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Abstracts & Fullpapers

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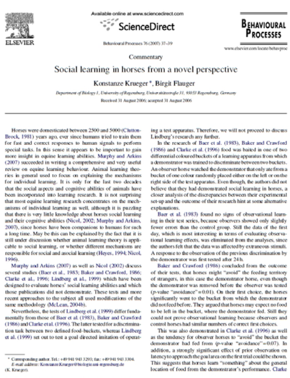

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Commentary

Social learning in horses from a novel perspective

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Received 31 August 2006; accepted 31 August 2006

Horses were domesticated between 2500 and 5000 (Clutton-Brock, 1981) years ago, ever since humans tried to train them for fast and correct responses to human signals to perform special tasks. In this sense it appears to be important to gain more insight in equine learning abilities. Murphy and Arkins (2007) succeeded in writing a comprehensive and very useful review on equine learning behaviour. Animal learning theories in general used to focus on explaining the mechanisms for individual learning. It is only for the last two decades that the social aspects and cognitive abilities of animals have been incorporated into learning research. It is not surprising that most equine learning research concentrates on the mechanisms of individual learning as well, although it is puzzling that there is very little knowledge about horses social learning and their cognitive abilities (Nicol, 2002; Murphy and Arkins, 2007), since horses have been companions to humans for such a long time. May be this can be explained by the fact that it is still under discussion whether animal learning theory is applicable to social learning, or whether different mechanisms are responsible for social and asocial learning (Heyes, 1994; Nicol, 1996).

Murphy and Arkins (2007) as well as Nicol (2002) discuss several studies (Baer et al., 1983; Baker and Crawford, 1986; Clarke et al., 1996; Lindberg et al., 1999) which have been designed to evaluate horses' social learning abilities and which those publications did not demonstrate. These tests and more recent approaches to the subject all used modifications of the same methodology (McLean, 2004b).

Nevertheless, the tests of Lindberg et al. (1999) differ fundamentally from those of Baer et al. (1983), Baker and Crawford (1986) and Clarke et al. (1996). The latter tested for a discrimination task between two defined food-buckets, whereas Lindberg et al. (1999) set out to test a goal directed imitation of operating a test apparatus. Therefore, we will not proceed to discuss Lindberg's research any further.

In the research of Baer et al. (1983), Baker and Crawford (1986) and Clarke et al. (1996) food was baited in one of two differential coloured buckets of a learning apparatus from which a demonstrator was trained to discriminate between two buckets. An observer horse watched the demonstrator that only ate from a bucket of one colour randomly placed either on the left or on the right side of the test apparatus. Even though, the authors did not believe that they had demonstrated social learning in horses, a closer analysis of the discrepancies between their experimental set-up and the outcome of their research hint at some alternative explanations.

Baer et al. (1983) found no signs of observational learning in their test series, because observers showed only slightly fewer errors than the control group. Still the data of the first day, which is most interesting in terms of evaluating observational learning effects, was eliminated from the analyses, since the authors felt that the data was affected by extraneous stimuli. A response to the observation of the previous discrimination by the demonstrator was first tested after 24 h.

Baker and Crawford (1986) concluded from the outcome of their tests, that horses might "avoid" the feeding territory of strangers, in this case the demonstrator horse, even though the demonstrator was removed before the observer was tested (p-value "avoidance" = 0.01). On their first choice, the horses significantly went to the bucket from which the demonstrator did not feed before. They argued that horses may expect no food to be left in the bucket, where the demonstrator fed. Still they could not prove observational learning because observers and control horses had similar numbers of correct first choices.

This was also demonstrated in Clarke et al. (1996) as well as the tendency for observer horses to "avoid" the bucket the demonstrator had fed from (p-value "avoidance" = 0.07). In addition, a strongly significant effect of prior observation on latency to approach the goal area on the first trial could be shown. This suggests that horses learn "something" about the general location of food from the demonstrator's performance. Clarke

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Invited Presentation

The Welfare of Horses During Transport

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The transport of animals „causes more episodes of acute stress than any other common husbandry practice."[1] The standard horse trailer requiring the horse to face the direction of travel contradicts the horses' behavioural, physiological, and physical needs. It limits the horse's ability to maintain its balance off its forequarters, lower its head to clear its respiratory tract, avoid activity in its hind area, and for certain male horses, urinate at will.

