PROCEEDINGS OF THE 15TH INTERNATIONAL EQUITATION SCIENCE CONFERENCE

Bringing Science to the Stable

August 19th-21st, 2019
University of Guelph, Guelph, Ontario, Canada

Proceedings edited by: Cordy DuBois, Katrina Merkies, Tina Widowski, Cathy Wentworth-Stanley





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International Society for Equitation Science
Presents

15th International Equitation Science Conference
August 19 - 21, 2019
Guelph, Ontario, Canada

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Editors: Cordy DuBois, Katrina Merkies, Tina Widowski, Cathy Wentworth-Stanley

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Proceedings of the 15th International Equitation Science Conference: Bringing Science to the Stable. August 19-21, University of Guelph, Guelph, Ontario, Canada / proceedings edited by Cordy DuBois, Katrina Merkies, Tina Widowski, Cathy Wentworth-Stanley. © International Society for Equitation Science 2019

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President's welcome to ISES 2019 Guelph

Welcome to the 15th Equitation Science Conference! Welcome to Canada's largest and most renowned agricultural university; the University of Guelph. The theme for this year's conference is "Bringing Science to the Stable" and a line-up of highly qualified invited speakers will take us on a journey through history, highlighting and challenging our past and present interactions with horses.

Some of you are already very familiar with the **International Society for Equitation Science (ISES)** whereas others are new to the society and are attending your very first ISES conference. I am sure we all have some very enjoyable days ahead. If this is your first scientific conference, don't worry – ISES is a very friendly society! The conference proceedings provides both a glossary and a quick guide to statistics for non-scientists that briefly explains what "p-values" are all about. Indeed, one of the main aims of ISES is to provide objective, evidence-based knowledge to the end user - the equestrian practitioner - at all levels. In order to facilitate this, each scientific abstract is accompanied by a Lay Persons Message to assist with the communication of the main results.

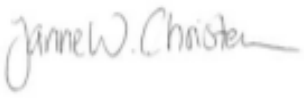
A few years back, ISES members voted on the title for a special presentation to be given by an invited guest speaker from a research field related to equitation science. The title 'Clever Hans' received almost all votes. For those of you who are not familiar with Clever Hans, he was a horse that was at first believed to be able to do maths; of course Clever Hans could not do maths but was instead reacting to very subtle human signals when he had reached the correct number. For equitation scientists there is an important lesson from this story that we must never forget: horses can respond to subconscious human signals, and this should be considered carefully in experimental studies.

I am very much looking forward to this year's Clever Hans talk; Dr. Bhattacharyya has observed wild horses, their impact on land, and their interactions with indigenous people. There is something truly fascinating about wild horses, and the enormous impact that the domestication of the horse has had on human history. I started my research career studying the behaviour of Przewalski horses in a large reserve in the south of Ukraine, and I was amazed with the striking similarities in the behaviour of these horses and our domestic horses. Indeed, this is something to remember in our daily interactions with horses: their basic behavioural needs are exactly the same as the needs of their wild relatives.

On behalf of the ISES council, I would like to extend my wholehearted thanks to the Local Conference Organising Committee: Now is the time to enjoy the results of all your hard work for this conference.

Enjoy the conference, take home as many messages as possible, embed them into practice and spread them widely in order to help to ensure and safeguard horse welfare, regardless of size, breed or discipline. I am very much looking forward to the next few days. I hope you are too.

ISES Honorary President



Janne Winther Christensen

Welcome from the Local Conference Organising Committee

Welcome to Guelph and the 15th International Equitation Science Conference. The Local Conference Organising Committee has been working hard for well over a year to bring you four days of stimulating discovery, the latest technology, networking, and fun. We have delegates from 21 different countries representing an array of interactions with horses, from academics and researchers, to veterinarians, coaches, trainers, and riders. Every one of us has more in common than we do differences – the love of the horse. It is this love that drives each of us to do our best everyday, to learn all that we can to ensure our horses have the best environment for a healthy, happy life.

The theme for this year's conference – bringing science to stable – takes us on a ride from our earliest relationship with the horse, through the dawn of equitation science, to modern technologies we can employ to assist us in learning from the horse. Scientists ascribe to empirical ways of knowing; however, we can also learn much from other cultures and disciplines which inform us about a horse's needs and desires. We can also learn from other species through comparisons and contrasts. And most importantly, we can look at changing our own behaviour; a small change on our part may have a large impact on a horse's life.

The beauty of these annual conferences is that it brings together like-minded people, some of whom are old friends, some of whom are new friends just met. It is through the interaction and exchange of ideas face-to-face that we get inspired. In this digital age, let's not lose this important form of communication – indeed, we highly prize the tactile communication we share with our horses.

We hope that you will enjoy the scientific and practical programme, but also take time to enjoy the beautiful Royal City of Guelph and surrounding area. There are many wonders to discover close by like the John McCrae house (author of *In Flanders Fields*), the Donkey Sanctuary of Canada, and Niagara Falls.

The Local Conference Organising Committee

Katrina Merkies, chair LCOC, *Dept Animal Biosciences, University of Guelph*
Cordy DuBois, *Industry Member*
Gayle Ecker, *Director, Equine Guelph*
Lena Levison, *Animal Care Services, University of Guelph*
Wendy Pearson, *Dept Animal Biosciences, University of Guelph*
Kim Sheppard, *Communications, Campbell Centre for the Study of Animal Welfare*
Lorraine Stubbs, *Two-time Olympic dressage rider, FEI dressage judge and Paradressage judge*
Cathy Wentworth-Stanley, *Industry Member*
Tina Widowski, *Director, Campbell Centre for the Study of Animal Welfare*

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Dr. Carissa Wickens (University of Florida)
Dr. Tina Widowski (University of Guelph)
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The new ISES training principles

A. McLean, P.D. McGreevy and ISES Council

Human and horse welfare depend upon training methods and management that demonstrate:

1. **Regard for human and horse safety**
    - Acknowledge that horses' size, power and potential flightiness present a significant risk
    - Avoid provoking aggressive/defensive behaviours (kicking /biting)
    - Ensure recognition of the horse's dangerous zones (e.g. hindquarters)
    - Safe use of tools, equipment and environment
    - Recognise the dangers of being ineffective, inconsistent or confusing
    - Ensure horses and humans are appropriately matched
    - Avoid using methods or equipment that cause pain, distress or injury to the horse

"Disregarding safety greatly increases the danger of human-horse interactions"

2. **Regard for the nature of horses**
    - Ensure welfare needs: lengthy daily foraging, equine company, freedom to move
    - Avoid aversive management practices (e.g. whisker-trimming, ear-twitching)
    - Avoid assuming a role for dominance in human/horse interactions
    - Recognise signs of pain
    - Respect the social nature of horses (e.g. importance of touch, effects of separation)
    - Avoid movements horses may perceive as threatening (e.g. jerky, rushing movements)

"Isolation, restricted locomotion and limited foraging compromise welfare"

3. **Regard for horses' mental and sensory abilities**
    - Avoid overestimating the horse's mental abilities (e.g. "he knows what he did wrong")
    - Avoid underestimating the horse's mental abilities (e.g. "It's only a horse...")
    - Acknowledge that horses see and hear differently from humans
    - Avoid long training sessions (keep repetitions to a minimum to avoid overloading)
    - Avoid assuming that the horse thinks as humans do
    - Avoid implying mental states when describing and interpreting horse behaviour

"Over- or underestimating the horse's mental capabilities can have significant welfare consequences"

4. **Regard for current emotional states**
    - Ensure trained responses and reinforcements are consistent
    - Avoid the use of pain/constant discomfort in training
    - Avoid triggering flight/fight/freeze reactions
    - Maintain minimum arousal for the task during training
    - Help the horse to relax with stroking and voice
    - Encourage the horse to adopt relaxed postures as part of training (e.g. head lowering, free rein)
    - Avoid high arousal when using tactile or food motivators
    - Don't underestimate horse's capacity to suffer
    - Encourage positive emotional states in training

"High arousal and lack of reinforcement may lead to stress and negative affective states"

5. **Correct use of habituation/desensitization/calming methods**
    - Gradually approach objects that the horse is afraid of or, if possible, gradually bring such aversive objects closer to the horse (systematic desensitization)
    - Gain control of the horse's limb movements (e.g. step the horse back) while aversive objects are maintained at a safe distance and gradually brought closer (over-shadowing)
    - Associate aversive stimuli with pleasant outcomes by giving food treats when the horse perceives the scary object (counter-conditioning)
    - Ignore undesirable behaviours and reinforce desirable alternative responses (differential reinforcement)
    - Avoid flooding techniques (forcing the horse to endure aversive stimuli)

"Desensitization techniques that involve flooding may lead to stress and produce phobias"

6. **Correct use of Operant Conditioning**
    - Understand how operant conditioning works: i.e. performance of behaviours become more or less likely as a result of their consequences.
    - Tactile pressures (e.g. from the bit, leg, spur or whip) must be removed at the onset of the correct response
    - Minimise delays in reinforcement because they are ineffective and unethical
    - Use combined reinforcement (amplify pressure-release rewards with tactile or food rewards where appropriate)
    - Avoid active punishment

"The incorrect use of operant conditioning can lead to serious behaviour problems that manifest as aggression, escape, apathy and compromise welfare"

7. **Correct use of Classical Conditioning**
    - Train the uptake of light signals by placing them BEFORE a pressure-release sequence
    - Precede all desirable responses with light signals
    - Avoid unwanted stimuli overshadowing desired responses (e.g. the horse may associate an undesirable response with an unintended signal from the environment)

"The absence of benign (light) signals can lead to stress and compromised welfare"

8. **Correct use of Shaping**
    - Break down training tasks into the smallest achievable steps and progressively reinforce each step toward the desired behaviour
    - Plan training to make the correct response as obvious and easy as possible
    - Maintain a consistent environment to train a new task and give the horse the time to learn safely and calmly
    - Only change one contextual aspect at a time (e.g. trainer, place, signal)

"Poor shaping leads to confusion"

9. **Correct use of Signals/Cues**
    - Ensure signals are easy for the horse to discriminate from one another
    - Ensure each signal has only one meaning
    - Ensure signals for different responses are never applied concurrently
    - Ensure locomotory signals are applied in timing with limb biomechanics

"Unclear, ambiguous or simultaneous signals lead to confusion"

10. **Regard for Self-carriage**
    - Aim for self-carriage in all methods and at all levels of training
    - Train the horse to maintain:
        - gait
        - tempo
        - stride length
        - direction
        - head and neck carriage
        - body posture
    - Avoid forcing any posture
    - Avoid nagging with legs, spurs or reins i.e. avoid trying to maintain responses with relentless signaling

"Lack of self-carriage can promote hyper-reactive responses and compromise welfare"



Scientific programme

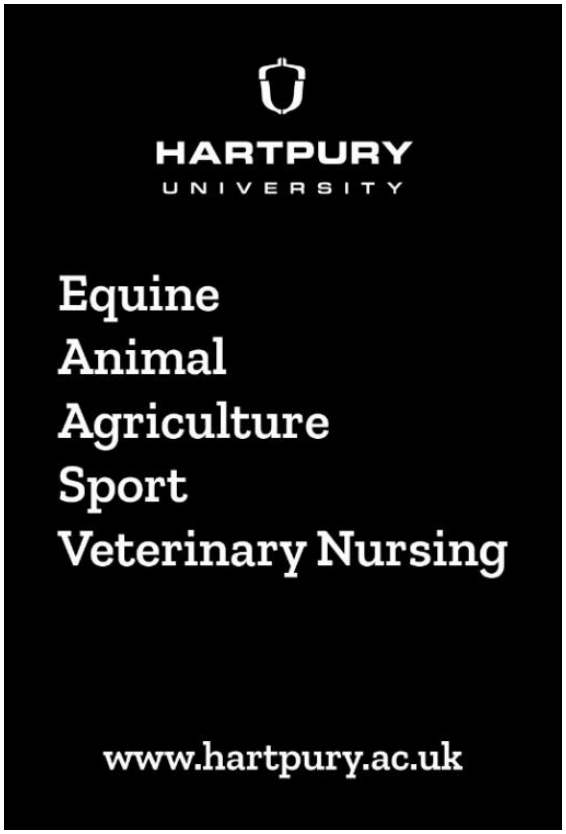
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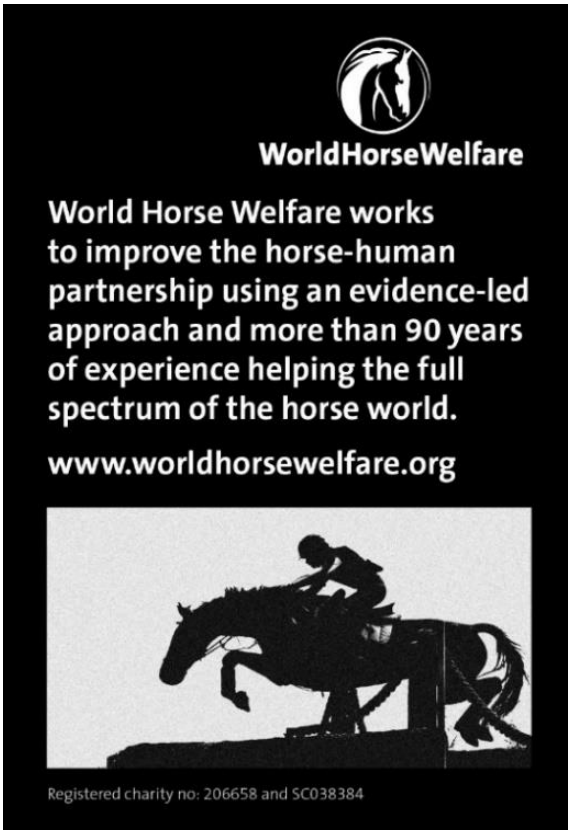
DAY O: SUNDAY AUGUST 18TH	
8:00-9:00am	**Theory Class for Large Animal Technical Rescue** (LLC 1714)
9:00-10:30am	**Large Animal Technical Rescue Training Workshop A** (Equine Guelph Arena) *Victor MacPherson (CA), Rebecca Gimenez-Husted (Clemson University, USA), Hayley Randle (Charles Sturt University, AU), Gayle Ecker (Equine Guelph, CA), and Susan Raymond (Equine Guelph, CA)*
10:30-11:00am	*Workshop restaging*
11:00-12:30pm	**Large Animal Technical Rescue Training Workshop B** (Equine Guelph Arena) *Victor MacPherson (CA), Rebecca Gimenez-Husted (Clemson University, USA), Hayley Randle (Charles Sturt University, AU), Gayle Ecker (Equine Guelph, CA), and Susan Raymond (Equine Guelph, CA)*
12:30-1:15pm	**LUNCH BREAK**
1:30-3:00pm	***Chair:*** Cordy DuBois **Pre-Conference Workshop 1** (LLC 1714) W1: Lost in translation? Understanding and improving the communication of science in equine communities. *Cristina Wilkins (Horses and People, AU) and Kate Fenner (Kandoo Equine, AU)*
3:30-5:00pm	**Pre- Conference Workshop 2** (LLC 1714) W2: An ethogram for horses: Can we all agree on what horses do? *Marc Pierard (Hartpury University, UK)*
7:00-9:00pm	**CONFERENCE WELCOME RECEPTION & REGISTRATION** *Summerlee Science Complex Atrium* Hosted by Terra Nova

DAY 1: MONDAY AUGUST 19TH	
6:00 am	**Wake up walk in the Arboretum**
7:00am-5:00pm	**REGISTRATION** (all day; Rozanski Concourse) All oral presentations held in Rozanski 103
8:00am	**OFFICIAL WELCOME** Katrina Merkies, Chair LCOC Janne Winther Christensen, President, ISES Malcolm Campbell, Vice President Research, University of Guelph
8:30-9:30am	**PLENARY #1** ***Chair:*** Katrina Merkies *PL1: Origins: How humans and horses began their everlasting friendship* Dr. Sandra Olsen; Curator-in-Charge, Biodiversity Institute and Natural History Museum, University of Kansas, USA
9:30-9:40am	**Poster Blitz Session A**
9:40-10:30am	**BREAK & EXHIBITORS, POSTER SESSION A** (Rozanski Concourse)
10:30-12:00pm	**SCIENTIFIC SESSION 1:** Horse and Rider ***Chair:*** Lena Levison
10:30am	O1: Did you put on weight? The influence of increased rider weight on horse behavioural and physiological parameters. *Janne Winther Christensen (Aarhus University, DK)*
10:45am	O2: On-ground rider weight symmetry mirrors balance in the saddle. *Mette Uldahl (Vejle Hestepraksis, DK)*
11:00am	O3: Riders' perception of balance and how it impacts equine welfare - Phase 1 - Assessing riders' perception of balance before riding. *Christine Ramsey (DMR 4 Balance, USA)*
11:15am	O4: Factors influencing show-jumping performance of top sport horses. *Klára Ničová* (Institute of Animal Science, CZ)*
11:30am	O5: Investigating safer human-interactions with horses: Tradition vs Science. *Meredith Chapman* (Central Queensland University, AU)*
11:45am	O6: Equine response behaviour to game encounters during horseback safari rides. *Evelyn Hodgson* (Bristol Veterinary School, UK)*
12:00-1:30pm	**LUNCH** (Creelman Hall)
1:30-2:30pm	**PLENARY #2** ***Chair:*** Renée Bergeron *PL2: What is Equitation Science?* Dr. Camie Heleski; Senior Lecturer, University of Kentucky, USA
2:30-2:40pm	**Poster Blitz Session B**
2:40-3:30pm	**BREAK & EXHIBITORS, POSTER SESSION B** (Rozanski Concourse)
3:30-5:00pm	**SCIENTIFIC SESSION 2:** Equipment Use ***Chair:*** Cathy Wentworth-Stanley
3:30pm	O7: A comparison of Micklem bridles and conventional bridles fitted with restrictive nosebands. *Dean Bucknell* (Charles Sturt University, AU)*
3:45pm	O8: Changes in pressures exerted on sub-noseband tissues by tightening the noseband. *Orla Doherty (University of Limerick, IE)*
4:00pm	O9: An investigation into equestrian spur use in the United Kingdom. *Victoria Lewis (Hartpury University, UK)*
4:15pm	O10: Preliminary investigation into the effect of noseband design on rein tension and the force exerted on the frontal nasal plane. *Jayne Peters* (Bishop Burton College, UK)*
4:30pm	O11: Understanding whip use in riders in sports horse disciplines. *Jane Williams (Hartpury University, UK)*

4:45pm	O12: Evaluation of whip use in British Showjumping. *Kirstin Spencer* (Writtle University College, UK)*
5:00-7:00pm	**DINNER BREAK**
7:00-8:00pm	**CLEVER HANS TALK** (ROZ 103) ***Chair:*** Paul McGreevy *Bush Trails and Horse Tales: Relationships between horses, people, and Indigenous lands in central British Columbia* Dr. Jonaki Bhattacharyya; Senior Researcher, The Firelight Group, Canada

*= student presenter





DAY 2: TUESDAY AUGUST 20th	
6:00 am	**Wake up walk in the Arboretum**
7:00am-5:00pm	**REGISTRATION** (all day; Rozanski Concourse) All oral presentations held in Rozanski 103
8:00am	**WELCOME**
8:15-9:15am	**PLENARY #3** ***Chair:*** Natalie Waran *PL3: The future of Equitation Science* Dr. Nic de Brauwere; Head of Welfare, Rehabilitation and Education, Redwings Horse Sanctuary, UK
9:15-9:25am	**Poster Blitz Session C**
9:25-10:15am	**BREAK & EXHIBITORS, POSTER GROUP C** (Rozanski Concourse)
10:15am-11:45pm	**SCIENTIFIC SESSION 3:** Kinematics and Management ***Chair:*** Wendy Pearson
10:15am	O13: A preliminary study investigating the effect of Slow/Trickle Feeders on nocturnal feeding behaviour and time budgets of stabled horses. *Barbara Hardman* (Royal (Dick) School of Veterinary Studies, UK)*
10:30am	O14: The methodological challenges associated with measuring the equine stress response in real life scenarios. *Gemma Pearson* (Royal (Dick) School of Veterinary Studies, UK)*
10:45am	O15: Lower neck and forelimb locomotion in horses: a clinical model of nerve root dysfunction. *Gwenola Touzot-Jourde* (University of Nantes, FR)*
11:00am	O16: The effects of surface and animal size on hoof loading in horses. *Alexis Szpakowski (University of Guelph, CA)*
11:15am	O17: Asymmetrical limb loading in Thoroughbred racehorses as a possible cause for injury. *Danielle Halucha* (University of Guelph, CA)*
11:30am	O18: Impact of a companion horse during stressful situations. *Claire Ricci-Bonot* (Lincoln University, UK)*
11:45am-1:00pm	**LUNCH** (Creelman Hall)
1:00-2:30pm	**SCIENTIFIC SESSION 4:** Welfare and Quality of Life ***Chair:*** Tina Widowski
1:00pm	O19: An investigation of Traveller/Gypsy horse owners' understanding of the concept of welfare. *Marie Rowland* (University of Edinburgh, UK)*
1:15pm	O20: Informing a social license to operate communication framework: Attitudes to sport horse welfare. *Julie Fiedler* (Central Queensland University, AU)*
1:30pm	O21: Prospects of non-invasive stress measuring in equestrian training. *Esmeralda Tuomi* (Imperial College London, UK)*
1:45pm	O22: Indicators on the outside: Behaviour and equine Quality of Life. *Natalie Waran (Eastern Institute of Technology, NZ)*
2:00pm	O23: Indicators on the inside: Physiology and equine Quality of Life. *Hayley Randle (Charles Sturt University, AU)*
2:00-2:10pm	**Poster Blitz Session D**
2:10-3:00pm	**BREAK & EXHIBITORS, POSTER GROUP D** (Rozanski Concourse)
3:00-4:00pm	**PLENARY #4** ***Chair***: Gayle Ecker *PL4: Learning theory across species* Dr. Andrew McLean; ESI International, Australia
4:00 pm	Sneak peak at ISES 2020 – Hartpury University/Hartpury College, Gloucester, England. Jane Williams
4:15 pm	Awarding of oral and poster presentation winners Book draw for Pasture Management text (2)

4:30-5:30pm	**Annual General Meeting** ***Chair:*** Janne Winther Christensen
7:00-12:00 pm	**BANQUET (Brass Taps, University Centre)** *The GMOs – rock and roll dance band*

*= student presenter



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DEPARTMENT OF ANIMAL BIOSCIENCES

Practical Day programme

Practical Day hosted at the Ancaster Fairgrounds, 630 Trinity Road, Ancaster, Ontario, Canada.

