsal aspect to level ground of ten healthy subjects (4 colts, 6 fillies) whose hind feet were no further than 5cm out of alignment. Measures were taken at three time periods: 0-1 week; 4-5 weeks and 8-9 weeks of age. A novel method of measurement was used in the form of two laser measures applied simultaneously that had been tested for and demonstrated acceptable repeatability of measurement. Between the first and second data collection foals experienced their first turnout. A questionnaire provided qualitative data in order to analyse potentially influential variables. Symmetry indices (SI) were calculated from raw data and were statistically analysed using appropriate inferential tests. Tests used on different data sets included Wilcoxon tests, Student T-tests, Mann-Whitney test with level of statistical significance at $p<0.05$. There was a significant presence of axial rotation of the pelvis (pelvic asymmetry), compared to pelvic symmetry, within 0-1 week of age (mean SI = 0.337±0.25; $W_{10}=55$, $p<0.01$). These asymmetries did not change significantly between week 0-1 and week 8-9. There was no significant difference of asymmetry between week 0-1 and week 4-5 suggesting turnout did not have an effect on the prevalence of pelvic misalignments in foals (mean SI±SD: week 0-1 0.337 ± 0.25; week 4-5 0.555±0.51; $W_{10}=17$, $p>0.05$). Gender had no significant effect (mean SI±SD: colts 0.694±0.38; fillies 0.410±0.07; $U_{30}=77$, $p>0.05$) on pelvic asymmetry. Foals of mares that gave birth standing up displayed significantly greater asymmetry of the pelvis during week 0-1 when compared to foals of mares that gave birth in a recumbent position (mean SI ± SD: recumbent 0.2497±0.659; standing 0.686 ± 0.4798; $U_{10}=8$, $p<0.05$). This study shows evidence of significant pelvic axial asymmetry from birth to 8-9 weeks of age in foals. Further research is required to ascertain if pelvic axial asymmetry was caused by the birth process or from attempts to stand and subsequent locomotor efforts. Identification of such influential factors may have welfare implications in injury reduction during future ridden careers and contribute to knowledge in the field of equitation science.

Lay person message: The importance of symmetrical development during training is widely acknowledged. However, this study indicates that pelvic asymmetries may be present in new born foals, or certainly develop very early in life. Such evidence can be used to improve the future welfare of the horse when ridden, an important aspect of equitation science.

Keywords: foal, development, asymmetry, pelvis, equitation, welfare.

Poster n°29

An investigation into the limb phasing characteristics and stride duration of fully shod, partially shod and unshod horses on a twenty metre circle in walk and trot gait

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An activity central to the equestrian industry is the use of lungeing horses for exercise and diagnosing lameness. Shoeing has been shown to alter the horse's locomotion as a result changing the horse's limb loading patterns. The aim of this study was to determine with the ETB-Pegasus limb phasing system, if there were any significant differences in the limb phasing characteristics and symmetry of stride in fully shod, partially shod and unshod horses on a twenty meter circle. A sample of twenty-one mixed breed horses (mares n=6, geldings n=15), kept at a single facility were recruited for the study; seven shod (mean age =11.57±6.45 years), seven partially shod (front feet only) (mean age =13.14±5.98 years) and seven unshod horses (mean age =8.71±2.28 years). The horses were lunged in walk and trot on a twenty metre circle, on a rubber-sand surface. Each horse was lunged first on the left rein followed by the right rein, and all were lunged by the same handler. The ETB Pegasus limb phasing system was used to determine limb temporal characteristics. Analysis of the results was completed through a two-way ANOVA test. There was no significant difference in the stride duration at walk ($F_{2,17}$=0.49, p>0.05) and trot ($F_{2,17}$=0.13, p>0.05) between horses that were shod (mean=1.26±0.76s and 0.09±0.04s, respectively), partially shod (mean=1.25±0.76s and 0.05±0.03s, respectively), and unshod (mean=1.19±0.73s, and 0.06±0.02s, respectively). The limb phasing characteristics (sagittal and coronal cannon range and time in stride for maximum protraction and retraction of the forelimb and hind limb) showed no noticeable differences between the different shoeing regimes. However, left and right rein showed significant differences between the limb characteristics ($F_{1,17}$±7.30, p<0.05). A post hoc Tukey test showed that the left and right rein differed significantly for limb phasing characteristics, indicating that left rein has the greatest effect on limb phasing characteristics when lunged on a circle (p<0.05). The lack of statistically significant differences in limb phasing between the different shoeing groups, suggests the horse does not appear to adapt its' stride pattern when presented in a shod or unshod condition. There are however limitations in the study which may have had an influence on the results such as, the uncontrolled variable of speed, surface used, influence of the handler and radius of the circle. The differences in rein can be attributed to the differences in body lean angle when a horse is circling on the left and right rein. Previous studies have found that trained horses have a preference on the left rein which may explain the greater difference obtained on the left rein in this study. However, further research needs to review this more in depth as other studies have disproven the findings. Further study should also be conducted on how a horse adapts to the removal and addition of shoes and on how the decreased radius of circle affects stride kinematics. This will aid in the development of lameness assessment techniques and understanding of injury occurrence when lungeing.

Lay person message: No statistically significant differences were found in the limb phasing characteristics and stride duration between the different shoeing regimes when horses were lunged on a twenty metre circle in walk and trot. However further research is needed in the development of lameness assessment techniques and understanding of injury occurrence when horses are lunged.

Keywords: horse, lunge, limb phasing, stride kinematics, shoeing, unshod.

Poster n°30

What methods are commonly used during weaning (mare removal) and why? A pilot study

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The behavioural effects on the foal and dam during weaning are well documented and it is commonly agreed that both mare and foal are likely to suffer from stress during this procedure. However, a wide range of different weaning methods are employed worldwide. The aim of this study was to determine frequency of weaning method versus type of breeder in order to understand common practice. A questionnaire comprising a mixture of closed and open questions was designed and piloted before being issued to breeders. Information sought included the types of weaning method used (METHOD), age of foals at weaning (AGE), stud size (SS) and number of foals bred per annum (FBPA). Questionnaires were sent to various breeders from all over the world with 10 questions in total. The questionnaire was distributed by social media and equine academic societies' distribution lists. 440 responses were obtained, of which all (100%) were usable over the 30-week period that the questionnaire was open for completion. Data were collated and statistically analysed using SAS v9.4. The gradual method was the most popular method used (40.5%), the abrupt method was second most popular (30.9%), 'other' method was third most popular (15.2%), paddock method was fourth most popular (8.6%), and barn method was least popular (4.8%). Frequency tests clearly show that AGE is much lower for the abrupt method and much greater for 'other' method than all other methods. Chi-square (likelihood chi-square) statistics of 146.75 (135.92) are both highly significant. OLS regression results showed that METHOD was positively associated with AGE (t=9.04; $F_{4,435}$=22.72, p<0.0001; Adj R^2=0.165) with younger foals more likely to be weaned using the abrupt (t=4.31; p<0.0001) and barn method (t=2.17; p<0.034) and older foals more likely to being weaned using the 'other' method (t=6.97; p<0.0001; $F_{4,435}$=-21.29; Adj R^2=0.244). AGE is significant and negatively associated with annual breeding (t=3.22; p=0.0014) and FBPA (t=3.49; p<0.0001) and positively associated with METHOD (t=9.04, p<0.0001; $F_{4,435}$=31.18; Adj R^2=0.215). Annual breeding is significantly positively associated with FBPA (t=2.82, p<0.01) and SS (t=5.47, p<0.0001) and negatively associated with AGE (t=3.22, p<0.01 $F_{4,435}$=29.08, Adj R^2=0.205). Inspection of respondents data suggest that large studs and those who breed many foals are more likely to breed every year and tend to remove foals from their mother earlier. Using objectively measured data, this study demonstrates that current weaning practices vary broadly in terms of method used and age at removal, but shows significant trends according to stud size and number, and frequency of foals bred per annum.

Lay person message: Understanding the effect of mare removal on foals is a very important consideration in an ethical approach to general foal husbandry. Safeguarding during key years may reduce negative associations and behaviour, and enhance positive training and ultimately performance in later years. Understanding appropriate weaning method may help reduce stress during this key period.

Keywords: equine, weaning, welfare, method, gradual, abrupt.

Poster n°31

Prevalence of back pain and its risk factors in professional horse riders

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Horse riding is perceived as a dangerous sport mainly due to the possible severity of injuries. However, there is little information on health-related conditions/disorders arising from daily practice. The aim of this study was to assess the prevalence of back pain (BP), neck pain (NP), thoracic spine pain (TSP) and lower back pain (LBP) and to characterize not only the link between competitive riders' health and riding but also that between professional riders' health and the type of work undertaken. A questionnaire based on a standardized Nordic questionnaire for musculoskeletal symptoms, on lifestyle, medical history, health status and career was answered by 666 professional riders via the National Riding School websites. Replies from 258 professional riders were processed. The mean age of this sample of professional riders was 33 ± 11 years and included 27% men and 73% women (the same proportion as in the general riding population) with 23 ± 9 years riding experience and 10±9 years as professional riders. A multiple correspondence analysis identified four distinct clusters according to their predominant activity: "teaching riding", "horse riding", "grooming" and "training young horses". From clusters, Chi-squared test was calculated with 266 variables from the questionnaire. The results showed a high prevalence of NP (67%) and TSP (59%) in the last 12 months, a high prevalence of pain lasting over one month, and of chronic pain: 25% and 9% for NP, 24% and 13% for TSP and 33% and 23% for LBP. In particular, the cluster with "grooming" as the prevailing activity was most affected by pain lasting over one month and by chronic pain (χ^2=10.2, df=4, p<0.05). This cluster comprised mainly women (85%), with average age of 33 years, having attended equine school (91%). In accordance with the literature, the prevalence of LBP in professional riders (75%) was not higher than in the general population and this pain reportedly disappeared during riding. Riding strengthens the paraspinal muscles, which are the same muscles that are rehabilitated in exercises prescribed by physiotherapists who recommend continuing of compatible activities. But in order to juggle professional activity and sport, 65% of professional riders with LBP consulted a physiotherapist (χ^2=5.24, df=1, p<0.05) and 84% of them an osteopath. When the LBP was chronic, 75% consulted a physiotherapist (χ^2=13.9, df=1, p<0.001). This epidemiological study established a link between back pain and the work conditions of a professional rider. Although no causal link was found between back pain and riding, one was found between back pain and walking activities like "grooming". Horse riding could even be considered as a form of physiotherapy for LBP.

Lay person message: No causal link was found between riding and back pain. The prevalence of back pain was very high for professional riders whose the main activity was "grooming". Horse riding could be considered as a form of physiotherapy for LBP. It is essential to separate the work aspects and sport to take into account professional riders' health and take preventive measures to protect careers and horse welfare.

Keywords: training, rider, stirrups, force, saddle, balance.

Poster n°32

Effects of osteopathic manipulation in horse riders: a pilot study

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A french epidemiological study showed that 81% of professional riders are treated by an osteopath. Despite its growing popularity the efficiency of Osteopathic Manipulative Therapy (OMT) has been little investigated. The aim of this preliminary study was to assess impact of an OMT. A group of four riders (aged 20 to 33 years old at the same level of riding) followed a two months-long OMT programme. The cranio sacral therapy osteopathic method developed by J. Upledger in the 1970s was used in this study for diagnosis and treatment. Riders were treated by a therapist five times, the first three sessions were at two week intervals and sessions four and five were at three week intervals. Diagnosis showed that at the beginning of treatment, all riders had a dysfunction of the three "blockage points" of lymphatic circulation: tentorium cerebelli, respiratory diaphragm and perineum. During OMT, the therapist focused on these points while respecting the physical and emotional condition of each individual and the chronology of their lesions. Riders were tested before and after each manipulation at walk, trot and gallop on an equestrian simulator equipped with pressure sensors on the right and left stirrups. The forces were measured at 1 kHz. For 20s mean peak force (MPF) and standard deviation were calculated for stirrup data. A pressure mat was used on the saddle to collect ischium pressures. Root mean square (rms) of ischium pressures and MPF on the stirrups were calculated and compared before and after each manipulation. An analysis of variance was used for statistical tests and P values of <0.05 were considered statistically significant. Results showed statistical differences of pressures after the first and the third osteopathic manipulation four weeks later. Stirrups pressure values decreased (example at walk: before OMT, right stirrup MPF=89.4±3.4N; left stirrup MPF=95±4.5N; after the first OMT: right stirrup MPF=41.4±2.2N; left stirrup MPF=48.6±3.9N; $F_{5,6}$=4.37, $p<0.05$) in favour of pressures on the saddle (example at walk: before OMT, right ischium rms=0.4N; left ischium rms=0.74N; after the first OMT, right ischium rms=3.65N, left ischium rms=2.32N; $F_{5,6}$=0.825, $p>0.05$). Significant decrease of MPF and an increase of ischium pressures were interpreted as an improvement of rider's balance. Results support planning a study with a larger number of riders and a control group. It would confirm improvement of rider's balance during an OMT. This study suggests that osteopathy used in its entire philosophy, while respecting the physical and emotional condition of each individual and the specific chronology of their lesions, can be used as a complementary method to improve an athlete performance.

Lay person message: Cranio sacral therapy might be an effective osteopathic technique for improving a rider's balance on an equestrian simulator. Indeed it can potentially help the rider to manage his impact on the locomotion and welfare of horses by balancing his/her weight, and therefore pressure, on stirrups and his/her seat.

Keywords: rider, seat, stirrup, osteopathy, cranio-sacrum, balance.

Poster n°33

Effects of osteopathic treatment in sport horses

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Sport horses are often put to the test before they reach maturity.They can develop disorders of articular mobility. Osteopathic treatment for horses has developed considerably over the past three decades. The objective of this study was to quantify the locomotion of sport horses, with their riders reporting their back dysfunctions, ten and twenty days after an osteopathic treatment. Twenty six healthy sport horses divided in two groups were tested using the same procedure. In the group A, 13 horses (aged 8.5±4.7 years) had an osteopathic treatment and in the group B, 13 horses (8.7±4.3 years) were not treated, only groomed. In both groups there were 6 young (≤6 years) and 7 older horses (>6 years). Gait related variables (propulsion, dorsoventral activity, lateral activity, propulsion time, symmetry, regularity) in walking, trotting and galloping paces, in a straight line in free conditions, were measured by two accelerometers Equimetrix® (one fixed on the croup and one against the sternum): before treatment, ten- and twenty- days post-treatment. Analyses of variance were used for statistical analysis. P values <0.05 were considered statistically significant to compare locomotion before treatment, ten and twenty days after the treatment for both groups and for young and older horses. Ten days after treatment, the results for group A, at trot, showed a significant increase of dorsoventral activity at the sternum (before 42±8.3; after 45.2±8.1 g²/Hz, $F_{1,116}$=4.35, p<0.05) and a significant decrease for group B (before 46.2±6.7; after 43.7±7.3 g²/Hz, $F_{1,121}$=4.06, p<0.05). For group B, lateral displacement decreased significantly at gallop (before 12.8±8; after 9.6±5.9 cm). Dorsoventral activity at trot, propulsion and propulsion time at walk and gallop decreased significantly. Twenty days after treatment, the symmetry of trot increased significantly (97.4±1.8 vs 98.1±1.4%; $F_{1,108}$=8.57, p<0.01) for group A. Lateral activity of the croup increased (2.6±0.8 vs 3.1±0.9 g²/hz; $F_{1,93}$=7.238, p<0.01) as well. For the group A young horses, dorsoventral displacement at sternum and croup, symmetry and propulsion increased significantly at trot. However, propulsion of old treated horses decreased at walk (before: 11.6±4.7; after: 8.1±4.2 g; $F_{1,41}$=6.41, p<0.05) and propulsion time at gallop (before: 19.5±2.5; after: 17.4±2.8 %; $F_{1,54}$=9.22, p<0.05). Osteopathic treatment improved locomotion of sport horses straight away, particularly for young horses. Changes were still obvious twenty days after treatment. It appears, to the older horses, that a second treatment should be administrated or that they would need a longer period of adaptation after the osteopathic treatment combined with a progressive re-education program.

Lay person message: Osteopathic treatment improved young sport horse locomotion immediately, with improvements persisting for at least 20 days after treatment. For older sport horses, a second treatment should be given and ideally combined with the use of a progressive re-education program.

Keywords: osteopathy, horse, locomotion, accelerometry, gait, welfare.

Poster n°34

A preliminary study into elite event riders who compete with pain

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Horse riding by nature creates a high risk situation and is considered more dangerous than motorcycling, car racing, skiing, football and rugby. Previous studies have reported riders experiencing chronic physical difficulties following traumatic accidents and yet continue to ride. Increased prevalence of pain and limited range of motion in higher level riders has been associated with postural defects, asymmetry and altered mechanics of the spine, which can negatively affect performance. These may also develop into long term chronic pain issues which may limit the career length of riders. This is a preliminary study aimed to determine the prevalence of event riders who compete with pain, and these riders' perceptions of the impact of that pain on their performance. A survey was conducted involving a closed answer, self-completion questionnaire. This was distributed in person to competitors at the Hartpury College FEI Three-Day Event. The responses were collated and analysed quantitatively with the use statistical analysis programme SPSS v 21.0. Only 7 of the 31 participants (23%) were competing without pain. 77% were competing with pain, with 33% experiencing pain during riding and 96% experiencing pain after riding. Pain was predominantly situated in the lower and upper back, shoulders and neck. 71% of the riders with pain felt that their performance was affected by pain in terms of fatigue, decreased range of motion, asymmetry, anxiety and irritability. Significance levels were set at $p<0.05$ and coefficient set at 0. No correlation was found between age and pain ($r_{31}=0.08$, $p>0.05$); a non-significant, weak, positive correlation between number of years riding and pain ($r_{31}=0.18$, $p>0.05$); a non-significant, weak, positive correlation between pain and number of horses ridden per day ($r_{31}=0.147$, $p>0.05$) was found. The majority of event riders competed with pain and they believed this affects their performance. Eventing is a multi-stage sport and therefore pain after riding is likely to affect preparations for future stages. Pain is known to impair decision making and mental processing and as such in a complex and high-risk sport such as eventing this is likely to place the health and safety of both horse and rider at increased risk. Further research is warranted into the lifestyle of riders and training techniques of horse and rider, in order to determine causes of pain and establish recommendations for pain avoidance.

Lay person message: Most event riders surveyed experience pain during or after riding. This pain is experienced mainly in the upper body. Both riders reports, and research supports the suggestion that this pain negatively affects competition performance and may increase risk of injury through impaired decision making.

Keywords: rider, pain, eventing, chronic, medication, performance.

Poster n°35

Horse and rider safety on the United Kingdom (UK) road system: pilot evaluation of an alternative conspicuity measure

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Previous studies have reported that the use of popular conspicuity equipment used by riders when using the UK road system does not necessarily lead to a safer environment. To date, the effectiveness of wearing fluorescent/reflective (FR) equipment as a conspicuity measure to prevent accidents has only been investigated for cyclists. Recent research using a questionnaire-based study showed that FR equipment does not significantly reduce traffic-related near misses experienced by horse-rider combinations. However, wearing lights leads to significantly fewer near misses for horse-rider combinations as does riding broken coloured horses (piebald/skewbald). Transport laboratory based research reported drivers exhibit significantly faster reaction times in visual identification tests with FR colours than with dark colours. Although this finding was replicated in the live cycling/traffic environment it failed to reach significance. The objective of this study was to determine the effectiveness of two different conspicuity tabards (FR and PieBold- a black/white tabard mimicking the coat of a broken coloured horse, PB) by comparing to a dark-coloured tabard (N). A visual identification test was designed using a specially developed slide show incorporating three images of a horse-rider combination, each wearing three different tabards, N, FR and PB. Each image was digitally manipulated to display the same combination but with different tabards. An opportunistic sample of drivers was selected from university students, 16 of whom had horse-riding experience. Drivers (n=23) were shown the images in sequence and asked to start and then stop the timer to indicate immediately when they saw the image. The timer used was a stopwatch function set to record reaction times in milliseconds on a touch sensitive screen next to the laptop used to display the slide show. Each driver was tested on each image once. Resulting reaction time data were collated in MS Excel and transferred to Minitab v17 software for analysis. Reaction time data were non parametric (AD=1.95; $p<0.005$). A non-parametric analysis of variance was conducted (S=31.91; df=2, $p<0.001$: FR median=9.01ms; range 8.41-9.71; PB median=8.8ms, range 7.9-9.74 and N median=9.83ms, range 9.65-10.06) on reaction times to determine the effect of tabard type. Further Wilcoxon tests indicated that there was no significant difference between reaction times with FR and PB (T_{23}=187.0, $p>0.05$), however there was a significant difference between PB and N (T=0.0, $p<0.001$) and FR and N (T=0.0, $p<0.001$). These results indicate drivers have a quicker reaction time when presented with a horse-rider combination wearing PB and FR than when compared with N. Evaluation of PB as a conspicuity measure therefore indicates it to be possibly as effective as FR when riding on road systems.