Market responses to transport risks include tranquilisers, herbal remedies, tail guards, head bumpers, shipping boots, face guards, padded blankets, anchored slings to keep the horse upright, and a newly patented harness for one-person loading.[2] Electric shock is sometimes recommended to punish the scrambling, kicking, or falling horse as it attempts to cope with acceleration, braking, cornering, trailer sway, driver behavior, and changes of direction. These are prescriptive—reacting to a symptom— rather than preventive measures.

Despite protective devices, horses present at veterinary clinics with head, chest, and leg injuries, colics, choke, diarrhea, myositis,[3] and fever associated with transport. „Emotional distress" has been reported in horses transported conventionally for thirty minutes.[4]

Reports of handlers injured during the loading and unloading process are common. An American Horse Shows Association survey found a significant proportion of injuries to arriving performance horses was due to standard transport practices.[5],[6]

Standard horse trailers are built with the same concept used to transport dead weight. The live cargo, like any solid equipment, is expected to remain stationary in transit. Live weight cannot

Figure 1. A horse in standard transport rocks behind the rear axle onto the butt bar. The mat is non-slip. The driver has gently increased speed. Loose dung indicates anxiety.

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remain stationary during transit. The result is injuries and loss of trailer and tow vehicle control.[7] The disconnect between standard trailer practices and safety challenged New Zealand horseman, David J. Holmes, to study a better way.[8]

Holmes had suffered a nearly fatal crash while hauling a racehorse in a standard two-horse trailer. The horse had smashed rump restraints, thrown its weight toward the rear of the trailer, and forced the driver to lose steering control as the weight shifted rearwards. The rig overturned as it approached a bridge, nearly plunging into a river. Holmes, an automotive engineer, horseman, licensed heavy goods haulier, and tractor-trailer (articulated lorry) instructor, applied his experience to a study of the anatomy and balancing mechanisms of horses at rest.

He observed horses in their natural relaxed stance, noting that the sixty percent or more of the body weight was ahead of the girth. The position required a forward lean. He concluded that a horse had what he called „automatic balance" permitting it to sleep while standing.[9] After numerous experiments observing untethered horses voluntarily facing the rear and positioning themselves directly over the axles on flat deck stock trucks, Holmes considered the possibility that a horse could balance naturally, drop its head below its withers, rest its hip and hind leg, keep its natural forward lean and not fight against unnatural transport motions, if it was permitted to travel facing away from the direction of travel.[10]

Figure 2. Conventional transport negates the head low, forward lean, effortless balance of the resting horse.

Holmes noted that when facing the direction of travel, the horse could not maintain a natural stance. In hundreds of cases it would resist the forward motion as the trailer floor moved out from under it. The horse adopted a high head carriage, transferring its weight to the rear and fragile sacroiliac joint,[11]

or toss its head up and down or side to side, continually trying to look behind itself, and spreading its hindlegs and sometimes

Figure 3. Handlers are never in the kicking zone. A 17h hunter is loaded after a short introduction.

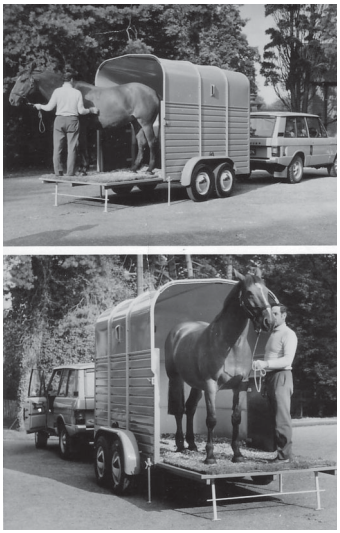
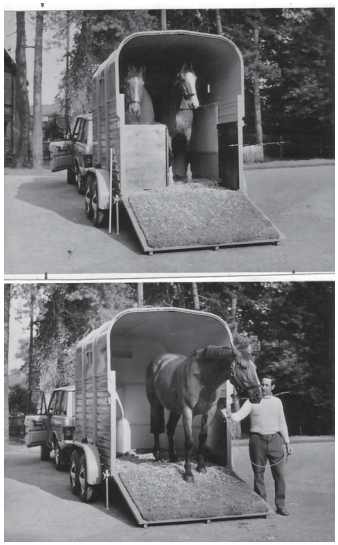


Figure 4. Horses may unload singly or together by one person.



forelegs outside of its ribcage in an effort not to fall.[12],[13] At its destination, height increases at the withers due to the tension of transport were noted.[14]

Holmes altered the axle position of a two-horse bumper hitch trailer. He reversed the horses into their rear-facing stalls from a level platform.[15] The heads were tied in such a manner as to allow complete up-and-down freedom to balance and rest, yet restrained the horses from walking forward to the chest door. The horse's girth area was aligned with the axle position of the trailer where there was the least rotational movement.