DAY 3: WEDNESDAY AUGUST 21ST	
7:45am	Buses Leave UoG Campus Travel to Ancaster Fairgrounds
9:00am	**WELCOME**
9:10-9:50 am	***Chair***: Antonia Henderson **PD1: Positive reinforcement training demonstration** (Arena) - Presented by Shawna Karrasch (Terra Nova)
9:50-10:30am	**PD2: Smart halter for monitoring distress demonstration** (Arena) - Presented by Jeffrey R. Schab (Nightwatch)
10:30-11:00am	**BREAK**
11:00-11:40am	***Chair***: Theresa Rondeau-Vuk **PD3: Codes of Practice and equine welfare assessment workshop** (Emick Room) - Presented by Katrina Merkies and Cordy DuBois (University of Guelph)
11:50-12:30pm	**PD4: Saddle fitting theory lecture** (Emick Room) - Presented by Jochen Schleese (Saddlefit4Life)
12:30-1:30pm	**LUNCH**
1:30-2:00pm	**Hamilton Police Horse Public Order Training Demonstration** (Arena)
2:00-2:40pm	***Chair***: Colleen Brady **PD: Saddle fitting live demonstration** (Arena) - Presented by Jochen Schleese (Saddlefit4Life)
2:50-3:30pm	**PD5: Technical sportswear to improve riding position demonstration** (Arena) - Presented by Allison Pezzack (Visualise)
3:40-4:20pm	**PD6: Rein sensor demonstration** (Arena) - Presented by Menke Steenbergen (IPOS)
4:30-5:10pm	**PD7: Measuring head angle, pace and heart rate while riding** (Arena) - Presented by Dominic Lombardo (equla Vert)
5:15pm	**CONCLUSION AND FAREWELL**
5:30pm	**Buses leave to return to UoG**

List and abstracts of poster presentations

Only the presenting author and their affiliation are mentioned. Please refer to the abstracts for further information.
*= student presenter

POSTER SESSION A	
P1: *Barn or Yard? When given the choice, where does a horse choose to spend its time?* (S. Wilson, Wishing Well Services, CA)	**p**. 68
P2: *A preliminary study of the effects of the number of consecutive days of training and days off on foal recall.* (H. Randle, Charles Sturt University, NZ)	**p.** 69
P3: *Examining the horse-human bond from the human perspective.* (D. Hayman*, University of Guelph, CA)	**p.** 70
P4: *The elusive "feel" : exploring the quality of the rider-horse relationship.* (L. Tufton, Nottingham Trent University, UK)	**p.** 71
P5: *The effect of police horse training on the behavioural and physiological responses to different environments encountered on the job.* (K. Merkies, University of Guelph, CA)	**p.** 72

POSTER SESSION B	
P6: *Electromyographic changes with exercise-induced fatigue on the treadmill in different muscles.* (Y. Takahashi, Japan Racing Association, JP)	**p.** 73
P7: *Preliminary findings of observations of affiliative and stress behaviours in large horse herds with variations in resources.* (E. Kieson, Oklahoma State University, USA)	**p.** 74
P8: *Behaviour and heart rate responses in horses exposed to novel stimuli.* (K. Lee*, College of Veterinary Medicine, KR)	**p.** 75
P9: *Development of a numeric scale to document and communicate the findings from Saddle Fit Thermograms in an objective manner.* (M. Guerini, DMR 4 Balance, USA)	**p.** 76
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THE *PRACTICAL APPLICATION* OF EQUITATION SCIENCE

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Biographies of plenary speakers, workshop leaders, and practical day presenters



Clever Hans speaker - Dr. Jonaki Bhattacharyya: Ethnoecologist and Environmental Planner Dr. Bhattacharyya works closely with Indigenous peoples and other communities to lead applied research on relationships between people from different cultures, wildlife, and the land in Canada. With a PhD in Environmental Planning, she is currently adjunct faculty at two universities and a Senior Researcher with The Firelight Group in British Columbia, Canada. Dr. Bhattacharyya partners with Indigenous communities, NGOs, and other agencies to strengthen and implement land and wildlife stewardship initiatives. She has extensive experience doing "boots on the ground" research on culturally appropriate wildlife planning, stewardship, and management. She works to apply her research to improve current methods surrounding conservation, protection, and management of wildlife and the places they and others dwell.



Dr. Sandra Olsen is a renowned scientist and zoo-archaeologist who has focused much of her research on the development of horse-human relationships throughout time and the impact of equine domestication on society. Dr. Olsen is a professor at the University of Kansas and Curator-in-Charge for the Biodiversity Institute and Natural History Museum. Although the lifestyle of a travelling archaeologist is not the most conducive to horse ownership, Dr. Olsen has had many incredible personal equine experiences including riding in Mongolia, Kazakhstan, China, and the United States as well as being able to observe wild mustangs in the summer in Wyoming. Her career path also allows her to appreciate these gracious animals in a whole new sense as she is constantly discovering and learning about their evolutionary progress and their significant impact on humans throughout history.



Dr. Camie Heleski has her Masters and PhD in Animal Science from Michigan State University. She currently is a senior lecturer at the University of Kentucky. In addition to teaching, she is highly involved in equine research. Her applied research interests revolve around equine behaviour and welfare, horse-human interactions and the welfare of working equids in developing regions of the world; more recently she has begun examining issues related to the Thoroughbred racing industry. In addition to her teaching and research, she has been actively involved with the International Society for Equitation Science as a Council member and currently serves as Senior Vice President.



Dr. Nicolas de Brauwere graduated from Onderstepoort Veterinary School in South Africa in 1991. Soon after, he took the position as in-house veterinarian at the Redwings Horse Sanctuary in the UK where he now works to rescue and rehabilitate feral, unhandled and mistreated horses as Head of Welfare and Behaviour. Dr. de Brauwere is chairman of the National Equine Welfare Council (NEWC) in the UK, an umbrella organization for accredited equine rescues and sanctuaries. He is particularly interested in theoretical and practical aspects of working with these equids and hopes to find solutions to their problems by "starting at the source." He believes that with his platform on the NEWC he will be able to provide equine charities and other organizations with tools and ideas to start making a change in equine welfare now and for future generations.



Dr. Andrew McLean is a prolific author of books and journal papers on the science and ethics of horse training, and has been awarded the Eureka Prize for Australian Science and the Flambio award from the Italian Equestrian Federation for his contributions. In Equestrian Sport, he has represented Australia in Eventing, ridden to Grand Prix level in Show-Jumping and FEI level in Dressage, and has also won bareback races in Australia and New Zealand. Andrew is also well known for his acclaimed systematic approach to elephant training in Nepal, India, Thailand, Myanmar and Laos, where his work is endorsed, continued and supported at government level.



Kate Fenner BEqSc (Hons) is a PhD candidate (Sydney School of Veterinary Science, University of Sydney), equestrian coach (Equestrian Australia and British Horse Society), and horse trainer (John and Josh Lyons Certified Trainer). Kate has ridden, trained and competed in Dressage, Jumping, Western and polo in Australia, Europe, USA and Asia. After years of experience starting horses for clients, Kate feels strongly that owners are best served by learning to train their own horses. As a result, she founded Kandoo Equine and has developed a series of ethical, easy to follow, step-by-step guides that are suitable for horses and riders of all levels.



Cristina Wilkins is the publisher and editor of Australian-based Horses and People, a magazine and online community that promotes ethical, sustainable and evidence-based information on horse keeping and training. She grew up eventing, showjumping and coaching in Spain, the UK, New Zealand and then Australia but everything changed after translating Dr. McLean's 'The truth about horses' into Spanish and discovering learning theory. 2019 marks Cristina's tenth year as editor of Horses and People, and eighth year in ISES Council. Her special interest is improving the dissemination of equitation science to the wider public.



Dr. Marc Pierard is a lecturer in animal behaviour and welfare at Hartpury University (UK). His research focuses on applied ethology and equitation science. As part of his PhD, he developed a first draft of a reference ethogram for horses. He is a past council member of the International Society for Equitation Science.



Victor MacPherson is a Retired Master Corporal, having served in the Canadian Military attached to armoured units, and with NATO in Europe. He was District Fire Chief for Station 2 for the Adjala-Tosorontio Fire Department for 19 years, and is currently employed with the City of Vaughan as a Master Emergency Vehicle Technician and Acting Chief Mechanical Officer. He also facilitates fire services response for Farm and Food Care Ontario. MacPherson became involved with LART in 2013 after completing several training seminars, and assists in both training and facilitating courses with Equine Guelph and Dr. Rebecca Gimenez-Husted.



Dr. Rebecca Gimenez-Husted's passion for horses started at a young age. While growing up, she had horses of her own on her family farm in Florida. After working various jobs including breeding manager, editor and freelance writer for a magazine and working in the US Army Reserves, Gimenez-Husted returned to school to pursue a PhD in animal physiology from Clemson University, SC. This is where she met her future husband Dr. Tomas Gimenez, and together they developed the Technical Large Animal Emergency Rescue program, providing veterinarians, horse owners and emergency responders with the appropriate training to handle emergency situations.



Dr. Hayley Randle is an Associate Professor in equine science at Charles Sturt University in Australia, and has worked in the field of education for over 20 years. She frequently reviews veterinary journals and is a past president and current trustee for ISES. Dr. Randle's expertise in equine behaviour will complement the delivery of the technical aspects of large animal rescue. In emergency situations, appropriate interpretation of and response to a frightened animal's behaviour can mean the difference between a tragedy and a successful rescue.



Gayle Ecker is the Director of Equine Guelph and played an instrumental role in its birth. She has dedicated her energies to advancing the equine industry through education and communications. Gayle created the 'pyramid of education' model – an educational approach that provides learning pathways for career development at all levels (youth education > industry skills > Equine Science Certificate > higher education) in the equine industry. In collaboration with the Office of Open Learning, Gayle developed the Equine Science Certificate program an on-line program targeted to the equine industry. She also acts as an instructor in the program.



Susan Raymond has been involved in the development and delivery, both online and in-person, of educational and skills training programs since 2003 (Equine Guelph). The focus of these programs is to improve welfare and safety of both animals and people on the farm during day to day activities and emergency situations. Susan's PhD research involved investigating the effects of exposure of horses to mycotoxins, as well as examining stable design and management as they affect air quality. Susan has completed Technical Large Animal Emergency Rescue Operations, Rescue Ropes/Rigging courses and Animal Technical Rescue Awareness Level Course (University of Florida). Susan has also completed Colorado State University – Equine Investigations Academy Level 1.



Shawna Karrasch began her training career far outside the equestrian world, working with large marine mammals. When introduced to the world of top equestrian competition, Shawna saw immediately how the reward-based training she was so successful with in training marine mammals could be used to engage the horse's willingness in equestrian pursuits. By using Shawna's positive reinforcement training methods, Olympian Beezie Madden taught her famous show jumper Judgment (now Judgment ISF) to overcome his fear of water and go on to win the $1,000,000 CN International at Spruce Meadows, among many other international show-jumping victories. Shawna's powerful and humane behavioral training techniques are an eye-opening experience for equine professionals, competitors, and amateurs alike. She has produced books and videos and traveled worldwide to teach the concepts of bridge conditioning and positive reinforcement for horses.



Jeffrey R. Schab (Founder & CEO, Protequus®) is an accomplished equestrian and engineer who has a passion for horses and an eye on innovation. Having built a career in healthcare marketing services, Schab intimately understands the critical success factors to bring value-added solutions to market. Immediately following the sudden and personal loss of one of his show horses in 2013 from a rare colic event, Schab was driven to find a solution to combat the devastating impact of this condition. He left his 15-year career to invent NIGHTWATCH®, the world's first smart halter™ that acts as an early-warning system for colic and other forms of equine distress. This ground-breaking technology has garnered international acclaim from both equestrian and technology communities and is available to horses in the US and Canada. Schab holds a dual degree in biomedical engineering and biology from Tufts University.



Dr. Katrina Merkies holds an honours BSc (Agr.) in Animal Science and a PhD in Reproductive Physiology, both from the University of Guelph. She was a faculty member at Lake Erie College in Ohio for four years, but returned to Canada in 2006 to develop and implement the first equine Bachelor's degree in Canada (BBRM Equine Management) at the University of Guelph. She maintains oversight of the programme and teaches a variety of equine courses. Her modest research programme focuses on the horse–human interaction, but she enjoys involving all of her students (graduate and undergraduate) in all aspects of equine research. Merkies has trained and competed up to FEI levels in dressage, earning the title of Canadian Champion in 1999. She is a Level II dressage coach in Canada and her students have been successful at all levels.



Dr. Cordy DuBois began her academic career with a degree in Conservation Ecology from York University, and an Equine Studies Diploma from Equine Guelph. Her passion for science and horses led her to a Master's Degree from the University of Guelph, examining lying behaviour and fecal cortisol as measures of equine well-being. She then continued on to a PhD degree also from the University of Guelph, further exploring insight into the perception of welfare issues in the Canadian equine industry, and designing an on-farm assessment tool. DuBois has traveled extensively to learn the necessary techniques to effectively and objectively assess animals and audit facilities. She has also completed the Colorado State University and Code 3 Associates' Equine Investigations Academy Level 1 & 2, a program designed for animal investigators to help them conduct better cruelty investigations.



Jochen Schleese established Saddlefit 4 Life® (2006) as an independent organization to teach saddle fit evaluation and analysis, and certify professionals in equine and saddle ergonomics. Schleese lectures at the German Professional Trainers Association in Warendorf, Germany, at veterinary conferences in Brazil and is a frequent clinician at trade shows and equine forums worldwide. Saddlefit 4 Life® courses are accredited by the United States Dressage Federation, the Certified Horsemanship Association and Ontario Equestrian Federation. Schleese is on the advisory board of the Equine Sciences Academy and an education partner with the American Riding Instructor Association and Ontario Equestrian Federation.



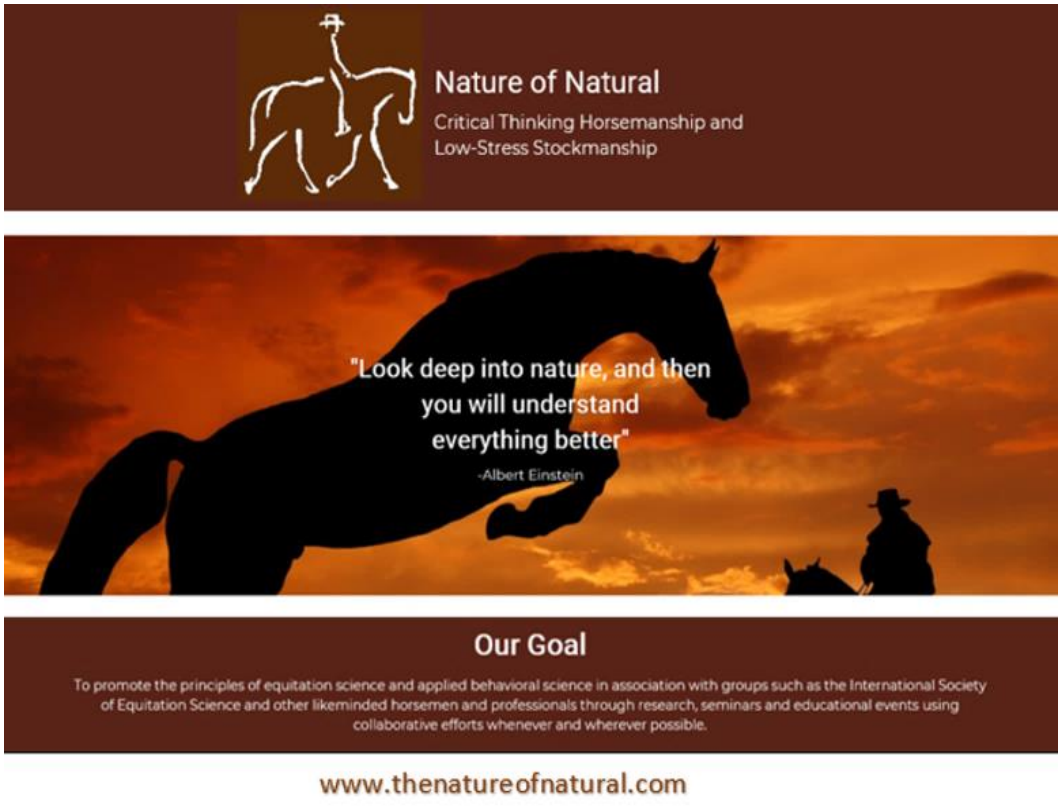
In 2013, **Allison Pezzack** began working with Russel Guire as the Canadian representative for Visualise Sportswear and Centaur Biomechanics. She has hosted many Rider Analysis Clinics and Introduction to Biomechanics Courses with Russel Guire. She also travels to Centaur HQ in the UK to work with Centaur and Visualise, and to continue learning about Visualise technology, rider straightness and its connection to performance and horse welfare.



Menke Steenbergen, founder of IPOS Technology, has a degree in Veterinary Medicine (Utrecht University) and Governance. IPOS is an innovative company dedicated to developing horse sports technologies and providing equestrians with the competitive advantages they seek. Being a rider and a veterinarian herself, Steenbergen has dedicated the past decade to investigating and developing rein sensor technologies. A second field of interest is the application of learning theory in the pursuit of employing lightness when using aids. By measuring rein aids, many discrepancies between intended and applied pressure become visible and thus trainable. Steenbergen is author of the book *Horse Signals* and co-author of many publications on Horse Sport Technologies. She is a Dutch certified dressage trainer.



Dominic Lombardo is the co-founder of equla, an equine technology firm. He is also the founder of the Equine Technology Guild, an industry group. Previously, he worked in a number of fields, including educational publishing, health insurance, and broadcast media. He has been an enthusiastic but unskilled equestrian for most of his life, most often as groom and handyman. Lately, his stable hours involve strapping, taping, and gluing electronics to skeptical horses and riders.



ABSTRACTS

W1: Lost in translation? Understanding and improving the communication of science in equine communities

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There is a need for dissemination of equitation science research findings in ways that are readily accessible and easily understood by lay equestrians. Material that is accessible, relevant and engaging to lay equestrians reaches a wider range of people than traditional scientific publications alone. Educational psychology shows us that change in practice is not simply a matter of exposure to material. Learners (in this case equestrians) need to engage in critical thinking to obtain a deeper understanding of the basis for their actions. Critical thinking can lead to transformative change in practice. During this workshop participants will practice and apply skills relating to justifying a decision after exploring a situation, question or issue. The aim of this workshop is to develop resources, including easy to populate templates, for timely, accurate, layperson appropriate and engaging information dissemination. Several methods will be used including survey results and interactive exercises. Horses owners will be surveyed prior to the workshop as to where they obtain their horse management, training and behavior information, as well as their perspectives of the usefulness of available sources of this information. Workshop participants will discuss these results during the workshop. Interactive participant exercises adapted from the field of climate science and designed to challenge participants' ways of thinking will also be used in the workshop. We will also use a modified form of deliberative polling of researchers to inform the development of methods to assist resource development. It is important to note that the field of equitation science is a relatively young one and researchers in this field also require knowledge, skills, and, most importantly, support in confidently disseminating results to a diverse audience. ISES members are ideally placed to be leaders in evidence-based result dissemination.

W2: An ethogram for horses: Can we all agree on what horses do?

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Horses can express a range of behaviours, which we can observe to evaluate their performance, health or welfare. However, at present, there is no formal agreement on how to name and define these behaviours and many behaviours are defined in different ways. The development of a reference ethogram for horses could help fill that void, provided the ethogram is valid and reliable and it is supported by a majority of stakeholders.

An ethogram is a catalogue of behaviours, containing names, definitions and potentially a classification of behaviour units. There are two main types of ethograms: species ethograms containing an exhaustive list of all the known behaviours of that species, and a study ethogram specifying the definitions of relevant behaviours as they are used in that particular study. Names and definitions of behavioural units can highlight different aspects, such as: structural definitions focus on patterns of muscular actions, describing movements, postures and vocalisations; functional definitions emphasize the consequences of behaviours on the animal itself or its environment (including other animals); causal definitions refer to environmental or physiological triggers for behaviours. Agreement on a structural ethogram is important, as this creates a foundation for more coherent research focused on function, cause or ontogeny of the behaviours.

The aim of this workshop is to discuss the development of a structural ethogram for domestic horses. The current state-of-affairs will be briefly presented, including a first draft of a structural reference ethogram for horses that was recently published (Pierard *et al.*, J. Vet. Behav.: Clin. Appl. Res. 29: 118-127, 2019). This first draft represents an initial attempt to start a process that will hopefully result in a widely supported and applied reference ethogram. The workshop is the next step in that process and will be interactive, discussing how to move forward, what behaviours it should contain, and crucial elements to include in the definitions.

A reference ethogram should not impede the flexibility that is needed for the broad spectrum of studies and applications that are available. It would only be a benchmark to promote a higher degree of comparability and compatibility of study ethograms, which would facilitate meta-analyses. A structural reference ethogram could also provide a common vocabulary for a clearer and more efficient communication between stakeholders, which include researchers working in different (sub)disciplines, veterinarians, veterinary nurses, farriers, breeders, judges, trainers, riders, grooms, stewards and welfare inspectors.

Valid and reliable definitions of behaviour units are fundamental for equestrian sports and for measuring horse welfare. Judges and stewards are often required to score and interpret horse behaviours, notably in equestrian disciplines such as dressage or reining. The interpretation of animal welfare is relying ever more on animal-based indicators, including behavioural assessments, which are based on ethograms. Automated systems to monitor animal welfare are expanding rapidly and being used more and more frequently. The validity and reliability of these systems depend to a large extent on algorithms to classify and interpret animal behaviour.

The workshop will allow participants to discuss what different stakeholders consider fundamental to generate support for the ethogram's ultimate use and how a compromise could be reached that would make the final document acceptable to a wide range of stakeholders. Of course, a reference ethogram would be a living document that would need regular updates to reflect the latest scientific and technological advances and changes in needs of stakeholders. The feedback from participants to this workshop will be used to prepare a more detailed version of the structural reference ethogram.

PL1: Origins: How humans and horses began their everlasting friendship

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Let us journey backward in time over 3.6 million years ago, if we may, to view early hominins serenely strolling along a path in Tanzania shared with now-extinct horses. Leap forward to 400,000 years ago, when Paleolithic hunters from our modern genus *Homo*, armed only with wooden spears, slew a band of 20 horses in what is today Lower Saxony, Germany. Moving forward in time again to 5500 years ago, we come to a village of 160 pit-houses in the very middle of the Eurasian steppes, where modern humans began the pivotal trajectory toward domesticating horses – a process that would forever change humanity in countless ways. Horses have played a variety of vital roles in societies over the millennia, including ones related to diet, transportation, work, religion, property/commodity, military, status and sports. The historical record, particularly in terms of empire building, breed development, and performance, has been thoroughly documented. However, teasing out the subtle nuances of the archaeological record to recreate the early stages of the horse-human relationship requires patience and a broad holistic approach. Join us as we scrutinize this very cold case to solve how humans and horses together created a long, rich and diverse history.