Lay person message: Drivers took part in visual identification tests to compare reaction times with three different colours of tabard worn by a rider. The tabard representing a broken coloured horse was seen by drivers more quickly than a dark tabard and compared favourably with a fluorescent/reflective tabard. This suggests horse and rider combinations could be safer on the roads if they adopted this novel type of tabard.

Keywords: Road, safety, equine, rider, conspicuity, equipment.

Poster n°36

Statics of neck and head in horses in relation to rein tension - a model calculation

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As soon as a rider mounts a horse, he/she influences the position of neck and head (HNP), regardless of which style he/she uses. In dressage riding, the degree and method of exerting influence is disputed. The equilibrium in the atlanto-occipital joint was calculated using the mechanical engineering methods. The dimensions used in our model calculation are taken from an average-sized German Warmblood. Based on this individual, as well as on data from the literature, we estimated the centre of gravity of the head and lever lengths of the weight, as well as the forces which keep the head in equilibrium. The maximum passive force of the ligamentum/lamina nuchae and the neck muscles, that are generated in a fully relaxed HNP (e.g. in a deeply sedated, standing horse) in the above mentioned individual is 900 N (Fn = Fh * lk/ ln, Fn= Force of passive structures (e.g. ligamentum nuchae), Fh= Force of head, lk= Lever head, ln= lever passive structures). Under unrestricted conditions in a "normal" HNP of the unrestricted horse the active muscles have to exert 245N. If the head is hyperflexed, the centre of head mass is 15 to 25cm behind the poll. In order to maintain this position, a pull of a prominent ventral neck muscle (m. brachiocephalicus) is required. To hold this HNP with the head kept e,g. 18 cm behind the vertical, 560 N must be exerted by the ventral muscle. As an alternative to the pull of the muscle, the necessary force can be provided by the reins. The very long lever arm of rein force is 55 cm, and therefore the required force is 98 N per rein. These forces are required only if the passive tension of the neck ligament is taken into consideration, and if the neck flexing muscles are completely inactive. Rein forces in this range are not too different to those measured repeatedly by Preuschoft, i.e. 150 N (75 per rein). If the horse is held in the hyperflexed position by the rider with the above calculated 196 N, a force of 466 N is necessary to move the head in a less flexed position. If the rider increases his pulling force on the reins, the horse has to exert greater forces against them; e.g. if the rider pulls with 150 N per rein, or 300N altogether (as measured with professional riders) the horse needs 1200 N to change to a wider neck angle. This is 4 times higher forces than is needed.

Lay person message: The lever arms of the rider´s reins are much longer than those of the horses' muscles. This means that from a biomechanical viewpoint, the rider is able to force the horse into strongly flexed HNPs, maybe even against its will. The rider has to take special care with the use of his own muscle forces in order to safeguard the health and welfare of the horse.

Keywords: model-calculation, HNP, hyperflexion, rein tension, muscle forces, rider.

Poster n°37

The development of an innovative and comprehensive protocol to better understand the horse-saddle-rider interaction

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The saddle and the rider can influence the occurrence of back pain and the reduction of performance on horses. However, studies about horse-saddle-rider interaction remain limited. The aim of this study was to develop a comprehensive protocol to measure the horse-saddle-rider interaction and to compare the effect of the rider's position at rising trot on the pressure distribution, spine movements under the saddle, stirrups forces and locomotion of the horse. The ridden horse's back movements were measured using inertial measurement units fixed under the saddle at T6, T12, T16, L2 and L5 vertebrae. The horse's and rider's centre of mass (COM), the pressure between saddle and horse's back and force on the stirrups were measured using 2D kinematics, pressure mat and stirrup force sensors respectively. The pressure distribution was analysed for the whole mat and for three parts (cranial, middle, caudal). Three horses were trotted in the right rising trot (3.8m/s for 80 strides) by the same rider. Means±SD of each parameter for sitting and standing were compared using a Student's t test ($t=1.96$, $p<0.05$). The two beats rhythm of the trot was visible on the horse's COM trajectory and both phases were similar. During the sitting phase, the maximum of the vertical displacement of the rider's COM was significantly lower (-23 cm) and the rider's COM was nearer to the horse's COM. Stirrups forces showed two peaks of equal magnitude in every stride cycle for left and right stirrups but increased during the standing phase. Maximal forces applied on the right and left stirrups were 7.4±1.6 N/Kg and 7.5±1.0 N/Kg respectively. During the sitting phase, the pressure for the whole mat significantly increased by +3.1kPa and was localised on the caudal and middle part, under the seat of the rider. During the standing phase, force exerted on the back was focused on the cranial and middle part of the saddle, region of the stirrup bars. During the sitting phase compared to standing phase, the T12-T16 and T16-L2 angular ROM were significantly reduced (-3.2°; -1.2°) and the T6-T12 and L2-L5 ROM were significantly increased (+1.7°; +0.7°). The present protocol synchronizing various measuring techniques, including the study of spine movements under the saddle, is a key to better understanding the horse-saddle-rider interaction. Both phases of rising trot created two distinct pressure distributions on the horse's back inducing a change on the horses' spine movements. During standing phase, forces exerted on the back derived from the rider via the stirrups. During the sitting phase, saddle pressure increased under the seat of the rider inducing a reduction of the horse's back mobility in the caudal thoracic and thoraco-lumbar regions compared to the standing phrase.

Lay person message: The effect of the rider on the horse's back movements is highly dependent on his/her position which modifies the pressure distribution under the saddle. This study found that an increased pressure under the saddle is associated with a reduction of the horse's back mobility.

Keywords: Equine, back, IMU, pressure, rider, trot.

Poster n°38

Determinant factors of efficiency of the horse-rider coupling during frequency changes

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In horse-riding, rider's postural balance is permanently threatened. Previous studies have shown an optimal horse-rider coordination. Experienced riders' motions were continuously phase-matched with the horse comparing to novice riders. Trunk orientation was closer to vertical, with a forearm more distant from the trunk in experienced riders than in novice riders. The present study aimed to assess the effect of frequency change of an equestrian simulator on modes of coordination and of segmental stabilization according to the level of rider expertise. It was assumed that experienced riders should display more in-phase coordination with horse movements, combined to an articulated segmental functioning. 10 experienced and twelve novice riders voluntarily participated in a horse-rider sensorimotor coupling task for 180 sec. Simulator' sway frequency was manipulated (60, 70 and 80 rpm). Riders were exposed to acceleration (60 to 80 rpm) and deceleration (80 to 60 rpm) patterns. Ten anatomical markers were placed on the rider (head, C7, T10, pelvis, shoulder, elbow, wrist, knee, ankle and heel) and on the simulator. Optoelectronic cameras (Optitrack®, 250 Hz) were used to record rider's and simulator's motion. Discrete relative phases between human's markers and simulator were studied around the anteroposterior axis. Analyses revealed an in-phase mode of coordination between the rider's pelvis, elbow, wrist and knee motions and the simulator (indicating that markers were moving in the same way), and an antiphase mode of coordination between the rider's head, C7, shoulder, ankle and heel and the simulator (indicating that markers were moving in opposite way). Deceleration did not show any effect of expertise ($F_{1,19}=0.14$, $p>0.05$). However, during acceleration experienced riders wrists were more in phase (12±10°) than novice riders (24±17°). Anchoring index analysis aimed at identifying modes of segmental stabilization (articulated vs in block); forearm was more stabilized in space (articulated mode) in experienced riders ($F_{1,20}=8.33$, $p<0.01$). The rider's forearm could serve as a favourite mode of spatial referencing for postural orientation and balance. Experience has an effect in demanding tasks, and mainly in acceleration and at the upper limb. The more the forearm is in-phase, the more it is stabilized. This is likely due to a greater proprioceptive ability in expert to use appropriately tactile cues provided by hand sensors through the horse's bridle, and to reduce uncertainty. This study indicates that the forearm stabilization in space can facilitate the control of head-neck orientation of the horse and the perception of cues related to horse welfare.

Lay person message: Teachers and coaches could use an equestrian simulator to help riders to learn how to better stabilize the arm in space and to gather haptic cues on horse acceleration movements. This will enable them to achieve greater bodily synchronization before riding live horses and consequently safeguard the welfare of ridden horses.

Keywords: horse-rider interaction, simulator, coordination, orientation, welfare.

Poster n°39

Rein tension peaks within canter

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Rein tension has a cyclic pattern within each gait but changes in magnitude and symmetry of rein tension during specific dressage movements has not been described. The aim was to describe and compare the amplitudes of rein tension at canter while performing different movements on the left and right reins. Using an observational study design, rein tension data were collected from 8 professional riders each riding 2-3 familiar horses during a dressage training session using a rein tension meter (128 Hz) logged by an inertial measurement unit sensor. Data were stride-split at the maximal positive vertical poll acceleration. Strides were categorized by rider position (sitting, two-point), corners, circles, lateral movements, and stride length (collected/working/lengthened). Within each stride, maximal (MAX) and minimal (MIN) rein tension peaks were identified (using a peakfinder (the Matlab tool peakfinds)) and peaks were analysed using mixed models technique. Direction of the horse's nose movement relative to the trunk (cranial, caudal) was determined using gyroscopic sensor data. Analysis of 21,548 strides indicate that MAX magnitudes were higher in sitting canter (60 N) compared to two-point seat (47 N, $p<0.0001$). The left circle had higher MIN (only outside, left/right 6.9 N/5.4 N, $p<0.0001$) and MAX rein tension values than the right circle (inside left/right 60 N/51 N, $p=0.01$; outside left/right 61 N/57 N, $p<0.0001$). MAX and MIN values (both outside reins) were higher at lengthened compared to working canter (MAX lengthened/working 81 N/64 N, $p<0.01$; MIN lengthened/working 13 N/5.7 N, $p<0.0001$). MIN values were lower in collection (5.7 N) than when lengthening (15 N) the stride ($p<0.0001$). Inside rein tension values were higher in half pass to the right (MAX/MIN- 77 N/13 N; $p<0.0001$) than in half pass to the left (MAX/MIN- 62 N/11 N; $p<0.0001$). For the MAX variable all evaluated pairwise comparisons were significant at $p<0.0001$, except inside and outside right canter ($p<0.010$) (left canter inside/outside 58 N/64 N; right canter inside/outside 63 N/59 N). Magnitudes were larger if the nose was moving caudally/cranially at the MAX (55 N/53 N) event or cranially /caudally at the MIN (3.3 N/3.1 N) event. Variation attributed to riders/horses was 0/27% for MAX and 19/7% for MIN. When analysed at stride-level rein tension varied between rider-horse dyads during canter and laterality/asymmetry influenced rein tension. This study suggests that rein tension should be studied at stride level and in the future correlated to behaviour during the stride or the adjacent strides. However, the often chaotic rein tension pattern makes these studies challenging, e.g. to interpret even raw rein tension for temporal causality is not straightforward.

Lay person message: During canter rein tension varies between low and high values within each stride. It was shown that riders influenced the size of the low values more whilst the horses influenced the size of the high values to an overwhelming degree. Sidedness, either in the rider or horse, also appeared to influence the resulting level of rein tension.

Keywords: rein, tension, horse, stride split, canter, behaviour.

Poster n°40

The impact of bitted and bitless bridles on the Therapeutic Riding Horse

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This study examined the impact of bitted bridles and bitless bridles on 8 control horses involved in Therapeutic Riding (TR) who always wore a bitless bridle and 8 study TR horses that changed from bitted to bitless or bitless to bitted bridles within TR sessions. Tacking up and untacking associated with each TR session (duration 30 minutes each) was videoed and data were analysed using a behaviour profiling ethogram. TR sessions involved the same riders in each session who were coached by the same coach at the same time each week, using the same lesson plan and with the same leader. The ethogram consisted of negative and positive behaviours displayed by TR horses. Negative behaviours included negative expression such as ears pinned back and attempts to bite the leader, aversive behaviour such as moving off prematurely from the mounting block, oral distress such as chomping (teeth) and clenching on the bit and resistant behaviour such as head shaking (side-to-side movement) and head tossing (up-and-down, nose flip). The results of each TR session were analysed and compared. Negative expression differed significantly across the four riding sessions (χ^2= 10.750, d=3, <0.05) and was highest in the bitted riding session (23.00±16.69 occurrences) compared to the other sessions (15.40±7.20). TR horses have the lowest negative expression when using bitless bridles (9.00±7.24). Aversive behaviour is significantly lower in the control horses (Mean Rank=4.08; U = 3.500, z = -2.658, p<0.05) compared to horses that switch from a bitless to a bitted bridle (Mean Rank=10.06). The control horses (Mean Rank=3.00) have lower incidences of oral distress than study horses that switch to bitted bridles (Mean Rank=9.50; U = 0.000, z = -2.932, p<0.01). No significant difference in resistant behaviour was present between the bitless control horses and the study horses when horses changed to bitted bridles or started in bitted bridles. Finally positive behaviours are highest amongst the bitless control horses (Mean Rank= 12.38) when comparing study horses that started in a bitted bridle (Mean Rank=4.50, U = 0.000, Z = -3.363, p<0.001) and also when comparing control horses (Mean Rank=12.50) with horses that changed to a bitted bridle during the session (Mean Rank=4.63; U = 1.000, Z = -3.258, p<0.001). These results suggest that TR horses in bitted bridles display higher rates of negative behaviours and lower rates of positive behaviours than those in bitless bridles. As a result this study challenges the necessity of bitted bridles in TR sessions.

Lay person message: This study suggests that Therapeutic Riding horses in bitted bridles may show higher levels of negative behaviours and lower levels of positive behaviours than horses wearing bitless bridles. This study contributes to the growing body of research which examines the impact of bitted bridles on horses' welfare, specifically within Therapy Riding.

Keywords: horse, therapy, bitted, bitless, bridle, behaviour, welfare.

Poster n°41

Influence of rider's actiontype profile on rein tension

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The connection that exists between the rider's hands and the horse's mouth through the reins and the tension that is executed on this connection is an important aspect of training horses. Rein tension is mostly determined by the rider and has been shown to differ between riders, as well as between the hands of each rider. The Action Types Approach (ATA) profiles differences in cognitive, emotional and motor preference of people and is therefore believed to influence the riding style of the rider. This pilot study investigated the influence of the Action Types profile (ATP) of a rider on the rein tension in a simple riding test. The ATP of sixteen riders actively competing up to Grand Prix St. George level in the Netherlands was determined by a certified Action Types tester on several binary variables. Individual rider rein tension was then measured with a rein tension meter (Centaur Pro S-2013) in Newton (N) showing the maximum and minimum tension as well as tension difference between left and right hand during a basic riding test on their own horse, including trot and canter on a right and left circle as well as on a straight line. The comparison of the different rein tension measurements for the binary variables of the defined ATP showed first significant results in the original measurements as well as in different averages (maximum and minimum tension during the whole test, difference in tension of both hands on all straight lines) calculated. Riders with a preference for the use of gross motor skills have overall in both hands a significantly higher maximum rein tension (M=76.5N; SD=21.6) than riders with a preference for fine motor skills (M=51.4N; SD= 17.9; t_{14}=2.55, $p<0.05$, two tailed). Riders with an ATP high in introversion have significantly higher minimal rein tension in both hands (M=9.2N; SD=5.8) than riders with an ATP high in extroversion (M=3.0N; SD=2.6; t_{14}=2.24; $p<0.05$, two tailed) as well as significantly higher maximum rein tension in both hands (M=65.7N; SD=22.8) than their extrovert counterparts (M=40.1N; SD=17.0; t_{14}=2.24; $p<0.04$, two tailed). The shoulder position of the rider shows to influence the rein tension in such a way that overall when riding on straight line with a counter clockwise position have a significantly higher tension in their left hand (M=-3.49N; SD=4.34) than riders with a clockwise position (M=2.44N; SD=4.62; t_{10}=-2.59; $p<0.05$). Further points of connection between rein tension and the ATA were indicated but were considered less valuable due to a lower power due to the small sample size ($p<0.1$). This pilot study reveals a connection between rein tension and rider ATP and forms a baseline for the development of specific training programs for dressage riders according to their ATP.

Lay person message: A rider's Action Type profile which is determined by cognitive, emotional and motor preferences of the rider influences the rein tension applied within a horse-rider combination. The measured individual rider preferences for gross and fine motor skills, extroversion/introversion and mobile point may influence the rider's rein tension when riding on a straight line or a circle in trot or canter.

Keywords: rein, tension, rider, Action Type profile, preference, training.

Poster n°42

The symmetry of rein tension in English and Western riding and the impact of human and equine laterality

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The aim of the study was to investigate the influence of equine and human laterality on rein tension and compare symmetry between Western and English riding styles. Mean and standard deviation of rein tension was measured in 36 riders (10 left-handed (LH), 25 right-handed (RH), 1 ambidextrous) and 36 horses (21 right-lateralised (RL), 17 left-lateralised (LL) as assessed by their riders based on the horses' preferred side for dressage tasks) in walk, rising and sitting trot, canter and gait transitions in both directions on straight lines and circles in E (32 rides) and W (13 rides). For 7 E and 9 W rides, the time shift between the tension peaks of left and right reins (deviance in time between maximum increase in tension) was determined for all gaits and manoeuvres. Depending on data-distribution, mixed- (normally distributed data) or generalized mixed-model analyses (non-normally distributed data) were used (F test throughout). No significant difference in mean rein tension between LH and RH riders or riding on circles and straight lines was detected (all $F<1.0$; $p>0.1$). Horse's laterality tended to affect mean rein tension with higher mean tension in both reins of the LL horses (9.2&8.8N) compared to the RL horses (6.9&5.8N, $F_{2,1355}=3.68$; $p<0.05$). In a clockwise direction almost equal mean tension was applied in the left (7.51 N) and right (7.58 N) rein. In a counter-clockwise direction mean tension in the left rein (8.58 N) was significantly higher than in the right rein (7.04N,$p<0.005$). Riders who were unfamiliar with the horse applied a lower mean tension (5.8 N, $F_{1,1355}=4.13$, $p<0.05$) with lower standard deviation (1.33 N, $df_{1,1355}$; $p<0.05$) than the familiar, regular riders (9.56 and 1.7N, respectively). Higher mean tension and standard deviation was detected in English (11.2 and 1.93N) rather than Western (4.16 and 1.1N; $F_{1,13575}=24.7$; $F_{1,1355}=28.52$; both $p<0.0001$) riding. In Western riding the mean time shift between tension peaks in left and right reins was significantly lower (0.026 sec vs 0.071 sec, $F_{1,407}=8.74$; $p<0.05$). Results suggest that factors such as riding style and rider's familiarity with the horse have a greater influence on the quality of rein contact compared to either horse or rider laterality. Since Western riding resulted in lower and more symmetric rein tension, and asymmetric rein tension and cues affect horses' learning process, training might be easier for Western horses.

Lay person message: There was no difference in rein tension between left- and right-handed riders. The horse's laterality tended to affect rein tension. Western riding produced a lower, more symmetric rein tension than English riding. Factors such as rider's experience and familiarity with the horse influenced rein tension. Since Western riding produced a lower, more symmetric rein tension than English riding it may be argued to be beneficial for the horse.

Keywords: rein, tension, laterality, Western, English, riding.