The horses now travelled with hind legs resting and heads carried at or below withers level. The forward lean over the forequarters was maintained. On deceleration, the horses' fleshy rump momentarily contacted the interior front of the trailer. On acceleration, the horses leaned forward over their forequarters. Some slept while in transit. Design changes to accommodate the new weight distribution requirements increased tow vehicle and trailer stability.[16]

At all times during loading and unloading the handler was at the horse's head. The horses could be unloaded singly or together by one person. It appeared that the horse's requirements for automatic balance, security during loading, travelling and unloading were met.[17] It was now possible for a horseman to unload at performance venue the same uninjured horse that began the trip.[18] During the 1960s and 1970s, Holmes's daughter Sherry used varieties of the design to travel her performance

horses 4,000 miles annually through mountainous terrain to show venues.

In 1967 he patented the two-horse bumper-pull Kiwi Safety Trailer. From then until 1984 approximately 20 „Kiwi Safety Trailers“ were built by a New Zealand firm to his design. Fourteen of these originals are still in use today. Records show that no harm has come to either horse or handler with the use of this method, spanning a total of forty-one years of incident-free transport.

The dvd accompanying this presentation demonstrates the introduction of three horses to the current version of the trailer. The flooring is non-slip. The 16.2 hh grey thoroughbred is considered a „good“ traveller in conventional trailers. The pinto tobiano is young, in the early stages of training under saddle.

Figure 5. Horses loaded for the first time will check for hazards behind, indicating the need for security in this area.

The Appaloosa-Quarter Horse mare is 14 years old. She has many physical and emotional scars from severe injuries while travelling in conventional floats and trucks. A scrambler, she suffered head trauma, deep cuts to her legs requiring surgery, and was inclined to fall completely under the centre partition. Attempts to load her caused her to rear and smash through rump restraints. Her handler was injured. Major interventions from a number of local and international clinicians representing a variety of methodologies were employed to train her to load. After five years of training, she would load but could not remain upright and continued to bolt out. After two approximately 20 minute training sessions, the mare loaded and travelled uneventfully.

Subsequent investigations by researchers around the world confirmed first one, or another, of Holmes's original observations and experience.[19] Perhaps the most significant was his observation that by allowing the horse to clear its respiratory passages at will, shipping fever could be reduced.[20],[21],[22] Standard horse trailers, forcing the horse to carry its head up and weight to the rear, did not accommodate this behavior. Poor construction, under-engineering, faulty braking equipment, improper tow vehicle and trailer and weight ratios — (local inspection procedures

and regulations rarely account for live weight requirements) — contribute to the injuries and fatalities reported in the press.[23]

A $250,000 horse truck designed feed bins and storage cabinets directly beneath the horses' heads. The horses were tethered high during transit. Heavy metal restraining barriers, and kick boards after two weeks' use of the transport recorded scramble and kick marks, bent stall supports, chewed fittings, and bloody leg bandages. If the manufacturers' claims for safety were true, there would be a vast reduction in equine transport stress, injury and fatality. Many slant-load trailers carry similar marks of distress.

At the 2008 Horse of the Year Show in New Zealand, veterinary staff gave pre-laminitic alerts. Measures against a possible outbreak of „shipping fever" were taken as hundreds of competitors arrived, some having been in transit for many hours. Top level horses arriving in „state of the art" transport presented with health issues. The transport environment was largely ignored as a factor.

Figure 6. A former hard-to-load hunter is loaded by a 14-year-old girl.

The rear face trailer design practically eliminates the prescriptive devices currently employed for horse transport. One-person loading and unloading is made convenient and safe compared to current practices. The trailer design appears to be the first to fully support the horse's physiology, behavior and balance. It conforms more closely than standard transport practices to the World Organisation for Animal Health equine transport welfare requirements.[24] These stipulate freedom from head restraint, freedom to balance in its natural position, the elimination of forceful methods to load and unload, suppression of mechanical noise, and the ability to monitor the horses during the journey among other provisions.[25] Horse trucks could be adapted to these standards simply and cost effectively. Gooseneck models accommodating four and six horses rear face have been built.[26]

Current equine care and management has made huge gains in nutrition, various therapies, farriery, surgery, and preventive medicine. The investment in high tech protective devices to

reduce injury in transit continues with little consideration to the transport system itself. Some prefer to insist that the problem is with the horse.[27]

Today's performance horse travels by road, sea and air frequently and far at great financial cost. All the more reason for the academic and scientific communities to offer sound solutions to the issue of transport safety for horses, be they domestic or commercial. The equine science community in close liaison with the design, manufacturing and automotive safety sectors has the tools and power to significantly reduce and potentially eliminate equine stress, injury or fatality during surface transport. Accidents attributed to the design and construction of our current transport practices could be a thing of the past.