PL2: Horses and humans – Can equitation science enhance equine welfare and improve human safety?

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What is "equitation science"? And what is the International Society for Equitation Science (ISES)? For those of us in North America, the term "equitation science" starts us off somewhat confused because most of us think of "equitation" as a show event where riders are judged largely on their ability to ride in a correct posture and perform an intricate pattern. While this might be a component of equitation science, "equitation science" (ES) actually is more about getting people to recognize some of the more enlightened views presented by early riding scholars, and then building upon that by using evidence-based research to enhance equine welfare and improve horse-human interactions. ES has no intention to diminish the "art" that is part of horse-human relationships, but it does strive to combine multiple scientific fields (e.g. animal behavior, biomechanics, sports psychology, welfare science, and physiology) into a framework that can lead to quality of life improvement for horses, while simultaneously improving human safety. How might the application of science help us enhance horse welfare and horse-human interaction? Fortunately, we now have literally hundreds of examples. A few that seem to resonate with people new to ES are (1) using saddle pressure measurement to assess saddle fit and comfort, (2) using rein tension meters to determine how much pressure is applied to a horse's mouth, (3) assessing video clips to identify equine facial expressions of pain, (4) comparing training methods and observing which produce the most effective results/lowest stress measures.

After establishing some foundational background, I'll delve into some ISES history. Though certain aspects of this field have existed for centuries, the official discipline didn't really get started until about 2002 at an equine behavior workshop in Iceland. The following year, a small satellite meeting on equine welfare was held in Italy. Another workshop was held in Scotland before the first official ES symposium was held in Australia in 2005. Two years later, we became an official academic society during our conference in the United States. We have now conducted conferences in 10 different countries and presented over 400 oral presentations, over 400 poster presentations and dozens of practical demonstrations. What was once very difficult to find in a search of refereed, scientific material, now produces several thousand results. During my talk, we'll review the Mission and Aims of ISES, talk briefly about the First Principles of Horse Training (recently revised by McLean, McGreevy & Christensen), and discuss the Position Statements that have been penned by ISES members: on restrictive nosebands, on alterations of head and neck posture in equitation, on aversive stimuli in horse training, and on the use/misuse of leadership and dominance concepts in horse training. Lastly I will present some of the "hot topics" and common conference themes that tend to sort into one of these categories: (1) the (roughly) one hour per day of 'direct' interaction with humans (e.g. training, ground work, riding, driving) and (2) the 'other 23 hours of the day.'

CH: Bush Trails and Horse Tales: Relationships between horses, people, and Indigenous lands in central British Columbia

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Relationships between horses and humans are often strong and complex. Wild or free-ranging horses, while often exalted in art and imagination, stir up intense controversy in many places. In Tsilhqot'in territory, (south central interior of British Columbia, Canada), free-ranging horses are interwoven with the history and identity of Indigenous peoples, people from other cultural backgrounds, and the land itself. Wild horses in south central British Columbia are part of an ecologically, culturally, and politically unique set of circumstances – where the relationships, impacts, and values of wild horses are perceived and experienced differently by different groups. Research indicates that while the horses' impacts on local ecosystems and wildlife are mixed, people's perceptions of the animals are deeply influenced by politics, culture, and economics.

Local people characterize horses in Tsilhqot'in territory along a spectrum of "wildness" in terms of their behaviours and home ranges. Ecologically, horses in the region vary in their impacts on forage plants, and are subject to a suite of population limiting factors such as cold winters, and predator populations. Politically, the wild horses are tied into a history of twentieth century power struggles between Indigenous peoples, colonial state governments, and economic interests. Culturally, wild horses are deeply ingrained in the lives and identities of local peoples, though Indigenous and non-Indigenous people interviewed for this research shared distinctly different perspectives on them. Traditional Indigenous systems of managing and relating to free-ranging and wild horses are part of the socio-ecological system that has created the characteristic horse populations in the region today.

The twenty-first century is bringing a new set of changes to the cultures, ecosystems, and human-horse relationships in the Tsilhqot'in and elsewhere in Canada, influencing the role of wild and free-ranging horses in people's lives and on the land.

PL3: The Future of Equitation Science

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For a discipline and community that's relatively young, Equitation Science (ES) has evolved to make a considerable impact. But like many scientific disciplines that seek to answer questions about current practices and thereby inspire change, it has come up against considerable resistance. So the future of ES really depends on whether the equitation science community is able and willing to expand their own skillset to understand the changes that are needed. The International Society for Equitation Science (ISES) describes its role as facilitating research into the training of horses to enhance horse welfare and improve the horse–rider relationship. Welfare is therefore at the heart of what motivates equitation scientists.

If ES is to reach beyond a small community and underpin the 'new normal' of good equestrianism we need to embrace the challenges ahead. This involves an objective understanding of people, horses and the factors that influence the relationships amongst and between humans and horses. It is imperative that equitation science research meets the highest standards for robust design and execution of research, honest interpretation and unbiased reporting of results. To influence change, we need collaboration between quantitative and qualitative research methods. If welfare motivates us, we need to understand it better and recognize how animal sentience influences the welfare experience for horses. Moving to the 5 Domains model to incorporate emotional states into the discourse on welfare brings the potential for an objective assessment of what a "happy athlete" is and how to ensure it. People control almost everything that horses experience, on a micro and global scale. ES can extend its impact by understanding everything from the meaning horses have for people, to how people can change their own behaviours to benefit the horse. We need to have a grasp of history, the "Industry", motivations of individuals and institutions, and the interplay between people, for example, as "voices for the horse".

Equitation science is a central cog in the wheel of change for horse welfare, and ISES a vital facilitator of that change. If ISES and the wider ES community wish to embrace the future challenges they can also become the engine, the steering wheel and even the grease to help positive change happen. In our enthusiasm we mustn't fall foul of the same behavioural tendencies that underpin the resistance to change we see in the face of evidence stemming from ES. Those who seek change also need to develop the skills to effect it, rather than expecting our evidence alone to ensure it.

PL4: How the elephant in the room can temper the ISES communication crisis

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The scientific ingredients for efficient, safe and ethical training have become progressively available to humanity during the past half-century. Yet surprisingly, when compared with the uptake of technological information, their acceptance in horse and elephant training circles is slow indeed (Warren-Smith and McGreevy, 2008). But why are horse trainers in the West and elephant trainers in the East so slow to incorporate the principles of what is now known as learning theory – the science of the learning processes? In this presentation, I begin with the parallel histories of horse and elephant training, the similar ethological needs of the two species and the consequent importance of accounting for these in our interactions with these species from the welfare standpoint.

Intertwined with this comparative approach emerges a similar blueprint for training the two species which enabled my smooth reassignment from horse trainer to elephant trainer over a decade ago. This discussion highlights Skinner's assertion that from the structural viewpoint, learning processes and therefore training can be considered a technology. In my life as an equitation science 'emissary' to the global horse industry, I have experienced that revealing the inter-species validity of this body of knowledge is very compelling.

The backdrop to this discussion is set by the rising community expectations for improved welfare embodied in the notion of social licence and the various forces within ranging from welfare science to the animal rights movement within the context of the post-truth era. These forces determine the similar welfare challenges that are faced by both the horse industry and the captive elephant industry. In a sense, the captive elephant industry can be seen as the 'canary in the coal mine' for the horse industry because the current politics surrounding elephant riding illuminate the future prospects of the use of the horse in sport and leisure.

Thus the central point of this presentation is that a comparative ethology approach, in this case between horses and elephants, can give greater credibility to equitation science and has the potential to safeguard, as far as possible, the future of humankind's interactions with horses and horse riding in particular.

O1: Did you put on weight? The influence of increased rider weight on horse behavioural and physiological parameters

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The effect of rider weight on horse welfare is much debated and is likely affected by a number of factors including horse type, work intensity, horse training level and rider skills. This study included 20 rider-horse combinations and aimed to evaluate the effect of an acute increase in rider weight on horses' behaviour, physiological responses - heart rate (HR/HRV), salivary cortisol (SC) - and gait symmetry (GS) when ridden in a standard dressage test (5:20 min). The riders rode their horse without additional weight (0%), and with extra 15% or 25% of their body weight added to a vest, in a balanced cross-over design on three separate test days. GS was measured objectively using Equinosis; SC was measured 30 min before the test, and 0, 5 and 30 min after the test, and behaviour was scored from video recordings. The experiment met all national regulations for research. Data were analysed in a one-way RM ANOVA. The initial rider:horse weight ratio (0%) was 15.2%±0.4 (range 12-19%). With added 15%: 17.1%±0.5 (range 14-21%); with added 25%: 18.4%±0.5 (range 15-23%). There were no overall treatment effects on HR (e.g. HR average (bpm) 0%: 106±2.1; 15%: 105±2.5 and 25%: 105±2.4, F_2=0.34, P=0.72), or HRV variables (LF/HF and RMSSD). To explore the potential effect of initial rider:horse weight ratio, we added three weight ratio classes based on the 25 and 75% quartiles. Surprisingly, horses in the lower rider:horse weight ratio group (<13.6%) had higher heart rates (two-way RM ANOVA: Group 1: 116±3.4, Group 2: 101±2.3, Group 3: 106±3.5, F_2=7.12, P=0.006). This result was consistent with a baseline lunge test, where these horses also had higher HRs. GS was unaffected by the acute weight increase, both in terms of the number of affected legs and degree of lameness. Similarly, the occurrence of conflict behaviour (e.g. head tossing, tail swishing, mouth opening) varied between horses but was unaffected by the acute weight increase. Saliva samples are currently being analysed for cortisol and will be presented.

Lay person message: Increasing rider weight by 15 and 25% did not result in significant alterations in heart rate, behaviour and gait symmetry in horses during a standard dressage test. Maximum rider:horse weight ratios were 15-23%. Thus, within this weight ratio range and during light to moderate exercise, acute increases in rider weight did not induce changes in the parameters analysed so far.

O2: On-ground rider weight symmetry mirrors balance in the saddle

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This study compared rider symmetry measured on the ground with their symmetry on horseback when riding with and without additional weight. The results are part of a larger study on the effects of rider weight on horse welfare (n=20 equipages). Riders were all female, aged 11-58, including both experienced and less experienced riders. Rider weight symmetry was measured as weight on left and right leg respectively, while standing on two identical bathroom scales focusing at a fixed point in front of them (mean difference (kg): 2.83 ±0.55). In addition, their mobility and balance when sitting on a gymnastic ball (size according to body height) was scored (1: Good, 2: Medium, 3: Poor) based on their ability to perform standardized exercises. Mobility on the gymnastic ball correlated with weight asymmetry (Spearman, r=0.45, P=0.05), suggesting that poor mobility may be associated with weight asymmetry.

Subsequently, the riders rode their own horse in a standard dressage test either with or without additional weight attached to a vest (0,15,25%) in a balanced cross-over design across three test days. Maximum rider:horse weight ratios were 15-23%. Saddle pressure was measured as mean load (Newton) per cm^2 on the left and right side of the saddle to explore rider crookedness. As expected, the mean load per cm^2 increased with increasing weight load (One-way RM ANONA; N/cm^2, 0%: 1.12 ±0.03, 15%: 1.21 ±0.03, 25%: 1.22 ±0.03, F_2=3.6, P=0.03). Rider crookedness was calculated as the difference between the loading (N) of the cells on the left and the right side of the saddle (the higher the difference, the more crooked the rider). Almost all riders (19/20) had more weight on the right side of the saddle in all treatments, but increasing rider weight did not significantly affect the degree of rider crookedness (P=0.70). Crookedness correlated between the 0 and 15% treatments (Spearman; r=0.62, P=0.003), but not with the 25% treatment. Crookedness correlated significantly with weight asymmetry on the ground (r=0.51, P=0.02), but only in the 0% weight treatment, and not when the riders rode with additional 15 and 25% weight, suggesting that artificial addition of weight might make some riders less crooked as they become more aware of their relative asymmetry.

Lay person message: A simple weight symmetry test with two ordinary bathroom scale weights reflects rider crookedness in the saddle and can thus help make riders aware of their imbalance. Lack of mobility of the pelvis on a gymnastic ball also reflects this imbalance.

O3: Riders' perception of balance and how it impacts Equine Welfare - Phase 1 - Assessing riders' perception of balance before riding

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Awareness of rider posture and the ability to adjust this posture is important for equine welfare. When the rider is out of balance, the equine must compensate, often leading to physical and emotional stress of the equine. We hypothesized that the use of a horseless balance instrument could help riders become more aware of and learn to improve balance. The current study, Phase I of a two phase study, collected data to describe and analyze riders' perceptions of balance on horseback. Qualitative analysis and statistical evaluations were utilized in this mixed methods study that used a "Balance Rider" horseless exercise instrument. Thirty-seven riders (2 male and 35 female, ranging from novice amateur riders to professional trainers) with English and Western riding backgrounds were recruited. The riders were asked a series of questions regarding equitation history prior to mounting the Balance Rider. Participants were provided a brief demonstration and instruction prior to using the Balance Rider. After allowing up to 5 minutes of adjustment time, riders provided feedback on balance by responding to questions. Observations were made about their interaction with the Balance Rider such as initial default position (chair seat, perched, collapsing ribcage, or balanced). A Likert Scale and descriptive responses were recorded in this research. Riders were asked to rate balance (on horseback) using a Likert scale, (1= Struggle to balance and 5 = Very Balanced) with a Mean = 3.269 for this question. Riders were asked how easy it was to find their balance on the Balance Rider (1= Cannot balance and 5 = Easy) with a Mean = 2.815. The t-value is 2.03798 with a p-value of .022563 and the result is significant at $p < .05$. Additionally, a Paired T-Test p value is 0.321; once again finding statistical significance in these results. Rider perception of balance was lower on the Balance Rider than on the rider's initial assessment of his/her balance. Riders expressed empathy for their equine because of a realization that it must compensate for poor rider balance. Participants expressed interest in improving their balance. Phase 2 of the study will have riders complete a set of maneuvers on horseback on day 1, then the next day utilize the Balance Rider for 20 minutes prior to completing the same set of maneuvers on horseback. Rider perception of balance will be evaluated as well as the willingness and comfort of the horse while executing the maneuvers.

Lay person message: The present study is the first part of a larger project in which we want to better understand rider perception of seated balance on horseback. We believe this will lead to improved performance and well-being for horses and riders. In this first phase, we gained better knowledge about how riders perceived their balance on horseback.

O4: Factors influencing show-jumping performance of top sport horses

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Show-jumping is one of the most popular equestrian disciplines. The aim of this study was to identify potential factors which can influence show-jumping performance during competitions. We investigated video records on FEI TV (https://tv.fei.org) of 644 jumping performances (144 riders, 222 horses) during the Western European League, a part of Longines FEI World Cup 2017/2018. Besides factors of horse/rider's age, experience, gender and course (obstacle type, jump order, single jumps vs. combinations), we also tested how the probability of fault is affected by the direction of approach which can be a possible sign of lateralization as a widespread phenomenon of advantageous adaptations (Vallortigara *et al*., Brain Res. Rev. 30:2, 1999). During 13 indoor competitions, there were 9114 jumps over 320 obstacles (height 140-160 cm). Obstacles were divided into solo jumps (6290) and combinations (1336 double and 1488 triple combinations) and according to type as a spread (168) or vertical (152). Overall fault rate was 7.851 %. The jump order further influenced the probability to drop the pole; the later in the course the higher the probability of failing ($F(1,7649) = 66.686$, $P < 0.0001$; PROC GLIMMIX, SAS, version 9.4). It probably reflects the increasing difficulty of obstacles during the course (easier "warming-up" initial obstacles while more complex obstacles are later in the course) and/or fatigue of horses. In the case of obstacle type ($F(5, 7649) = 2.511$, $P < 0.03$) the water element in the vertical and spread obstacles increased the probability of a fault, compared to triple bars and walls. The least number of faults was found on single jumps (6.654%) than on combinations (21.812%, $F(5,7649) = 5.292$, $P < 0.0001$). However, the role of experience of the rider was important ($F(1,7649) = 6.174$, $P < 0.02$); the more starts the rider had in a career, the lower was the fault rate. Other factors did not have any effect on the show-jumping performance, including the direction of approach ($F(2, 7649) = 1.958$, $P = 0.14$). The probability of fault was similar on left-handed (0.078 ± 0.010), right-handed (0.069 ± 0.010) jumps or jumps approached on the straight line (0.084 ± 0.013). On the population level of top sport horses/riders, the direction of approach was not relevant to the jump success. The identification of the main factors influencing the show-jumping performance of top sport horses can help trainers to set an adequate training plan for horses.

Lay person message: Show-jumping is one of the most popular equestrian disciplines; therefore, the aim of this study was to identify factors which influence show-jumping performance. We investigated data of 644 performances (144 riders, 222 horses) during the Western European League, a part of Longines FEI World Cup 2017/2018. Result revealed 4 influential factors: jump order, type of obstacle, type of jump (single jumps vs. combinations) and the rider's experience. Other factors and direction of approach as a sign of lateralization, did not have an impact on the show-jumping performance. Results can help trainers to set an adequate training plan for sport horses.

O5: Investigating safer human-interactions with horses: Tradition vs Science

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Horses are dangerous. Their size, speed, herd instincts, flight-fight responses and independent-mind poses a risk of harm to humans during any interaction. The on-line survey contained both quantitative and qualitative questions analysing human-horse-interactions and human safety-risk perceptions resulting in 1718 respondents from 25 different countries. The sample was predominantly female (90.12%), with the majority (70.70%) of all respondents deriving from a non-work context (leisure, sport or social) of 85 varying horse interests-disciplines. Analysis of respondent's safety beliefs, values and interests highlighted 10.7 % believed they were unable to control risks around horses and 12.5% agreeing it was okay to drug a horse to make it safer to ride. Over one-quarter of all respondents (25.74%) were willing to put their horse's safety before their own. This paper will report the key findings from the qualitative responses in the survey. Qualitative responses provided insight as to why humans make various choices, influences on their safety behaviors and what or who has motivated their actions and beliefs. All respondents' comments were categorized into themes for data sorting. Analysis involved identifying respondent's safety sequencing choices when approaching or mounting a horse, along with value-rating training of human and horse. Attitudes and beliefs around safety standards were explored, some compromising safety vs. human safety being paramount. Qualitative responses highlighted distinct differences between horse-related disciplines. For example, respondents in a work environment demonstrated more safety knowledge and acceptance of safety-first principles compared to some non-work, social or sporting environments. English-European horse disciplines appeared to be more accepting of safety influences "talking it up", whereas Western or Australian style respondents appeared to be more abrasive and vocal about their embedded tradition. In addition, many training methods were extremely assorted, with entrenched generational training styles being less flexible to change, compared to modern-researched or competitive influences being more readily adopted. This study has emphasized that humans who interact with horses have very strong and variable beliefs, principles and opinions. Safety principles during horse interactions appear to be influenced by tradition, developed through training methods or failures that have resulted in severe injury-illness or fatality.

Lay person message: Despite differences in human-horse interactions globally (sport, social, work or pleasure), one premise remains. Safer interactions with horses result from learned knowledge and the beliefs or value humans place on their own personal safety. Horses are embedded in our history. However, modern society has changed human-horse interactions through domestication, financial gain and competitiveness, along with the introduction of welfare issues. This transition may explain some of the human risk-taking behaviors, and poor safety choices. As humans strive for the ultimate connection with a horse to achieve purposeful outcomes harm to either species is imminent, unless safety, care and respect is achieved.

O6: Equine response behaviour to game encounters during horseback safari rides.

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Equestrian tourism is a rapidly growing industry encompassing a variety of horse-orientated activities. One sector which has received little research attention is that of horseback safaris. Horseback safaris are a common tourist activity throughout Africa, involving close encounters with game. It is a unique and exciting way to experience African wildlife, as horses are able to approach the game animals much closer than a car or person. However, this is a potentially stressful situation for the horses. An exploratory observational study was conducted at Antelope Park, a private game reserve in Zimbabwe. The study used an ethogram to investigate horses' behavioural responses to game encounters, to determine the welfare impacts for the horses and assess the safety and enjoyment for the riders. Ethical approval was granted by the University of Bristol human and animal ethical committees. 20 horses and 50 riders were used throughout the study and the game species encountered included giraffe, zebra, impala and wildebeest. The potential influences of horse type, rider ability and game species were assessed. Kruskal-Wallis and Mann-Whitney tests were used to reveal differences between the behavioural responses and test the aforementioned variables. Horses predominantly exhibited alert behaviour with pricked ears but minimal flight behaviour was observed and horses were generally willing to approach the game calmly, suggesting that they were not experiencing extreme stress. Individual differences in behaviour were found, and horse type was shown to influence their response; Thoroughbred ex-racehorses exhibited more reactive behaviour than bush ponies (more alert ear position $P<0.001$; more alert standing score $P<0.001$; less likely to approach $P=0.001$). Rider ability was found to affect response behaviour; horses with lower ability riders exhibited significantly less reactive behaviour (less alert ear position $P<0.001$; less alert standing score $P\leq0.001$). However, lower ability riders were more likely to be paired with a calmer, more experienced mount so this may have confounded this result. Significant differences in the horses' behavioural responses were also found between different game species. This may be influenced by the game's behaviour which differed significantly between the species. Although the horses' behavioural responses did not generally suggest extreme or unnecessary stress, differences were found between horse type, rider ability and game species and therefore the results encourage further study. This research can be used to inform best practice guidelines to create the best and safest experience for the tourist, whilst improving the welfare of horses working within the safari industry.

Lay person message: Horseback safaris are an exciting way to experience African wildlife and are therefore a common tourist activity. However, little research has been carried out investigating the horses' welfare and riders' safety. A study was carried out to observe the behaviour of horses on safari, as behaviour has been shown to be a good indicator of welfare. The horses were found to be generally alert but not extremely stressed. The influence of horse type, rider ability and wildlife species were assessed and many differences were found, which can be used to help guide the best experience for both horse and rider.