Poster n°43

The relationship between approach behaviour and jump clearance in show-jumping

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Behavioural signs of conflicting motivation in ridden horses may result from underlying physical and/or mental issues that can be detrimental to both performance and welfare. In the competitive sport of show jumping, performance is measured by obstacle clearance, regardless of behavioural signs of conflict during the jump approach, which can be overlooked. If an association between the occurrence of specific behaviours and jump errors is found then these behaviours could be key signs of underlying problems. The aim of this study was to investigate whether specific behaviours are indeed associated with errors made during jumping. Video footage of the Hickstead Longines Royal International Horse Show was used to record the approach behaviour and jump clearance of 20 horse-rider combinations over five different jump configurations (J1 treble, J2 water jump, J3 double of gates, J4 oxer, J5 double upright/oxer). The frequency of the following behavioural events was recorded: tail swish (TS), head toss (HT), backing off (BO), ears prick forward (EF), ears twitch back (EB), drops head (DH), lateral head shake (LHS). Behaviour was recorded from landing from the previous jump to the take-off, with the frequencies being divided by the number of strides between jumps to control for distance differences. Faults accrued at each jump were recorded. Two horses withdrew before J5 so analyses used data from N=18 horse-rider combinations. Overall, significant differences in the frequency of LHS and EB behaviour were recorded in relation to subsequent jump clearance. On the approach to jumps that were cleared, significantly less LHS (Mann-Whitney U Test: $U=530$, $z=-2.69$, $p<0.01$) and EB behaviour (Mann-Whitney U Test: $U=611$, $z=-2.73$, $p<0.01$) occurred than during the approach to jumps that were knocked down. The faults accrued at each jump varied significantly (Friedman test: $\chi^2=43.39$, df=4, n=18, $p<0.001$), with more errors being made at J3 than at any of the other jumps (Wilcoxon: $p\leq 0.001$) and none at J2. The frequency of the following behaviours varied significantly on the approach to the different jumps (Friedman test): HT $\chi^2=30.79$, df=4, n=18, $p<0.001$), EF $\chi^2=17.44$, df=4, n=18, $p<0.01$), LHS ($\chi^2=16.59$, df=4, n=18, $p<0.01$), DH ($\chi^2=19.12$, df=4, n=18, $p\leq 0.001$). The association between jump type, approach behaviour and subsequent jump clearance requires further investigation. However, the increased frequency of specific behaviours (EB, LHS) during the approach to jumps at which errors were made suggests that these particular behaviours relate to underlying problems and should not be ignored.

Lay person message: During the approach to a jump two specific behaviours (ears back and lateral head shaking) were found to be associated with subsequent jumping errors and as such may be signs of underlying problems that warrant further investigation.

Keywords: equine, jump, performance, conflict, behaviour, welfare.

Poster n°44

Assessment of poll pressure induced by a baucher/hanging cheek snaffle

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Levered bits such as the Pelham and bits with a pulley-action e.g. the continental gag are commonly accepted to produce pressure on the poll upon tensioning of the reins. Non-levered bits such as snaffles are thought to apply pressure solely on the tongue and lips of the mouth. The baucher, also known as the hanging cheek snaffle, is included in the category of fixed cheek snaffle bits. Its action on the poll appears to be unresolved with a clear division between two schools of thought, the first, that it causes pressure on the poll, and the second, that it alleviates pressure on the poll. The aim of this study was to determine the nature of the pressure (or not) on the poll due to the action of the baucher bit, through measurement of the forces transferred from the reins to the poll independently of a riders' ability. A lever, consisting of a bar resting on a fulcrum (pivot), transmits an applied force in one direction on one end, over the fulcrum, to move a load in the opposite direction. In a levered bit the rein force is applied to the lower shank of the lever backwards and upwards and transmitted through the mouthpiece (fulcrum) to the upper shank which causes the cheek pieces to be pulled forwards and downwards resulting in poll pressure. The baucher lacks an extension arm below the fulcrum and therefore cannot formally be described as a lever. Electronic force gauges were inserted into the cheek-piece and rein on the same side of a bridle on a horse to measure any forces applied to the poll by the baucher. This closed system finds the operational characteristics of the bit by measuring the ratio of the data from the two gauges. High rate (200 samples per sec) data signals were transmitted to a computer during three independent 30s sequences of canter. Plotting cheek-piece tension values against rein tension values shows the amount of rein tension transferred to the poll. It was found that over a range of rein tensions between 0 and 30 N the baucher exhibited no additional poll pressure. Beyond this range only a very modest incremental increase in poll pressure develops. This rise at extremely high rein tension values transfers no more than a 5% increment of the rein tension forces. For example, at 60 N the additional poll pressure was only around 2.5 N. We propose that the baucher acts no differently to all other bits in translating backwards along the tongue and towards the poll when tension is applied to the rein. This relaxes the cheek-piece tension rather than adding to it as is often seen by the bulging of the cheek pieces whilst riding. Any action that could produce tensioning in the cheek-pieces has first to overcome this relaxing of pressure on the poll before becoming apparent. Without a full understanding of the action of a bit a rider may use it inappropriately leading to conflicting signals, potential discomfort to the horse and even put both horse and rider at risk for injury. The baucher appears to be one of the most misunderstood bits and this work clarifies its action on the horse.

Lay person message: Certain bits are expected to act on the poll of the horse and are considered useful when more control is desired. The baucher is often confusingly described as having a strong effect on the poll. This study showed that in reality the baucher exerts a poll-relief effect likely by lifting up inside the horse's mouth when the reins are taken up. Riders may inadvertently be using this bit on horses with mouths that are sensitive to pressure thus causing undue discomfort.

Keywords: bit, Baucher, poll-pressure, rein tension, lever, force.

Poster n°45

Interaction between human voice and horse gait transitions in longeing training

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Longeing training is a method used between initial and advanced training and often involves teaching horses how to respond to non-contact human signals. This training frequently uses auditory and visual stimulation such as tongue clicks, vocal sounds and long whip motions. Specifically, auditory stimulation is considered to be the key part of the communicative function of horses, which have excellent hearing ability. However, few studies have considered how auditory stimuli are used in various training methods. Accordingly, the aim of this study was to elucidate how the human voice is used in longeing training and how it aids the training, with a particular focus on auditory stimulation. The experimental task involved gait transitions between walk, trot, and canter in an indoor circular arena. The handler was instructed to signal a gait transition at a particular point. The voice of the handler was recorded with a microphone (20 kHz) and the acceleration of the horse was measured with an accelerometer (60 Hz). Thereafter, audio data were labelled with the conversation analysis software ELAN, and the acceleration data and the labelling of gaits were based on the infinite Gaussian mixture model. Low-tone voice (e.g. "*Oh*"), high-tone voice (e.g., "*Good*") and tongue clicking were identified from the voice data, and the most frequent of these was tongue clicking. Thereafter, voice data were divided into 2s sections. The independent t-test was used to test for significant differences in frequency of occurrence between all sections and sections around the transition point. Tongue clicking was used more frequently in the 2 s before (t_{1014}=10.10, $p<0.001$) and after (t_{1014}=4.11, $p<0.001$) upward transition points compared with all sections. Likewise, the low-tone voice was used more frequently before (t_{1011}=9.14, $p<0.001$) and after (t_{1011}=3.00, $p<0.01$) downward transition points compared with all sections. Therefore, tongue clicking was considered a signal for encouraging horses to move forward, and the low-tone voice was considered a signal for encouraging horses to slow down. Although the number of observations was small, the high-tone voice generally appeared around the upward gait transitions. Based on these observations, the voice signal changed the gait and transition, and therefore is a means of instructing a moving horse via the human voice. The changes in the horse's behaviour associated with the voice signals suggested that information was transmitted during this interaction. The study of the transmission of a wide variety of signals has increased rapidly in recent years, and new sensory technologies are expected to develop as a result.

Lay person message: Horse movements in equitation involve non-verbal communication between horses and humans. We studied voice signals, which are frequently used in longeing training, and the results suggested that different types of voice signal were used successfully to signal upward and downward gait transitions.

Keywords: clicking, voice, interaction, longeing, gait, transition.

Poster n°46

Measurements performance of a horse rider – a case study on contribution of the stirrup forces

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The horse rider, as every athlete, studies the measurement of his body movement and he particularly interests in the biomechanics relationship between his/her body and his/her athlete horse. The human's body movement produced is characterized by a distribution of the weight and a coordination of horse rider, i.e. legs, reins and stirrups. The aim of this study was to propose instructors or coaches a procedure for assess rider balance, particularly rider actions on stirrups. In this case study of one rider, stirrup pressures were investigated across five conditions: at gallop on horseback in a straight line with the personal saddle of the rider, at gallop and at sitting trot on an equestrian simulator with the personal saddle and with a unfamiliar saddle. Stirrup pressures were recorded using a specific device embedded in a pocket on the saddle pad and transmitting live data by Wi-Fi to a computer. The forces exerted by the horse rider on the stirrups were measured at 1 kHz. For six strides, mean peak force (MPF) and standard deviation (± SD) were computed for the right stirrup (RS) and for the left stirrup (LS). These values in Newton were normalized by dividing them by the body weight of the horse rider (667 N) and are therefore dimensionless. At sitting trot, on the equestrian simulator, MPF ranged from 0.20±0.03 to 0.48±0.07. These values corresponded to values in the literature. Comparing to the trot, MPF were the highest at gallop on horseback (0.71±0.09 on the RS and 0.57±0.13 on the LS). In this case study, stirrup pressures were quite asymmetric. On the equestrian simulator, at gallop and at sitting trot, the asymmetry was more significant with the familiar saddle (at sitting trot: 0.48±0.07 on the RS vs 0.24±0.08 on the LS; at gallop: 0.72±013 on the RS vs 0.20±0.07 on the LS) compared with the unfamiliar saddle (at sitting trot: 0.25±0.07 on the RS vs 0.20±0.03 on the LS; at gallop: 0.34±0.06 on the RS vs 0.20±0.05 on the LS). Measurements on stirrups, which are collected and transmitted in live to instructors or coaches, allow them to objectify the link between the actions of the rider that are often invisible and their expertise of locomotion of the horse. The coach or the teacher can verify whether the rider actions are correct and can also evaluate their effects on the horse. The procedure proposed in this study with measurements on an equestrian simulator removes the effect of the horse on the rider balance. Measurements taken when riding in the familiar and the unfamiliar saddle showed the impact of the saddle on the rider balance. A combination of stirrups, reins and saddle force data could provide additional information about rider balance.

Lay person message: The instructor or the coach can complete their expert assessment with measurements of stirrup forces on an equestrian simulator and on the track. Comparing the rider's movement when riding in their personal saddle and in an unfamiliar saddle, at trot and at gallop, the instructor or the coach can objectify the factors that influence the performance of the rider, particularly his/her balance.

Keywords: Training, rider, stirrups, force, saddle, balance.

Poster n°47

A preliminary investigation to compare the pressure exerted by a conventional square saddle pad and a novel wing saddle pad behind the saddle

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Anecdotal evidence suggests that square saddle pads can cause pressure sores and chafing in the area behind the saddle. The aim of this study was to determine if pressure on the lumbar spinous processes region of the horse's back applied by a novel wing saddle pad was measurably different to that of a conventional square saddle pad made of the same fabric. A two condition counter-balanced repeated measures crossover design study involved six horse-rider combinations competing at BE 100 and BE Novice level eventing. A Tekscan Conformat pressure system was fitted between the saddle pad and the horse's back to extend at least 50mm behind the most caudal aspect of the saddle pad. The pressure system was calibrated as recommended by the manufacturer using load calibration before each horse-rider was tested. The horse-rider combination then spent a total of ten minutes in walk, trot and canter adjusting to the environment. Pressure data (kPa) were collected, during two minute data collection periods at each gait, at five frames per second for five seconds post thirty seconds in each gait. This protocol was repeated three times in halt, walk, sitting trot, rising trot and canter on a straight line. The combination then halted and the saddle pads were removed and recalibrated before being used on the next horse-rider combination. The mean pressure (kPa) at each gait was calculated for an area corresponding to the lumbar dorsal spinous processes, with the most caudal aspect of the saddle pad at its' centre. Data were then analysed and a Wilcoxon's test for matched pairs (SPSS v21.0) conducted to test for significant differences. The mean pressure between the wing saddle pad and the horse over the lumbar spinous processes was significantly less (stand, walk, sitting trot and canter ($z = -2.201$, $n=6$, $p<0.01$ for all and rising trot $z = -2.207$, $n=6$, $p<0.01$) than the mean pressure when using the conventional square saddle pad, in all gaits. During sitting trot, rising trot and canter the wing Saddle Pad resulted in no detectable pressure behind the saddle over the lumbar spinous processes. If a horse is in physical discomfort, or even pain, during ridden activities they are more likely to exhibit behaviours indicative of conflict. This has a negative impact on horse welfare and places the handler/rider at increased risk of injury. The wing saddle pad significantly reduced, and in trot and canter removed, the detectable pressure exerted at the caudal aspect of the saddle pad over the lumbar spinous processes.

Lay person message: A square saddle pad may cause pressure over the equine lumbar spinous processes. Using the wing pad instead reduced this pressure and completely removed it during trot and canter. This should improve the health and safety of both horse and rider and reduce the chance of injury.

Keywords: Saddle pad, pressure, equine, back, health, welfare.

Poster n°48

Practice and attitudes regarding trimming of equine vibrissae (sensory whiskers) in the UK and Germany

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Vibrissae or sensory whiskers of the horse are specialised stiff hairs on the facial skin connected by sensory nerves to the somatosensory cortex of the brain. Despite the important role of these sensory organs for detection of the near environment and protection of the eyes and muzzle area, it has been a traditional practice to trim vibrissae. In Germany, the trimming of muzzle and eye vibrissae was made illegal in 1998 for welfare reasons. The aims of this study were to compare practices and attitudes regarding trimming vibrissae in Germany and the UK (where vibrissae trimming is legal), and to investigate if the prevalence of trimming varied between equestrian disciplines. A questionnaire was distributed via social media in the appropriate language in both countries. Horse-keepers were asked to categorise themselves as leisure or competitive, and if the latter their main competitive discipline. They were further asked whether and why they trimmed vibrissae. Relationship between country, discipline and tendency to trim vibrissae were analysed using Pearson's chi-squared tests. Differences between disciplines were further examined by post hoc analysis of residuals. Horse-keepers in the UK were more likely to trim vibrissae (28%, 116 of 412 respondents) than those in Germany (1%, 2 of 171) (χ^2 (1, n=583) = 54.51, $p<0.001$). In the UK, those that do not trim were significantly more likely to agree with the practice being banned (80%) than those who do trim (15%) (χ^2 (1, n=412) = 150.8, $p<0.001$). Competition respondents were more likely to trim (44%, 69 of 158) than leisure (17%, 37 of 223) (χ^2 (1, n=412) = 33.8, $p<0.001$). There was variation in trimming between the competitive disciplines (χ^2 (3, n=158) = 17.5, $p=0.001$) with highest rate of trimming in showing (67%) and lowest in dressage (25%) (analysis of residuals, $p<0.05$ in both cases). The most common reasons given by respondents who trimmed were 'it looked tidy' (65%), 'competition requirement' (27%) and 'taught this way' (25%). Almost all respondents correctly identified at least one function of vibrissae, but 1% of UK respondents stated they had no function. As vibrissae are of welfare importance, horse-keepers should be encouraged to leave them intact. Based on the German data, the results of this study suggest that making the practice of trimming vibrissae illegal in the UK may reduce its occurrence. In this study UK competition riders, particularly those in showing, were most likely to trim. In the absence of (or as a step toward) a legislated ban, it is recommended that efforts should be made to educate horse-keepers about the anatomical and physiological role of vibrissae in equine welfare, and to ensure that trimming is not required, rewarded, or encouraged within competition.

Lay person message: Vibrissae or sensory whiskers are valuable to the welfare of the horse by protecting the eyes and muzzle. In this survey 28% of horse-keepers in the UK (where trimming is legal) trimmed whiskers, compared to 1% in Germany (where trimming is illegal). Competition riders, particularly in showing, were more likely to trim than leisure riders and the most common reason given was for a tidy appearance.

Keywords: vibrissae, whiskers, trimming, equine, welfare, management.

Poster n°49

To eat or not to eat: A review of feeding practices in relation to prevention and treatment of equine behavioural problems

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Horses have been evolved to spend a considerable amount of time foraging; 12-16 hours of the 24-hour cycle are common for feral horses in moderate climates. Their average feeding cycle is 2-3 hours foraging followed by an hour of resting. Since the domestication of the horse, husbandry and management has gradually deviated away from these natural cycles. Currently, horses experience modern husbandry practices in which the availability of resources do not seem to be in line with their ethological needs. As a result many horses have adapted their behaviour to the time budget schedules of their keepers. Meanwhile a substantial proportion of modern horses show some sort of behavioural problem, ranging from severe and life threatening to just oddities. These behaviour problems often influence equine trainability and performance and vice versa. This review explores if, and if so how and to what extent different elements of modern feeding practices could be related to the prevention and treatment of equine behavioural problems. A list of deviations of modern feeding practices compared to feral feeding was constructed, including features such as 'uniformity in fodder', 'possibility for social facilitation during foraging' and 'seasonal variation in body condition score'. The outcomes of searches of peer-reviewed literature (>100 papers) and more "grey" literature (>50 reports) allowed associations or causal relationships between these listed elements of feeding practices and behavioural problems to be extensively explored. The results show that oral stereotypes are often related to feeding practices in general. However, the question of whether this is caused by the feeding routine itself or not remains unanswered, since many aspects of feeding practices were not mentioned. In addition, it was reported that anticipation of food might be related to the display of stereotypic behaviours. Anticipatory behaviour can be a potential indicator of welfare since it reflects reward-sensitivity related to previous experiences within the husbandry system. This presumes compensatory mechanisms between stress- and reward-systems, but fails to determine which elements are responsible. The reliability of the reviewed studies ranged close to zero (in many studies) to significant in a few (cohort) studies. In conclusion manipulation of the nutritional profile, adaptation of feeding time interval, altering the flavour-, presentation- or location of the foodstuffs, using unusual foods or designs as enrichment or redesigning (solitary) housing systems to allow visual contact while foraging, could all reduce equine behavioural problems. However, it will also made clear that there is a need for more evidence-based studies to examine the separate elements of feeding in more detail which are essential to enhance the prevention and treatment of equine behaviour problems and thus to equine trainability and performance: i.e. Equitation Science.

Lay person message: This study explored to what extent different elements of modern feeding practices could be related to the cause, prevention and treatment of equine behavioural problems. Many elements of feeding practices need more and robust scientific study to gain a greater insight into the relation of feeding to trainability and performance and thus link to ES and welfare.

Keywords: equine, feeding, practice, behaviour, problems, welfare.

Poster n°50

Physiological stress responses of mares to gynaecological examination in veterinary medicine

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Horses are exposed to a variety of anthropogenic stressors. While stress perceived by horses during riding, transport or in different housing systems has been quantified, their stress response to most veterinary procedures has not been assessed so far. The gynaecological examination of mares includes transrectal palpation and ultrasonography of the genital organs. Potentially stressful situations can trigger a violent flight response in horses. Therefore stressful challenges during veterinary examinations should not only be minimised for animal welfare reasons but may also endanger safety of the examining veterinarian and the horse itself. We hypothesized that gynaecological examination causes a stress response which decreases with repeated examinations. Based on salivary cortisol concentration, cardiac beat-to-beat (RR) interval and heart rate variability (HRV) parameters SDRR (standard deviation of the RR interval) and RMSSD (root mean square of successive RR differences), the stress response of mares (n=21) to transrectal palpation and ultrasonographic examination of the genital tract was analysed. Examinations lasted 185±56 seconds (mean±SD; range 120-300). Mares differed in experience to the examination procedure and were either pluriparous (experienced; n=13) or in their first breeding season (inexperienced; n=8). They also differed with regard to examination frequency and were either examined every 6 hours (n=10) or at 24-48 hour intervals (n=11). All mares were followed for 3 examinations and 13 mares for 4 examinations. Data were analysed by GLM-ANOVA for repeated measures with group or examination number as between subject and time as within subject factor (statistics program SPSS 22). The RR interval decreased (F_6=3.9, p<0.01) during the veterinary procedure but neither changed from examination 1 to 4 nor differed between experienced and inexperienced mares. The RR decrease was higher in mares examined every 6 hours than in mares examined every 24-48 hours (F_1=4.20, <0.05). In response to gynaecological examinations neither SDRR nor RMSSD changed while salivary cortisol concentration increased slightly with a peak 15 min after the examination (F_6=8.8, p<0.001,). The cortisol response was more pronounced in mares examined at 6-hour intervals (from 1.5±0.7 to 2.4±1.3 ng/ml) than in mares examined every 24-48 hours (from 1.5±1.1 to 1.9±1.2 ng/ml; time x examination frequency (F_6=3.1, p<0.01). No significant differences existed between experienced and less experienced mares and between examinations 1 to 4. The lack of changes in heart rate and HRV and only minor increase in cortisol release indicates that gynaecological examination was not perceived as a major stressor by the mares.