Although the trailer is unavailable on a commercial scale, the international equine science community now have a successful working model of what can be achieved. The trailer and the work of dozens of other researchers in horse transport are there for interested parties as a basis for dialogue and further dedicated research.[28]

Almost all of the inquires we receive, averaging 500 a month, are from horsemen very concerned with the shortcomings of their transport options, be they modest or premium, for pleasure or performance horse. Your interest and work toward resolving these problems is needed. We appreciate the opportunity to share our concerns and proposals. We look forward to working with you.

Note: Do not attempt to travel horses rear face in a conventional trailer. The axles must be moved to accommodate the weight change. A special tethering configuration allows freedom of up and down head and neck movement during travel to clear the respiratory passages.

(Endnotes)

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[8]Military engineer, West Point Military Academy instructor, and consultant to the American Association of Equine Practitioners, Wentworth Tellington hauled dressage, endurance, film, and show-jumping horses (about 500 horses in all) 300,000 miles across the United States through desert environments, over the Rocky mountains, on roads slick with black ice, and through cities. His four-horse bumper pull, modified to transport loosely tied horses facing away from the travel direction, increased handling safety and petrol savings. Tellington's observations were largely pragmatic and not adapted to specially designed two-horse trailer transport. Holmes devised the unique loading and unloading system as well as thought out the axle placement and other considerations accommodating horse behavior. Cf. Wentworth Tellington, personal communication. April 1, 1978.

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[14]Hickman, J. and C. Colles. 1984. Measurement of horses. Veterinary Record. May. 114:20. pp. 491-493.
[15]The action used is the same as that employed over 2000 years ago by charioteers placing their teams into the starting stalls at some Roman hippodromes or today by teamsters reversing into a loading dock. Carriage horsemen today and in the past have used it to put their horse between raised shafts. The shafts are then dropped and harnessing more efficiently completed.
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[25]World Organisation for Animal Health (OIE). 2008. Terrestrial Animal Health Code. http://www.oie.int/eng/normes/Mcode/en_chapitre_1.7.3.htm
[26]O'Brien, J. 2008. www.animaltransportation.com Equine division. NB: The red-shirted handler shown is not positioned properly on the platform with the horse. Nevertheless, this first time attempt went successfully. Although no prior introduction had been given the horses, simple, non-coercive ground training to aids and the platform configuration is strongly recommended.
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Invited Presentation

Temperament and personality in horses: an overview

Hausberger Martine

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The existence of individual variations in behaviour has been demonstrated in all species investigated. Horses do show individual variations in a variety of behaviours from an early age on, as well as in behavioural traits underlying temperament/personality. Temperament is generally described as the „biological“ (i.e.genetic) basis on which personality, as a result of environmental influences (i.e. experience), will be constructed. Indeed, genetic factors such as breed or patriline do have an influence on aspects like emotional reactions to fear-inducing situations or cognitive abilities while environmental factors, such as the conditions of life or the type of work performed, have also an influence on horse personality. We will review here the existing evidence of this interplay between genetic and environmental influences, showing that different traits can be differently influenced, and then look more thoroughly at the processes involved.

A particular accent will be given to the influence of the human-horse relation on personality traits of horses, both at adult stages through management, daily interactions and type of work, and at early stages through management and handling of foals.

The question of the stability of traits across situations and over time, that is of the possible predictibility of behavioural traits, is central, especially where the transfer from experimental situations (behavioural tests) to working situations and performance is concerned. The question of methodological approaches (behavioural tests, observations, questionnaires) can be crucial here and will be discussed.