O7: A comparison of Micklem bridles and conventional bridles fitted with restrictive nosebands

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Equestrians and sporting governing bodies are under pressure from equestrian communities and beyond to improve equine welfare. In order to continue to operate, they require social licence and community approval of their actions. As a result, many people who participate in equine sports are seeking new products and techniques to improve their horses' welfare and the market is responding with a plethora of new products claiming to be 'welfare friendly'. One such product is the Micklem™ bridle; which the manufacturer claims is "more comfortable, more humane and more effective". However, as with many 'welfare friendly' products the claims would benefit from robust scientific scrutiny. The aim of this study was to test these claims using measures of rein tension and horse behaviour. Nine horses, with a mean age of 6±3 years, from two professional training stables, were ridden by one professional rider who was familiar with all the horses used. The horses were at various levels of training as dressage mounts. Horses were allocated to either the control condition - worked in a traditional bridle with restrictive flash noseband (tightened to two fingers) or the experimental condition - worked in a Micklem™ bridle (tightened to two fingers) on day 1, and in the opposing condition the following day. Rein tension (N) and equine behaviour were recorded simultaneously during a standardised workout comprising canter left lead (x3), canter right lead (x3), canter/trot transition (left lead) (x3), canter/trot transition (right lead) (x3), and trot/halt transition (x2). Horses showed a significant increase in the time spent with 'correct' head carriage (i.e., eyes the same height as the wither and the head held in a vertical position) (0.53±0.24) in the Micklem™ bridle as opposed to a conventional bridle with restrictive flash noseband (0.31±0.24; $t8=3.08$; $P>0.05$). Horses were also found to spend significantly more time with their ears pricked, which is commonly seen as a positive behavioural sign, when ridden in the Micklem™ bridle (0.21±0.21) compared to a conventional bridle with restrictive noseband (0.12±0.12; $t8=2.64$; $P>0.05$). A number of other behavioural trends emerged that appear to support the manufacturers claims that the Micklem™ bridle is a more welfare friendly alternative to conventional bridles with restrictive flash nosebands. These trends did not reach statistical significance nor were there significant differences in rein tension (all $P<0.05$). The results of this study appear to support the manufacturer's claims however, further research is needed in order to draw definitive conclusions.

Lay person message: As calls for greater equine welfare standards grow, numerous 'welfare-friendly' products are appearing on the market without undergoing objective scrutiny. One product is the Micklem™ bridle. This study demonstrated improvement in two key behavioural indicators, 'correct' head carriage (eyes the same height as the wither and the head held in a vertical position) and having ears pricked, in the absence of increased conflict behaviour or rein tension. The findings of this study comparing Micklem™ bridles to conventional bridles with restrictive nosebands suggest that the claims of the manufacturer of the Micklem™ appear justified; however, drawing definitive conclusions requires further research.

O8: Changes in pressures exerted on sub-noseband tissues by tightening the noseband

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Concern exists regarding the possible adverse effects of excessively tight nosebands on horses. The aim of this study was to identify the levels of pressure exerted by tight nosebands on specific underlying tissues and to compare two noseband tightness measurement approaches. Using a cadaver horse head, acquired from a licensed abattoir, biomedical interface pressure transducers were used to measure pressures exerted on the frontal nasal planum and left nasal bone by a cavesson noseband at a range of tightness levels. The ISES Noseband Taper Gauge (TG) was used to assess approximate noseband tightness level at each tightness setting. A digital tightness gauge of 1.5 cm height and width was then used to measure noseband force at six TG settings to investigate equivalency and noseband force at each tightness level (N). A load cell calibrated over a range of 0 to 100 N, integrated into the noseband, measured the noseband tension through both trials.

Highest pressure levels were measured at the left nasal bone, from 40 mmHg (loose) increasing exponentially from 1.0 F (324 mmHg) to 2875 mmHg (0.0 Fingers). The exponential pressure increase may be due to soft tissues becoming maximally compressed, unable to absorb further changes in noseband tightness. Pressures at the frontal nasal planum ranged from 13 mmHg (loose noseband) to 1342 mmHg (0.0 F). At six TG noseband tightness settings (from 2.0 F to 1.0 F) noseband force measured by the digital tightness gauge increased from 8 to 71 N. Noseband tension measured by the load cell ranged from 1 N (loose noseband) to 56 N at 0 Fingers. The high pressures measured are of a magnitude that are likely to cause pain and reduced welfare in the competition horse.

Lay person message: Excessively tight nosebands may cause undesirable effects to the horse. Pressure sensors were placed under a noseband fitted on the head of a euthanized horse, to allow pressures under the noseband to be measured as the noseband was tightened from loose to very tight. Extremely high pressure levels were measured where the noseband passes over the nasal bone.

O9: An investigation into equestrian spur use in the United Kingdom

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Spurs are a piece of horse-riding apparel worn by riders to refine leg aids prompting for locomotion, activity or direction of the horse. Equestrian competitions have seen elimination of riders and horse welfare concerns raised due to the presence of blood on the horse related to spur use. The aims of this inductive study were to describe spur use across equestrian disciplines and identify reported risk factors that are associated with an increased frequency of skin abrasion. An online survey was administered via social media platforms, industry connections and national online media sources. It included questions on rider demographics, spur design, injury rates and perception of current competition regulations. Inclusion criteria required that participants were aged over 18 years old, a horse owner/loaner/sharer and resided in the United Kingdom. The survey was accessible for a six-week period and offered no incentive for participation. Eight hundred and fifty-eight responses were received resulting in 628 complete responses for further analysis. Data validation revealed no apparent pattern for survey abandonment and to prevent false-positive assumptions from incomplete responses, partial surveys were not included in analysis (n=230). Descriptive statistics were used to report frequencies and percentages within data. Odds ratios [OR] and Chi-squared tests were utilized (IBM SPSS v24.0) with an alpha value set at $p<0.05$ (confidence interval 95%) unless otherwise stated.

597 were female (95%) and 31 male (5%). The majority were aged between 18 and 29 years (47%), with 41 participants (7%) reporting their age at 58 years or over. 19 types of equestrian activities were reported and categorised into FEI competitive disciplines, non-FEI competitive disciplines and recreational disciplines. 47% of all participants used spurs. Relationships were found between spur use and gender and duration of years riding. Males were 2.88 times more likely to use spurs than females ($p=0.005$). Riders within competitive non-FEI disciplines were 1.53 times more likely to use spurs than recreational riders and 1.48 times more likely to use spurs than those competing in FEI disciplines. Longer spur shanks significantly increased the risk of skin abrasions or hair loss related to spur use ($p<0.0001$). Rotating spur designs were 1.5 times more likely to be associated with injury compared to fixed shank designs. Future research should consider motivational factors for equipment selection and how it then affects the horse. This information may aid policy makers to formulate ethical guidelines for equestrian sport but also extends to inform riders of all levels how their choice of day-to-day equipment can affect equine welfare.

Lay person message: Male riders are 2.88 times more likely to use spurs than female riders. Competitive riders use spurs more than recreation riders. Longer spur shanks increase the risk of skin abrasions or hair loss and rotating spurs cause 1.5 times more injuries compared to fixed shank designs.

O10: Preliminary investigation into the effect of noseband design on rein tension and the force exerted on the frontal nasal plane

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Flash nosebands are the most prevalent design seen in international competition (46%) (Doherty *et al.*, Plos. One. 12:1, 2017). The flash is a restrictive design, the purpose being to increase sensitivity to the bit. Increased sensitivity has been shown with increased noseband tightness (Randle and McGreevy, Jrnl. Vet Beh. 8:2, 2013) however, the effect of different designs has limited investigations. Restrictive nosebands are a welfare concern as they can inhibit natural oral behaviour and cause stress (Fenner *et al*., Plos. One. 11:5, 2016). The aim of this study was to investigate if different noseband designs affected rein tension (RT) and the pressure exerted on the nose during a ridden protocol. Method: A convenience sample of leisure riding horses (n=8) were tested in a Latin square design in four noseband conditions (no noseband; cavesson; flash; drop). All nosebands were fastened to the recommended "two fingers" using the ISES taper gauge for accuracy. Noseband pressure was measured using Pliance pressure system (100Hz), and RT was recorded using Telerein tension gauge (10Hz) during walk and trot for each condition. Data were statistically analysed using the Friedman test and Wilcoxon signed rank test. Results: There were significant differences for mean noseband pressure in walk ($X^2 = 13$; df = 2; $P>0.01$) and trot ($X^2 = 10$; df = 2; $P>0.01$). Post hoc testing showed higher noseband pressure during walk; for the flash (31.78 ± 23.80mmHg) and the drop (22.93 ± 4.65mmHg) compared with the cavesson (6.41 ± 9.83mmHg) ($P>0.05$). Similarly, this was identified in the trot with the flash (41.24 ± 21.51mmHg) and the drop (24.62 ± 12.08mmHg) being higher than the cavesson (9.68 ± 11.82mmHg). RT values ranged 12.35 - 17.51N, with no significant differences between conditions ($P<0.05$). Discussion and Conclusion: This research identified that the restrictive noseband designs resulted in higher pressure on the frontal nasal plane, in the absence of any detectable change in RT. The higher pressure identified within the correctly fitted flash and drop noseband designs is likely a result of oral movement. Further investigation to explore causative factors could include the use of an ethogram to identify behaviours associated with increased noseband pressure. These findings appear to indicate that the common industry perception that restrictive noseband designs allow a lighter rein aid may be inaccurate and warrants further investigation. Preliminary investigations such as this, highlights that the effect of tack on equine welfare is not yet fully understood.

Lay person message: This study aimed to compare the pressure exerted on the nose by three different noseband designs; cavesson, flash and drop. It was found flash and drop designs showed significantly higher average pressures on the front of the nose compared to the cavesson, even when all nosebands were fitted using the 'two finger rule'. Nosebands that are designed to prevent the horse from opening its mouth could cause high pressures on the nose and the potential damaging effects of these pressure are not yet known.

O11: Understanding whip use in riders in sports horse disciplines

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Equestrianism is subject to increasing public scrutiny with non-equine stakeholders questioning if traditional practices such as whip use are ethical and necessary. Evaluation of whip use in racing has resulted in regulatory changes to protect racehorse welfare. However high-profile examples of inappropriate whip use in non-racing disciplines have turned the spotlight on how wider equine disciplines protect horse welfare. This study aimed to create a preliminary evidence base for how horse-riders use whips. Participation was voluntary via an online survey, available on equine-related Facebook pages, which asked riders a) if, b) how and c) why they did/did not use a whip, to establish if potential issue with whip abuse existed in horse sports and recreational riding. 3463 riders responded; the majority were female (96%, n=3325), 46% (n=1593) held equine qualifications, and 96% (n=3311) considered themselves experienced riders. Most riders regularly rode with a whip (60%; n=2047), 12% (n=412) sometimes did and 28% (n=966) never carried a whip. Respondents were asked to rate agreement (Strongly agree (5) —strongly disagree (1)) for 12 statements related to how the whip could be used and the response of the horse to whip use. Riders regularly riding with a whip recorded significantly different opinions on whip use compared to riders who sometimes rode with a whip and those that never carried a whip (Kruskal wallis: $P<0.0001$, post-hoc Mann Whitney U: $P<0.01$), but agreed whip use does not boost rider confidence and that only experienced riders should use whips ($P>0.05$). Thematic analysis identified riders predominately carry whips to reinforce the aids or as an emergency aid, whilst respondents who didn't use whips believed training negated their use, due to horse sensitivity, or whip use was not ethical. Respondents felt whips should only be used when absolutely necessary for education and reinforcement, and not as punishment, due to rider frustration/anger or to cause pain, although only 30% (n=1036) believed whips caused pain. Most riders advocated tighter whip regulation in competition, commenting: good riders do not need a whip, professionals regularly abuse horses in public and better training/education is needed. Interestingly, 21% (n=727) of respondents believed public perception of horse sports will lead to a future whip ban. These results suggest mixed practice and knowledge exists regarding whip use in horse riders. Further work is required to understand how to better educate riders and to ensure equestrianism operates under a social license that promotes equine welfare.

Lay person message: Whip use in horse sports outside of racing is receiving more attention as the general public increasingly question if traditional equestrian practices are ethical and necessary. This survey found most horse riders regularly ride with a whip and use them to reinforce the aids and in emergency situations. Riders who don't use whips believe good training reduces the need to carry them. Generally, riders felt whips should not be used in anger or as punishment, and better rider education is needed on how to train horses and stricter whip regulation is needed in equestrianism to protect horse welfare.

O12: Evaluation of whip use in British Showjumping

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Science involving sentient animals has progressed, methods eliciting performance from horses by use of the whip, a previously common and accepted aid, have become subjected to increased public and scientific scrutiny. Research on the impact of using the whip has mainly focused on horse racing to date and no association with improved performance has been identified. This preliminary investigation aimed to evaluate the effect of whip use in British Showjumping (BS) competition in terms of horse/rider summative performances and potential effect on horse welfare. Using retrospective streamed data recordings, 285 adult amateur/professional competitors were observed jumping at heights between 0.8m to 1.25m in affiliated BS competition on Grade B/C showjumping horses. Ethograms based on research of Waite *et al.*, (2018) and Pierard *et al*. (2019) were developed to determine how riders use the whip, including force measured by whip distance from body and arm height of rider; Chi-squared/Spearman were applied to identify if relationships found were significant. Of the total rider population 10.5% (n=30) used the whip during competitions. Whip use associated with increased faults across the competitions ($\chi 2$ (6) = 30.07; $p<0.0005$), corresponding to horses refusing or knocking fences down (Figure 1). Excessive force (elbow and arm raised above shoulder to strike horse) and strong force (>30cm) of use were observed in 44% of whip-strikes. A significant positive moderate correlation (Rs = 0.425, p(30) = 0.19) was found between force of strike and increased faults. Evasive behaviours were observed in response to stronger whip strikes. No horse-rider partnership completed the course following a whip-strike of excessive force. Discussion and Conclusions: The cognitive abilities of the horse may not permit an understanding that a whip strike after a fence relates to rider-perceived horse misdemeanour at the fence. Additionally, due to the associative way a horse learns, whip use approaching the fence may create negative associations with jumping. Misunderstanding a horse's response, riders may direct a mis-appropriation of responsibility and punishment. Confusions may be mitigated if whip-use was understood by both horse and rider as a clear signal eliciting a mutually agreed/negotiated behavioural response. Declining performance could be explored through biomechanical analysis of horse movement to investigate possible underlying, undiagnosed physical causes. This preliminary investigation indicated certain trends within BS whip use associated with poorer performance. Despite several clear infractions of whip rules, no regulatory action to support horse welfare and ethical sporting standards of behaviour was observed.

Lay person message: Riders using the whip in affiliated British Showjumping competitions were found to accumulate more faults than those who did not. Rider desire for improved performance though use of the whip may not be understood by the horse. If the horse does not associate the whip as a trained signal to which it can offer a trained response, then misunderstandings within the horse-rider dyad may lead rider to mis-appropriate responsibility of fault onto the horse. Equestrian sports regulations should impact positively on horse welfare and ethical sporting standards of behaviour. Current regulations and the strategy to enforce them could be reviewed.

O13: A preliminary study investigating the effect of Slow/Trickle Feeders on nocturnal feeding behaviour and time budgets of stabled horses

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Forage is an essential nutritional component for horses, maintaining gastrointestinal health and species-specific intake behaviour. Recent recommendations highlight that horses should not be without forage for more than 4 continuous hours, a time often exceeded during nighttime stabling. The aim of this study was to assess the effect of slow-feeders on feed intake behaviours in horses. Four horses (estimated BW 519±63 kg, age 9±1 years), stabled on oat straw, were used to evaluate nocturnal behaviours. Behaviour was recorded using infrared LED cameras taking one image every 30 seconds over 16 hours (1500-0800). Horses were first observed under their normal management of loose haylage [LH], fed on the floor, followed by a cross over design study using two slow-feeders: the Harmony Trickle Feeder [HTF] and PaceFeeder [PF]. Observation periods consisted of 5 days acclimatisation and 2 days observation. For all protocols 8.0±1.4kg wet matter haylage was provided at the beginning and end of the recording times. ANOVA was performed and mean results are given ± standard deviation. There were no significant differences in behaviours between the first 2 acclimatisation days and the last 2 observation days within protocols. The frequency (number of images) of browsing in bedding (head/neck down in straw) was significantly higher in LH (374±105), compared with the PF(103±64) and HTF (108±58) ($F=104$, $df=3$, $p<0.001$). The frequency of eating haylage (head/ neck down by haylage area/bin) was significantly higher in PF (624±120) and HTF (545±129) compared to LH (281±106) ($F=63$, $df=3$, $p<0.001$). The time ranges when horses were last seen eating haylage, was earlier in LH (22:00 to 00:00) compared the slow feeders (02:00 to 08:00). There were no differences in estimated times (frequency x 30 seconds) performing stand-resting (407±96 mins), recumbent-resting (113±60 mins), stand-alert (97±106 mins) and locomotion (17±9 mins) between feeding methods. Estimated foraging hours (browsing and haylage eating times) were higher for PF (6.5±1 hours) than for HTF and LH (5.4±1.2 hours). Although the sample population was small this study showed that slow-feeders increased haylage eating time by 95-120% for HTF and PF respectively. Horses on loose haylage spent 72% more time on browsing in bedding which may have involved ingestion of faecal matter and straw, increasing energy intake and the risk of colic. In similar situations, 'inedible' bedding would increase fasting hours and could contribute to ulcers or stereotypic behaviour.

Lay person message: Foraging is an important behaviour for horses as it maintains gut health and promotes natural feed intake behaviour. Recent recommendations highlight that horses should not be without forage for more than 4 continuous hours. This study showed that in stabled horses, two types of slow feeders reduced bedding foraging by 72% and nearly doubled the time of haylage ingestion compared to feeding the same amount of haylage loosely. If horses have to be stabled on restricted forage diets, slow feeders can be used to extend feeding times for horses, potentially preventing bedding ingestion, coprophagy or the development of stereotypical behaviours.

O14: The methodological challenges associated with measuring the equine stress response in real life scenarios

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This presentation will highlight some of the challenges associated with measuring the stress response of equines, hopefully allowing other scientists to avoid the same pitfalls. Measurement of the stress response requires analysis of at least one physiological parameter and, as physiological parameters tend measure only arousal, behavioural measures which analyse both arousal and valance. To determine the most appropriate physiological measure, a Delphi analysis including Equitation Scientists, Animal Behaviour and Welfare Scientists (Non-Equine) and Equine Veterinarians was undertaken, revealing very poor agreement. Following veterinary ethics approval, a feasibility study (n=30) equines undergoing routine veterinary care was undertaken. Physiological measures included salivary cortisol (SC), surface eye temperature (SET) and, using a Polar HRM, Heart Rate Variability (HRV). An ethogram/scoring system was also developed and utilised. SC is a well validated measure of stress; however, it measures cumulative changes over time and so is a poor indicator of short-term fluctuations. Swabbing was not tolerated by one horse and 81 of 192 results were excluded due to spurious values after access to molasses 'Horselyx'. SET was a promising measure; however, careful calibration of equipment is required for meaningful results. It also proved challenging to capture in focus images when horses were actively responding to a stressor. HRV measures collected via Polar HRM are common in Equitation Science studies. Concerningly, though, we were unable to validate the Polar monitors against an ECG. These challenges will be discussed in depth in the oral presentation. HRV was considered the most robust measure under these circumstances for the next part of the study (n=49). Given the inaccuracies of the Polar HRM an ECG was utilised, currently considered the gold standard. Even so, as the software was developed for humans, careful analysis of the data needs to be undertaken. As this was not possible with the 'Televet' monitor a 'Holter' ECG was purchased. The morphology of the equine ECG results in t-waves being commonly, but incorrectly, identified as QRS complexes - these can be manually corrected before analysis. Other challenges to overcome include the presence of arrhythmias; with a prevalence is 31%. Of these n=13 had 20 AV Block, which can be corrected through commercial software. More challenging were cases of atrial fibrillation (n=1), ventricular tachycardia (n=1) and ectopic beats (n=2). Recognition and, where possible, correction of these arrhythmias is vital to have confidence in the subsequent results.

Lay person message: Measuring the horses stress response via physiological parameters in commonly undertaken in Equitation Science based research. However, many of the methods used are poorly validated and may produce questionable results. Confidence in scientific results, and in turn the discipline of Equitation Science, relies on accurate data. This presentation will explain some of the common pitfalls not widely discussed in current literature and suggest ways to maximise the accuracy of the data collected.

O15: Lower neck and forelimb locomotion in horses: a clinical model of nerve root dysfunction

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Cervical spine osteoarthritis in horses has been associated with lameness and abnormal locomotion including loss of balance, stumbling and/or falling (Dyson, Clin North Am Equine Prac. 27:417, 2011). Articular process joint arthropathy is a common cause of cervical osteoarthritis in horses and affects dominantly the caudal cervical spine segments. These articular processes are in close vicinity to the cervical nerve roots forming the brachial plexus innervating the forelimb. Articular process arthropathy results in joint hypertrophy and has been documented to result in nerve root compression possibly causing forelimb pain and motor nerve dysfunction. The aim of this study was to evaluate equine locomotion after a perineural anesthesia of the 7th cervical nerve root (C7) with lidocaine in an attempt to modelize clinical forelimb lameness due to nerve root compression. The study was granted approval by the Ministry of Research, France (approval number: APAFI$#4392-2016022820236408). Ultrasonography-guided perineural anesthesia of C7 was performed on 4 standing horses with lidocaine mixed with a radiographic contrast agent. Caudal cervical radiographic and video recorded locomotor examinations were performed before and after the injection until disappearance of any locomotor abnormality.

A total of 6 injections were performed on 4 horses. Injections were considered nerve root selective upon contrast agent analysis on radiography. Four injections lead to clinical signs of suprascapular paralysis: shoulder joint instability due to infraspinatus and supraspinatus muscle paralysis with lateral deviation of the point of the shoulder while standing and at walk during the weight bearing phase of the stance. Signs of suprascapular nerve motor dysfunction waned within 3 hours. Lameness due to suprascapular paralysis didn't lead to loss of balance, stumbling nor falling during testing horses at walk on a straight line on uneven grounds, up and down a step, and a short circle. It is hypothesized that a majority of the nerve fibers for the suprascapular nerve comes from C7 nerve root.

The remaining two injections resulted in clinical signs of central spinal neurologic deficits (ataxia, muscle weakness, hypermetria). Signs retroceded in less than 30 minutes. This complication was attributed to a more extensive local anesthetic diffusion resulting in a central spreading into the vertebral canal and around the spinal cord.

Perineural anesthesia of C7 nerve root in horses as a model of forelimb lameness due to neurologic impairment of C7 brachial plexus root conducted to clinical signs of suprascapular nerve dysfunction. Central bilateral neurologic deficits constitute a complication of the injection technique.