Lay person message: We evaluated the stress response of mares during rectal palpation and ultrasonographic examination of the genital organs by measuring cortisol concentration in saliva and analyzing heart rate and heart rate variability. The gynaecological examination was no major stressor for the horses. The stress response was influenced by examination frequency but did neither change with repeated examinations nor differ between experienced broodmares and mares in their first breeding season.

Keywords: equine, mare, breeding, veterinary examination, stress, welfare.

Poster n°51

Relationships between owner-reported behaviour problems and husbandry, use and management of horses

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Using an online-questionnaire sent to 5158 horse owners, information regarding husbandry conditions, management and use of their horses as well as the presence of (owner-perceived) behaviour problems was gathered from 1562 respondents (response rate=30.3%) living in Germany. Health data were available for these horses from an insurance company. For a proportion of 9.5% of the horses, owners indicated the presence of at least one behaviour problem such as crib-biting or wind-sucking (2.7%), excessive fearfulness (2.6%), teeth-grinding (1%), excessive aggressiveness (0.9%), box-walking (0.7%), weaving (0.6%) or excessive wood-chewing or pawing (both 0.2%). Further behaviour problems such as stallion-like behaviour and food-guarding were grouped together into miscellaneous behaviour problems (2.7%). Generalized linear mixed models were used to assess the probability of the occurrence of behaviour problems in dependency of husbandry conditions, management and use of the horses. For horses that received only once (25±22%) or twice (33±27%) a week turnout, the probability (± standard error) of owners reporting excessive fearfulness was substantially higher than for horses that received more frequent turnout (3±0.5%, t_{1213}=3.36 and 2.40, respectively; both $p<0.05$). However, horses that were perceived to be unduly fearful by their owners, were not more likely to suffer from accidents or diseases resulting in sutures or other surgeries, compared to horses with normal levels of fearfulness ($F_{1,1285}$=0.28 and $F_{1,1285}$=0.01, respectively; both $p>0.1$). Possibly, the horse owners' perception as to what constitutes excessive fearfulness differs considerably and does not provide an accurate reflection of horses' behaviour. Alternatively, it is also possible, that owners of particularly fearful horses take increased precautions to prevent accidents. Horses that were kept individually rather than in group-housing were significantly more likely to exhibit a behaviour problem (11.4±0.01 vs 4.5±0.01% probability of occurrence; $F_{1,1285}$=11.6, $p<0.05$). Contrary to some previous research, owners of dressage horses were not more likely to report a behaviour problem than owners of horses working in other disciplines ($F_{1,1273}$=0.6, $p>0.1$). Based on these results, further investigations are warranted to shed light on mechanism e.g., how to reduce overt fearfulness thereby improving training and welfare of horses.

Lay person message: The present survey revealed a prevalence of 9.5% for owner-reported behaviour problems in horses kept in Germany. Daily turnout was associated with a lower risk for behaviour problems in general, and group housing was associated with lower levels of fearfulness. Although a causal relationship has yet to be proven, results indicate that some problem behaviour might be reduced by introducing changes in horses' housing.

Keywords: equine, behaviour problems, stereotypy, aggression, fearfulness, housing.

Poster n°52

An objective measure of noseband tightness in horses: a novel tightness gauge

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Bridle nosebands may be loose or tight but they should not be so tight as to effectively clamp the horse's mouth shut thereby giving rise to serious welfare concerns. It is difficult, however, to provide tightness guidelines or to regulate and control the tightness of nosebands. Reasons for this difficulty include: (a) lack of a clear definition of tightness in this context, (b) absence of an instrumented objective measure of tightness and (c) limited scientific research relating to the short and long term effects of tight nosebands on horses. A tightened noseband is subject to tensional forces. These tensional forces generate compressive pressures on the supporting tissue which will, in general, be a complex function of the local anatomical and physical environment. These pressures and associated pressure gradients are likely to be key factors in any scientific assessment of noseband effects in the horse. Sub-noseband pressures have been measured directly but the complexity of the measurement site imposes stringent measurement protocols which are difficult to implement. A noseband lift-off principle is exploited in a novel noseband tightness gauge (0-200 N range) reported here. The gauge measured force is combined instrumentally with noseband width to provide a direct measurement of tension, i.e. an objective measure of tightness. Furthermore, a simple model is developed, combining anatomical and noseband parameters, which indicates nose sites most likely to experience extremes of noseband induced pressure. In a preliminary study designed to demonstrate the safety, utility and robustness of the gauge, an ISES taper gauge was used to classify the tightness of 3 noseband settings, 'two fingers' (2F0), 'one finger' (1F0) and 'half a finger' (0F5), on each of 15 horses prior to measurement with the noseband tightness gauge (3 x 15 = 45 measurements). Measured mean gauge tightness at the nasal planum was 23±2 N/cm at 0F5 tightness and 9±1 N/cm at 2F0 tightness. The corresponding forces for these tightness settings are 52 ± 5 N and 20 ± 2 N respectively (equivalent to 5 kg and 2 kg dead-weights). Clearly, these simple statistics serve only to demonstrate a quantitative correlation between ISES taper gauge based settings and measured tightness gauge readings. Much more significant is the fact that pre and post study calibration checking indicated excellent instrumental stability and reproducibility (linearity greater than 0.99, R^2 =1.0). Therefore, the gauge offers the prospect of a practical objective measure of tightness (a and b above) which could form the basis for evidence focused future studies to address (c) and, with expert guidance, could ultimately lead to a reliable tightness index for nosebands.

Lay person message: A novel electronic bridle noseband tightness gauge has been tested on 15 horses. The device proved to be safe, reliable and easy to use. Judging tightness levels using the common 'fingers' measure, 2.0 fingers and 0.5 fingers were found to correspond to the application of masses of 2 kg and 5 kg respectively to the noseband. The device is likely to prove useful in regulating noseband tightness.

Keywords: nosebands, tightness, electronic, measurement, gauge, welfare.

Poster n°53

Welfare of the hospitalized horse in veterinary clinics: assessment and impact of environmental enrichment

(Withdrawn at author's request)

Poster n°54

A preliminary study on the effects of head and neck position during feeding on the alignment of the cervical vertebrae in horses

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Evidence on the subject of how feeding could affect overall musculoskeletal health is largely anecdotal with very little scientific research. In modern stabling routines, the use of a hay net or other container to feed forage is common as many owners want to reduce wastage from floor feeding. The effect of head and neck position has been studied regarding its influence on the biomechanics of the horse during locomotion and how it can affect musculoskeletal health and function. The aim of this study was to investigate whether head and neck position during feeding had a significant effect on the alignment of the atlas and cervical vertebrae in the neck of the horse. Using a crossover study, twelve horses (4-14 years, mixed sex, similar work level) were fed hay from three different sources (haynet, Hay Bar, floor) spending 14 days in each condition. All horses were fed the same type and similar quality of forage (hay) and all had been examined by a veterinarian or equine dental technician within six months of the start of the study. All participants received four chiropractic (McTimoney approach) treatments by a qualified therapist blinded to treatments; at time periods 0, 14, 28, 42 days, each at the start of a new condition. Duplicate palpations for vertebral asymmetries and soft tissue tension (poll, neck, shoulder, pectoral, thoracic, lumbar, gluteal regions) were noted and recorded by the investigator. Soft tissue tension noted as were behavioural reactions. Frequency data were analysed using chi-squared test using a two-way contingency table. Data included the frequency of atlas rotation and tilt following each condition and the frequency of misalignments found in the cervical vertebrae (2-5) following each condition. Analysis indicated there was no significant association between forage feeding method and frequency of atlas rotation misalignment (Chi^2=5.5, df=4, $p<0.05$), atlas tilt (Chi^2=1.0, df=4, $p<0.05$) or cervical vertebrae misalignment (Chi^2=1.22, df=4, $p<0.05$). There was a significant association between muscle tension frequency in fore and hind quarters and feeding method (Chi^2=10.6, df=4, $p<0.05$). There was a higher frequency of horses with neck muscle tension following the haynet (36%) and Hay Bar (41%) condition but lower frequency following the floor condition (17%). Following the haynet condition all horses showed muscular tension in noted areas of the body, compared to the floor and Hay Bar conditions where a percentage of participants (33% and 16% respectively) had no muscular tension noted. This study provides preliminary data that feeding method may affect cervical spinal alignment and associated muscle tension. Further research is recommended using skin markers and electronic data analysis to establish measureable effects. Results may have implications surrounding rehabilitation following injury or encouraging healthier joint motion but more importantly it shows how horses are fed could have a detrimental effect on overall musculoskeletal health.

Lay person message: The method of feeding hay to horses (floor, hay net, Hay Bar) affects the head and neck position on a daily basis. This study suggests an effect on the musculoskeletal system, with notable differences in areas of muscle tension. It highlights concerning links between how horses are fed and their musculoskeletal health, as well as implications for rehabilitation.

Keywords: equine, welfare, vertebrae, forage, hay net, hay bar.

Poster n°55

Acute physiological response of male and female horses to different short-term stressors

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Horses are exposed to a variety of short-term potential stressors. This includes equestrian sports, transport, exposure to new conspecifics, humans, novel objects or unknown situations and tasks. In order to reduce stress in horses, it has to be known to what extent a particular challenge is perceived as stressful by horses. In this study, salivary cortisol concentrations, heart rate (HR) and heart rate variability (HRV) parameters SDRR (standard deviation of the beat-to-beat interval) and RMSSD (root mean square of successive beat-to-beat differences) were determined in 12 Shetland ponies (6 stallions and 6 mares) in response to exposure to a stationary flashlight (novel object), running exercise (free movement without a rider), road transport, adrenocorticotropic hormone (ACTH) injection (positive control) and placebo treatment (negative control). Saliva samples were collected from 1 hour before to after 24 hours after the stress stimulation and cardiac activity was recorded from 1 hour before to 2 hours after the stress situation. Data were analysed by GLM-ANOVA for repeated measures with test and sex as between subject factors and time as within subject factor (statistics program SPSS 22). Data given are means ± SD. Salivary cortisol concentrations increased in response to ACTH injection (from 2.0±0.8 to 11.9±4.6 ng/ml) and transport (from 1.7±0.6 to 7.2±4.11 ng/ml (F_{11}=39.0, p<0.001). Cortisol concentration remained unchanged during exercise and in response to flashlight exposure and placebo treatment (F_4=19.1, p<0.001 among tests). Heart rate increased most pronounced during running (from 46±8 to 148±22 beast/min), followed by transport (from 50±5 to 88±34 beats/min and remained unchanged in response to flashlight exposure and placebo treatment (F_8=40.3, p<0.001; among tests F_4= 88.6, p<0.001). The HRV variable SDRR decreased during running (from 80±70 to 40±36 msec) and in response to ACTH injection (from 93±49 to 38±17 msec; F_8=3.1, p<0.01 over time) and remained unchanged in the placebo control experiment (among tests, F_4=11.6, p<0.001). Changes in RMSSD were similar (F_8=7.0, p<0.001 over time) except for the lack of changes in response to flashlight exposure (F_4=8.20, p<0.001 among tests). Only SDRR and none of the other parameters determined differed between mares and stallions (F_1=13.5, p<0.01) with an earlier decrease in mares than in stallions. In conclusion, horses were not stressed by exposure to the flashlight and physical exercise without a rider while road transport was perceived as a stressful challenge. Injection of ACTH induced a comparable response as external stressors. The stress response did not differ markedly between stallions and mares.

Lay person message: Horses were not stressed by exposure to a flashlight and by running freely (exercise without a rider). However transport by road was perceived as a stressful situation by the animals. The stress response was similar in stallions and mares.

Keywords: stress, exercise, transport, ACTH, flashlight, welfare.

Poster n°56

Do stabled horses show more undesirable behaviours during handling than field-kept ones?

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Handling issues are becoming a growing concern in the equine industry. Biting and kicking when being tacked up is just one of the problems often encountered when handling horses on a daily basis. Such behaviour is likely to compromise horse-human relationships therefore, investigating the reasons behind these behaviours is fundamentally important. The present study, carried out over 3 months, examined whether horses kept in a field environment for two weeks demonstrated desirable behaviours and easier handling compared to when they are stabled for a full day. College horses (n=9) with an average age of 14.5 +/-6.5 years and of various breeds were observed in three situations: field, stabled when not intensively handled (checked twice a daily for injury) and stabled and handled at least twice daily. Direct observations during basic handling procedures were used, which included tacking and being trotted-up in-hand. Duration and frequency of behaviours was recorded on an ethogram which categorised behaviour into three groups, 'DESIRABLE (alert, friendly), NEUTRAL' (no response, depressed) and UNDESIRABLE (aggressive or apprehensive). No novel events were recorded throughout the observations. In addition, the horses' heart rates were measured before and after handling by finding the pulse at the mandibular artery using two fingers by the same experienced (British Horse Society qualified Stable Manager) handler. The frequency of each type of behaviour was analysed using the Friedman's statistical test which showed a significant difference in both 'undesirable' (Friedman csq_r, df=2, p<0.05 =0.0153) and NEUTRAL behaviour (Friedman csq_r, df=2, p<0.05 =0.0203) in the three given situations. Differences in DESIRABLE behaviour were highly significant (Friedman csq_r, df=2, p<0.01 =0.0021). More DESIRABLE behaviour was observed when horses resided in a field suggesting that field-kept horses show less negative behaviours when handled. Heart rate (HR) in beats per minute data were analysed using the 2 way ANOVA test. This presented a significant difference in heart rates both before and after handling (ANOVA $F_{1,7}$, p<0.05 =0.0148) and between the three environments (ANOVA, $F_{1,7}$, p<0.05 =0.0479). This was significantly different between horses in fields (mean HR=32.57 b/m) and stabled without intensive handling (mean HR=37.71 b/m). This suggests that horses initially kept in fields then placed in a confined environment demonstrate increased resting heart rates, correspondingly these horses also demonstrated more UNDESIRABLE behaviours. However, after 2 months of being handled, resting heart rate values decreased (mean HR=33.14 b/m). This could be due to horses habituating to their new surroundings when exposed to an environment with consistent stimuli –such as the stable- for a prolonged period of time. Habituation to the new environment has been suggested to cause reactivity, which is often seen in new environments, to diminish and can be further associated with the horses' decreased heart rates after 2 months of handling at least twice daily..

Lay person message: The environment in which horses are kept may have a significant effect on how they behave when handled. This study suggests that horses kept in fields show more positive behaviour during basic horse handling procedures than horses housed in stables for long periods.

Keywords: behaviour, husbandry, interaction, housing, stress, acclimatisation.

Poster n°57

Food anticipation in domestic horses – anticipating something good or frustrated with waiting for a desired resource?

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During several pilot observations, we noted the possibility of different interpretations of horse behaviour close to feeding time. Though our original hypothesis was that heart rate variability (HRV) and behavioural indicators of horses pre-feeding would show they were anticipating something 'good' about to happen, actual pilot data suggested that horses were actually frustrated by having to wait for feed. A follow up study with a more controlled protocol was conducted. Eight Arabian horses (3-10 years of age) were fitted with Polar heart rate monitors ~40 min prior to their afternoon meal of pellets and alfalfa/grass mix. Ten minutes of baseline heart rate (HR), HRV, and behavioural data were collected before any external feeding cues were presented. Approximately 10 min before the afternoon feeding (16:00 hrs), barn staff turned stall feeders outward in a locked position and filled them with hay and pellets. During this time, an additional 10 min of HR, HRV and behavioural data were collected (feed anticipation/FA). Behavioural data were videotaped so that a post-trial ethogram could be developed. Sample behaviours included slight head shake and stomp/paw; sample FA behaviours included vigorous head shake and vocalization. In analyzing the HRV data via Kubios methodology, the LF (low frequency) to HF (high frequency) ratio went from 1.52±.31 during the baseline to 4.91±1.39 (t_{14}=6.72, $p<0.001$) during feed anticipation. This suggests that horses were more likely experiencing frustration/stress versus perceiving that something positive was about to happen. Behavioural data were less revealing, and yielded no statistically significant data in total number of behaviours (baseline average 4.75±5.23, anticipation average 2.43±1.40, t_{13}=1.13, $p>0.05$) or in which fraction of behaviours executed were stress behaviours (baseline average 0.601±0.34, anticipation average 0.88±0.16, t_{13}=1.98, $p>0.05$). A small problem in the protocol was that some horses were able to reach over the top of the stall front and access small amounts of hay. The HRV was not significantly different between the horses that could reach their hay and the one horse that could not, dividing the horses into two equal groups based on time they spent eating, the half that spent more time eating averaged a HRV of 4.54±1.50, and the half that ate less averaged 5.28±1.39 ($p>0.05$). Although the horses least able to reach hay showed a slightly larger percentage of stress behaviours, there was no statistically significant difference in the percent of stress behaviours between the horses most able to reach hay and those least able (t_{14}=1.55, $p>0.05$).

Lay person message: We should be cautious when interpreting equine behaviour. Sometimes what appears obvious to our human interpretation may relate to a different motivation from the horse's perspective.

Keywords: feeding, Heart Rate Variability, behaviour, frustration, anticipation, welfare.

Poster n°58

24h-time-budget of sport horses housed in boxes

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A good knowledge of the time-budget of sport horses housed in boxes can improve horses' welfare by an early detection of abnormal behaviour. This study aims to determine the 24-hour time-budget and the activity distribution over 24 hours of sport horses housed in boxes. Sixteen show jumping horses, Selle Français or Anglo Arabs, 3 mares and 13 geldings, aged between 5 and 10, were filmed continuously in their usual boxes for 6 non-consecutive days (6:00 am to 5:59 am next day) between March and April, 2015. They received 5 kg of hay twice daily and concentrates three times a day according to their individual needs. They had water and straw *ad libitum* and could interact with another horse through box partitions. All horses were out of their boxes for about 1 hour per day (average duration: 1h26min). The time spent eating, moving, standing still (SS), standing at rest (SR), lying in sternal recumbence (LS), lying in lateral recumbence (LL), out of the box, and in the box with a human were recorded on video and registered. The activity distribution over 24 hours was analysed in 8 time slots of 3h each. For this study, the 3 time slots between 9:00 pm and 6:00 am were considered as night-time and the others as day. Statistical analyses between the time slots were done using a Friedman test for paired data and a Nemenyi test for bilateral comparisons. The horses spent an average ± SD of 45.2±5.2% of the time eating, 10.6± 4.7% SS, 21.1±7.0% SR, 10.9±3.8% LS, 4.6±3.5% LL, and 1.2±1.0% moving. They spent more time resting (LS, LL or SR) and less time eating and SS at night than during the day (Friedman test: $Q=86.93$; $Q=84.78$; $Q=81.40$; $Q=95.17$ and $Q=92.02$ respectively, $p<0.0001$ for all tests) excluding the 12:00 am to 3:00 pm time slot. During this time slot, horses also spent more time SR than during the 2 previous time slots (6:00 am to 12:00 am). Excluding the 12:00 am to 3:00 time slot, the mean duration of behavioural bouts was longer during the night than during the day for SR and LL (Friedman test: $Q=18.50$, $p<0.0001$ and $Q=22.26$, $p<0.0001$ respectively), and longer during the day than during the night for SS (Friedman test: $Q=18.38$, $p<0.0001$). No differences were found between day and night for eating or LS bout (Friedman test: $Q=11.62$, $p<0.05$ and $Q=22.26$, $p<0.05$ respectively). Mean behavioural bouts observed during the 12:00 am to 3:00 pm time slot were not different from those at night for all behaviour except LL and eating. Although the box housing does not allow horses to walk or socialize as much as in more natural housing, the time-budget of sport horses housed in boxes shows an activity rhythm similar to free-living horses. This however does not measure horses' welfare. The results of this study can serve as a database for the development of electronic devices that will automatically send an alert if abnormal behaviour or an alteration in the normal time-budget are detected. Early detection of these behavioural issues can improve the welfare and health of the horses and the security of the riders.