In overall, this review should help understanding the determinants of horse temperament/personality traits and their implication in terms of choice of the appropriate horse for a given owner, better management and training for a better welfare and horse-human relationship. Genetic influences may lead to different susceptibilities to the same environmental conditions which mean that there are no such thing as „bad“ or „good“ horse temperaments but rather different horse types that may require different management or training schedules…

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Invited Presentation
Maternal behavior in horses

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Mares quickly form a bond with their foals, probably within the first hour. They lick the foal usually beginning at the tail end, then the head and later the body of the foal. Licking behavior disappears within the first hours in most mares. Once the bond is formed the mare will let no other foal nurse and stays within a meter of the foal most of the time during the first week. The foal follows her when awake, but when he sleeps she stands over him. As the foal matures the distance the mare maintains from the foals get longer and she may graze as he sleeps. The bond of the mother to the foal gradually weakens as revealed by her response to separation from the foal. Weaning usually takes place shortly before the birth of the next foal. Some mares will attempt to steal foals and this can lead to injury of either the mares or the foal. Because of the strong and exclusive bond of most mares to their foal, foal rejection is especially abnormal. It occurs in some breeds more frequently than others, indicating a heritable component. Arabian mares reject 5% of their foals and other breeds reject less than 2%. There are three types of foal rejection- simple fear of the foal that can be quickly solved by holding the mare so the foal can suckle. The mare learns that nursing is pleasurable. This process usually takes only a few hours of holding the mare because foals suckle so frequently- about four times an hours. The second form of foal rejection is avoidance of tactile stimulation of the inguinal fold. When the foal attempts to suckle he usually strikes that skin fold and causes the mare to cow kick and move away. Desensitization to stimulation of the inguinal fold can solve this problem in a few hours. Treatment is more complex and longer for mares that are aggressive to the foal even when it does not touch them. This type of foal rejection can be treated with drugs that inhibit dopamine such as acepromazine-not the alpha adrenergic agent xylazine. Dopamine inhibits the pituitary hormone prolactin, a putative maternal hormone, which increases milk production. Blocking dopamine will increase prolactin. The mare should always have visual contact with the foal, but be restrained so she can not bite or kick the foal. A pole across the stall confining the mare against a wall is best. Maternal behavior can be induced in non-pregnant mares using injections of estrogen, progesterone, and the dopamine inhibitor sulpiride. Once lactation begins cervical stimulation can be used to elicit maternal behavior toward the next foal the mare sees.

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Invited Presentation
Social Organisation of the Equids

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Two distinct types of social organisation have evolved in the Equidae. Type 1: In Horse *Equus przewalskii*, Plains Zebra *E. quagga* and Mountain Zebra *E. zebra* the adults live in non-territorial, stable, one-male families and as single bachelors and in bachelor groups. Family stallions have the exclusive mating rights with the mares in their harems. These consist of up to 6 unrelated mares plus their offspring, totalling up to 20 members.

Mares stay in their harems until death. Stallions' tenure is from age 5-6 years, i.e. when they succeed in controlling a harem, for close to life time, but are replaced when dead or incapacitated. Harems are stable even in the absence of a stallion, indicating voluntary membership. Adolescent mares leave their parental families to become members of another harem. In Plains Zebra the adolescent mares are abducted, during an oestrus, by suitors who fight the defending family stallion/father. Successful stallions are bachelors who start a family, or family stallions enlarging their harem. Young stallions leave their parental families voluntarily at age 2-3 years and join bachelor stallion groups from where the family stallions are recruited.

An individualised dominance hierarchy excists with the stallion in the alpha position. It is based on individual knowledge and recognistion of the members. Type 2: In Grevy's Zebra *E. grevyi*, African Wild Ass *E. africanus* and Asiatic Wild Ass *E. hemionus* adult stallions monopolise territories in which they have the exclusive mating rights. Stallions are tolerant of any conspecifics entering their territory. Bachelor stallions behave subordinately - or fight for the possession of the territory which is a prerequisite for reproduction.

Mares join up to form anonymous and unstable groups or herds. The only stable unit is of a mare and her offspring. In Grevy's Zebra mares with foal join preferentially conspecifics of the same soial status, as do mares without foal. Matings take place inside the territory. There is no lasting relationship of the mare with a particular stallion, and the mare may be mated by any stallion whose territory she is visiting. Territories measure up to 10 or more square kilometres, and tenure is for several years. Grevy Zebra territorial owners leave their territories for a few hours to visit a water hole, or for months when grazing and water conditions are below requirements, and re-occupy it upon return, unchallenged. Except for a few small populations, the extant equids live in semi-arid to arid regions where environmental conditions force them to migrate seasonally or opportunistically.
The ranges of the various species overlap: Mountain Zebra and Plains Zebra in South Africa and

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Namibia, Plains Zebra and Grevy's Zebra in Kenya and Ethiopia, Grevy's Zebra and African Wild Ass in Ethiopia, Asiatic Wild Ass and Przewalski Horse in Mongolia andChina. Although, in the overlap zones, individuals of different species are using the same resources like water and grazing simultaneously and next to each other, they rarely make closer contacts. Infanticide has been recorded in captive situations.