Lay person message: Cervical spine osteoarthritis in horses has been associated with neck pain and dysfunction but also lameness and abnormal locomotion including loss of balance, stumbling and/or falling. When affecting lower neck vertebras, it can compress roots of forelimb nerves. Following ethical approval, the study aimed at reproducing dysfunction of the 7th cervical nerve root by local perineural anesthesia. Clinical signs of suprascapular nerve paralysis ("Sweeney shoulder") were observed in 4 out of 6 injections and didn't include stumbling or falling at walk. A complication encountered twice was the anesthetic diffusion into the vertebral canal that resulted in short-lived signs of ataxia.

O16: The effects of surface and animal size on hoof loading in horses

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Purpose: The interaction between the hoof and ground surface is important in equitation science because of its significance to injury in horses. Numerous variables affect this interaction. We examined the combined effects of animal size and surface on 16 measurements of loading (ML) that encompassed impact, slide and midstance. Our purpose was to assess whether the surfaces investigated change all of the ML in the same way; if impact loading increased from surface to surface while midstance loading decreased, that would have implications for the role of each in different injuries. Methods: Ten horses of varying breed and ranging in size from approximately 356 kg to 673 kg were used. Three strain gauges and an accelerometer were glued to both front hooves to measure the strain, as a surrogate of force, and acceleration experienced by the hoof while the horse was in motion. All horses were ridden by the same rider at a trot (speed, 3.2±0.53 m.s-1) on two surfaces (S1=inside arena, firm sand mix; S2=outside arena, soft sand). Sixteen ML quantifying impact, slide, and midstance were extracted from a minimum of 10 stances per horse per surface. Body masses were calculated from published formulae based on body length and circumference. The effects of size and surface on each ML separately were tested with ANOVA (α=0.05), and the percentage changes from S1 to S2 for statistically significant ML were calculated. The relationships between body mass and ML were quantified with least-squares regression. Results: Comparison of surfaces—Fifteen ML were significantly lower for S2 than S1, by 10-60% (twelve at $p<0.0001$, one each at $p=0.0003$, $p=0.0033$ and $p = 0.0498$); 1 was non-significant. Effects of size and surface—Body size differentially affected the magnitude of change in several significant ML from S1 to S2. Impact accelerations decreased with size on S1 but not on S2; slide values were not affected by size, and midstance loading increased with size on S2 but not on S1. Conclusions: For these two surfaces, the decrease in all ML from the indoor surface to the softer outside one, suggests that the latter is generally less likely to cause injury—an intuitive conclusion now supported by data (and not true for all surface-surface comparisons we have made). The interactions between surface and body size, however, suggest that larger animals experience more midstance loading on the softer surface, which is not immediately intuitive.

Lay person message: The interaction between the hoof and ground surface is important in equitation science because of its significance to injury in horses. We examined the combined effects of animal size and surface on measurements of hoof loading throughout the stance. Ten horses of varying breed and size were used. Strain gauges and accelerometers measured strain, as a surrogate of force, and acceleration experienced by the hoof on two distinct surfaces. The results support that one surface is superior in terms of the likelihood of injury, but other interactions are not immediately intuitive and could be a key factor in injury prevention.

O17: Asymmetrical limb loading in Thoroughbred racehorses as a possible cause for injury

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The purpose of the following study was to quantify mechanical changes in loading throughout the stance in both forefeet of Thoroughbred racehorses among various locomotory conditions that are normal for training and racing: speed, lead, and curve (turn or straight). Its aim was to identify changes with condition that are sufficiently large to be implicated in the causation of injuries for which the conditions are known risk factors. The phases of the stance include primary impact, secondary impact, midstance, and breakover, and the hoof experiences phase-specific loadings, based on its own acceleration and on forces. Each phase may be broadly associated with different risks for injury, on the basis of its characteristic loading, but differences in that loading are likely to underlie injuries. To identify mechanical changes in loading, a three-step approach was taken: (1) collecting multiple variables that characterize hoof loading for each phase of several stances for each condition; (2) identifying variables showing statistically significant difference under the conditions measured, and from that subset, (3) determining the percent change between conditions. Ten Thoroughbred racehorses were used ranging in age and sex (one 3 y/o, eight 2 y/o, one 10 y/o; 2 fillies, 1 mare, 1 gelding, 6 colts). Each horse completed one run that incorporated all conditions. To measure acceleration and forces on the hoof, accelerometers and strain gauges were used, as strains in the material are proportional to forces on the hoof itself. The gauges were mounted on the right and left forehoof of each horse and were connected via wire leads to a recording device on the saddle pad. Using a custom Matlab program, 36 variables were extracted representing loading and acceleration at different phases of the stance. Data were analyzed in SAS using a MIXED procedure and UNIVARIATE procedure. The four main effects tested were curve, lead, speed, and foot. All primary effects and interactions were examined for both means and variances for all 36 variables, and different subsets of the variables were significant for each primary effect and interaction. Among those subsets, high-percentage differences in loading were seen throughout the stance, between -1112.92% and +671.18% for differences in means and between -73.54% and +150.69% for variances. The high values of variability in loading, under relatively minor conditions, suggest that differential changes in mean loading throughout the stance and the variability in loading may both play key roles in the mechanical cause of injuries.

Lay person message: The stride of the horse includes two phases: the swing phase, when the hoof is in the air, and the stance phase, when the hoof is on the ground. The stance can be divided into four phases: primary impact, secondary impact, midstance, and breakover, during which the hoof experiences different forces and accelerations. Each phase is associated with a risk factor for injury; however, it is difficult to identify mechanical cause of injury. The purpose of the study was to describe changes in loading throughout the stance in Thoroughbred racehorses, with the aim of identifying mechanical risk factors for injury.

O18: Impact of a companion horse during stressful situations

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Reasons for study: Social buffering is the capacity of an individual (usually conspecific) to reduce the stress of another in a variety of ways. The horse as a highly social species that is often kept in isolation, is a good model for researching social buffering effects. Aim: This study assessed the impact of a horse companion on the reaction and recovery time of horses to an unusual event (opening of an umbrella, or appearance of a large ball). In addition, we wanted to know if a companion habituated to the environment will be more efficient than a naïve one. Methods: The delegated authority of the University of Lincoln Research Ethics Committee has approved this research (CosREC433). 32 ponies (16 subjects and 16 companions) living 2 or 3 per stable were used. Each subject performed 4 tests: Novel Stimulus Test (ball) - alone and with companion; Sudden Stimulus Test (umbrella) - alone and with companion. Half of the companions were habituated to the stimulus and the other half were naïve like the test subjects. To avoid order effects, the 16 pairs were randomized into 4 groups; with each group performing the tests in a different order. Physiological parameters (heart rate, surface temperature measured using thermography) and behavioural parameters (reactivity score, locomotor activity) were recorded. In the Linear mixed models, dependent variables were the reactivity score and heart rate recovery, subject identity was a random factor, fixed effects were partner (absent/present) and companion (naïve /habituated). Results: Initial results indicate the companion reduces the behavioural response (reactivity) in the novel stimuli test (Linear Mixed Models: $p=0.008$) but not in the sudden stimulus test (Linear Mixed Models: $p=0.362$). However, we found the opposite results for the heart rate recovery. The companion was associated with quicker heart rate recovery in the sudden stimulus test (Linear Mixed Models: $p<0.002$) but not the novel stimulus test (Linear Mixed Models: $p=0.151$). We did not find habituation of the companion had an effect on the subject's reaction and recovery time. Conclusions and potential relevance: The effect of the companion depends on the nature of the stressor. Future work will seek to elucidate further the factors relating to the companion which affect its capacity as a social buffer.

Lay person message: Horses are gregarious, highly social, and capable of forming close relationships with conspecifics. One potential benefit of a close social relationship is that the presence of a social partner may help to attenuate the stress response of the subject, during or after a stressful situation. We examined this experimentally and found that familiar companions could reduce the stress responses of subjects, but this "social buffering" effect depended on the nature of the stressor. This work enables a better understanding of the social benefits that are lost when horses are kept in social isolation.

O19: An investigation of Traveller/Gypsy horse owners' understanding of the concept of welfare

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Attitudes to animals are a key concern, with attitudes correlated with the application of animal care, management and welfare. Travellers and Gypsies are distinct ethnic minority groups in the UK and Ireland. Horses are an important part of their lives. Horse owners within these communities are often singled out as the main contributors to reduced horse welfare. Fly-grazing (unauthorised grazing), tethering, indiscriminate breeding and abandoned horses are regarded by some as Traveller/Gypsy practices. Traveller/Gypsy views of and approach to horse care, health and welfare and their understanding of the concept of animal welfare constitutes a relatively unexplored area of scientific research. This study investigated attitudes to horse care, health, management and welfare of 40 Traveller/Gypsy horse owners using semi-structured interviews. Participants were invited to reply to open-ended questions on the subjects of horse care, health, management and welfare. Participants were primarily males recruited through horse welfare organisations, related horse projects and horse fairs. Qualitative content analysis was conducted using Nvivo12 to identify key information, reoccurring themes and key concepts that consistently arose and were relevant to the project's aims. A theme found to be of particular interest was participants' understanding of the concept of horse welfare. In the current study, Traveller/Gypsy horse owners demonstrated that they understood the concept of welfare in various ways. The view of welfare was associated with the role of and need for animal welfare organisations by four participants while three participants stated that they did not know the meaning of welfare. The most common view related to the care and management of the horse with the onus of care placed onto the horse owner/carer. Participants' referred to the horse's health in both positive and negative terms such as a healthy horse and a horse that is not sick or thin. Further, the horse's body condition and work status were also considered important facets of welfare. Participants also highlighted the importance of resource provision (e.g. food). Additionally, participants' perception of welfare included the horse's emotional state which included references to happiness in horses. Overall, the concept of welfare appears to be understood by Traveller/Gypsy horse owners with a holistic-based approach to welfare articulated by participants. The relationship between attitudes and subsequent horse welfare practices warrants further investigation in order to establish whether Traveller/Gypsy horse owners' seemingly positive attitudes translate into good welfare.

Lay person message: Traditionally, socially and culturally, horses are an important aspect of Traveller and Gypsy lives. However, there have been a limited number of studies with Traveller/Gypsy horse owners and their attitudes to equine care and welfare remain unexamined. In this study, 40 Traveller/Gypsy horse owners were asked about their understanding of the concept of horse welfare. Results indicate that Traveller/Gypsy horse owners view welfare in relation to the care and management of horses, resource provision and the horse's emotional state, with some participants referring to animal welfare organisations. The relationship between Traveller/Gypsy attitudes to welfare and ensuing welfare outcomes requires investigation.

O20: Informing a social license to operate communication framework: Attitudes to sport horse welfare

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Social media platforms potentially showcase horse sports to naïve audiences. Negative discourses featuring 'voices for the horse' may be triggered when the public perceives possible threats to horse welfare, and this may result in questions about horse sport organisations' capacity to manage welfare transparently. These voices, from inside and outside the sport, include that of the human guardian of the non-human athlete, the horse. This negative discourse may trigger questions about an organisation's social licence to operate (SLO), the informal, unwritten level of acceptance or approval by stakeholders of organisations and their operations. SLO, a concept well known in business and mining sectors but not yet in the horse world, sits 'within' the community, and sport cannot 'un-own' disapproving public sentiment. Ultimately this informal, unwritten licence may be withdrawn, and the organisation will fail. Sports participants are the primary interface with the public about horse welfare, and from this perspective, this mixed-method study investigated participants' attitudes towards welfare, and whether these attitudes align with the contemporary Five Domains Animal Welfare Assessment Model (5D). The results may inform organisational communication frameworks addressing SLO. The online Likert-scale survey, distributed by email through a national Australian horse sports organisation, questioned respondents about their attitudes to horse welfare and asked the open question 'Horse welfare is…?'. From a potential field of 1601 organisation members over the age of 18 yrs., 107 responded, identifying variously as professionals (gaining income from horses) (22.2%, n=18), or as amateurs (gaining no income from horses) (77.7%, n=63), with an average age of 52 (range, 21 to 72). ANOVA analysis revealed that females ($p < 0.05$) were more likely than males to listen to and act on welfare messages from an organisation. Amateurs ($p < 0.05$) were more likely than professionals to agree that scientific researchers provide the lead when building new knowledge about welfare, while professionals ($p < 0.05$) were more likely than amateurs to agree that they contributed to building new knowledge about welfare. The high average age of respondents is reflective of participants in high-performance equestrian sports. There was little evidence of knowledge of the 5D in the responses, tested through direct word match applied to the open question. Further research is warranted, including investigation of participatory approaches to the design of organisational communication frameworks with a focus on horse welfare, incorporating a welfare-centric vocabulary which resonates with sport participants.

Lay person message: The future of horse sports increasingly rests with the public, and horse sport organisations face maintaining public trust while being transparent about horse welfare. This project investigated sport participants' attitudes about horse welfare, and the findings may inform organisational communication frameworks which enable horse sport organisations to participate in contemporary discourses about welfare and address their social licence to operate.

O21: Prospects of non-invasive stress measuring in equestrian training

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Wearable technology has revolutionised many industries from healthcare to cattle farming. The purpose of this theoretical study was to review benefits and issues of using wearable sensors to evaluate equestrian training methods. The equestrian industry has recently experienced an explosion of different wearable devices to measure physical aspects such as gait, symmetry, activity, heartrate and temperature. While such sensors are undoubtedly increasing objectivity and analysis, the results often fail to question different factors, such as the emotional state of the horse, which could be contributing to measurements (Hall *et al*., Applied Animal Behaviour Science. 205:183, 2018). Horses often disguise stress and even owners and riders who have a strong relationship with their horse might miss subtle signs of stress (Hall *et al*., Applied Animal Behaviour Science. 205:184, 2018). As the perfect balance of stress and arousal is key to optimal learning (McBride and & Mills, BMC Veterinary Research. 8:180, 2012), developing non-invasive ways to measure these factors could greatly encourage better training practises. In collaboration with equine learning theory, the addition of mood assessment and an analysis of a horse's individual behavioural patterns, could increase the personalisation of training across disciplines. When designing and developing a technological intervention or enhancement for the human-horse relationship, the importance of using natural senses must not be replaced, as the relationship between horse and human is formed over time by learning to communicate with each other. This is the foundation upon which the human has built a lasting relationship with the horse (Walker, Horse (London: Reaktion Books Ltd), p.14, 2008) and thus it should be integrated into the core of commercial measuring devices. Through the development of wireless technology, measuring has become much easier and adaptable for equestrian use (McGreevy, *et al*. Journal of Veterinary Behavior: Clinical Applications and Research. 9:34, 2014). This could lead to the development of new forms of non-invasive measuring. Current research in the field of non-invasive stress and mood assessment shows promising applications for using wearable technology as part of evaluating equestrian training methods. One of such is measuring the spontaneous blink rate of the horse, which has been shown to be a reliable, yet non-invasive way to measure stress levels. Further research into the area of automated real-time stress analysis could open new possibilities of developing effective and positive personalised training methods to enhance the collaboration between humans and horses.

Lay person message: As wearable technology is enhancing various traditional industries, the possibilities of introducing real-time objective analysis to equestrian training is an interesting area to investigate. Measuring non-physical aspects of the horse, such as mood, stress and behavioural patterns, has been difficult in the past. However, wearable sensors and artificial intelligence could offer non-invasive ways to measure stress in training situations. This could lead to the validation of different schooling methods and an increase of personalisation within equestrian practises. Even though technological advancements can improve equine welfare, caution needs to be practised when designing interventions for the human-horse relationship.

O22: Indicators on the outside: Behaviour and equine Quality of Life

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In order to evaluate the quality of life of an animal evidence of its subjective experience, 'how it feels', is required. For the horse, such information is needed to assess the impact of management and training and identify factors that require change. The aim of this systematic review was to assess the behavioural evidence of emotion in the horse and how this is indicative of equine quality of life. Electronic databases were searched using Science Direct, PubMed, Scopus, Web of Science, PubPsych and PsycINFO. Two separate sets of search terms were specified: 1. (Emotion* OR affective OR cognit*) AND (behav* OR welfare OR physiol*) AND (horse OR Equid* OR equine*); 2. (Horse OR equid* OR equine*) AND (stress AND respons* AND behav). All primary peer reviewed experimental and observational studies referring to equine emotional responses and emotional state were included in the initial pool (n=1446). The application of retention criteria (relevance to the objective of the review; involving > 4 equid subjects; clear description of methodology and justification for the attribution of emotion) resulted in 75 publications being included. Factors found to affect emotional responses included age, social grouping and previous training methods. There was inconsistent use of ethograms with limited justification for behavioural interpretation. Over 30 different journal articles and nine books were cited in relation to ethogram development. Differentiation between behaviours indicative of negative and positive emotional responses was context specific, with head and neck position / movement being most frequently referred to (positive: n=9; negative: n=28). More conclusive signs of response valence included vocalisation, facial expression and movement patterns (approach/avoid/escape /attack/freeze). The valence of underlying emotional state, potentially a better indicator of equine well-being, was implied by changes in the frequency of specific behaviours. Increased feeding behaviour, affiliative social interactions (horse and human) and interest in the environment were indicative of positive emotional state. Negative emotional state was associated with increased repetitive non-functional movement patterns, agonistic interactions, decreased feeding and reduced interest in the environment. Responses to cognitive bias testing and static and dynamic features of facial expression also reflected underlying emotional state. Further validation and the development of an evidence-based ethogram is now required. Equine quality of life is demonstrated during everyday behaviour and responses to training and once the key indicators have been validated, all horse owners and carers should be able to assess and improve the quality of life of horses under their care.

Lay person message: This review was carried out to identify equine behaviour that is indicative of underlying mood state and general well-being of horses, i.e. how they feel. Everyday behaviour, including that associated with training, was found to be the clearest indicator of this and will underpin criteria to enable all horse owners and carers to assess and improve the quality of life of the animals under their care.

O23: Indicators on the inside: Physiology and equine Quality of Life

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The recent move away from resource-based assessment of welfare exemplified by the Five Freedoms towards an animal-based framework such as the Five Domains Model, has highlighted the need to develop an Equine Quality of Life (EQoL) assessment framework based on evidence-based, observable behaviours that reliably reflect underlying emotional state. This Systematic Review aimed to identify potential physiological indicators of equine emotional states. A pair of online database searches #1 '(Emotion* OR affective OR cognit*) AND (behav* OR welfare OR physiol*) AND (horse OR Equid* OR equine*)' and #2 '(horse OR equid* OR equine*) AND (stress AND respons* AND physiol*)' yielded 1600+ publications. After application of predetermined selection criteria 124 were retained for analysis. Heart rate (HR), heart rate variability (HRV) and cortisol are the most commonly measured physiological indicators of equine emotion. The effects of negative and positive stimuli are not consistently reported across studies. Additionally, these measures are at risk of confounding by physical exertion. HR is considered a reliable indicator of equine emotional state due to changes being rapid and sensitive to the intensity of the experience. Increases are reported with arousal, pain, novelty, anticipation and exercise, whilst decreases occur during allogrooming and habituation. Although HRV is considered a more sensitive indicator of emotional state encompassing parasympathetic and sympathetic nervous system activity, a variety of methodological and interpretive questions about its reliability remain. A lack of association between behaviour and cortisol results is not uncommon. Cortisol increases due to acute stress, anticipation, stereotypy prevention and physical exertion are reported, whereas it decreases with chronic stress. The modifying effects of factors such as physiological habituation, coping style, past experience and individual variability remain unknown. Other suggested correlates of emotional state include eye temperature, ACTH challenge, haematological, immunological, neurological factors, respiratory rate and salivary alpha amylase but many of these lack validation in relation to association with emotional state. Methodological problems exist with all physiological measures, including lack of standardisation of reporting and interpretation, calibration and validation difficulties, confounding effects of 'outlier' values and erroneous use of human baseline data when deriving equine HRVs. Valid interpretation of the contribution of physiological data in relation to emotional state requires an understanding of the context in which the data are measured. This is the first Systematic Review to confirm that physiological data alone are of limited use in assessing equine emotional state and working towards a good life for horses.

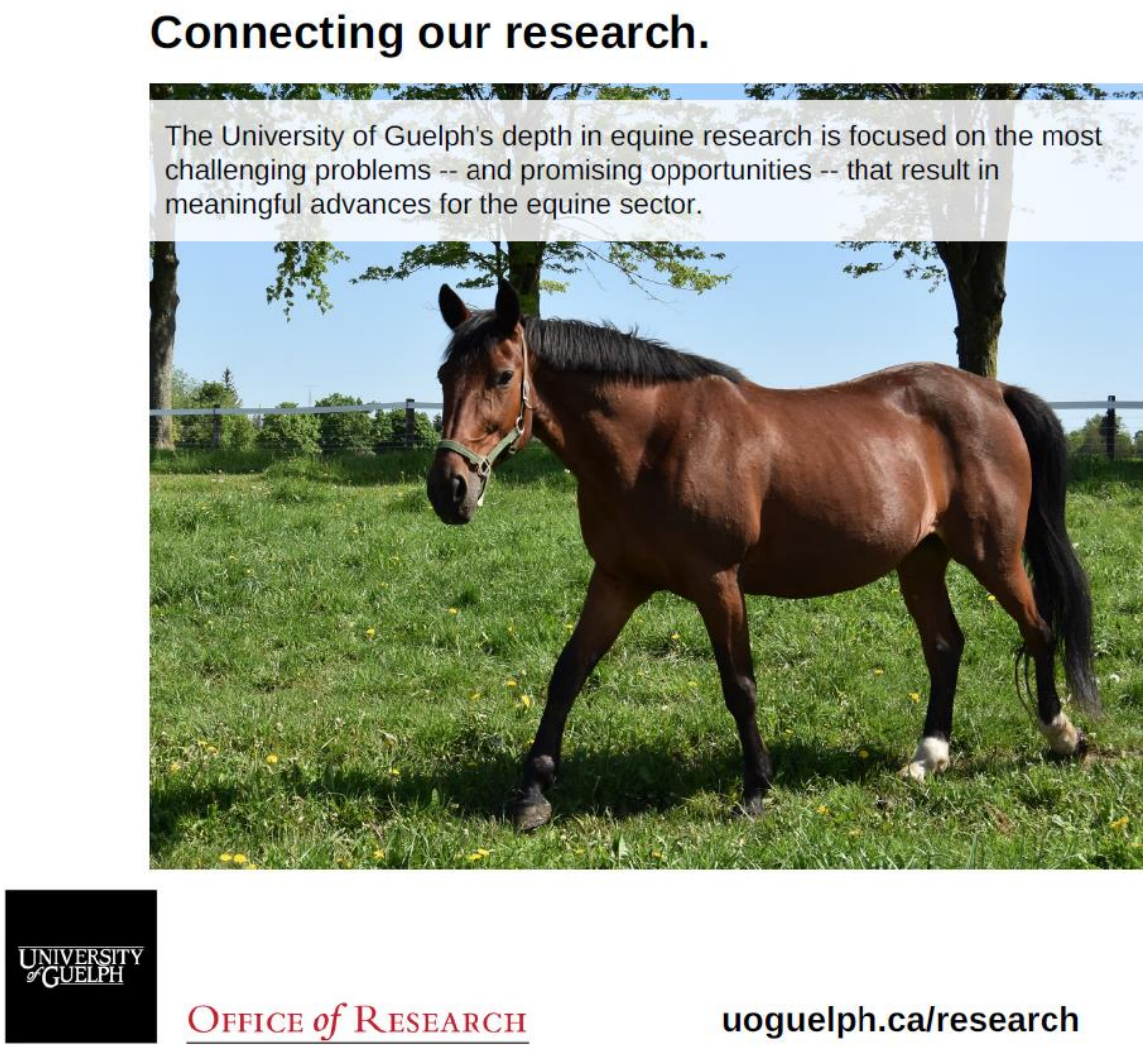
Lay person message: Horse welfare is coming under increasing scrutiny worldwide. An individual horse's welfare relies on more than just having food, water and an appropriate place to live. The mental health of the horse is now also being investigated, including his/her emotional states and positive/negative (affective) experiences. A review of 124 research papers focussing on physiological measures of equine emotion (e.g. heart rate) revealed that these may have limited use when assessing horse welfare. A comprehensive set of measures that takes into account the horses experiences at any one time is needed to assess equine welfare and his/her overall quality of life.