Lay person message: Knowing the time-budget of sport horses in boxes is crucial for monitoring health and welfare as it enables the early detection of abnormal behaviour. The results of this study can serve as a database for the development of electronic devices that analyse equine behaviour and automatically send an alert if abnormal behaviour or an alteration in the normal time-budget are detected. Early detection of these behavioural issues can improve the welfare and health of the horses and the security of the riders.

Keywords: equine, time-budget, box, auto, behaviour, welfare.

Poster n°59

Evaluation of physiological parameters of barrel racers in the home and competitive environment

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Modern sport events are physically and mentally challenging for horses. This study compared the behaviours and physiological responses of barrel racing horses between home and competition environments, using 3 mares, 3 geldings and 1 stallion between 3-13 years of age and between 1 and 11 months in training. Stabled horses were on a hay/grain ration and had a 6-day workweek including 45 min hot-walker training. Horses were habituated to heart rate monitor belts and venipuncture of the left jugular vein prior to data collection. Baseline values of heart rate parameters (HR/HRV), blood glucose (GLU) and blood lactate (LAC) were collected in stalls prior to, during (only HR and HRV), and after racing (HR and GLU, LAC, at 0, 2, 5, and 25 min post exercise). All stall and ridden exercise observations were recorded for subsequent behavioural analysis. Trajectory analyses were performed to compare the change in physiological parameters for each available time point, between home and competition environments. Trajectory analysis performs a factorial MANOVA, as well as compares three trajectory attributes - size, direction, and shape - corresponding to the amount of change, the general correlated change, and the specific time-point to time-point concomitant changes in parameters. Location (R^2=0.26, Z=11.69, p<0.001), time of measurement (R^2=0.40, Z=7.94, p<0.001) and the location x time interaction (R^2=0.11; Z= 4.79, p<0.001) were all significant sources of variation for trajectories comprising HR, GLU, and LAC, before and after racing. Home and competition trajectories differed only in their shapes (Z=1.70, p<0.01), indicating that the correlations between changes in HR, GLU, and LAC changed over time. The key difference was comparable LAC, much lower GLU and HR at home before racing, suggesting the competition environment induced stress before racing. Over time, HR differences were maintained, suggesting the challenge remained, while increased GLU and LAC values suggested a greater level of exercise. Parameter values converged 25 minutes after racing. Trajectories for HRV parameters did not significantly vary between environments. Ethogram data comparing exhibited behaviour (paired t-test, t_6=2.45) at baseline values revealed no significant differences (p>0.05). However, ridden training at home and during competition revealed significant differences in exhibited gaits (walk: t_6=-2.66, p<0.05; trot: t_6=4.48, p<0.01; fast canter: t_6=11.85, p<0.001 and a significant increase in evasive mouth gaping during competition (t_6=3.37, p<0.05). Together, these results suggest that horses are more stressed and exercise-challenged in competition compared to at home.

Lay person message: Novice barrel racing competition horses were increasingly stressed and more strenuously exercised during barrel racing competitions compared to training sessions at home. More research is needed to evaluate stress levels during competition in experienced barrel racers in order to evaluate their adaptability to a challenging environment, and an overall impact of competitions on equine welfare.

Keywords: equine, barrel racers, competition, stress, physiology, welfare.

Poster n°60

Does a commercial pheromone application reduce separation anxiety in separated horse pairs?

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Horses (*Equus caballus*) are social animals and tend to bond with certain conspecifics. Individuals may display increased locomotory and vocal activity when separated from their preferred partners which can increase anxiety levels and injury risk. The objectives of this study were to evaluate physiological and behavioural evidence of separation anxiety in separated preferred partners, and to evaluate the potential stress-reducing effect of Confidence EQ® (CEVA), a pheromone gel for intranasal application. Five female and three gelded male horses (4 pairs) of various breeds were chosen for this study. Prerequisite for participation was a perceived strong bond with their equine partner and reported evidence of distress when separated. Prior to the start of the trial the horses were familiarized three times with Polar equine belts, and intranasal application of the product or a placebo. A Latin Square research design was used with complete randomization of separation combinations comprising 2 horses × 2 locations × 2 treatments. Baseline recordings of heart rate (HR) and HR variability were undertaken on pasture for one hour prior to separation. Both horses were given either a placebo or treatment thirty minutes before separation (one horse in stall, one in pasture, both with conspecifics), which persisted one hour. Video cameras recorded both animals during baseline and separation sessions for behavioural analysis. MANOVA with pairwise comparisons was performed on standardized physiological or behavioural variables to test for location and treatment effects. Preferred partners grazed within a 15 m distance from each other on pasture 74% of the time. No anxiety-related behaviours were observed during separation in stalls, but treatment and location explained approximately 14% of the multivariate variation in physiological variation (effect size, $Z=3.93$ SD; $p<0.0001$). Multivariate means were significantly divergent from baseline values for stalled horses (placebo $Z=2.87$, $p<0.001$; treatment $Z=2.98$; p<0.00a) but not pastured horses ($Z<1.33$, $p>0.05$). Stalled horses had lowered maximum heart rates, increased mean RR, reduced maximum speed, and reduced distance travelled. There were no significant differences between treatments within separation locations ($Z<1.26$; $p>0.05$), but the pheromone marginally lessened the physiological disparity between pasture and barn locations ($Z=1.76$, $p>0.05$). These results suggest that the pheromone does not profoundly reduce separation anxiety, but could mitigate the extremeness of anxiety, especially when separation involves relocation of horses to a novel environment. Further research for its use in increasing the safety of horse and handler during the training of horses is needed.

Lay person message: The use of a commercial pheromone to reduce anxiety in separated preferred equine partners reduced stress parameters to a mild degree. Its use can be helpful for management purposes. Further research is needed to support the use of this product to increase safety for horses and handlers during training.

Keywords: equine, social, separation anxiety, pheromone, safety, welfare.

Poster n°61

Accuracy of horse workload perception by owners when compared to published workload parameters

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A noted consequence of modern management of equids is that obesity is becoming ever more problematic. As with human health, over-consumption of a highly calorific diet, coupled with an increasingly sedentary lifestyle, appears to be instrumental in the increasing numbers of over-weight animals seen. Horses are reliant on their owners for provision of the food they consume, and in many cases, the exercise they receive. In order to accurately provide a suitable ration, the weight of the horse, plus the workload they are in must be considered to ensure suitability of the diet and thus minimise the occurrence of obesity. To date, the majority of research conducted which aims to examine causes of obesity in domesticated equidae has focused on diet alone, with few studies looking at both owner-perceived and actual levels of workload. The aim of this study, therefore, was to compare the level of work a horse was in, as stated by NRC (2007), with the perceived level of work that the owner attributed to the animal. A face-to-face survey was carried out with owners of 1207 horses over the period of 2 years. Owners were asked to state the level of workload their horse was in, the levels being thus: maintenance, light, medium, hard and very hard work. Using a pro-forma sheet to record the detail, each owner was then asked how many times per week they rode/worked their horse; the length of time each bout of work lasted, and the type of exercise the work formed. Using this information, the researchers then assigned each horse to one of the previously mentioned five workload categories, based on the description of each category stated in NRC (2007). Data were analysed using a Mann-Whitney U (Wilcoxon rank sum) test via Genstat 14. It was found that data were significantly different ($U=446317.5$, $df=1206$, $p<0.001$), with the owner-perceived score being significantly higher than the actual score. In a small number of animals, owners had in fact, stated that their animals were in very hard work, the type of work used to describe a TB in full race training, when in fact they were deemed to be in minimal light work. Nearly three quarters of horses were categorised by their owners as being in either medium ($n=407$) or hard ($n=314$) work, whereas the largest percentage of these animals were placed into the light work category ($n=535$) by the authors. Given the importance of accurate workload perception for suitable dietary maintenance, it is little wonder that obesity in on the rise if these results are indicative of the wider population. It is therefore possible to conclude that horse owners in the UK significantly over-estimate the amount of work that their horses are in, which may, in turn, lead to over-feeding and confound the problems of obesity in the domestic horse population.

Lay person message: Accurate workload estimation is essential for the correct calculation of dietary needs. If workload is over-estimated, then too many calories may be provided which could lead to obesity. Owners of 1207 horses were asked to rate their horses workload and were measured against published guidelines. It was found that owners significantly over-estimated workload which it was concluded could lead to welfare-limiting health complications.

Keywords: nutrition, workload, diet, owner perceptions, obesity, welfare.

Poster n°62

Longitudinal survey of turnout in show-jumping horses in four European countries in 2009/2010

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Turnout in paddocks or fields is considered beneficial, if not essential, for the health and well-being of horses. In Sweden, daily turnout is mandatory for horses since 2010; Switzerland has similar legislation since 2008, requiring turnout at least 2 days a week for daily exercised horses and daily turnout for non-exercised horses. The aim of the survey was to assess whether turnout was routinely included in management regimens for show jumpers by professional riders in four European countries. A longitudinal survey of daily management regimens of show-jumping horses was conducted in 2009/2010. Participants were selected from National Equestrian Federation ranking lists and included elite riders at professional Advanced/S-level. Using training diaries participating riders registered daily activities of all horses, including time spent in paddocks or fields. Of 61 riders recruited for the study 31 provided data on 263 horses. There were 18 riders in Sweden with 145 horses, five riders in the United Kingdom with 30 horses, five riders in Switzerland with 40 horses and three riders in the Netherlands with 48 horses. The data collected totalled 39,028 days. Mean horse age was 7.3 (±2.7) years and mean level competed at 130 (±13) cm. During the data acquisition period 98% of horses with Dutch riders were turned out, 100% of horses with Swedish and Swiss riders and 63% of the horses with UK riders. Overall, a mean of 95% of all horses had turnout. The median turnout duration, excluding horses with zero time out, varied from 5.5 (min 1.6-max 12.5) hours in Sweden to 1.0-1.7 hours per day (min 1.0-max3.7) in the other countries. The mean number of days with turnout per week varied from 1.4 in the UK to 5.8 in Sweden, with a mean of 4.4 days. For all variables there was substantial variation among riders within and between countries. In the UK, horses with two of the riders had no turnout at all. In addition to turnout all riders except three in Sweden used mechanical walkers. Total daily mean time outside the stable, including other reasons than turnout, varied from 1.3-11.8 hours. The majority of elite riders tended to routinely include turnout time for show-jumping horses, irrespective of animal protection legislation. It emerged from the rider interviews that the recent legal change in Sweden had not influenced turnout regimens. There was no relationship between competition level and differences in outdoor activity between riders, as most riders had horses of various levels with a similar turnout regime, but may have been affected by seasons and weather conditions. Practical constraints, such as availability of land, are likely to play a role in the choice and length of turnout, as could personal preference, possibly based on experience or tradition.

Lay person message: A survey of management regimes among elite show-jumping riders in four European countries demonstrated that paddock turnout was common in most places. On average, 95% of all horses had turnout in a paddock or grass field, but there were large differences in average number of hours per day (from 1.0 to 12.5) and number of days with turnout per week (1.4 to 5.8) among riders and between countries.

Keywords: turnout, show jumping, horse, welfare, health, legislation.

Poster n°63

An industry view of perception and practice of equine management in Canada

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In Canada, the heterogeneity of horse farms through differences in geographic location, equestrian disciplines, breed, background and ownership creates an assortment of welfare visions and management practices that have a direct influence on horse health and welfare. Empirical data on the prevalence of management practices in Canada is lacking and comparing perceptions of optimal management to actual practices may point to areas where research and education are needed. An online survey was circulated to horse enthusiasts in Canada. Data was analyzed using descriptive statistics and Chi-squared tests to compare perceptions of management practices from respondents who do not currently own horses (R; n=193) to actual practices by those currently owning horses (RH; n=708). RH reported horses are kept on 24/7 turnout much more than R believe (59% vs 33% for RH and R respectively; Chi^2=29.16, df=4, p<0.001). While on turnout, RH reported that >80% of horses have access to hay/grass, shelter, water, minerals, a mud free area and live with a companion; however only 40% have access to all these resources concurrently, and R believe only 30% of horses have access to all these resources (Chi^2=4.66, df=1 p<0.05). When stabled, 73% of horses have all-day turnout while R believe 56% have <4h/day (Chi^2=36.06, df=2, p<0.0001). Stabled horses (45%) have physical contact with neighbouring conspecifics, but R believe 71% of stabled horses are physically isolated (Chi^2=36.46, df=1, p<0.001). The main reason RH provide stall enrichment (e.g. toy) is to keep the horse stimulated (Chi^2=17.27, df=1, p<0.0001), while R believe the main reason is to stop a behavioural issue (Chi^2=129.64, df=1, p<0.001). RH (72%) provide a diet primarily composed of hay or grass with 54% giving concentrates every day and 50% offering supplements, however R believe only 33% of horses receive supplements every day ($\chi 2$=12.64, df=1, p<0.001) and 17% of horses never receive concentrates (Chi^2=6.77, df=1, p<0.05). Both R (81%) and RH (85%) report manure management as important (Chi^2=0.905,df=1, p>0.05). Practices such as regularly inspecting pastures for poisonous plants (60%; Chi^2=37.91, df=1, p<0.0001), hazards (88%; Chi^2=43.03, df=1, p<0.0001) and having a parasite control program (98%; Chi^2=19.77, df=1, p<0.0001) are very common, however R believe these practices are not regularly being carried out. These results point to a large discrepancy between the perception and the practice of keeping horses in Canada. Such discrepancies may carry over to how horses are handled and trained, and underscores an opportunity to better educate those involved in the industry.

Lay person message: The typical Canadian horse is reported to be kept outdoors most of the time with access to food, shelter, water and companions, fed a mainly forage diet, and has physical contact with other horses when stabled. However, there appears to a gap in understanding between how horses are managed and how people believe they are managed.

Keywords: horse, management, husbandry, survey, perceptions, welfare.

Poster n°64

Horse-riding techniques as an interspecies communication tool

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Ethology teaches us that the horse is a very sensitive species. It is able to sense the human attitude at first eye-contact. It can feel a fly on its body and remove it by flexing its muscles. In a study completed in 2014, we questioned what horse-riding is in the 21th century and what does it means to be a horse-rider? This work is based on four pillars: sociology of experience, Becker's sociology, Goffman's interactionism and Elias theories of configuration and civilising process. In an inquiry lasting three years in four equestrian centres (three giving classical lessons with one of them offering competitions, and one practicing "Natural Horsemanship"), we learnt horse-riding techniques and representations, questioning the activity with a methodology in which the researcher's body was central. Fifty professional horse-riders were interviewed in a semi-structured way, asked about their personal history, equestrian representations and comparing the inquisitor body feelings and sensations to every one of them. These interviews and a consequent ethnographic book allow us to understand what it means to become and live in a horse-rider body. It appears that in this relationship between horses and humans, it is the humans that need to make the most important work to let this kind of interaction exist. It can be seen that this world of shared sensations between horse and human is sustained by the quality of the relation. It appears that during eras, horse welfare improves as horse-riding techniques gain softness. The state of "homme de cheval" in France means a lot more than just techniques: it speaks about feeling, respect of horses, living with them. Equestrian techniques are, as Mauss defined it, the most efficient gestures for a human to produce. These Horse-riding techniques are indeed tools that allow interactions between the two species. Becoming a proficient horse rider is a long process, which needs to learn the "good" techniques to do and the "good" way to be for a beginner. While the horse-rider is getting better and better, his techniques evolve and his empathy grows. We observe that, even if the rider learns in a competitive, a tourist way or an "art" way, it does not interfere with the importance of increasing the quality of the techniques, although we can see that tourism riders are more interested in a nature-horse relation than in a good technical behaviour. Regardless of what the ultimate goal of the horse-rider is, be it competition, tourism or art, it appears that horse riding is in fact a kind of language that allows us to qualify the horse-human relationship as an anthropo-equine society, accompanied by a large world of sense and values.

Lay person message: In a three year long study, we learnt horse-riding in four equestrian centres. We studied the feelings of fifty professional horse riders towards riding and found that, despite the changes in the representations of animal welfare, that the road to become a horse-rider depends on the teacher's representations. However, whatever these representations are, the essence of horse-riding is the communication tool of a human-horse society.

Keywords: interaction, horse, human, technique, art, sport.

Poster n°65

Equines as tools vs partners: a critical look at the uses and beliefs surrounding horses in equine therapies and argument for mechanical horses

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Current models of Equine Assisted Activities and Therapies (EAAT) utilize horses for a range of physical, psychological and learning therapies in order to benefit humans, often referring to horses as therapeutic "*partners*". In order to fulfil certification requirements for existing models of EAAT, practitioners are required to study equine behaviour through the belief systems currently modelled in the natural horsemanship community. Despite requiring knowledge in horse behaviour, studies and anecdotal evidence suggests that horses used in EAAT commonly display confusion or escape behaviours, "burn out" and/or display signs of depression. These behaviours could be a result of contradictions in the interpretation of equine behaviour within the natural horsemanship practices or a lack of understanding and utilization of equine learning theory within the context of EAAT. This paper looks at four leading models of equine therapy through the Professional Association of Therapeutic Horsemanship (PATH), Equine Assisted Growth and Learning Association (EAGALA), Natural Lifemanship and Eponoquest and how each incorporates horses into both physical therapy and psychotherapy and suggests the need for models that incorporate mechanical horses in addition to existing equines in order to differentiate the use of horses as tools versus therapeutic partners. These models are contrasted against recent research in equine behaviour, equitation science and ethology to determine where they fit with existing studies. This paper aims to show that gaps in knowledge of equitation science within the EAAT community may be the primary cause of equine behavioural problems in that industry. As a result, EAAT practitioners should consider changes in models to better accommodate for more accurate understanding of equine behaviour in order to further utilize behavioural feedback from their equine partners while simultaneously improving equine welfare in the therapeutic industry. Furthermore, the physical therapy associated with some EAAT models suggests that the benefits of bilateral rhythmic stimulation could be gained from a mechanical device instead of a horse. Current mechanical horses are often rigid and cannot provide the physical benefits associated with horseback riding. In order to further equine welfare and prevent additional confusion resulting from inconsistent cues by riders, more anatomically accurate mechanical horses are needed. Such devices could prove beneficial to the rider by allowing for physical therapy in addition to learning the motor control and consistency needed to effectively communicate with a horse, a change that would benefit both human and equine partners in EAAT.

Lay person message: Horses used in Equine Assisted Activities and Therapies (EAAT) are often seen as therapeutic "partners". This study analyzes the use of horses in four models of EAAT and compares them to known principles of equitation science. The goal is to help improve existing models through better understanding of equine behaviour and welfare and promote their use as partners instead of therapeutic tools.

Keywords: equine, behaviour, assisted, therapy, welfare, horsemanship.

Poster n°66

Straight from the Horse's Mouth: Understanding experiences of Professional Event riders' techniques in mental preparation for maximising self-confidence

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Using a qualitative method and expanding information within the equestrian sport discipline, this study contributes towards increasing knowledge and support of the sport and exercise relationship with psychology. It focusses on understanding mental techniques, specifically the coping strategies used by professional event riders (i.e. those who make a living from the sport of Eventing) leading up to top level international competition, to maximise self-confidence and manage anxiety. The riders, who have each represented their country at international level, discussed different coping strategies and psychological skill interventions used. Previous research supported that high self-confidence or sport-confidence has been defined as a key psychological characteristic required by elite athletes and has demonstrated that a mix of psychological interventions such as self-talk, goal setting, imagery, pre-performance routines and relaxation techniques are used as coping strategies. This study, through semi-structured interviews of five professional event riders (mean age 36 year±5.48) exploring the experiences of psychological interventions used, leading up to and during top international competition. Experience-type data were collected using pre-prepared questions in a 45-60 min interview. Thematic Analysis of the participants' data revealed two themes, which are "Planning and Preparation" and "Arousal and Distraction Management". Within the "Planning and Preparation" there were three sub-themes of goal setting, time management and pre-performance routines. The "Arousal and Distraction Management" had two sub-themes of Psychological Skills Interventions and Support Team. The professional riders interviewed compete at the highest level within the sport and all of them eluded to a form of self-confidence in their aims and goals. They spoke of resources and interventions they use that enable them to be more confident and belief that they can compete at the highest level. The findings of this study suggest that these riders are similar to other non-equestrian athletes in using a combination of coping strategies to manage competition anxiety and build self-confidence. This study has provided a small insight into understanding the mental techniques that professional event riders use to help maximise their self-confidence and manage their anxiety, in preparation for competition. They all spoke of using a mix of strategies that play different roles within the different phases of the competition which help them with their self-confidence and the management of anxiety. This research provides some support to International Society for Equitation Science (ISES) aims in understanding how rider interventions could impact rider-horse relationship.