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International Equine Science Meeting 2008
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Invited Presentation

Human-horse interaction: Where are behaviorists in 2008?

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This presentation will include commentary on work presented at this meeting as representative of the rapidly growing body of equine behavior science evidence relevant to human-horse interaction and the welfare of domestic, feral, and wild horses.

A substantial literature has accumulated detailing the behavior patterns of wild and feral equid populations, and to some extent the behavior of horses in various domestic environments. Professor Klingel's and Professor Houpt's work, begun nearly 40 years ago, continues to inspire colleagues around the world to qualitatively and quantitatively describe behavior of equids in a variety of environments. Several examples of the importance of this type of work to human-horse interaction and horse welfare are evident in throughout the meeting. It forms the basis for assessing the disturbance of behavior in wildlife management projects such as fertility manipulations (Hopkins; Ransom & Cade) or species reintroduction (Kaczensky et al). Study of the apparent variability in observations among the populations will lead to a better understanding of environmental and other factors, which will have fruitful application to welfare of horses both in domestic and natural environments. Unfortunately, this work always brings to mind what I perceive as a nagging threat to horse welfare and quality of human-horse interaction is misinformation concerning natural horse behavior. Natural horse behavior seems to be of great general interest, but unfortunately inaccuracies and misinterpretations are pervasive in popular „horse culture" and continue to be a conspicuous influence on management and training of domestic horses. Unfortunately, this misinformation often makes its way and influences equine education, both lay and equine science/veterinary education. Comparative observational study of behavior of horses in all settings by trained behaviorists, along with research designed to address purported implications for management of domestic horses, along with initiatives to transfer knowledge to educators at all levels should be encouraged.

Included in this meeting is considerable work addressing questions of domestic management practices such as forced weaning, transportation, stabling, and arbitrary grouping and regrouping of horses. This adds to a growing body of applied physiology and behavior research that has established trained behaviorists as a critical resource on teams making decisions on humane management.

Also well represented in work presented at this meeting is the exploration of cognition, perception, and temperament in horses. It is personally pleasing to see examples of direct investigation of the ability of the horse to respond to subtle human posture and gesture, which for many of us has represented just annoying possible confounders of earlier cognition studies. Behaviorists trained in perception and learning will no doubt contribute enormously to this exciting area of investigation.

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International Equine Science Meeting 2008
University of Regensburg, Germany

Invited Presentation
Przewalski Horses, Satellites and Wild Asses

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The Przewalski's horse (*Equus f. przewalskii*) was extinct in the wild by the mid-sixties of the past century. The species only survived due to captive breeding from 13 founder individuals. In 1992 a reintroduction program was initiated in the Great Gobi B Strictly Protected Area in southwestern Mongolia. During it's initial years, the project concentrated exclusively on P-horses. In the past decade activities have expanded significantly. The ecological project start point can be summed up as follows: i) species is extinct in the wild, ii) severe bottleneck, iii) practically no ecological data prior to extinction, iv) released into an extremely harsh, highly variable and poorly understood environment. The ecological knowledge constraints were compounded by i) highly emotional species, ii) simultaneous and competitive projects, iii) logistic nightmare, iv) non-scientific basis in planning phase. By the late 1990s project leadership and management was overhauled with research and scientific data firmly integrated into the decision-making process. Early scientific input concentrated on determining causes of death and low reproductive rates. The elucidation of the effects of endemic piroplasmosis on the population and subsequent management changes lead to remediation this deadly problem. P-horses have been fitted with ARGOS and GPS-ARGOS collars in order to determine home range and habitat preferences. Simultaneously the Mongolian wild ass and the wolf have been studied with these methods in the shared habitat. Satellite-based technologies provide the backbone for all habitat related project issues. At the onset (digitized Russian maps) data collection was restricted to the Eastern part of the Gobi B. Subsequently the spatial scale encompasses the entire Gobi Region in Mongolia and Northern Xingjian in China (e.g. Landsat, MODIS, NOAA, SRTM). Research has also focused on the role, needs and possible impacts of local semi-nomadic herders that use the protected area. Capacity building and training workshops (e.g. construction of fuel efficient stoves, felting) have been initiated. In 2007 a trans-boundary project in collaboration with the Xingjian Institute of Ecology and Geography of the Chinese Academy of Sciences, was initiated. This project aims to support rural communities of nomadic pastoralists living in the trans-boundary area of the Dzungarian Gobi, in China and Mongolia. Today, this project and the one in Hustain Nuruu (Mongolia) are the only ones that have resulted in free-ranging non-supplemented populations. In the Gobi B area some 120 (status 05.2008) P-horses roam in the protected area. In 2003 the IUCN downlisted the Przewalski\'s horse from to . Further downlisting to is predicted to occur in 2011. There is no consensus on when a reintroduction program is deemed successful. Clearly viewing the self-sustainable re-establishment of a population as a successful end-point is at best a short-term approach, constrained by time (today and now). Comprehensive interdisciplinary monitoring and research was and is the foundation for management strategies and decisions in this project. However, a self-sustaining financial base in conjunction with dedicated training and empowerment of local scientists and residents constitute essential prerequisites for the project's future. Defining success and thereby inferring an end-point can easily lead to complacency compromising species persistence. As others have stated the ultimate project objective must be a constantly re-evaluated state of population persistence without intervention.