PD1: Positive reinforcement training demonstration

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In this demonstration we will work through the stages of systematically utilizing positive reinforcement training to address common mounted issues. We will demonstrate the earliest stages, move to ground work, then transitioning to under saddle work. Typically, horses have become desensitized to the cues we use for ridden work. We will demonstrate the implementation of a positive reinforcement protocol to elicit a more desirable response to the cue. Instead of spurs, whips or escalating pressure, we will use targets, a conditioned bridge signal (clicker) and food as a primary reinforcement to change the horse's desire to respond to the given cue.

I will also discuss and possibly show, depending on progress that is made within this demonstration, how to fade the target from the equation. We will demonstrate one example of creating a positive reinforcement, science-based training solution to traditional training challenges. I will discuss and answer questions about utilizing positive reinforcement solutions in other training scenarios.



PD2: Smart halter for monitoring distress demonstration

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Nearly 40% of the approximate 8.2 million horses in the United States and Canada are used for performance (i.e., racing and showing), which means there are well over 3 million horses at increased risk for developing colic, getting cast, or experiencing other forms of distress.

Equine distress can stem from many factors, including, but not limited to injury, trauma, illness, fear, and boredom. While there are many common distress conditions (eg, colic, being cast, foaling), colic is of the greatest concern because it's the leading natural cause of death in horses, second only to old age. Unfortunately, signs of distress can be elusive and often occur overnight while horses are unsupervised. This, coupled with the fact that horses are prey animals who instinctually suppress expression of pain/distress, results in delayed intervention. Delayed intervention is a negative prognostic factor that has dire impact on survival and quality-of-life outcomes.

To address this unmet need, there is a new approach that leverages artificial intelligence, biosensors, and the latest in IoT technology to alert caretakers at the early signs of equine distress. This technology is called NIGHTWATCH®, the world's first smart halter™.

NIGHTWATCH® is a breakaway leather halter with ~2 ounces of embedded technology that acts as an early warning system by alerting caretakers via text, voice, and email at the early signs of equine distress. Because no two horses are alike, this patented technology learns each horse's unique physiology and looks for deviation that correlates with possible pain/distress, which is quantified on a 10-point scale called the equine distress index®(EDI®) In short, NIGHTWATCH® collects and analyzes biometric (HR, RR) and behavior (activity, posture, motion) data and issues early-warning alerts for earlier intervention to limit down-time, injury, costly surgery, and possible death.

The EDI® is a new 10-point scale that makes understanding a horse's general well-being easy. The lower a horse's EDI® score, the happier and healthier they are. A horse's EDI® score is an objective measure of their relative distress and derived using a fuzzy inference system with multiple parameters, including biometric and behavioral inputs, environmental conditions, pre-existing risk factors, and more.

As caretakers, it is our responsibility to protect horses that do so much for us. The advent of NIGHTWATCH® not only has the potential to protect these beloved animals, but also revolutionize how equine insurance companies manage risk, how veterinarians practice telemedicine, and how researchers design future comparative studies.

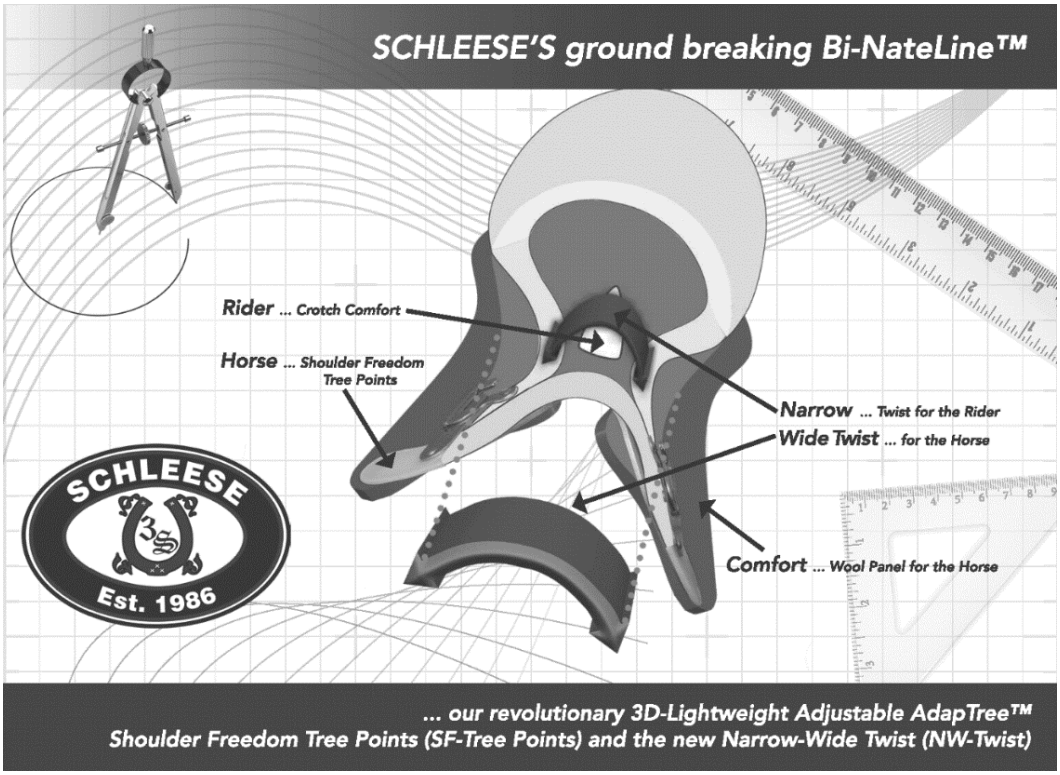
PD3: Codes of Practice and equine welfare assessment workshop

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A growing body of scientific literature is the basis for our understanding of what constitutes good equine welfare and, as a result, is used to shape the standards and legislation that govern the equine industry. While in theory these standards should make welfare evaluation "on-farm" a straightforward task, the reality is that there are still many challenges when it comes to applying welfare science in the field. Should "good welfare" be evaluated at the individual or group level? Can welfare be measured objectively and reliably? If so, what are the best measures to use? Should all measures be animal-based, or is there a place for management- and resource-based measures? Can the same measures be applied uniformly to a population as diverse in breed and purpose as horses? These are only some of the questions that must be tackled by researchers looking to make headway in the field of equine welfare science.

Through the lens of a pilot on-farm welfare assessment project, this workshop will explore the journey from scientific literature to stable, utilizing Canada's National Farm Animal Care Council's (NFACC) Code of Practice for the Care and Handling of Horses (2013) as a model set of industry standards. This Code of Practice contains over 120 Requirements, each of which relates to specific sections such as feed, water, and health, but all of which focus on good care and management of the horse. This interactive workshop will involve delegates in defining "good welfare" for horses and determining what measures are best suited for evaluating their definition of welfare on-farm, in both a reliable and timely manner. They will then be tasked with assessing "good welfare" objectively to the standards outlined in the Requirements of the Code of Practice, navigating the same challenges faced by researchers involved in the assessment pilot project. Delegates will also have the opportunity to learn and practice scoring body condition, one of the many measures used in the on-farm assessment.

National Farm Animal Care Council (NFACC). (2013). Code of Practice for the Care and Handling of \ Equines, http://www.nfacc.ca/pdfs/codes/equine_code_of_practice.pdf [Online]



PD4: Saddle fitting theory lecture

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Based on anatomy and biomechanical needs of the horse and rider, there are 9 basic points which should be taken into consideration when determining whether or not the saddle fits your horse – with many more to consider for the rider. All these points, but specifically the first 4 are relevant to the ISES First Principles of Horse Training, as horse discomfort may cause behavioural issues, inhibit performance, and cause welfare issues.

Saddle Balance: A saddle too high in the pommel and too low in the cantle causes pressure on the horse's back, making it difficult to engage, as too much weight is on his last 2 floating ribs. A saddle too low in the front will pinch the shoulder.

Wither Clearance: No clearance on the side and top of the withers will restrict movement and range of motion through his shoulders, resulting in a reluctance to go forward.

Gullet/Channel Width: A gullet that is too narrow or wide can cause permanent damage to your horse's back. The width of each horse's spine will determine how wide his saddle's gullet must be.

Full Panel Contact: The saddle should sit evenly on the saddle support area of the horse's back, ending at the last rib.

Saddle Straightness: The centre of the saddle should be in alignment with your horse's spine. A saddle that falls or twists to one side can lead to problems with your horse's sacroiliac (SI) joint.

Saddle length: Even a horse with a back that appears to be of normal length may actually have a very short saddle support area (SSA). The length of the SSA will determine the length of the saddle panels.

Tree angle: The angle of the tree should match the angle of the horse's shoulder to allow the shoulder to slide freely up and back during movement.

Tree width: The tree width must be wide enough for the horse's shoulders to rotate freely under the tree. Sometimes you have the paradox of a 'narrow wide' tree (narrow angle with wide width).

PD5: Technical sportswear to improve riding position demonstration

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How do horses respond when you are not symmetrical and balanced in the tack? Physical and/or behavioural responses such as rein lameness and/or refusing may result from lack of rider straightness.

Patented internationally by Russel Guire of Centaur Biomechanics, Visualise Training Jackets were designed and tested in 2011 to help improve the position and awareness of a rider. Used by the British Equestrian Federation's World Class Team, the Visualise Jacket has become an essential training tool to improve rider performance from the amateur level rider to the Olympic competitor.

Rider straightness affects performance as well as horse welfare. Visualise Training Jackets are the ultimate training tool to improve riding position and effectiveness, allowing you or your coach to see any postural change at a glance. Using the Visualise Training Jacket in conjunction with the Objectivity App, developed by Centaur Biomechanics in 2018, videos of rides in slow motion may be recorded so that changes in posture and straightness can be analysed with your trainer/coach. The app allows you to add vertical and horizontal lines to match the strategic lines on the training jacket, making it easier to record and track changes.

Ensuring a rider is symmetrical and balanced in the saddle will improve horse welfare and make it easier for the horse to respond correctly to the rider's aids.



PD6: Rein sensor demonstration

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Rein pressure is the negative stimuli through which we demand specific behaviors of the horse, either being a change in posture, speed or direction. In order to be effective, avoid stress, conflict behavior, and habituation, each aid should be different for each response and the pressure should be released as soon as the horse shows the right behavior, with the ultimate goal being self-carriage.

Asymmetry in rein pressure can originate from either the horse or the rider. If there is an underlying physical problem, the horse will not be able to maintain a balanced position and will move its weight away from the painful side. A rider will have a difficult time getting the horse in balance. By using rein sensors, it can be determined whether asymmetry originates from the horse or the rider. If an underlying physical issue in the horse is the cause of the asymmetry, the horse should always be examined by a veterinarian.

Asymmetry caused by the natural imbalance of both the horse and the rider should be addressed by the rider. In practice, trainers around the world use different methods for this. Rein sensors might be used to provide objective insight into the efficiency of such methods.

Understanding learning theory is still very different from applying it in practice. By measuring rein pressure it becomes clear which aids riders use. Are they really different for different responses? And how is the timing of the release of an aid in relation to the behavior? What happens if the aid is released? Will the horse remain in the required posture or gait, or are we unconsciously helping the horse instead of letting him make the mistake and teaching him self-carriage? These challenges, recognized and improved with rein sensors, would have beneficial effects on the horse's emotional state.

PD7: Measuring head angle, pace and heart rate while riding

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Equla Vert is the world's first horse head angle sensor measuring your horse's head angle in relation to the vertical. When the horse's nose is behind the vertical, it is a red flag for problems in the generation and/or transmission of energy from the hindquarters, and, of course, large angles behind the vertical are a serious horse welfare issue. In contrast, the nose moving or staying too far ahead of the vertical can indicate evasion. When the horse is straight, the rider is not able to determine the head angle from the saddle, so without an arena with mirrors, or "eyes on the ground", an accurate determination of head angle is not possible.

By attaching Vert to the headpiece of the bridle at the poll, then using the smartphone app, currently only available on iPhones, Vert can be set to each horse's head. As the horse flexes at the poll, digital sensors detect the angle of the head. As the settings are easily adjustable, a range of head positions can be chosen depending on the level of training. For a green horse, a broader center zone is best. For an advanced horse, a narrow center zone. Vert does not replace a rider's feel, but can be used to help the rider develop feel and prevent bad habits from starting. As a measurement and feedback tool, it can be used to enhance your existing instruction and lesson regimen, working in cooperation with your trainer.

To enhance your training, Vert also allows riders to track pace, current speed and heart rate.

P1: Barn or Yard? When given the choice, where does a horse choose to spend its time?

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This study was designed to assess the amount of time that a horse chooses to spend in the shelter of a barn or outside in a paddock versus time of day and seasonal weather conditions. A small herd of horses lives freely in a 9-acre paddock with easy access to a 740 ft^2 barn near Guelph, Canada. Free choice hay is available in 4 widely spaced slow feeders in the paddock and 4 hay bags in the barn. Water is also available in the paddock and in the barn. A Garmin GPS was attached to the dominant horse (Major) and his location was tracked each minute for 10 days from January 25-February 4, 2019 (winter) and 7 days from May 19-26, 2019 (spring). Data was downloaded into MapQuest software and location was classified as either "in the barn" or "outside". Location data were summed for each hour for comparisons of location to time of day and weather conditions. Hourly weather data was available from a Canadian Weather Station, located 10 km northwest of the farm. This data included temperature, wind speed, wind chill and humidex. Results: Major's location in the barn or outside was analyzed for 368 hours during the study period. In total, Major spent 79.0% of his time outside. He spent significantly more time outside in the spring compared to the winter (87.5% vs. 74.5%, $p<0.05$). The weather conditions varied considerably over the study period. Hourly average temperatures including wind chill or humidex ranged from -36 to +30ºC. The temperature range dataset was divided into 37 hour deciles and Major's location was analyzed over this range. Major spent significantly more time in the barn during the 4 extreme temperature deciles (cold temperatures from -36 to -18ºC or hot temperatures +15 to +3ºC) versus during the 6 mid-range deciles (-18 to +15ºC). Specifically, he was in the barn 40.1% of the time during extreme cold and hot temperatures versus only 9.2% of the time during moderate temperatures ($p<0.05$). The circadian pattern of his location was significantly different between the 2 seasons. Specifically, in the "dead of night" (21:00 - 03:00), Major was in the barn 54% of the time in the winter, versus only 1% of the time in the spring ($p<0.05$). Conversely, during the "heat of the day" (09:00 - 15:00), Major was in the barn only 2% of the time in the winter, but 41% of the time in the summer ($p<0.05$). Conclusions: When given the choice, this horse spent the majority of his time outside vs. in the barn. He tended to spend more time in the barn in temperatures of extreme cold (less than -18ºC) or extreme heat (more than 15ºC). Time of day was not a predictor of his choice of barn or yard.

Lay person message: Horses are commonly stabled in barns during the night and during inclement weather, with turn-out based on human schedules and preferences. This study assessed where a horse chooses to be during typical winter and spring weather in Ontario, Canada. The study horse lives in a small herd in a large pasture with access to a cozy barn for shelter. The weather conditions varied considerably over the study period with hourly average temperatures including wind chill or humidex ranging from -36 to +30ºC. GPS tracking revealed the horse chose to spend the majority of time (79.0%) outside. He tended to spend more time in the barn in the extreme cold or extreme heat, while spending 90.8% of his time outside in the moderate temperature range of -18 to +15ºC.

P2: A preliminary study of the effects of the number of consecutive days of training and days off on foal recall

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It is critically important that early foal handling and training takes into account foals' cognitive abilities. The inclusion of days off during horse training has been found to be beneficial. This study aimed to determine how the incorporation of days off during initial training influences foal learning outcomes and behaviour. Twenty Thoroughbred foals (age 47±13.6 days) were blocked by age (< or >8weeks) and randomly allocated to either Method A (trained for two consecutive days followed by a rest day, two more training days, rest day, ending with up to three more consecutive training days) or Method B (trained for four consecutive days, two rest days, ending with up to three more consecutive training days). Qualified Foal NZ instructors used negative reinforcement to train foals to 'go' (cranial pressure on the halter until foal steps forward) and 'stop' (caudal pressure until the foal stops) from both left and right sides. Occurrences of foal biting behaviours were instantaneously recorded during training sessions. Session length was determined by progress made and did not exceed 25 minutes. Training success was assessed using number of signals required (recall) for the foal to perform the task in the next training day. Recall data for all tasks were nonparametric (left 'Go' AD=6.32; 'Stop' AD=2.89; right 'Go' AD=4.24; and 'Stop' AD=6.10; all $P<0.005$). Foals' recall of any of the tasks did not differ according to whether they were trained with two non-sequential days break (Method A) or two consecutive days break (Method B) for either younger or older foals (all Mann-Whitney U $P>0.05$). Younger foals (<8weeks) trained using Method B showed significantly more biting (median=7) in session four than those trained using Method A (median=0; W=36; $P<0.05$). However, this difference in biting behaviour disappeared by session five (median=0; W=46; $P>0.05$). There was no difference in biting behaviour exhibited by older foals (>8weeks) according to training method. This study shows that whilst the foal's ability to recall previously learnt responses is not influenced by the number of consecutive days of training or days off during a 7-9 day training programme, foals <8weeks that had four consecutive days of training showed significantly more biting behaviour than those who had a day off training prior to day four. It is recommended young foal initial training programs incorporate a day off within the first four days in order to decrease potential stress related behaviours such as biting.

Lay person message: Handling foals appropriately and creating a positive human-horse relationship that takes foals cognitive abilities and limitations into account is critically important for future behavioural development. Having a day off during the training programme did not hinder foals training progress. Young foals (less than 8 weeks) who had four consecutive days of training before having a day off showed more biting. Initial training of young foals should avoid four consecutive days to avoid negative behaviours such as biting occurring.

P3: Examining the horse-human bond from the human perspective

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The relationship between horses and humans is one that many people would perceive as being unique, for instance the horse nickering at them when they arrive at the barn. A better understanding of this bond and how it is classified from a human perspective provides insight into where pitfalls for welfare might occur, especially in instances where the horse-human bond is romanticized to the detriment of the horse's comfort or wellbeing. This exploratory study sought to expound on the reasons through which people believe there is a bond between a horse and a human and to search for any significant patterns. An online survey on horse-human attachment relationships was distributed to the Horse Canada website and various social media groups (e.g. the ISES closed Facebook group). Questions were asked about horse ownership, days per week of one-on-one contact, length of time the participant had been riding the horse and their primary reason (Western riding, English riding, etc.) for spending time with the horse. Demographic data were also collected (gender, age, ethnicity, household income and country of residence). Finally, an open-ended question asked participants to describe an instance where a horse had done something that made them think a bond between a horse and a human had been demonstrated. Qualitative responses to the open-ended question were coded using NVivo software. Pearson chi-squared analyses determined relationships between coded responses and demographics. Participants (n=444) most often referred to the horse voluntarily approaching them (27.3%), vocally greeting them (20.3%), trusting them in a frightening situation (17.6%), taking care of them (16.6%) and initiating physical contact with them (16.4%). Participants who owned their horse were more likely to refer to their horse prioritizing them over other humans than those who leased or borrowed their horse ($\chi 2$ (3,N=314) = 8.74, p=0.033). Most other demographics had no correlation to the coded responses, indicating that the way humans describe their bond with a horse seems universal across age, gender, income, ethnicity, discipline and contact with the horse. Thus the bond as perceived by humans appears to be represented through common themes that transcend physical factors of those who interact with them. Knowledge of the perception of the horse-human bond can improve horse welfare through directed research and communication of horse ethology and cognition.

Lay person message: Regardless of where a person comes from, how much money they make, their age, gender, discipline or experience with horses, people appear to regard their bond with a horse in much the same way. The most frequent references to a bond with the horse involve the horse approaching them, greeting them, trusting them in a frightening situation, taking care of them during hardships, and physically touching them. This implies a common level of understanding of how the horse regards humans.

P4: The Elusive "feel": exploring the quality of the rider-horse relationship

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This qualitative study explored how riders perceive and understand the relationship with their horse. A literature review revealed consistencies within the dynamics of rider-horse and coach-athlete relationships, both advocating the importance of self-awareness, empathy, and effective communication. Ethical approval was granted before the commencement of data collection. Participants included ten elite female riders with a mean age of 40.6 years, five of whom competed in Eventing and five in Dressage with an average of 30.9 years competitive experience, and their chosen horses (one stallion, two mares, and seven geldings with a mean age of 11.8years). The average duration for the relationship between horse and rider was 6.8years. Each rider-horse combination completed a typical flatwork training session, which was video recorded. Riders were asked to watch their video and provide a commentary of their direct (their own) and meta (their horse's, as understood by the rider) perceptions of their interaction including descriptions of the characteristics that underpin the relationship. The riders' verbal reports (Ericsson & Simon, Psych Rev, p215-251, 1980) were transcribed in full, and examined using a thematic analysis. The analysis was both deductive and inductive, a process known as "abductive reasoning" (Sparkes & Smith, Qual Res Meth Sport Exerc Healt Proc Prod, p27, 2014). The sub-themes were generated inductively through initial coding, and then afforded deductively to the rudimentary framework of the 4Cs (Closeness, Commitment, Complementarity and Co-orientation) model of quality relationships (Jowett & Shanmugam, Rout Inter Hand Sport Psych, p471-484, 2016), the most prevalent coach-athlete relationship model to date. Closeness represents individuals' feelings, and sub-themes included respect, trust, appreciation, and emotional bond. Commitment represents individuals' thoughts and sub-themes included will, attentional focus, motivation, and effort. Complementarity represents behaviours and sub-themes included cooperation, reciprocity, support, and personality. Co-orientation represents mutual knowledge and understanding, and sub-themes included self-awareness, shared knowledge, optimal learning, and empathic accuracy. Additionally, sub-themes were induced to new themes outside of the rudimentary framework; Welfare with sub-themes of psychological well-being, physical well-being, treatment/therapy, and Performance with sub-themes of groundwork, judgement, scales of training, guidance, relaxation and harmony. The overarching theme of Rider-Horse Psychophysiological Confidence underlined the importance of quality rider-horse relationships to performance and welfare for both horse and rider. An adaptation of the 4Cs coach-athlete relationship model is offered as an educational framework for the rider-horse relationship and opportunities for further research.