Lay person message: This study interviewed five professional event riders, all of whom represent their country and compete at the highest level internationally, in order to broadly understand what techniques they may use to manage their anxiety and exploit their self-confidence. In using these techniques, these riders are similar to athletes in both equestrian and non-equestrian sport. This research provides some support to ISES aims in understanding how rider interventions could impact rider-horse relationship.

Keywords: qualitative, equestrian, anxiety, coping, intervention, self-confidence.

Poster n°67

Visual appeal of horses may be linked to human personality

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Equine-Assisted Therapy (EAT) is becoming popular for treatment of humans with various mental health illnesses. The selection of the horse for therapy work may be important to the success of the treatment. This pilot study looked at possible connections between human personality type and preferred choice of horse in terms of appearance and personality. Participants not currently involved in EAT (n=37) completed a survey consisting of basic demographic information, horse experience, a personality assessment, and picture-based questions to sequentially choose between sets of pictures to create their ideal horse. Choices were made for size (pony, horse, draft), colour (black, bay, chestnut, grey, palomino, roan), speed (fast or slow), facial (blaze, star, snip, none), leg- (sock, stocking, none) and body-markings (patches, spots, none). Participants also had the option not to create an ideal horse. A points system allowed determination of the human personality type (brave, friendly, or shy), and General Linear Model and Chi-squared analyses were used to explore/determine connections between human and horse personalities, mental health diagnosis and visual horse preferences. Humans with little prior experience with horses chose not to create an ideal horse whereas those with prior experience did ($F_{3,32}$=6.03, $p<0.01$). Of those who chose to create their ideal horse (n=21), age ($F_{3,1}$=4.08, $p>0.05$), sex ($F_{1,3}$=2.09, $p>0.05$) and horse personality ($F_{2,19}$=1.25, $p>0.05$) did not influence horse choice. To describe the ideal horse, leg markings ($F_{1,4}$=0.34, $p>0.05$) did not influence horse choice, however size of horse, colour, speed, face and body markings all did. Horse size was preferred over draft or pony sizes ($F_{2,7}$=10.45, $p<0.01$). Roan or palomino horses were preferred over any other colour, and no one chose chestnut horses ($F_{14,71}$=9.66, $p<0.01$). Fast horses were preferred over slow or idle horses ($F_{1,7}$=14.54, $p<0.01$). Blazes or stars were preferred over other or no face markings ($F_{3,7}$=6.22, $p<0.05$). Large white body patches were preferred over no markings ($F_{2,7}$=6.12, $p<0.05$), and no one chose appaloosa markings ($F_{2,7}$=6.12, $p<0.0001$). Humans categorized as a friendly personality preferred a roan horse with a blaze and white body patches, whereas shy human personalities chose either a roan, grey or palomino horse with a blaze and white body patches (Chi^2=4.80, df=1, $p<0.05$). It appears that the preference humans may have for particular horses may be based on visual characteristics and by their previous horse experience. Understanding visual preferences of humans interacting with horses may allow for a more informed selection of horses for use in a therapy program, and consequently a more tailored relationship for optimal outcomes for both horse and human.

Lay person message: The preference humans may have for a particular horse appears to be based on its visual characteristics and is influenced by previous experience with horses. Roan horses with face and body markings are preferred over other colours, particularly by humans self-categorized as friendly. Knowing preferences may assist in pairing humans with horses for optimal outcomes, particularly in EAT.

Keywords: horse, preference, visual appeal, human, personality, match.

Poster n°68

Exploring human horse relationships in Australian thoroughbred jumps racing

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This study explores the nuanced values and attitudes about horses held by participants of Australian thoroughbred jumps racing. The research question was "how do people describe their relationship with individual horses and what do they value about this relationship?" Twenty three semi-structured interviews, median duration one hour, were conducted during May and June 2015 with trainers, jockeys, owners, strappers and pre–trainers and racing officials. Interviews were recorded on a digital hand held recorder and professionally transcribed for narrative analysis and coding of emergent themes using NVivo 10 (QSR International). Participants used anthropometric language to describe their relationship with individual horses and the majority of participants ascribed agency to the horse. Emergent themes included the horse as family, as companion, as co-worker, as competitor; and as athlete. Emotions expressed by participants included pride, trust, empathy, affection and love for individual horses as well as grief and grieving related to separation and or death. Conflict behaviours such as biting or bucking were frequently accepted and regarded as part of the relationship dynamic, both physically and emotionally, creating individuality in the horse-human relationship, rather than being perceived as conflict related behaviours. Such behaviours were regarded to be part of the horse's 'character'. Participants' descriptions were characterised as reflecting tacit, personal and embodied knowledge of their horses. Participants used anthropomorphic language to express their love and affection for their horses and to ascribe personality to individual horses. There was limited understanding that some behaviours tolerated within the relationships and regarded as part of the individual horse's personality were behaviours indicative of conflict, and therefore potentially affecting horse welfare. We suggest educating industry to better understand the significance and causes of such behaviours may improve longer term welfare outcomes for horses.

Lay person message: This study found that participants in Australian thoroughbred jumps racing love their horses and regard them as partners, and as part of the family, as well as athletes. Behaviours such as biting or bucking are tolerated in individual relationships because of the bond between people and their horses. It is suggested that horse welfare could be increased longer term if the significance of these behaviours was explained.

Keywords: jumps, racing, human-horse relationship, conflict, behaviour, welfare.

Poster n°69

The influence of equine popular art forms in the invention of a contemporary human-horse relationship based on an alter ego paradigm

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The objectives of this study are to (1) understand the historical role of popular art forms (literature, movies) in the construction of a new philosophy of human-horse relationships, since the end of the 19th century and (2) examine the effective influence of these popular equine arts on the activities of today's riders, questioning diverse criteria such as age, gender, riding-styles, how long they have been riding for, professional activities, nationality. A bibliographical analysis of a corpus of systematically chosen 133 works from Europe, North America and Australia, consisting of 34 books, 75 films, 11 TV series and 13 comic strips all containing *equine stories* in which one or more horses are the primary characters, was conducted. The influence of these works on riding and relations with horses for contemporary riders was assessed via an international survey comprising 30 questions between January and October 2013 involving 101 riders (18-70 years) from France, UK, US, Spain, Australia, New Zealand, Norway, South Africa, Ireland and Canada identified via various riders' networks (e.g. EqRn - The Equine Research Network, riding schools, Equimeetings). Results demonstrated that early codification of the human-horse relationship was based on respect, observation and affective relations seen in the popular arts at the end of the 19th century in literature (notably Anna Sewell's Black Beauty in 1877), films (1940s) and TV series (1950s), especially in UK, US and France. This resulted in a new ideal model of human-horse relationships, focusing on child-horse relations highlighted most frequently by urban authors who dreamt of having a horse when they were children rather than professional riders, and the influence of women. The survey data suggest that the influence of this mythology of an ideal human-horse relationship based on an alter ego paradigm still has an important influence on many of todays' riders, who aspire to secure a better relationship with their horse, based on love, respect and reciprocity. The influence of popular arts and the mythology of an ideal relationship with the horse depends on factors such as gender (women are far more sensitive than men) and activities (leisure), but not, surprisingly, age, how long they have been riding for, or nationality. Professional activity and urban origins may also be important as are riders who have a predominant interest in horse ethology compared to technical aspects of riding.

Lay person message: This study demonstrates that the contemporary human-horse relationship based on an alter ego paradigm can enhance horse welfare and improve the horse-rider relationship, and is partially "dreamt" of by riders before they put it into practice. The models of ideal human-horse relationships have found their roots in the popular arts since the end of the 19th century yet surprisingly still influence lots of riders, especially women, in their desire for an osmotic relationship with their horse.

Keywords: popular arts, invention, human-horse relationship, empathy, welfare.

Biography of practical day presenters

Andy Booth

The Australian Andy Booth has always been interested in the process of starting young horses under saddle. He searched for a method that was both effective and ethic. In 1997 he received a Queens Trust Award, enabling him to study the New Age Horsemen in the U.S.A for the following five years. This experience gave him the opportunity to study the various techniques with horses of different breeds and disciplines, including the famous Zorse (half zebra half horse). In 2001 Andy brought these techniques to France with the Haras De La Cense near Paris. With the emergence of "Equitation Ethologique" he searched for a more scientific (iess anthropomorphic) manner of teaching and explaining good horsemanship. In 2006 he invited Dr Andrew Maclean to France to explain the concept of Equitation Science and demonstrate applied Learning Theory. At the 2014 World Equestrian Games in Normandy, Andy launched Horseman Science to explain the science behind good horsemanship. He currently runs five Horseman Science professional schools, as well as teaching clinics and working with high level sport horses.

Jill Carrey

Jill Carey is Chief Executive Officer of Festina Lente, an organisation dedicated to providing equine facilitated programmes (EFLs) for young people and adults affected by socio economic disadvantage. Jill is a member of the Board of Horses in Educational and Therapy International (HETI) and Chairperson of Equine Facilitated Education Therapy Association (Ireland) (EFETA). Jill has a strong research interest in Equine Facilitated Programmes (EFL) and equine welfare based on equitation science principles and evidence based outcomes. Jill is currently completing her PhD which examined the benefit of an EFL programme for young people affected by educational inequality.

Colonel Patrick Teisserenc

Colonel Patrick Teisserenc is at the head of the "Cadre Noir" of Saumur, a position known as "Ecuyer en Chef". He was assigned to Saumur in November 2014. After graduated in 1986 from Saint-Cyr, he was commissioned as an Armed Cavalry Officer. He also graduated from "War School" and has a master degree in science from the university-level college of advanced technologies in Paris. After being an Ecuyer at Saumur between 1988 and 1992, he followed a regular military career and was assigned to different French Head Quarters in Paris, then to NATO Head Quarters in Brussels. From 2011 to 2014, he was assigned to the Combined Arms Center, at Fort Leavenworth, Kansas, USA. With his personal horse, competed in dressage up to Grand Prix level

Fabien Godelle

Fabien Godelle was assigned to the “Cadre Noir” in 1991. He is a senior “Ecuyer” in charge of the training of the Cadre Noir horses and riders, known as ‘’Maître Ecuyer”. He competes in dressage up to Grand Prix level and performs at an international level.

Lindsay Wilcox-Reid

Lindsay Wilcox-Reid is the founder of UK based Equipilates™. She is a dressage rider and trainer, Pilates teacher, Specialist Biomechanics Coach and master trainer for Biomechanics Education™. She has experience of competing and training horses up to advanced levels in dressage and currently has three horses. Lindsay enjoys working with individual riders and horses, but is now predominantly involved in teacher training, and delivers courses in intrinsic biomechanical screening and her unique approach to rider performance coaching for health and fitness professionals who work with riders, and also riding instructors/trainers who want to improve their skills in position focussed coaching. She has featured in a number of national and international equestrian magazines and has two published books, 'Pilates for Riders' and 'Core Connection for Rider and Horse'.

Manuel Godin

For 15 years, the Haras de la Cense has developed and has taught educational methods, based on riders experience. The team collaborates with scientists, who are experts in science popularization. Knowledge in ethology is used every day in managing the horses and in pedagogical approaches. The Haras de la Cense associates empirical and science knowledges about behaviour, in order to take care of horses' welfare in all equitation practices. Manuel Godin, Technical Director of the Haras de la Cense, is an equitation instructor and holds the 3 federal degrees in ethological equitation. He is a professional rider who uses ethological principles on horses to optimise their athletic training. He illustrates these principles during commented work sessions.

Nicolas Sanson

Nicolas Sanson is an "Ecuyer" of the Cadre Noir of Saumur. He is a teacher and also the pedagogical manager of training of the NATIONAL RIDING SCHOOL. He joined the Cadre Noir in 1991. In 2000, he defended a PhD in Science and Technology of Physical Activities and became a Professor in sports in 2004.

Marianne Vidament

Marianne Vidament is veterinarian. In 1985, she started working at the French Institute for Horse and Riding as a teacher in reproduction and as a researcher (evaluation of fertility in stallions, quality of fresh and frozen semen). Since 2007, she is working on developing behaviour sciences in fields, and mainly in the topic of evaluating temperament.

Hugo Cousillas

Hugo Cousillas is a Professor of behavioural neurosciences at Rennes1 University, he is a researcher on Neuroethology in the Ethos “Human and animal ethology” research unit of the CNRS (UMR6552). His main research concern the brain processing of vocal communication signals used during social interactions. The animal model used for these studies is a highly social songbird, the European starling. He is the author of neurosciences scientific publications in which he showed the importance of the social interactions in the functional organization development of brain areas involved in the process of these vocalizations. The electrophysiological methods that he used in these studies allowed him to design an easy to use EEG helmet for horses. H. Cousillas is also the president of the Rennes’ ethic committee of animal experimentation. This committee performs ethic evaluations of the research projects of many animal experimentation laboratories in Brittany and Normandy.

Abstracts of practical day demonstrations

Demonstration 1

Applied learning theory and the basic responses: ground work and ridden work

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This demonstration is based upon the three major principles of Learning Theory:

1. Learning: Associative and non-associative.
2. Conditioning: operant and classic
3. Reinforcements: positive and negative,

using two French Saddle horses, Midrac (Rox de La Touche) 16 years old, Volkane (Quite Easy/ Voltaire) 7 years old, who are at different levels of training. The following excercises will be demonstrated and the learning processes explained: 10 exercises in-hand and 10 exercises ridden.

Ground Work (20 minutes)

1. Basic Responses: required before beginning the desensitising process.
   - step forwards, step backwords, stand still.
   - Control the hindquarters and "face-up"
   - Lower the head
   - Lateral flexion

2. Desensitisation
   - habituation, and avoiding the conditioning of unwanted responses.
   - The processes of desensitising and sensitising.

3. Pressure removal
   - Step backwards, isolate the hindquarters, isolate the forequarters. Training the horse to remove a variety of pressures by yielding as opposed to developing defences or resistances.

4. Backing-up, stepping forward (drive and draw)
Through operant (stimulus/response) conditioning and classical (signal/response) conditioning.

5. Lungeing
   - Move the forequarters, accelerate, and move the hindquarters.
   - Conditioning acceleration and deceleration responses whilst lungeing circles.

6. Crossing obstacles
   - Crossing tarpaulines, coloured surfaces, jumps and so on Counter conditioning to create "comfort zones" (rivers, horse trailer)

7. Leading
Training the horse to maintain a position beside the human without passing behind or in front, from both sides.

8. Controlling the feet from a distance
   - Isolate the hindquarters
   - Isolate the forequarters
   - Forewards
   - Backwards

9. Lateral movements
Sideways and two tracks in hand.

10. Liberty
Controlling the horse at a distance without the halter.

Ridden Work
1. Mounting
- Learn to stand still

2. Control the body and the feet
Isolate the head and the neck, isolate the hindquarters, isolate the forequarters.

3. Direction
- Operant conditioned responses (pressure/response) from the reins and riders legs.
- Classical conditioned responses (signal/response) changes in rider positions and light aids.
-

4. Step forwards, stop and back-up
- Conditioning the responses for forwards and backwards.
- Learning to stop by the release of the reins
- Learning to go forward by the release of the riders' legs.

5. Impulsion
- Acceleration
- Deceleration
- Explaining "the seat" to the horse
-

6. Direction and impulsion on a loose rein
- Controlling direction and impulsion with the legs and seat.

7. Flexion
- Take and give
- Training lightness through the release of the reins.

8. Combining direction impulsion flexion
- Maintaining an independence of the aids
- Avoiding contradictory and conflictual aids

9. Self carriage
- Training the horse to maintain responses
- Taking and releasing the reins without charges in line, rhythm or frame.

10. "In the box"
- Training the "box". Rather than blocking the horse between hands and legs, the horse can be trained to maintain speed and line.

Lay person message: Learning Theory is based upon three basic principles: 1. Learning: associative and non-associative; 2. Conditioning: Operant and Classical; 3. Reinforcement: positive and negative. These principles should be incorporated into all forms of equitation and coaching. They should be placed into all programs taught by international equestrian federations. The incorporation of Learning Theory into equitation will reduce accidents, horse wastage statistics, and non-ethical treatment. Research is required as to why the principles of Learning Theory have not yet been adopted by all international equestrian federations.

Demonstration 2

The story of managing horse welfare in a riding school

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Given a choice - horses would probably prefer to remain with their herd in their natural environment rather than work in our world, as this represents everything unnatural to them. However, even if we could accommodate a horse's ideal, this notion is unsustainable given the shortage of land that would be necessary for this to happen. And so it becomes our job to continuously try and manage horse welfare and well-being in a responsible and ethical manner particularly because most of what we ask horses to do runs counter to their natural lifestyle. This can include their feeding regime, living conditions, socialisation opportunities, work regime, wearing of bits, shoes and saddles and an expectation that horses perceive and process the world through a human lens. One or more of these factors have been shown to cause varying levels of behavioural and stress for horses. Riding Schools represent one of the many sectors of the equestrian world where there are varying degrees of concern relating to horse welfare. This presentation tells the story of how Festina Lente Equestrian Center attempts to reduce horses' behavioural difficulties, stress levels and physical difficulties associated with multiple riders over time.Viewing horse welfare difficulties however should be done in a broader context which can help not only to develop a better understanding of the causes but can also help to identify ways to counter them. For example, figures from the British Horse Society, as the main accreditation body for equestrian coaches in the UK and Ireland, shows that between 2005 and 2015 – there were 2,217 Advanced Intermediate Instructors (BHSAI), 411 Intermediate Instructors (BHSII) and 93 Instructors (BHSI). The implications of this suggests that progression of Instructors education and training dramatically slows down after completion of the BHSAI – resulting in supervision of 'new recruits' more like to be done by BHSI's than BHSII's and significantly less chance by BHSI's. As many qualified BHS staff work in the Riding School context, this is but example of the broader problem that needs to be addressed.

Festina Lente has been addressing the problems facing stabled horses over the past 12 years. The approach adopted is a multidimensional and can be illustrated by a combination of factors including developing the right culture, appropriate and relevant education and training programme, engagement in research and development programmes, ensuring the necessary resources are available and finally being clear about the strategy for improving horse welfare and well-being.

In order to effect any change, it is necessary to create a culture that is conducive to support it. This presentation will describe how Festina Lente has and continues to develop a culture that is supportive of peoples learning, horse welfare from an evidence based perspective and a culture of continuous improvement. Changing our behaviour necessities elements of risk taking which in itself requires a supportive culture that supports such risk taking. How to develop such a culture will also be addressed.

This presentation then outlines the educational and training approach that has been developed over the past 12 years and will describe the various programmes in terms of their success but also in terms of the programmes that did not work. Reference will be made to the education and training programmes that are delivered to helpers, volunteers, and staff and also describe innovative ways of approaching learning programmes in order to change behaviours. Action research has been shown to be particularly effective when the researcher can identify the problem at hand. The quality of learning through action research has been shown to be particularly rich and empowering for those involved. Over the years, a number of studies have been conducted by Festina Lente staff such as the introduction of continuous feeding, wearing of bitless bridles (the focus of a study being presented during this conference) and the introduction of clicker training, amongst other projects. The challenges inherent in conducting research in a Riding School will be described together with ways of overcoming them.

The cost of keeping horses is high. The cost of keeping horses in such a way to reduce behavioural difficulties and stress is even higher – though this may depend on how one measures costs as higher costs in the short term may produce better economy in the medium to long term. This presentation will describe how it has managed to resource a number of the initiatives and how it proposes to resource future projects and/or capital items. Finally, the presentation will refer to the role of strategy in managing horse welfare in a Riding School and how this has served to support a variety of changes.