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Contributed Presentation

Influence of Sex and Age on Color discrimination in caspian Pony

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Although an early and influential review led to the often-cited conclusion that color discrimination is rare among mammals, more recent findings suggest that it is actually widespread. According to jacobes, all non-nocturnal mammalian species that have adequately exmined show some color vision capacity. Data on the presence and characteristics and the influence of sex and age on color vision in the horse, remain spares and non in Caspian pony. Eight Caspian ponies were presented with a series of two-choice color vs. grey discrimination problems. One mare pony was eliminated due to traumatic injury to her eye. Experiments were performed in a box of 3 * 3 meter containing a wall with two translucent panels that were illuminated from behind by light projected through color or grey filters to provide the discriminative stimuli. Ponies were first adopted to the stall (box) with two panels in it and then learned to push one of the panels in order to receive the food rewards behind positive stimuli in an achromatic light-dark discrimination task. The ponies were then tested on their abilities to discriminate between grey and four individual colors; red; 617nm, yellow; 581nm, green; 538nm and blue 470 nm. The answer to the question "do the ponies see color" was yes but sex and age had no influence on the color discrimination of the ponies .

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Contributed Presentation

Equine Science and Management Programme in Vienna

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With a growing importance of equestrian sports and horse breeding, there is an increasing need for well-trained professionals in the equine sector. While well-established vocational training programmes exist in Germany, they do neither provide qualifications for leading positions nor train for scientific work on the horse. The need for specific equine university programmes has been questioned occasionally, however, neither university programmes in equine veterinary medicine (focussing on diseased horses) nor animal science (focussing on food-producing farm animals) meet the broad requirements of today´s equine industry.

The first academic programme in equine science and management in the German-speaking countries was established in 2003 by the Universities of Veterinary Sciences and Agricultural Sciences in Vienna, Austria. The 3-year bachelor programme (180 ECTS points) includes sciences, anatomy, physiology, genetics, nutrition, ethology, economics, marketing, management, legislation, reproduction, healtcare, equitation science and organisation of breeding and equestrian sports. Courses are provided by the partner universities and by lecturers from practise and equestrian organisations including the German and Austrian equestrian federations. Lectures and seminars are complemented by a scientific thesis and placements in the equine industry.

Out of 100-150 applicants each year, 50 students are selected on the basis of their previous activities, a written test and interviews. Students are coming from Austria (40%), Germany (50%) and other countries (10%) ensuring a truly European programme. The majority of students enter the programme directly after leaving secondary school, but approx. 20% have undergone previous vocational training (e.g. *Pferdewirt*).

About 40% of the graduates enter into subsequent MSc programmes in animal science or agribusiness. Others are studying for an MBA or a degree in veterinary medicine, journalism, law and other disciplines. Graduates from the 2003 class finish their MSc in agriculture this year at universities in Austria, Germany and the United Kingdom and some of them will continue with a doctorate. Students not entering graduate programmes after obtaining their BSc do work as stud managers or management assistants in Germany and English-speaking countries or are employed by equestrian organisations such as the German and Austrian national federation, equestrian journals, equine nutrition companies, non-university research and consulting institutions, the Ministry of Agriculture and in a variety of other fields. The success of the Vienna equine programme has also encouraged activities at other universities and programmes with near-similar curricula have recently been established in Germany and Switzerland.

In conclusion, graduates of the Vienna equine science programme follow a wide-range of professional and academic activities within the equine industry. This spectrum is by far more extensive than the sector covered by professionals from traditional vocational training. With practical experience obtained on the job, adaequately qualified graduates will more and more obtain leading positions. In addition, the programme is a first step in the training of future researchers and teachers. By promoting and conducting research on the horse, equine science programmes do also secure the leading role of the European equine industry for the future.