Lay person message: This research explores elite riders' understanding of their relationship with their horse by providing commentary of a pre-recorded training session. Whilst recognising that each relationship is unique, the research outcomes suggest a number of consistent factors that contribute to quality rider-horse relationships, and in turn, performance and welfare. This research offers an educational rider-horse relationship framework adapted from a relational coaching model and provides scope for further research.

P5: The effect of police horse training on the behavioural and physiological responses to different environments encountered on the job

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Police horses are exposed to high stress environments for which they must be appropriately trained using gradual desensitization techniques that ensure their overall well-being and the safety of police officers and public. This exploratory study examined the physiological and behavioural stress police horses experience during training and while on duty in the community and on the streets. Behavioural and heart rate (HR) data from five police horses and six police officers from the Hamilton Mounted Police Unit were collected on three occasions in each of three different environments: 1) training (arena exercises), 2) community patrols (public presentations) and 3) street patrols (night patrol). Heart rate monitors were placed on each horse and rider with data being collected in 5sec intervals throughout each trial. Behavioural Observation Research Interactive Software (BORIS) was used to retrospectively score behavioural data from 2-minute video segments recorded in 30min intervals for the duration of each trial. Five-second interval sampling from each video recorded the position of the horse's left ear, head and neck position, gait, mouth and tail movement, restlessness, rooting and interaction with people or objects. A GLM with repeated measures analyzed the occurrence of behaviours and horse and human HR among the three environments. Gait was used as a covariate to account for physical exercise impacts on HR. Horse HR was highest during training (84±32a beats per minute (bpm)), intermediate on the streets (69±33b bpm) and lowest during community (44±13c bpm), even when including gait as a covariate (a,b,c differ, $P>0.0001$). Rider HR was highest during training (115±16a bpm), intermediate during community (94±18b bpm), and lowest on the streets (86±17c bpm; $p<0.0001$), indicating that rider responses differed from horse responses. Compared to the community and street environments, during training the horse's ear was focused towards the rider more often (37%a, 40%a and 59%b of the time respectively; a,b differ $p<0.0001$), the head was raised more often (0.8%a, 1.3%b and 3.5%c of the time respectively; a,b,c differ $p<0.0001$) and the mouth moved more often (55%a, 37%b and 64%c of the time respectively; a,b,c differ $p<0.0001$). These results show that horses were more attentive to their riders even though they displayed more physiological and behavioural signs of stress during training compared to community and street environments, suggesting that the training appropriately prepares the police horses for situations they may encounter on duty, improving their overall welfare.

Lay person message: Police horses must be trained to remain calm even in stressful environments they may encounter while on duty. A desensitization training program appears to adequately prepare them for the stresses of the job as their heart rates and behavioural signs of stress were reduced when they were observed on duty compared to during training sessions. It is important that police horses remain calm for the safety of the police officer and the public.

P6: Electromyographic changes with exercise-induced fatigue on the treadmill in different muscles

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Understanding fatigue can lead to better training regimens or injury prevention. We have previously reported that the integrated-electromyogram (iEMG) values of the gluteus medius decreased with exercise-induced fatigue during galloping. Another study showed that exercise-induced fatigue increased iEMG values of the extensor digitorum longus during trot. These different responses might reflect different muscle functions. We aimed to investigate the association between EMG changes induced by high-intensity exercise and muscle function. Fifteen Thoroughbred horses (7 for forelimbs and 8 for hindlimbs) were used for surface EMG recording of the triceps brachii, common digital extensor, ulnaris lateralis, semitendinous, extensor digitorum longus, extensor digitorum lateralis, and flexor digitorum profundus. Horses galloped on a treadmill inclined to 3% at a constant speed (12.6-14.8 m/s) to make them fatigued, which means that they could not maintain their position with minimal humane encouragement after approximately 5-min. Stride frequency and iEMG for a stride were calculated every 30-s. These parameters were compared at the start and end of 5 min test-phase for the leading and trailing limbs using a paired t-test. Stride frequency significantly decreased at the end of test (2.14 ± 0.04 to 2.04 ± 0.04 strides/s, $P = 0.008$). iEMG values of the semitendinous in both leading ($P = 0.019$) and trailing limbs ($P = 0.049$) and those of the extensor digitorum longus in trailing limbs ($P = 0.022$) significantly decreased at the end of test. Exercise-induced fatigue caused inability to maintain speed, which was associated with decrease of iEMG values in the semitendinous and the extensor digitorum longus in the trailing limbs. In contrast, those of muscles which stabilize fetlock and carpal joints did not change. Considered with our previous reports, EMG changes caused by exercise-induced fatigue might be associated with muscle functions. Training hip joint muscles can lead to increasing performance and daily therapy especially for those muscles should be recommended for racehorses' welfare.

Lay person message: Exercise-induced fatigue on the treadmill decreased muscle activity in hip joint muscles which have propulsive function. In contrast, the activity of muscles which stabilize fetlock and carpal joints did not decrease with fatigue.

P7: Preliminary findings of observations of affiliative and stress behaviours in large horse herds with variations in resources

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This study identifies behavioural indicators of preferred equine affiliates and changes in behaviour between areas with open access to resources (low stress) versus areas where resources were restricted (mild stress). Two herds of Quarter Horse mares with 150 horses each (total n=300) with varying ages (6-22 years) were observed in open pastures and smaller confined arenas (one indoor and one outdoor) in which they spent 4 hours each evening. Each herd was video recorded for seven days in March 2019 with at least 30 minutes of video recording in each location on each day. Pasture recordings were conducted between 12:00 and 18:00 while confinement recordings were conducted between 18:00 and 19:30. Each pasture was at least 16 hectares with open grazing and multiple access points for water. Confined arenas measured approximately 30m x 20m with no access to food or forage. The outdoor arena had two large water troughs and the indoor had three troughs. Observations of interactions between conspecifics included proximity, physical interactions, movement, vocalizations, and behaviours around water. Mares formed in pairs or threes and chose to remain together in both locations. In pasture these small groups remained within 16m of one another, moved in synchrony, and shared access to resources. Average number of observed allogrooming sessions in pasture per 30 minutes was one ($x = 1$). In confined areas groups remained within 1-2m of each other, prevented other horses from separating them, moved in synchrony, shared access to resources, and performed mutual grooming. Average number of observed allogrooming sessions per 30 minutes in arenas was 30 ($x = 30$). Furthermore, allogrooming did not occur between all pairs of conspecifics whereas preference for proximity, movement, and resources access was observed in all groups, suggesting that allogrooming may only occur between preferred conspecifics, but proximity, resource sharing, and movement may be stronger indicators of social bonding between horses. There was also no obvious social hierarchy either within the large group or within each small social group. The preliminary results indicate that, under mildly stressful conditions, affiliative conspecifics increase propensity for allogrooming, engage in behaviours that indicate a desire for closer proximity, and share access to limited resources. These observations are part of a study examining social bonding between equine conspecifics including the creation and maintenance of social bonds, effects of management strategies (separation, sales, housing) on emotional welfare, and behavioural correlations between equine affiliative behaviors and equine-human interactions.

Lay person message: Social behaviours between mares that are familiar with each other change when large herds are subjected to conditions with restricted space and resources. Individuals who are seen together in more open areas with no restricted resources engage in more mutual touching, synchronized movement, and closer proximity when in smaller areas. There are no obvious leaders or hierarchy, but there are definitive social groups usually consisting of between two and three individuals.

P8: Behaviour and heart rate responses in horses exposed to novel stimuli

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The aim of this study was to determine which parameters of behavioural and HR reactions are effective to infer the temperament of horses and to see if there are significant differences in horses' temperament between breeds, sexes, and ages. All horses had stayed on the same facility for at least a year at the time when the test was conducted and had been housed at individual indoor stables under the similar type and amount of feeding, exercising, and management. Females (n=22, age =11.36±4.24) and geldings (n=17, age=10.65±3.66) of the Jeju crossbred (n=12, age=9.42±4.57), Thoroughbred (n=15, age=10.73±3.09), Warmblood horses (n=12, age=13.08±3.55) were subjected to this study. A trained experimenter stimulated the right neck area of the subject horses with a white plastic bag, which is a visual, olfactory, auditory complexed multifactorial stimuli and the test finished when the horse stopped escaping response and the increased value of heart rate dropped down to the basal level. The following parameters were recorded for each experimental stimulus: reactivity score and duration of escaping, maximum HR (MHR), the difference between basal HR and maximum HR (IHR), maximum HR*100/basal HR (MHR*100/BHR), and the lead time between the time point of MHR and BHR (Tm-Tb) as HR-related parameters. Pearson correlation test between behavioural and HR-related variables of all the individuals showed the most positive correlation was between the reactivity score and MHR. ANOVA test revealed that Thoroughbred horses had significantly higher reactivity score (df = 2, P = 0.039), and MHR*100/BHR (df =2, P= 0.035) values than Jeju crossbred horses. Also, at the result of ANOVA test, the reactivity score (df =2, P= 0.049), MHR (df =2, P= 0.025), IHR (df =2, P= 0.013) and MHR*100/BHR (df =2, P= 0.031) were distinctly higher in female Thoroughbred horses than in female Jeju crossbred horses. As the result of t-test for sex and both simple linear regression and Pearson correlation test for age, while treating it as a linear factor, all parameters did not differ distinctly between sexes, ages and sexes within breeds. In conclusion, the correlation test results showed that emotional responses, represented as HR related parameters, had significant correlations with behavioral response and Tm-Tb, implying that these parameters might be valuable to predict the emotion of horses. According to the result exploring the differences of responses between breed, sex and age, significant differences were observed among the breeds, but not among sex and age.

Lay person message: The aim of the present study was to get knowledge on characteristics of horses by observing their behavior and heart rate responses during stimuli test touching the horses' body with a white plastic bag. The differences of responses between breed, sex, age were explored. The evaluation was done by two behavioral parameters and four heart rate related parameters, which were recorded during the test. In terms of the breed factor, Thoroughbred horses had more fearful temperament reactions than Jeju crossbred horses. There were not much statistically significant differences in terms of sex and age.

P9: Development of a numeric scale to document and communicate the findings from Saddle Fit Thermograms in an objective manner

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Improperly fitting saddles are a major concern for Equine Welfare. With the rise in availability of thermography cameras, an objective scale is necessary to have a common language to describe a saddle thermogram. We developed and tested the feasibility of a numeric scale to assess saddle fit based on an objective assessment of thermograms. This study used a retrospective examination of 95 thermograms of saddles from an opportunistic sample of riders interested in saddle fit and may not represent the overall population. The rider warmed up the horse at a walk for 5 minutes in no set pattern. A 20-meter circle was marked using cones and after the warmup, horses were walked five times in each direction on the 20-meter circles. Following the walk, horses were ridden at both the rising (posting trot) and sitting trot for five times in each direction on the 20-meter circle. Once this was completed, horses were taken back to the barn and the saddle was removed and the thermographic images of the saddles were collected. Saddle thermograms were collected in a stall out of the wind to limit air current movements that could affect thermography image collection. The use of thermography in the barn or arena environment can be problematic because of environmental influences from wind, sun, or temperature. We used comparative qualitative measurements to develop this scale instead of absolute temperature differences because of environmental factors that cannot always be precisely controlled in real life situations in the barn or arena. The scale was developed based on the patterns found in thermograms of the saddle or pad. The scale consists of a numeric score (1-5), a verbal assessment (Bad, Poor, Acceptable, Good, Excellent), a qualification, and examples of potential reasons (descriptions of thermograms for that category) for each of the scores. Descriptive analysis of the data from the five-point scale found that 12.6% of thermograms fit into the lowest category of 1 (Bad), 18.9% scored as a 2, 30.5% scored as a 3, 21.2% scored as a 4, and 16.8% scored as a 5 (Excellent). This scale was developed by individuals trained in thermography and the intra-observer variability was minimal when the scale was employed by trained thermographers ($p < 0.05$). We discuss these findings and present photographs of the thermograms and written descriptions that represent each numeric category.

Lay person message: We developed a numeric scale for the assessment of saddle fit thermograms so that the quality of saddle fit can be communicated objectively among professionals and lay people in the equine community. We found that approximately 1/3rd of all saddles were either a bad or poor fit based on the evaluation of thermography images.

P10: Interpreting heart rate variability measures in the stable

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Heart rate variability (HRV) measures are a non-invasive method used to evaluate the emotionality and well-being of horses. Time and frequency domain estimates are calculated from the inter-beat interval of heart rate. Within each domain there are several measures which contribute to the complexity of the overall interpretation of the HRV response to various stimuli. In addition, different activities are known to influence basal HRV measures. Previously, time domain measures (mean RR interval: mean RR, mean heart rate: mean HR, root mean square of successive RR differences: RMSSD) and frequency domain measures (low frequency to high frequency power ratio: LF/HF) were shown to be reliable during activities in the stable. The purpose of this study was to examine and characterize HRV measures obtained from horses in their normal environment undergoing three routine activities (standing in a stall, confined on crossties, and being led at a walk). Thirty-five horses (20 Standardbreds, 9 Quarter Horses, 6 Warmbloods) were fitted with a Polar HR monitor during the three activities which lasted for 10 minutes. Five minute segments of R-R interval data were chosen for analysis using Kubios software. HRV measures were graphed to show the consistency of time and frequency domain measures for each horse in each activity. Bland-Altman plots were produced to illustrate the measure of agreement between stall and crossties; stall and walk; and crossties and walk. For each plot, 95% measures of agreement based on 1.96 x SD were calculated along with tests for relative bias using one sample t-tests. The selected HRV measures (HR, RR, RMSSD, LF/HF) showed consistent responses for each horse across each activity (e.g. Test for Bias H0:0; t=0.12; df=1; n.s.). without systematic differences (fixed bias). In particular, stall and crossties demonstrated the most consistency. These findings were illustrated in Bland-Altman plots where nearly all paired comparisons fell within the 95% agreement intervals for activities evaluated. LF/HF ratio was especially valuable in demonstrating parasympathetic attenuation of sympathetic drive during the walk in a subgroup of the sample. The consistency of HRV responses of individual horses lends to within participant comparisons. Horses moving around a box-stall yielded data that was not significantly different than horses restrained in crossties (t=0.96; df=34; n.s.). Both activities provided reliable basal HRV measures. Basal HRV measures from normal daily activities compared with new and changing environmental stimuli may facilitate an awareness of activities and conditions that are stressors for horses.

Lay person message: Heart rate variability (HRV) is a non-invasive approach to evaluating the emotionality and well-being of horses. The present study examined reliable HRV measures of horses in their normal environment (riding / racing stable) in three activities (standing in a stall, confined on cross-ties, and walking). Thirty-five horses (20 Standardbreds, 9 Quarter Horses, 6 Warmbloods) were fitted with a HR monitor during the activities. Comparison of HRV across activities showed that the measures were robust. Basal HRV from normal activities compared with new and changing environmental stimuli may increase awareness of stress horses perceive while exposed to various activities and conditions.

P11: Kinematic and saddle pressure analysis of elite side-saddle riders versus novice level side-saddle riders

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Current research has identified significant differences in rider ability across different levels. As rider ability has been known to have a distinct effect on equine performance, it is important to identify the optimal riding style to enable the optimal rider-horse combination. To date there have been no studies assessing side-saddle rider ability. A comparison of novice and advanced side-saddle riders offers an insight into the potential differences and variations in riding style. The purpose of this study was to identify whether there were any significant differences in the riding position and weight distribution of novice and advanced side-saddle riders in halt, walk, trot and canter on an equine simulator. 2-D motion analysis was used to determine the angles of the trunk, lower left leg, shoulder symmetry and pelvis symmetry of 8 advanced (ADV) riders and 10 novice (NOV) riders in the 4 conditions stated above. A Tekscan pressure pad was also placed between the simulator and saddle to assess weight distribution by calculating differences in peak pressure (PP). Statistical analysis was performed using IBM SPSS version 24 for Mac. A non-parametric Mann Whitney U Test for difference (P=0.05) was performed for the comparison of NOV and ADV riders for each positional angle as well as the comparison of PP symmetry. Statistical differences were seen between the NOV and ADV groups for shoulder symmetry at walk (P=0.034) and pelvis symmetry for both walk and trot (P=0.043 and P=0.034 respectively). Further positional differences were identified between the two groups, however none were significant (P>0.05) results; this may have been due to the small sample size assessed. This preliminary study has identified significant differences between the NOV and ADV riding styles in different gaits through kinematic and pressure distribution analysis. There is an abundance of research assessing the astride riding position and its influences on the horse which offers a platform for future studies assessing the side-saddle rider position. Out-of-saddle discipline specific exercises to improve rider symmetry and strength are increasing in popularity for the modern rider. Results identifying side-saddle rider asymmetries offer the potential for side-saddle specific exercises to be developed enabling a clear application to industry.

Lay person message: This study identified differences between novice and advanced side-saddle riding positions. Greater pelvic and shoulder asymmetry was seen in novice riders compared to advanced riders. Advanced riders rode with a lower leg closer to the vertical than novice riders. Advanced riders also had a greater trunk angle from the vertical (leant further forwards) than novice riders. The advanced group had greater difference between the left and right side of saddle pressure which may be as a result of training to ride with minimal weight through left seat bone to prevent saddle shifting to the left, as suggested in lay literature. Understanding rider positions used when riding side-saddle could assist in improving ridden horse welfare.

P12: A Comprehensive evaluation of stress in horses during therapeutic riding sessions

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In order to conduct a comprehensive evaluation of stress in horses during therapeutic riding sessions, both observable behavioural indicators and physiological indicators of stress (heart rate variability measures and salivary cortisol concentrations) were obtained. Four Joyriders therapeutic riding horses participated in an eight-week program to provide equine-assisted therapy for riders with developmental, physical, cognitive and psychosocial disabilities. The horses also participated in four control sessions where they were ridden by experienced riders, without disabilities, during the same session activities. The behavioural indicators and heart rate variability measures were analyzed for each horse across three activities including baseline (in their stall), as well as the mounting and dismounting of the rider. A saliva sample was collected from each horse following two activities (baseline and dismount) to measure salivary cortisol concentrations influenced by the activation of the sympathetic nervous system. The activity of mounting induced a significantly higher mean number of stress-related behaviours across the three activities, during both the therapeutic riding and control sessions, indicating the highest level of stress during mounting. The mean heart rate (MnHR) was significantly higher in two horses during the control sessions, while heart rate variability (RMSSD and LF/HF ratio) parameters demonstrated that two horses experienced significantly higher baseline measures. There was no significant difference in cortisol levels between the sessions however, the concentrations in two horses increased significantly following the dismount of the rider. In conclusion, the results indicate that mounting induces the highest level of stress responses during riding and this stress was greater during the therapeutic riding sessions. In addition, although the sample size was limited to four horses, the results indicate a shift towards a more sympathetic balance of the autonomic nervous system, indicating an increase in physiological stress experienced by the horses. Observable in both therapeutic riding and control sessions, this demonstrates that the stress experienced by the therapeutic riding horses was not limited to the therapeutic riding sessions, but correlates with the specific activities endured by the horses.

Lay person message: A comprehensive evaluation of stress was conducted on horses during therapeutic riding sessions through the use of behavioural and physiological indicators of stress including heart rate variability and salivary cortisol concentrations. The horses were observed during 3 session activities including baseline (in their stalls), as well as mounting and dismounting. The horses also participated in 4 control sessions where they were ridden by experienced riders, without disabilities. The results indicate that the horses experience stress during the therapeutic riding sessions, higher than that observed in the control sessions, with mounting inducing the highest number of stress responses in both sessions.

P13: Head and neck positions in the ridden horse: An exploration of trends observed in an Australian horse sales magazine from the years 2005 and 2018

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The impact of head and neck position (HNP) on biomechanics has received much attention in the scientific literature within the last decade. Studies have identified physiological and behavioural signs of distress in horses ridden for prolonged time in an HNP with their noseline behind-the-vertical (BHV), thus potentially compromising their welfare. The objective of this study was to explore trends of HNPs from the years 2005 and 2018. Additionally, factors potentially impacting HNPs were investigated. The sample population (n=570) comprised horses ridden with headgear and bit in walk, trot, or canter, advertised in an Australian horse sales magazine. Magazines from April 2005 and October/November 2018 were selected. It was assumed photographs depicted HNPs considered "correct" or favored by sellers. HNP was assessed based on the noseline's location relative to a vertical line to the ground and categorised as behind-the-vertical, on-the-vertical (OV), slightly-in-front-of-the-vertical (IFV), or extremely-in-front-of-the-vertical (EIFV) (any HNP <30˚ IFV). Data were analysed using Chi-squared test and post-hoc testing via multiple regression approach through SPSS, and test of proportions via the z-score calculator for two independent population proportions. Analysis of combined data from years 2005 and 2018 showed 47.0% of the horse sample population were advertised with HNPs BHV. 79.1% of all horses BHV were ridden in dressage saddles ($p<.000$; d.f.=9; $Chi^2=31$). Further, BHV HNP was observed as the predominant HNP (57.8%) in the warmblood/eventers/ show/performance (WESP) category ($p>.000$; d.f.=6; $Chi^2=24.60$). Differentiating between the years, in 2005 53.4% of the sample population were ridden BHV compared to 39.7% in 2018 ($p>.001$; d.f.=1; $Chi^2=10.68$), 12.9% were OV in 2005 compared to 15.0% in 2018, and 10.9% were IFV in 2005 compared to 27.3% in 2018 ($p>.000$; d.f.=1; $Chi^2=25.2$). This perceived positive trend may be explained by the larger proportion of horses advertised in the WESP category in 2005 (63.0%) vs. 2018 (28.5%), and the WESP category predominantly comprised of dressage, showjumping, and eventing horses. Further, the reduction of HNPs BHV from 53.4% in 2005 to 39.7% in 2018 could be attributed to the observation that in 2018, a larger proportion of horses were listed in categories that do not require the horses to be worked with a flexed HNP referred to as "on-the-bit" (e.g. Western, Endurance, Australian Stock Horses). In conclusion, the HNP BHV remains preferential by a substantial proportion of the horse owning public, particularly in disciplines where the horse is worked in a flexed HNP. Despite ongoing efforts to disseminate information regarding the importance of correct HNP (e.g. by the Equitation Science community), our results indicate further interventions are required to fully engage the general horse owning public.