Lay person message: Our guide to improving horse welfare should always be that for horses living in a human world – we should always try to improve their well-being in such a way that it evidence based and replicates as much as possible of what is natural to them.

Keywords: horse welfare, strategy, culture, research, resources, education, training.

Demonstration 3

Teaching airs above ground at the French national riding school

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The appearance of airs above the ground during the Italian Renaissance embellished the choreography of the Carrousels. They showed the security and strength of the rider in the saddle and the accomplished training of the horse. It is possible to see the military origins of the airs above the ground. The prime goal in training a horse of war was perfect submission and great manoeuverability, preparing the riders for rough combat and allowing the officers to parade at the head of their troops. The airs above the ground were not used during combat, in spite of the temptation.

The airs above the ground practiced at Saumur are the Courbette, the Croupade and the Cabriole. The Cabriole only 'the highest and most perfected of the airs' has maintained its classical style. At Saumur the airs are practiced without stirrups. The horse who demonstrates the airs is called a jumper.

The specific training of a jumper begins in hand, when such a work is well assimilated we begin the mounted work. The demonstration of the master horseman Fabien Godelle aims at exposing the preparatory work with a horse whose training is not over. It will present the successive stages of growth and the means implemented.

The progression of the exercises during the learning is very precise. It begins with transitions where the horse learns to move forward on the outside rein and slow on the inside rein. It is practiced at the two hands. Then comes the habituation to the whip: the horse learns to sweep her hips and to "come to" whip. Then she does the same with the shoulders (sweep, draw). Finally, she ends up mobilizing on site which is a "small" piaffe and prepares the airs. She does this by taking two distinct frames: high neckline to prepare the "courbette", low neckline and bow to prepare the "croupade".

Fabien Godelle comments on the observed behaviours of his horse to share his feelings with the audience. Thus, how to train the horse can be better understood. Different elements of the relationship between the horse and the trainer will be discussed. A great importance is attached to the development of trust. This is often linked to the concept of contact. The horse learns to seek physical contact with the hand of the trainer through the reins; he also learns to seek contact with the whip. In addition, the relationship between the posture of the rider and the horse's behaviour will be emphasized.

Finally some more conventional and general concepts often used in the mounted training will be addressed. We have already spoken of the contact, straightness is an important element of dressage in hand. The search for impulsion is also a strong aspect of the jumpers training. The collection prepares also the airs above the ground. Finally the development of athletic power is certainly one of the points to be discussed.

Lay person message: The airs above the ground are still practiced in Saumur. Their function is to develop the riders stability and to perpetuate a tradition. The jumper is initially trained in-hand using a mastered progression. The observation of the horse's behaviour during training is fundamental. Developing trust through contact is sought. Finally improving the straightness, the impulsion, the collection and the athletic power are discussed.

Keywords: airs above the ground, in-hand training, shaping, trust, behaviour.

Demonstration 4

Intrinsic biomechanics for riders: the inside story

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This practical session will explore how rider performance (and in fact all sporting performance) is influenced by intrinsic biomechanics. There is a need to bridge the gap between exercise professionals who are being asked by riders for fitness, core and conditioning programmes to improve their performance, and health professionals who are dealing with clinical issues. Both approaches at different ends of the spectrum are seeking the same result for their riders; better long term performance with less risk of injury. The approach to rider assessment demonstrated has been developed over 25 years of research and uses evidence based practice to assess clients/athletes with the aim of mitigating risk of injury, manage the impact of abnormal biomechanics on an injury and improve performance through biomechanical screening and preventative exercise.

Martin Haines and his team have performed biomechanical tests on over 4000 sports people. They have identified the most relevant manual tests which correlate highest to the gold standard tests performed in a laboratory, when assessing the key biomechanical factors that relate to performance and injury. This research has now evolved into a full range of simple manual tests, which link to a series of exercises that help to eradicate many mechanical weaknesses. For riders, this means that programmes can be prescriptive, objectively assessed for efficacy, and functionally applicable for shock absorption capacity, symmetry and core control in the saddle.

The core of the matter
Many riders are becoming increasingly aware that they are one half of an athletic partnership and are seeking out ways to improve their own performance, with sport specific conditioning programmes, cross training, Pilates and the ever popular ‘core stability’ training. One factor which affects the efficacy of either strength and conditioning programmes or clinical interventions is the individual’s intrinsic biomechanics; how their joints, muscles and nerves have the capacity to function synchronously to perform any given task.

Core training has become vogue; we consider though that core stability work helps some people but hurts other. Why? Biomechanical inefficiencies can prevent good core control. However, if the body is out of alignment core stability work will maintain that mal-alignment; effectively stabilising people in the wrong position. This is currently at the beginning of everybody’s training programme, but we have shown that there is a level that needs to be worked ‘before the core’ and certainly before ‘functional’ exercises programmes; we need to ‘normalise’ people first.

What is core stability? ‘Muscles stabilising or supporting a body segment statically or dynamically while other muscles carry out a movement involving other joints. Therefore, core stability is ‘muscles stabilising or supporting the SPINE statically or dynamically while other muscles carry out a movement involving other joints’. In core stability terms, if a single muscle was weak or unable to contract, in any plane or axis, this would cause instability; so, no one muscle or muscle group is more important than any other. Many writers will talk of transversus abdominus and multifidus as the most important muscles in the core, but if only one group or muscle in the full range of stability muscles is not functioning correctly, then the trunk is unstable.

Identifying how an individual’s exercise programme is constructed begins with the screening process, part of which will be demonstrated in the practical session. Assessments include pelvic, spine and shoulder function, as well as core muscle ratio testing, quad, ligament and leg dominance, plus analysis of foot function. Many riders are presenting with functional leg length discrepancies and associated biomechanical compensations throughout the body including impaired integrity of the facet joints which can cause~~s~~ increased wear and tear on discs, tethering of nerves and poor shoulder mechanics. Corrective exercises begin with the pelvis which for riders is particularly pertinent, before working through a systematic process to address the kinetic chain. Functional leg length discrepancies and associated compensations can be reduced and eliminated with simple and effective techniques; horses are extremely sensitive to the changes which can be effected and in many cases significant improvements in performance noted immediately.

Lay person message: How your body *looks* (your 'form') and how your body actually *works* inside biomechanically (how you 'function': the workings of your joints, muscles and nerves) – determines how you sit on your horse, how well your body can absorb the shock of his movement without strain and how well you can stay balanced whilst resisting any unwanted movement forces being exerted (like a spook or buck). It also determines how well you can apply aids to your horse, and cease them when they aren't needed anymore. If there is restriction present in your body, it is very difficult to keep your weight in a correct, centred and balanced position ('neutral') or to use weight aids with any precision, as there will always be one side of you that is easier to load than the other.

Your 'form' is how you look to your trainer or other observers and how your weight appears to be distributed in the saddle; where your legs hang, whether you're in neutral spine, the angles of your joints, how your shoulders are positioned, etc. We refer to this as 'extrinsic biomechanics', which also refers to the study or analysis of performing movements or tasks in the most mechanically efficient way. Movement analysis, including visually assessing rider position and riding, is working with your extrinsic biomechanics. In this age of complex technological advances, there is software available that can capture measurements of joint angles, pressure sensors and a variety of scientifically useful devices, and there are experts specialising in interpreting and making sense of the data readings.

Your 'function' refers to how the rider's body is actually working on the inside – the behaviour of your muscles, nerves and joints. Your horse can feel which areas within your body are working properly to absorb his movement, and which aren't, which results in blocking it. We refer to these 'inside workings' as 'intrinsic biomechanics'. Two people could present with extremely similar postural patterns, or 'forms' and yet the areas in their bodies which are actually restricted (their intrinsic biomechanics) could be totally different. Having good form is an important half of the mechanical requirements of riding – this is what we are taught to develop almost from the moment we start riding; the ear, shoulder, hip, heel line which is the classic neutral spine. However, although it is an important half, it is just that; half the story. The 'function' bit is really the missing link in so much of what is taught today to improve rider posture and position. Having a more 'functional form' improves the triplanar shock absorption, symmetry in the saddle, balance and core function required for riding.

Keywords: horse riding, biomechanics, rider performance, horses, assessment.

Demonstration 5

Improving the athletic training of the horse

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Haras de la Cense is recognized 15 years for its expertise in education of horses. Precursor in Ethological riding, la Cense continues his interest in education and the behaviour of horses by working alongside recognized ethologists. Haras de la Cense is eager to participate in the questions that today feed the world of the horse. Education, behaviour, learning and well-being are concepts that feed into the daily life of the La team. It is in this context that have opened, respectively in 2015 and 2016, the diploma ethology and equine science and the University degree ethical, welfare and rights of the horse. These courses help to riders and non-riders to develop or deepen their knowledge in these areas.

Caroline Godin and Manuel Godin, teachers at haras de la Cense, and riders in competition, use daily a method based on scientific results and empirical horsemanship knowledge to prepare horses for their future use, be it leisure or competition. During their demonstrations, they will endeavour to show the essential steps of education of a horse in order to make a complete athlete. Haras de la Cense will first present a young dressage Mare in order to explain the importance of base codes, useful for good communication but also the work to obtain confidence in stressful environment. This education gives you the clues to build a solid relationship based on trust and understanding. The horse is then in the best provision to learn its discipline-specific movements and more technical exercises can be addressed.

In a second step, an older horse will be presented in order to explain the principles of education which allow to teach a more technical exercise by keeping his motivation. Over training, we are requested to the horse exercises increasingly complex, often physically hard and the horse is sometimes unmotivated. It is essential that the horse understands what he must do, know what answer, what action is expected of him. When the understanding is there, the horse has a way to act on his environment, he is somehow actor of his apprenticeship. Thus there is less stress, and the horse is more inclined to produce the necessary effort because he knows that he will be rewarded.

Lay person message: Knowledge of the nature of the horse allows a better understanding, a fairer education and thus optimizes the performance offered by the horse to his rider.

Keywords: education, horse, learning, pedagogy, equestrian sports.

Demonstration 6

Associating work, health and performance in riding and horse-management

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All horse practitioners share a passion for working with horses. The aim is to use work and training effectively to achieve a higher level of performance. This is probably the shared aim of everyone who works with horses.

However in the long-term the performance of a horse depends on the rider, trainer and groom. It is important that equine practitioners keep themselves in good physical and mental shape through adopting a healthy lifestyle. This will also enable them to maintain a good reputation for reliability and success.

The aim of this presentation is to encourage horse practitioners and training centres to ensure that themselves and their staff apply the basic principles of physical and mental training. This includes thorough warming up before physical work and maintaining a stable mental state, in order to reduce the risk of injury and stress.

You can take advantage of your daily activities to warm up physically and mentally. As a manager, it is possible to introduce initiatives to facilitate warming up whilst your team undertake their routine horse-related tasks. This presentation will provide some advice and suggestions in order to improve individual's health and welfare and therefore the performance of the horse.

This presentation gives you some reference points and tips to ensure a better balance between health and performance. We particularly show you how to:

- Acknowledge and take into account the different attitudes and physical constraints specific to working with and around horses (from the grooming and up-keep to the exercising and competing)

- Apply the principles of security and economy of effort (warm-up and physical preparation, perception, concentration, attention)...

Keywords: work, health, performance, riding, perception, concentration.

Demonstration 7

Simplified personality tests for young show jumping horses and ponies during breeding shows in France

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Personality (temperament), a set of behavioural tendencies called dimensions, is an important factor when working with horses because it influences learning performances and abilities to be used by humans. An early objective evaluation of personality of horses would give reliable information to the purchasers.

A set of tests called "Complete personality tests" have been developed in our laboratory and allows to measure 5 dimensions (fearfulness, gregariousness, locomotor activity, reactivity to humans, tactile and auditory sensitivity) on horses in a test pen, but these tests are not easily applied in the field.

The tests to evaluate fearfulness and tactile sensitivity have been adapted to facilitate their use during horse shows for young horses (2 and 3 years old) in France: breeding shows assessing conformation and gaits. To achieve this, the tests were modified to require no specific facilities or locality and to be conducted while horses were held in hand by their owners. Certain behaviours were also observed during existing show assessments (assessment of horse conformation and jumping ability) and measurement (height at the withers). All this procedure is now called "Simplified Personality Tests".

"Simplified personality tests" are composed of four specific tests and of behavioural observations conducted during three customary rounds of breeding shows:

1. Specific test for tactile sensitivity: response to Von Frey filaments (0.008 g, 0.02 g, 1 g and 50 g).

2. Specific fearfulness test: novel object. The horse is led with a leading rein round a novel object (a 1.3m x 1.7m x 0.7m cube, covered with red and grey fabric). The leading rein is allowed to remain slack so that the horse is free to move. The path taken by the horses is used to calculate the evasion distance from the object.

3. Specific fearfulness test: novel surface. The horse is presented with pellets in a bucket held up high (maximum 90 seconds for eating). The bucket is then placed in the centre of a novel surface on the floor (a 3x3m green tarpaulin with edges maintained by sand). The handler moves towards the centre of the tarpaulin with the horse on a slack leading rein. The moment the leading rein become taut they stop moving. The time necessary for the horse to put the 1st foot on the novel surface and the head in the bucket is recorded (maximum duration of 90 seconds after which it was stopped).

4. Specific fearfulness test: suddenness. A trained person positions himself 5 m from the horse front legs, the horse is held by its owner on a slack leading rein. Once the horse is immobile in front of the trained person, the latter rapidly opens and closes a black umbrella. The test is repeated with a reduced distance between the experimenter and test horse (3 m). The evasion distances and the type of flights are recorded.

5. Behavioural observations during habitual tests at breeding shows: model assessment. A panel of judges assess the conformation and gaits of each horse in hand performing a halt (1 min), walking and then trotting in one direction and then back, followed by a second halt (30 sec). The number of steps taken by the horse during the two halts is recorded.

6. Behavioural observations during habitual tests at breeding shows: free in the show ring and jumping. The horse is set free in an oval show ring (sand, 18m x 36m) 30 seconds before the free jumping test, the “speed of gait” is recorded. Then, the horse is observed during the jumping sequence: 1 warm-up jump, 2 jumps above a straight obstacle (1.15 m) and 2 jumps above an oxer (1.15 m -1.20 m, width: 1.30 m).

7. Behavioural observations during habitual tests at breeding shows: height measurement at the withers with a metric stick. The time necessary for approaching the horse with the stick from 2 m of the left shoulder until placing it on the withers and measuring its height is recorded. The number of steps taken by the horse during is recorded.

During each specific tests and each breeding show assessments, the posture of the horse, the number of whinnies, and the number of evasive behaviours are recorded.

These “Simplified personality tests” have been validated they are stable across time and situation, when compared with “Complete personality tests”. They measured mainly two independent dimensions: fear and tactile sensitivity. These measurements are linked to a certain degree to the ease of use of horses and how they perform when ridden by professional riders in show jumping competitions for young horses.

Due to the ease with which they can be applied, they have enabled the testing of more than 650 jumping horses and ponies since 2012 during breeding shows. This regularly growing data base enables the analysis of both genetic and environmental factors which influence horse personality.

First evaluation of heritability of these measurements have been calculated within this population composed mainly of French Saddle Horses and French Saddle Ponies, these two breeds are genetically related. Heritability values were elevated for fearfulness measurements.

Thus, although these new tests are probably less precise than the “Complete personality tests” because they are conducted in more varied environments and measure fewer dimensions, they can be used in the field to characterise personality provided that they are performed correctly by trained personnel.

In this demonstration, we will show a part of these tests and will explain the elements that we are looking at to evaluate the horses.

Lay person message: The “Simplified personality tests” are composed of specific tests to evaluate tactile sensitivity and fearfulness (novel object, novel area and suddenness tests) and of behavioural observations conducted during three customary rounds of breeding shows (free jumping, conformation judgement, height measurement). They are easy to perform and provide relevant information.

Keywords: temperament, personality, fear, tactile sensitivity, breeding shows.

Demonstration 8

An ambulatory electroencephalography system for free moving horses: an innovative approach

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Electroencephalography (EEG) has been extensively studied in humans over the last decades. It has been especially used in human medicine as a diagnostic tool to assess cerebral dysfunctions like for example epilepsy. EEG is especially useful to characterize different levels of vigilance from the different stages of sleep to wakefulness. Electroencephalography presents also a large interest for studies of animal brain processes from basic research on sleep, attention, awareness to applied issues such as the impact of anaesthesia, brain damages, induced or spontaneous brain diseases, epilepsy.

In humans, EEG recordings are mostly based on non-traumatic external electrodes placed on the head’s skin. The quality of these human EEG recordings depends on the subject’s quietness. Of course, more difficulties are thus encountered with animals. Thus, in awake animals, it is almost impossible to avoid movements and therefore most EEG recordings in animals have been done either by means of invasive deep implanted electrodes (in the skull) requiring a surgery under anaesthesia, or by a non-invasive approach but requiring the immobilization of the animal to avoid any muscular activity and the head’s shaving in order to glue the electrodes. These methods require a relatively long preparation and can be practiced only in adapted facilities such as veterinary clinics.

However, EEG is a precious tool for evaluating brain alterations or dysfunction due to diseases or trauma, but also the vigilance state of the animal, for testing the impact of drugs, welfare reasons or studies on cognition. It is then crucial to be able to use it in a field situation that is in the home environment of the horse, and preferably on free-moving animals.

This tool must thus be non-invasive and furthermore not require too "visible" interventions as the shaving of the zone where electrodes are placed, as do the actual studies using an ambulatory system. Not gluing electrodes that can also induce other problems, as risking to cause a rejection of the animal after electrodes extraction. The existing systems not being thus satisfactory, a new recording system easy to use seems necessary in order to perform new researches on horses using EEG.

This system must be:
1) usable in the horse home environment;
2) easy and rapid to adapt to each horse head;
3) usable on a free moving animal

We developed a new EEG helmet (patent # R23701WO) adapted to the horse’s head that solves all the above mentioned issues. It allows an easy and fast (less than 5 minutes) positioning of 5 electrodes on the horse forehead. The electrodes positioning allows to record independently each brain hemisphere. The EEG amplifier developed by the company RF-Track Rennes possess an embarked memory and a Bluetooth emitter that allows to record and visualized the data in a computer in real time.

This demonstration will consist in showing that this new helmet can be positioned on the horse head within 5 minutes and allows to make quality EEG recordings on a free moving horse in its usual environment. It will show that this easy to use helmet will open a field of new possibilities in cognitive sciences as well as in veterinary clinic.

Lay person message: This EEG helmet which is easy to use on free moving horses presents a large interest for studies on animal brain processes from basic research on sleep, attention, awareness to applied issues such as the impact of anaesthesia, brain damages, induced or spontaneous brain diseases, epilepsy.

Keywords: EEG, horse, free moving, helmet, application, cognition, welfare.

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Glossary

Aid: Any of the signals used to elicit responses in horses. Rein, leg, whip and spur aids are initially learned through negative reinforcement and then transformed to light aids (light rein, light leg, voice, seat) via classical conditioning. The difference between cues and aids is that aids may vary in intensity, whereas cues are typically of the same intensity. Traditionally, the aids are divided into two groups: natural aids and artificial aids. This distinction is misleading as it refers to what is "naturally" available to the rider, but it neither identifies nor correlates with the two learning modalities through which the horse acquires its responses to the aids.

Approach conditioning: An operant conditioning technique that reduces flight behaviours using the natural tendency of horses to investigate and approach unknown objects, in combination with systematic desensitisation. The horse is encouraged to approach the object that it is fearful of, which then retreats as the horse approaches. The horse may then be signalled to stop before it reaches its fear threshold, so that the object retreats even further. The horse is then signalled to catch up. As soon as the horse slows its approach it is deliberately stopped and this is repeated until the horse comes as close as possible to the object. The horse usually becomes increasingly motivated to investigate the object.

Blocking: A form of interference with classical conditioning; once an animal has learned that a given stimulus predicts a certain event the animal may fail to learn new associations, i.e. a second stimulus may not become a conditional stimulus because learning has been blocked by the presence of the first conditional stimulus.

Classical conditioning: The process whereby an animal learns to correlate external events, e.g. the animal is presented to a neutral stimulus (e.g. a sound) which is followed by a biologically important stimulus (e.g. a noxious stimulus such as a shock, or a positive stimulus such as food). In equitation, classical conditioning is the process where learned responses are elicited from more subtle versions of the same signal or to entirely new signals, e.g. when a horse learns to react to voice commands, visual cues, or rider seat cues.

Cognition: The mechanisms by which animals acquire, process, store, and act on information from the environment. The study of cognition covers many topics such as perception, learning, memory and communication.

Conflict behaviour: Stress-induced behavioural changes that arise from conflicting motivations, especially when avoidance reactions are prevented. Conflict behaviour may be agonistic behaviours, redirected aggression or displacement activities. If the stressor is recurrent, conflict behaviour may manifest as repetition and ritualization of original conflict behaviours. Stereotypies and self-mutilation may develop from severe, chronic or frequent stressors. In equitation, conflict behaviours may be caused by application of simultaneous opposing signals (such as go and stop/slow) such that the horse is unable to offer any learned responses sufficiently and is forced to endure discomfort from relentless rein and leg pressures. Similarly, conflict behaviour may result from incorrect negative reinforcement, such as the reinforcement of inconsistent responses or lack of removal of pressure.

Contact: The connection of the rider's hands to the horse's mouth, of the legs to the horse's sides and of the seat to the horse's back via the saddle. The topic of contact with both hand and leg generates considerable controversy relating to the pressure that the horse should endure. In classical equitation, contact with the rein and rider's leg involves a light pressure (approximately 200 g) to the horse's lips/tongue and body, respectively. A heavy contact may cause progressive habituation leading to diminished reactions to rein and leg signals as a result of incorrect negative reinforcement and/or simultaneous application of the aids.

Counter-conditioning: A type of training based on the principles of classical conditioning that attempts to replace fear responses to a stimulus with more desirable responses. The term means training an animal to show a behaviour which is opposite or different to the one the trainer wishes to eliminate. The technique is widely used in combination with systematic desensitisation. By ensuring that the preferred behaviour is more rewarding, the animal learns to perform the new behaviour when exposed to the problematic stimulus.

Cue: An event that elicits a learned response.

Ethogram: A list of the type of behaviours performed by a species in a particular environment. The list includes precise descriptions of each behaviour. It is fundamental to any study of animal behaviour to define which behaviour types are being observed and recorded.

Ethology: The scientific and objective study of animal behaviour, usually with a focus on behaviour under natural conditions, and viewing behaviour as an evolutionarily adaptive trait.

Extinction: The disappearance of a previously learned behaviour when the behaviour is no longer reinforced. Extinction can occur in all types of behavioural conditioning, but it is most often associated with operant conditioning. When implemented consistently over time, extinction results in the eventual decrease of the undesired behaviour, but in the short-term the animal may exhibit an extinction burst.

Extinction burst: a sudden and temporary increase in the frequency or magnitude of a behaviour, followed by the eventual decline and extinction of the behaviour targeted for elimination. Extinction bursts are more likely to occur when the extinction procedure is in the early stages.

Flooding (response prevention): A behaviour modification technique where the animal is exposed to an overwhelming amount of the fear-eliciting stimulus for a prolonged period of time while avoidance responses are prevented, until the animal's apparent resistance ceases. The method is generally not recommended because there are severe risks associated with the method, e.g. injuries due to exaggerated fear reactions.

Foundation training: The basic training of a young horse to respond to aids and cues that control its gait, tempo, direction and posture for whatever purpose may be required. Foundation training may also include habituation to saddle and rider.

Freeze: The sudden alert motionless stance associated with a highly attentive reaction to an external stimulus.

Habituation: The waning of a response to a repeated stimulus that is not caused by fatigue or sensory adaptation. Habituation techniques include systematic desensitisation, counter-conditioning, over-shadowing, stimulus blending and approach conditioning.

Hard/tough-mouthed: Describes horses that have habituated to rein pressure. This is generally a result of incorrect negative reinforcement and can result in learned helplessness and conflict behaviours.

HPA axis (Hypothalamic–Pituitary–Adrenal axis): An organ system comprising the hypothalamus, the pituitary gland and the adrenal gland. The activation of the HPA axis is heightened when an animal is challenged with a stressor, and HPA axis products, such as cortisol, can serve as a physiological indicator of stress in animals.

Hyper-reactive behaviour: Behaviours characteristic of an activated HPA axis and associated with various levels of arousal. Such behaviours typically involve the horse having a hollow posture and leg movements with increased activity and tempo, yet shorter strides. Hyper-reactive behaviours are quickly learned and resistant to extinction because of their adaptiveness in the equid ethogram. Behavioural evidence of hyper-reactivity ranges from postural tonus to responses such as shying, bolting, bucking and rearing.

Learned helplessness: A state in which an animal has learned not to respond to pressure or pain. Arises from prolonged exposure to aversive situations or insufficient environments without the possibility of avoidance or control. It may occur from inappropriate application of negative reinforcement or positive punishment, which results in the horse being unable to obtain release from or avoid the aversive stimuli. If this continues over a period of time the horse will no longer make responses that were once appropriate, even if they would be appropriate under the present conditions.

Negative punishment (Subtraction punishment): The removal of something pleasant (such as food) to punish an undesired response and thus decrease the probability of that response.

Negative reinforcement (Subtraction reinforcement): The removal of something aversive (such as pressure) to reward a desired response and thus increase the probability of that response.

Operant conditioning (Instrumental conditioning)**:** The process whereby an animal learns from the consequences of its responses, i.e. through positive or negative reinforcement (which will increase the likelihood of a behaviour), or through positive or negative punishment (which will decrease the likelihood of a behaviour).

Overshadowing: The effect of two signals of different intensity being applied simultaneously, such that only the most intense/relevant will result in a learned response. It can explain why animals sometimes fail to associate the intended cue with the desired behaviour in favour of a different stimulus that was happening unintentionally at the same time and was more relevant to the animal. The term overshadowing also denotes a desensitisation technique where habituation to a stimulus is facilitated by the simultaneous presentation of two stimuli that elicit a withdrawal response (such as lead rein cues/pressure and clippers or a needle).

Positive punishment (Addition punishment): The addition of something unpleasant to punish an undesired response and thus decrease the probability of that response. Incorrect use of positive punishment can lower an animal's motivation to trial new responses, desensitise the animal to the punishing stimulus and create fearful associations.

Positive reinforcement (Addition reinforcement): The addition of something pleasant (such as food or a pleasant scratch) to reward a desired response and thus increase the probability of that response.

Punishment: The process in which a punisher follows a particular behaviour so that the frequency (or probability) of that behaviour decreases. See also Positive punishment and Negative punishment.

Reinforcement: The process in which a reinforcer follows a particular behaviour so that the frequency (or probability) of that behaviour increases. See also Positive reinforcement and Negative reinforcement.

Reinforcement schedule: The frequency of the reinforcers used in training. The schedule may be continuous, intermittent or declining.

Reinforcer: An environmental change that increases the likelihood that an animal will make a particular response, i.e. a reward (positive reinforcer) or removal of an aversive stimulus (negative reinforcer).

- *Primary reinforcer*: a stimulus that is considered naturally rewarding (e.g. food)
- *Secondary reinforcer*: a stimulus that has become associated with a rewarding stimulus and thus has been conditioned to be rewarding for the horse (e.g. the sound of a clicker which has been associated with a food reward)

Shaping: The successive approximation of a behaviour toward a targeted desirable behaviour through the consecutive training of one single quality of a response followed by the next.

Stereotypy: A repeated, relatively invariant sequence of movements that has no function obvious to the observer. Stereotypies are abnormal behaviours and are generally considered as a sign of impaired welfare. Stereotypic behaviour arises from frequent or chronic stress and may help the animal to cope with adverse conditions. The behaviours may persist even if the triggering factors are eliminated. A number of stereotypic behaviours, such as box-wandering, pacing and crib-biting are seen in horses and are erroneously referred to as stable vices.

Stimulus blending: A desensitisation technique that uses a closely resembling stimulus, to which the horse has already habituated, to systematically desensitise the horse to the fear-inducing stimulus. The fear-inducing stimulus is applied simultaneously with the known, non-fear-inducing stimulus, and then systematically increased in intensity. The aural and tactile characteristics of the two stimuli are gradually mixed, making identification of the new one difficult and different. The old benign stimulus can then be diminished and finally terminated after which the horse will show habituation also to the new stimulus.

Stimulus control: The process by which a response becomes consistently elicited by a light aid or cue.

Stress: Stress is a state which is characterised by the behavioural and physiological responses elicited when an individual perceives a threat to its homeostasis ('internal balance'). The threat is termed a stressor.

Stressor: Anything that disrupts homeostasis, e.g. physical and psychological threats incl. lack of fulfilment of natural behavioural needs. Stressors appear to be stressful to the extent they contain elements of loss of control, loss of predictability, and absence of outlets for frustration.

Stress response: The body's adaptations evolved to re-establish homeostasis. Stress responses are elicited when an animal anticipates or faces a stressor and involves a range of endocrine and neural systems. The responses are somewhat nonspecific to the type of stressors that trigger them. Stress responses are in nature adaptive; however, when these responses are provoked for a long duration or repeatedly, they can cause negative effects such as increased susceptibility for diseases, gastric ulceration, abnormal behaviour, reproduction problems, and reduced performance.

Systematic desensitisation: Systematic desensitisation is a commonly used behaviour modification technique for the alleviation of behaviour problems caused by inappropriate arousal. In a controlled situation, the animal is exposed to low levels of the arousing stimulus according to an increasing gradient, until habituation occurs. An increase in the level of the stimulus is not made until the animal reliably fails to react to the previous level. In this way the technique aims to raise the threshold for a response. The decrease in arousal can be reinforced by either negative or positive reinforcement.

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A quick guide to statistics for non-scientists

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The 'scientific process' comprises the six steps listed below. The application of statistics is a tool which enables reliable conclusions to be reached and the research objective to be answered. Statistical analysis is not that difficult and simply involves following a series of simple steps and rules. An example is used to demonstrate the steps needed for a simple scenario where the researcher needs to apply the two sample t test in order to statistically assess the difference between two sets of data. (All text relating to the example given is highlighted with grey shading).

EXAMPLE: A study is planned to investigate the success of dressage horses trained using two different training methods (Method A and Method B).

1. Generating a research question
A good project will have a simple title which clearly describes the objective of the study.

Is there a difference in the success of dressage horses trained using Method A and Method B?

2. Identifying variables and measures
There are two types of variables – independent variables which are determined by the researcher and dependent variables which provide the measurements upon which statistical tests are conducted.

The Independent Variable is 'Training method' and has two levels: Method A and Method B. The Dependent Variable is 'success' – which can be measured by scores achieved in competition.

3. Formulating hypotheses
All research projects rely on the examination and testing of hypotheses. Each statistical analysis relies on the simultaneous examination of a pair of hypotheses which are opposites of each other and always follow the standard format:

- The Null Hypothesis (Ho) states that *'There is no significant difference between A and B'*.
- The Alternative Hypothesis (Ha/H1) states that '*There is a significant difference between A and B*'.

Ho: There is no significant difference in the dressage scores achieved by horses trained using Method A and the dressage scores achieved by horses trained using Method B.

Ha: There is significant difference in the dressage scores achieved by horses trained using Method A and the dressage scores achieved by horses trained using Method B.

4. Designing the experiment ~ data collection
When designing an experiment it is important to obtain a decent sample size (n, as a rough guide is that anything less than 30 is considered to be a 'small' sample) and to match everything about the individuals contributing to each sample as evenly as possible.

All of the horse and rider combinations in this study will be competing at a similar level, and performing the same dressage test, under the same conditions, and be judged by the same judge.

5. Data analysis

Two types of data analysis are applied, first, exploratory, descriptive analysis which provides averages and an indication of the spread of the data, and second, confirmatory statistical analysis which yields 'test statistics' and probabilities and ultimately allows a statistical conclusion to be reached. The latter will then allow a conclusion to be reached in relation to the objective of the study.

Sample data (Dressage scores, %)

Method A

60	*60*	*60*	*50*	*64*	*56*	*55*	*56*	*48*	*44*	*53*	*53*	*57*	*59*	*54*
52	*52*	*59*	*56*	*61*	*55*	*50*	*58*	*56*	*52*	*62*	*53*	*67*	*58*	*51*

Method B

60	*73*	*69*	*67*	*72*	*67*	*65*	*64*	*64*	*72*	*64*	*72*	*70*	*74*	*61*
63	*66*	*68*	*66*	*72*	*70*	*68*	*55*	*87*	*68*	*69*	*61*	*68*	*60*	*66*

Exploratory, descriptive analysis of the sample data shows that horses trained using Method A achieve an average score of 55.7% with a variability of 4.93% typically presented as 55.7±4.93%. Horses trained using Method B achieved a higher score of 67.4±5.80%.

At this point the general impression is gained that there is a difference in the scores achieved by horses trained using the two different training methods.

Confirmatory, statistical analysis is necessary in order reach a reliable conclusion. A standard process is now followed:

- Conduct a statistical test (here the two sample t test). This will produce a test statistic and a probability value, P.

For this example:
t_{56}=8.40; p<0.001.

6. Reach a conclusion

In statistics there is a one important number: **p=0.05**.

A P value of 0.05 means that if a study was repeated 100 times then 95 times out of 100 the same result would be found, and 5 times out of 100 the opposite result would be gained. As far as interpretation of results goes, the P value should be less than 0.05 in order for the results to be considered to be reliable (and repeatable).

A simple procedure is followed to relate the P value to the hypotheses in order to reach a statistically sound conclusion:

- If the P value obtained is less than 0.05, the Ha is accepted and the Ho is rejected. The conclusion is then reached that there is a significant difference between the two samples. The averages found in exploratory data analysis show that training Method B is more successful than Method A.

- If the P value obtained is equal to, or greater than, 0.05, the Ho is accepted and the Ha is rejected. The conclusion is then reached that there is not a significant difference between the two samples. (Here scientists state that there is a non-significant difference.)

This guide is intended to enable non–scientists to understand the statistical references made in the abstracts and presentations during the course of the ISES international conference.

Author index

Numbers are abstracts numbers either plenary (Pl), Oral (O), Poster (P) or demo (D)

FIRST PRINCIPLES OF HORSE TRAINING

International Society for Equitation Science

These principles are essential for optimal welfare and training efficiency. They apply to all horses regardless of age, breed, training level and equestrian discipline. Does your training system demonstrate each principle?

Train according to your horse's ethology and cognition

Horses have evolved to live and process information about the world in a certain way

- ✓ They need the company of other horses, movement and virtually continuous eating
- ✗ Take care about blaming them for past behaviours as they may not recall events like humans do

Use learning theory appropriately

Learning theory describes the processes by which horses learn.
Your learning theory toolkit includes:

Habituation

Use habituation techniques to help him become accustomed to events and stimuli and no longer react.

- ✓ Habituation techniques include progressive desensitisation, overshadowing, stimulus blending, counter conditioning and approach conditioning.

Operant conditioning

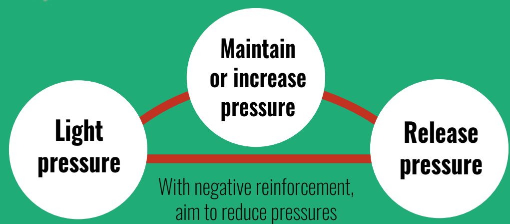
The use of rewards and consequences.

- ✓ Use both positive and negative reinforcement. When used correctly these forms of operant conditioning are ethical and effective.
- ✓ Timing is everything. Aim to quickly reduce any pressure-based cues to light forms of pressure.
- ✗ For optimal welfare you should avoid punishment.

Classical conditioning

Using cues to trigger and elicit behaviours. When training cues your timing needs to be precise to coincide with the start of the desired behaviour.

- ✓ Classically conditioned cues include, seat, voice, posture and gestures.



With negative reinforcement, aim to reduce pressures to light cues. Release as soon as he responds correctly.

Train easy-to-discriminate cues

- ✓ Each cue should be unique
- ✓ Cues for each response should be clearly separate (particularly acceleration and deceleration)
- ✓ This relates to all rein and leg pressures, as well as voice, seat and posture cues

Elicit responses one-at-a-time

- ✓ Ask for one thing at a time
- ✓ Time cues so they elicit the correct limb movement
- ✓ Cues can be closer as responses are consolidated
- ✗ Simultaneous or clashing cues inhibit each other and gradually he will desensitise to your cues

Shape responses and movements

- ✓ First reinforce a basic attempt at the target behaviour
- ✓ Then aim to improve the behaviour in a step-by-step way

Train persistence of responses (self-carriage)

- ✓ He should maintain rhythm, straightness and outline without the need for constant cueing
- ✗ Constant cueing ('nagging' or 'motivating') can lead him to habituate to your cues

Demonstrate minimum levels of arousal sufficient for training

- ✓ He should be as calm as possible during training
- ✗ When certain levels of arousal are exceeded learning and welfare suffer

Train only one response per signal

- ✓ Each cue should elicit a single response
- ✓ Rein cues, which relate to deceleration and turning, are clearly separate from leg cues, which relate to acceleration
- ✗ He can't differentiate leg and rein cues which are used for a multitude of responses

Form consistent habits

When training new responses, always:

- ✓ Maintain the same context / environment (it can be gradually altered once responses are consolidated)
- ✓ Use the same cues in the same place on his body or relative to his body
- ✓ Shape transitions so they are the same structure and duration each and every time

This is a brief overview of the horse training principles. It has been simplified for ease of use. It may be printed in its exact form for public display. You can find a more complete description of each principle on the ISES website. Visit:

www.equitationscience.com

Avoid and dissociate flight responses

- ✓ Avoid flight response behaviours at all costs

Did you know? Flight response behaviours resist extinction, may reappear spontaneously, and are often accompanied by many physical and behaviour problems. They can result in acute and chronic stress.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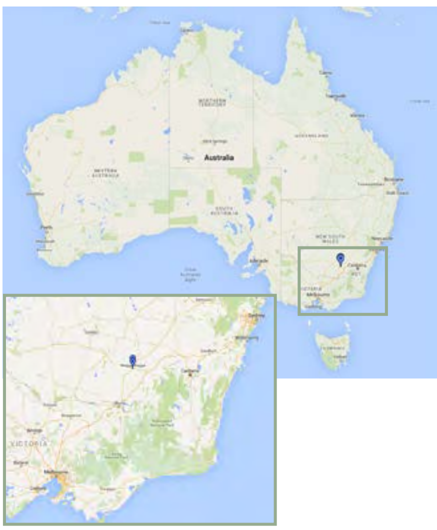
2017 Equitation Science Conference, Wagga Wagga, Australia

Hosted by:
Charles Sturt University,
Wagga Wagga Campus,
New South Wales, Australia
Date: Late November (Date TBC)



Plan ahead to visit Australia for the 2017 Equitation Science Conference.

Stay tuned for updates and information:

www.equitationscience.com/upcoming

Wagga

Situated on the banks of the Murrumbidgee River, Wagga Wagga - known simply as Wagga to locals - has a proud sporting history, a thriving cultural calendar including theatre, music, art and markets, and a growing restaurant and café scene.

CSU's campus at Wagga Wagga is the biggest, spanning more than 640 hectares and including a campus farm, equine centre, vineyard, winery and huge range of technical and industry standard facilities. A central dining room provides for students who live on campus, and the campus offers a range of playing fields, netball, basketball, tennis and squash courts, a gymnasium and a swimming pool available for student use.

The name of the City is derived from the language of the Wiradjuri tribe, which was the biggest aboriginal tribe in New South Wales, embracing the Riverina area.

'Wagga', 'Wahga' or Wahgam' in aboriginal dialect means 'crow' and Wagga Wagga means 'crows' or 'the place where crows assemble in large numbers'. The Murrumbidgee River which runs through the City also derived its name from the aboriginal language and means 'plenty water' or 'big water'.

Useful Links:

http://www.csu.edu.au/about/locations/wagga-wagga

http://www.wagga.nsw.gov.au/

http://www.equitationscience.com

Getting There:

	Plane	Car	Train
Sydney to Wagga:	1 hr	4.5 hrs	6 hrs
Melbourne to Wagga:	1 hr	5.5 hrs	5 hrs
Canberra to Wagga:		2.5hrs	

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