Lay person message: Horses ridden for prolonged periods of time in a head and neck position (HNP) with the noseline behind-the-vertical (BHV) show signs of physical and behavioural distress, potentially compromising their welfare. This study assessed trends in HNPs presented in Australian horse sales magazine during two periods (2005 and 2018) representing past and present day. The results showed that a large proportion of horse owners still consider the HNP BHV to be a desirable position despite the growing evidence indicating compromised welfare. Additional efforts are required to further educate the general horse owning public of appropriate HNPs.

P14: Effect of horses' reactivity to challenging situations on horse-rider match or mismatch

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Knowing the effect of the horse's reactivity on the match or mismatch is very important to ensure the safety of the horse-rider couple in new and challenging situations. In order to verify the effect of the horse's reactivity to challenging situations on horse-rider matching, 37 horses (with ages between 5 and 15) were used. Five tests were used to determine the reactivity of the horses: bridge test (mounted and guided), where the horses were guided or ridden to transposed a bridge simulation and it was analysed the way the animals approached and transposed it; challenging objects (analyzing the distance and the escape velocity); and the active and passive human test (to know the behavior of the horse in front of the human contact). Scores were assigned to the variables in each test and the reactivity classification was made of a mean of the total points obtained in the five classes (calm, little reactive, reactive, very reactive and aggressive). The horse-rider interaction over the bridge test was considered a 'match' when there was harmonious communication between rider and horse, and indicated no repeated behavioural signs of discomfort and that all responses arose from consistent signals of least invasive nature. A 'mismatch' was registered when the horse exhibited signs of discomfort such as ears turned backwards, head shaking and shortened stride, and/or the rider was not able to react to the horse's behaviour: i.e. inappropriate timing and use of cues, rider not sensitive to the cues of the particular horse, or a poorly trained response by the horse (McGreevy and McLean, Equi. Scien. 20:00, 2010). Twenty-four of the horses were ridden by known rider and nine by unknown rider and this effect was also considered. The data were analyzed by mixed linear models, which considered the fixed effects of match or mismatch, riding by an unknown rider; besides the random effects of animal and residue. A mismatch between horse and rider showed a higher ($p < 0.05$) reactivity ($60.32 \pm 13.38\%$) when compared to horse and rider in match ($43.04 \pm 13.88\%$). Being ridden by a known rider or not did not effect ($p > 0.05$) horse reactivity. Horses with less reactivity have a greater ability to match with their riders and the prior knowledge of the rider by the horse does not influence their reactivity when a challenging object is presented.

Lay person message: Equestrian activities take into account the formation of the horse-rider pair. The greater connection or the more positive connection will improve the work of the pair. Little is studied about the relation of horse and rider and this information can be very useful for ensuring the safety and performance in the various equestrian modalities. The reactivity of the horse can influence this relationship and this was the aim of our research. Horses with less reactivity have a greater ability to match with their riders and the prior knowledge of the rider by the horse does not affect their reactivity when a challenging object is presented.

P15: What's in a warm-up? A preliminary investigation of how French dressage riders and show jumpers warm-up their horses for competition.

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Warming-up before intense exercise is acknowledged as an effective way to lower the risk of injury and increase performance in human athletes. Dynamic warm-up regimes prepare the body for exercise, increasing heart rate and blood flow, stretching muscles and loosening joints. Despite potential links between inadequate warm-up regimes and increased risk of injury and poor performance in the horse, equine warm-ups have not been widely studied. Previous work has shown that warm-up duration varies between disciplines with show jumping (SJ) warm-ups reported as 5-10 minutes and 12-27 minutes, and dressage (DR) ~29 minutes. However to our knowledge, no one has evaluated what goals inform rider decision-making when planning and implementing warm-up regimes in DR and SJ. This study aimed to understand how SJ and DR planned their warm-up regimes and what factors were important during warming-up. The present study included 49% SJ (n=126) and 51% DR (n=131) riders; the majority of respondents were female (96%, n=247). Participation was voluntary via an online questionnaire (available in French) distributed via social media horse pages and consisting of open, closed and Likert-scale questions to identify time spent warming up pre-competition and what riders' key goals were from the warm-up regime. The majority of DR and SJ riders agreed or strongly agreed that the warm-up should relax the horse (98%, n=128 and 100%, n=126, respectively), make the horse supple (90%, n=118 and 86%, n=108, respectively), make the horse more reactive to the aids (85%, n=111 and 82%, n=103, respectively) and to decrease injury risk (99%, n=130 and 99%, n=125, respectively). 23% (n=30) of DR and 30% (n=38) of SJ riders used a fixed warm-up regime, whilst only 39% (n=51) of DR and 21% (n=26) of SJ riders felt warm-up length should depend on the horse. The selected optimum length for the warm-up did not vary between disciplines (Mann Whitney U: 1917.5, $P>0.05$; median DR /SJ: 10-20 minutes). Most riders (98%, n=128 DR, 99%, n=125 SJ) reported they warmed-up their horse symmetrically (equal time on both reins). This preliminary study shows that DR and SJ riders use warm-up regimes to prepare the horse physiologically and psychologically for competition to enhance performance and reduce injury risk. These findings were recorded via survey, therefore future work is needed to evaluate if riders' perception of how they warm-up is accurate in practice, and if warm-up strategies should be designed for the individual horse, or if 10-20 minute warm-up duration is sufficient.

Lay person message: Warming-up is essential to prepare the horse physiologically and psychologically for the exercise demands of competition. Despite this, little is known about how riders select the content and duration of warm-ups. Show jumping and dressage riders surveyed aimed to relax, supple and improve the horse's response to the aids in the warm-up to reduce injury risk and improve performance. Warm-up length did not vary between the disciplines, with most riders either spending 10-20 minutes or changing warm-up length depending on the individual horse.

P16: Comparison of functional movement screening scores between novice and advanced show jumping riders

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The functional movement screen (FMS) is an easily administered and non-invasive tool to identify areas of weakness and asymmetry during specific exercises. FMS is a common method of athlete screening in many sports and is used to ascertain injury risk, but has yet to be used within equestrian show jumping population. The aim of this study was to establish FMS scores for novice and advanced show jumping riders, and to inform a normative data set of FMS scores in horse riders in the future. Twenty-three female show jumping horse riders (mean age 21.5) participated in the study. Twelve participants that competed at 80cm or less were classed as novice, and 10 that competed at 125cm were classed as advanced. All participants were assessed based on their performance on a 7-point FMS (deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, trunk stability and rotary stability). The mean composite FMS scores (± s.d.) for the novice group was 12.08 ± 1.9 and for the advanced riders was 14.8 ± 1.77. There was no significant difference in median FMS composite scores between the novice rider and advanced rider groups (Mann-Whitney U test, p=0.004). A cumulative score of 14 or lower is suggested to be a predictor of injury. Therefore, these riders may be at risk of injury. Riders' FMS scores demonstrated asymmetric movement patterns potentially limiting left lateral movement. Asymmetry has a potential impact on equestrian performance, limiting riders' ability to apply the correct cues to the horse. The findings of such screening could inform the development of axillary training programmes to correct asymmetry pattern and target injury prevention.

Lay person message: Both novice and advanced riders had a cumulative score of 14 or lower, which is suggested in other sports to be a predictor of a risk of experiencing injury. The advanced rider group did report higher scores than novice riders. Both groups showed some asymmetry movement patterns within the functional movement screening. This inability to perform basic functional movement without the presence of symmetry might have an impact on postural symmetry whilst riding which in turn could have an impact on horse welfare due to poor or inaccurate application of aids.



P17: Validation of the IPOS Gait Detection Algorithm for horses

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The intensity of horse training sessions is typically determined by riders' perception, which is often not very accurate. Many riders, therefore, express the need for measuring the actual intensity of their horses' training based on the time they spent in each gait. The IPOS Mobile Phone Application incorporates a machine-learning based algorithm that can automatically detect gaits during a training session using the sensors of a smartphone. Objectives: Validate the reliability of the IPOS Gait Detection Algorithm during a number of real-life training sessions. Methods: A total of five warmblood horses (height > 1,48m) were used during 2 trials. Data were collected using a smartphone positioned under (1) the lunging girth, (2) a specially designed pocket in the saddle pad and (3) the riders' pocket. Data were collected while subjects were performing 2 standardized trials of 12 minutes that were recorded on video. An observer blind to the treatment determined the true time spend per gait by visually evaluating the foot placement of the horse in the video. The reliability of the computed time per gait was calculated as the difference in seconds between results of the IPOS Gait Detection Algorithm and the video analysis. A variance-analysis was performed to check for differences between the three smartphone positions Results: On average, the algorithm detected the same gait as observed on the video in 98% of the time. The algorithm performed best in detecting the trot with 99,1% reliability and scored the lowest with 96,8% reliability for the canter. For the three different phone placement positions, the reliability numbers were: 98,7% under the lunging girth, 98,5% in the saddle pad and 97,4% in the riders' pocket. A significant difference was seen comparing position under the lunging girth or saddle pad and the riders' pocket (sig. < 0.05). No difference was found between detecting gait from the saddle pad and the lunging girth. No significant difference was found in the reliability detecting the gait in either the counterclockwise and clockwise direction (98,2% and 98,4% respectively). Main limitations: The described algorithm has not been tested on horses greater than 1,48m or gaited horses. Conclusion: The IPOS Gait Detection Algorithm was able to correctly detect the gait 98% of the time. The gait detection was reliable in all three mobile phone placement positions. No significant difference was observed measuring gaits in counterclockwise and clockwise directions.

Lay person message: The IPOS gait detection algorithm is able to detect the gait of the horse, hereby turning every smartphone into a horse training monitoring device. By keeping track of the time spent per gait, the intensity of training can be estimated, making it easier to plan training, build up muscle more efficiently and prevent overloading. This study evaluated the accuracy of the gaits detected by the algorithm. In 98% of the time, the algorithm detected the gaits accurately. The detection of gaits was the most accurate (98.7%) with the smartphone placed in a specially designed pocket in the saddle pad.

P18: What methods are used to limit horses grazing in the UK and what are horse carers' opinions on these?

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Most domestic horses in the UK are grazed on pasture that has been cultivated for production animals which have contrasting energy requirements to horses. Health issues such as obesity or laminitis can develop due to excessive access to lush grass, therefore horses may require their grazing restricted. Common methods of restricting grazing include muzzling, stabling, strip grazing and 'starvation' paddocks. Little research exists on the welfare implications of these methods or their efficacy at managing health issues. This preliminary study investigated the use of restricted grazing practices in the UK and horse carers' opinions on these methods. An online questionnaire, approved by Bristol University Human Ethics Committee, was distributed on relevant equine social media groups and pages, and via email to equine colleges and riding schools resulting in 503 responses. Strip grazing was the most commonly tried method (67.6% of respondents), followed by grazing muzzles (61.3%), starvation paddocks (57.2%), stabling (49.9%) and yard/arena turnout (27.6%). Respondent perception of welfare impact differed significantly between methods ($P<0.01$) with strip grazing considered to have the least negative impact on welfare and stabling the most. Perceived welfare impact was not associated with the methods respondents used, suggesting owners may not always be able to use their preferred method. Indeed, 24.0% of respondents reported that yard restrictions determined how they managed their horses. Ease of implementation influenced the initial decision of which method to use for 52.3% of respondents. Despite scoring low for perceived welfare muzzles may be commonly used to restrict grazing as they are easily implemented, whereas yard/arena turnout may be preferred but unavailable for many owners. How effective owners rated each method was significantly associated with the reason it was used ($P<0.01$), e.g. 17.2% found strip grazing effective in preventing laminitis, 28.8% for weight management, but only 12.8% for managing a metabolic disorder. Further research is required to establish whether scientific evidence supports owner-reported effectiveness of restricted grazing methods for different conditions, so the best advice can be made available. Owners restrict their horses' grazing so that they are healthy and can remain in use (unless retired), while maintaining a good quality of life. However, restricted grazing methods can potentially impact quality of life in other ways. Horse carers have conflicting opinions and experiences of which methods are best; the next stage of this project will use semi-structured interviews to explore these further.

Lay person message: Horses may require their access to grass limited to prevent health issues. There are several methods available and respondents reported trying strip grazing most frequently, which was also perceived as best for welfare. Grazing muzzles were tried second most frequently but rated second lowest for welfare, and yard/arena turnout was rated second best for welfare but used least frequently. This indicates horse carers may be unable to use their preferred methods. How effective owners found each method depended on why it was being used. The next stage of the project will further explore horse carers' conflicting experiences with restricted grazing.

P19: Ammonia absorption in various equine stall beddings

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With current equine management practices, humans and horses are potentially exposed to hazardous levels of ammonia on a daily basis. The Occupational Safety and Health Administration (USA) has declared over 50 ppm of ammonia unsafe for workers; however, popular show barns have been discovered to have 450 ppm. Most domesticated horses are stalled indoors which creates a large ammonia build up. The average 1,000-pound horse produces 50 pounds of waste and 2.4 gallons of urine every day. The type of bedding within the stall can contribute to the ammonia levels both horse and human are exposed to, leading to increased health risk. This study investigated the difference in ammonia exposure over a 16-hour time period using four different types of popular equine beddings: coarse wood shavings, sawdust, wood pellets, and straw. Ammonia exposure for horse and human was tracked using ChromAir Ammonia Badges, which measure ammonia levels in the air (exposure range 4 - 300 ppm/hr) for up to 16 hours. It was hypothesized that the most absorbent bedding types (wood pellets) would have lower ammonia exposure ranges than less absorbent bedding types (straw). The absorption rate and ammonia exposure of the four bedding types was investigated in a controlled laboratory setting. A uniform volume (3L) of each type of bedding was sealed in an airtight container and 100 mL of urine (specific gravity 1.046) was added. Absorption and anhydrous ammonia were recorded at 1, 2, 3, and 16 hours. Ammonia exposure was also investigated in a practical setting. A 10x10 stall with an impervious asphalt floor covered with rubber mats was stripped and limed to neutralize any residual ammonia. A uniform volume (950L) of bedding was added and a horse was stalled for 16 hours with mature grass hay and two 20-L water buckets (average water intake 19.32 L, average urine specific gravity 1.027). The ChromAir Ammonia Badge was braided into the horse's mane and ammonia exposure was recorded at 1, 2, 3, and 16 hours. Human ammonia exposure was also recorded for the duration of stall cleaning (average exposure time of 15 minutes). This was repeated for each of the four types of bedding. A correlation was found between different types of bedding, absorption rates, and level of ammonia gas exposure. The bedding types with the highest absorption (wood pellets, coarse shavings) had the lowest ammonia readings of 4ppm/hr. The bedding type with the lowest absorption (straw) had the highest ammonia readings of 8-20ppm/hr. In addition, straw was the only bedding type with a measurable human ammonia exposure reading during stall cleaning. The results of this study will help decrease ammonia exposure and in turn decrease the incidence of respiratory diseases in both horses and humans.

Lay person message: Horses produce a large amount of ammonia each day, which can be hazardous to animals and their caretakers. This study looked at different types of commonly used bedding materials used in the Northeast United States and evaluated the levels of ammonia exposure with each material. Wood pellets were found to be the most absorptive bedding type and had the lowest level of ammonia exposure. Straw was found to be the least absorptive bedding type and had the highest level of ammonia exposure. Selecting a bedding that reduces ammonia exposure can lead to improved animal welfare and respiratory health.

P20: Interpretation and understanding of equine behaviour terminology of participants at the 2018 International Society for Equitation Science conference

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Confusing behavioral terminology, or using terms inconsistently, may elicit diverse perspectives among equestrians, potentially resulting in the improper human intervention to modify horse behavior. Different behaviors require unique training methods to address the problem and promote welfare. The purpose of this study was to pilot test an instrument exploring equestrians' interpretation and understanding of horse behavior terminology. A convenience sample of 25 participants at the 2018 International Society for Equitation Science (ISES) conference completed an online survey containing 19 videos of horse-human interactions, including 7 with heart rate (HR) data. Participants were asked to define fear, stress, and reactivity related to horse behavior and to select if the horse in each video was displaying these behaviors. Participants were given the opportunity to add additional behaviors they felt were being expressed. Data were analyzed with SPSS (Ver. 25) and are reported with descriptive statistics and qualitative thematic analysis. As a collective sample, participants were inconsistent when determining if fear, stress, and reactivity were being expressed in each video. Participants recognized 54 additional behaviors with the most common being curiosity (52%), playful (38%), and pain (24%). Most participants related stimulus responses to reactivity (44%) and fear (32%), but less to stress (16%). Participants reported specific observable identifiers for fear (72%) and stress (68%), but few (12%) were recognized for reactivity. Participants may have acknowledged the difficulty in distinguishing fear and stress based on observable behaviors as several identifiers overlapped between these behaviors, including teeth grinding, widened eyes, snorting, muscle tension, and widened nostrils. Participants only acknowledged physiological factors such as heart rate and cortisol levels to identify fear (56%) and stress (28%), but not for reactivity. Few participants (n=14) recognized both positive and negative aspects of reactivity (16%) and stress (12%). Of these participants, all identified as white females and most (71%) did not reside in the United States. Of the same subset, most (86%) correctly identified resting HR in horses, but indicated knowing HR did not change their interpretation of behaviors in 6 of the 7 videos. This suggests participants believed the horse's HR matched the observable behaviors being expressed for all but one of these videos. Consistency of participants' responses was used to identify the five videos included for the final survey instrument. Research with this instrument is ongoing across the horse industry to further evaluate interpretation and understanding of behavior terminology.

Lay person message: When exploring equine behavior, having a clear understanding of the behavioral terminology is important. Different behaviors require distinctive training methods and blurring behavioral terminology influences perspectives amongst equestrian communities. This study pilot tested an instrument to explore participants at the 2018 ISES Conference interpretation and understanding of horse behavior terminology. Results indicated participants were inconsistent in their interpretations and understanding of fear, stress, and reactivity in horses. Data from this study contributed to the development of an instrument that is being used to further explore other audiences across the horse industry.

P21: The Polyvagal Theory applied to horses and horsemanship

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The current two-branch model of the autonomic nervous system (ANS) is over 100 years old, yet continues to dominate the fields of psychology, biology, and behavioural sciences. It is also the foundational model used in equine science when teaching ethology, learning theory, behaviourism, and a neuroscience-informed perspective to behaviour shaping, enrichment, training, and health care. Researchers began to propose changes from the 1960s onwards, including Dr. Stephen Porges, who developed the polyvagal theory (PVT) based on animal models and studies. The PVT is a second order theory that provides a useful and accessible roadmap of complicated psychophysiological terrain, in terms of understanding individual nervous systems and how they interact in relationship – providing a more nuanced lens on attachment theory and behaviour in mammals, including horses and humans. Rather than two branches, Porges proposes that the ANS has three. The sympathetic nervous system (SNS) remains the proverbial gas pedal for mobilization. The PNS is influenced by the vagus nerve, which can further be divided into two brake systems for immobilization: the myelinated ventral vagus (innervating the parts of the body involved in social engagement, which acts like a pacemaker on the heart allowing mammals to slow down and feel safety in connection), and the non-myelinated dorsal vagus (innervating sub-diaphragmatic organs that support rest and digest under conditions of safety, shifting to conservation, shutdown, gastrointestinal and other issues under situations of threat). This means that rather than a simple, linear reciprocal system (when the SNS is on, the PNS is off, and vice versa), the ANS is understood to be a complex, dynamical system where the three branches can be functioning to varying degrees at the same time, fluctuating in response to the neuroception of safety, danger, or life threat. Using this model, tracking and adapting antecedents, behaviours, and consequences becomes more nuanced when observing the intricate interplay between sustainable physiology, survival physiology, and conservation physiology. The PVT has numerous practical implications and applications for the horse-human relationship, including equine behaviour consulting, training, riding instruction, horsemanship, equestrian disciplines and sports, equine health and medical sciences, equine-assisted therapy, and therapeutic/adaptive riding. Understanding the link between adversity, neural templates, the hierarchical defense cascade, co-regulation and co-dysregulation (entrainment), attachment, behaviour patterns, health conditions, and relational concerns becomes all the more refined when using this three-branch model as a lens.

Lay person message: The polyvagal theory (PVT), developed by Dr. Stephen Porges, offers a practical framework for understanding problematic equine behaviour, body language, and horse-human relationship challenges. In spite of its unusual name, the PVT simplifies complicated neuroscience so that we can recognize the conditions and factors that lead to difficulties, and identify changes that can help both our horses and ourselves shift from being in survival mode to feeling safe with one another. When our bodies and our brains feel safe, we have more capacity for connection, trust, effective communication, learning, productivity, and performance.

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 ritualisation 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 200g) 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. It 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 which 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 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 is 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 non-specific 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.

THE QUADRANT OF REINFORCEMENT AND PUNISHMENT

	Reinforcement Increases the likelihood of a behaviour	Punishment Decreases the likelihood of a behaviour
Negative (Subtraction)	The removal of an aversive stimulus to reward a desired response *Ex. Rein tension is applied until the horse stops and the removal of the tension rewards the stopping response.*	The removal of a desired stimulus to punish an undesired response *Ex. The horse begs for food but food is withheld until the behaviour ceases.*
Positive (Addition)	The addition of a pleasant stimulus to reward a desired response *Ex. The horse approaches when called for and receives a carrot.*	The addition of an aversive stimulus to punish an undesired response *Ex. The horse bites and receives a slap on the muzzle.*

Original source of the glossary: McGreevy, P. D., McLean, A. N., Warren-Smith, A. K., Waran, N., Goodwin, D. (2005) 'Defining the terms and processes associated with equitation'. In *Proceedings of the 1st International Equitation Science Symposium*, Australian Equine Behaviour Centre, Melbourne, Australia, 10–43.

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 required 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:

3. Formulating hypotheses

All research projects rely on the examination 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.

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 59 54 57 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 61 68 70 74 61 63 66 68 66 72 70 68 55 87 60 66 68 69 183

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 to 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.

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.

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

- 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.)

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