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International Equine Science Meeting 2008
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Contributed Presentation

Cognition Tests in Equids (*Equus caballus* and *Equus Asinus*)

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For ages horses and donkeys constituted the most important domesticated animals. Even though equids were often bred and kept in close proximity to humans, surprisingly little is known about their cognitive abilities. Traditionally, horses are not regarded as clever animals; common beliefs maintain that the horses' behaviour is merely driven by conditioned-responses. Additionally, from an anthropomorphic point of view donkeys are believed to be „stupid" animals.

Our study investigates the equids' ability to recover a hidden object. For this purpose the animal has to create and maintain a representation of the object and its location in space, from the moment in which it disappears from direct perception, till the moment in which it reappears. The knowledge about objects being entities that continue to exist even when they are no longer available for direct perception is refered to as the well known concept of „object permanence".

We primarly assessed the ability of Esperia's pony and donkeys to solve a Detour problem while employing an opaque „U-shaped" barrier. Each animal observed a food bucket moving and disappearing behind the barrier. Immediately after the object's disappearance, the animal was released to search for the object. If it solved the task by detouring the barrier it was positively reinforced.

The ability to retain in memory the hidden object as well as its spatial location was subsequently tested in the presence of two, rather than one, screens (Working Memory testing phase). The food bucket was made to move and hidden behind one of the two identical screens, while the animal was watching it. Following a pre-established delayed period of 10 sec, the animal was set free to look for the food. In such a test the detour problem is combined with the classical delayed-response task, which is in use for the comparison of memory duration in different species.

In order to recover the hidden objects, animals must encode, maintain and correctly regain from their working memory the existence of the no longer visible object and its location from their working memory.

Both donkeys and ponies performed the Detour task showing to grasp the fact that an object which is no longer perceivable still continues to exist and can be regained. They also were able to correctly retrieve the goal object after a delay of 10 s in the Working Memory tasks, showing that they had encoded, maintained and correclty retrieved from their working memory the spatial location of the hidden object as well as its existence.

Nevertheless, when Standardbreds, raised in traditional stables, were tested in identical conditions to those describe for the ponies and donkeys, they could not succeed in the Detour tasks. The reason for such differences needs to be studied Even though it would be interesting to focus on handling differences, i.e., the ponies had been living in an environment rich in natural stimuli, while the Standardbreds had lived in a man-controlled environment since birth. It is also noteworthy that, like donkeys, the Esperia's pony have a reputation for being hard to handle.

Several considerations could arise from our preliminary investigations, and we will have the pleasure to leave them open for discussion.

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Contributed Presentation

Comprehension of human pointing gesture in domestic horses: Effect of training method

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Horses have been considered to rely on human gesticular cues (McKinley and Sambrook 2000, Anim Cogn 3:13–22; and recently Maros et al. 2008, Anim Cogn 11:457-466), however large variability among individuals tested in two-ways object choice tasks was found. Part of the horses in those studies (40 and 26 %, respectively) even failed to pass adequately through the training session which preceded the testing phase and served to learn a horse to carry out a task. Therefore, we alternated the experimental design designed by McKinley and Sambrook (reduced number of testing trials to 10 per horse to keep its attention, applied just one, a dynamic-sustained pointing cue with touching the bucket, etc.), and tested an effect of training method, sex, age, and learning on proportion of correct choices. We hypothesised, that horses trained by „traditional“ method (TTM) will get lower score than those experienced with „horsemanship-based“ methods (HTM), being characterized by closer and more frequent human-horse contact and also extended exercising „from the ground“ with frequent using of arms cues. Despite simplification of the methods, only about 60 % of tested horses passed through the training phase (i.e., learned to come to and upturn the bucket with hidden treat). Successful completion of training phase was reached regardless of age or sex of a horse, but by the training method; HTM horses ran better compared to TTM ones. No significant effect of age, sex, or learning (i.e., trial order within all 10), and training method as well was found on proportion of correct trials in the testing phase. Horses made a correct choice in more than 70% of trials. Individual scores ranged from 50 to 100 %. In conclusion, horses showed high level of comprehension of human pointing gesture, regardless of their sex or age. No effects of training method or learning process within a test suggest low impact of handling and learning on the level of comprehension at least of the most vivid human pointing gesture. Horses trained by methods based on „natural human-horse communication“ did enhance cooperation with people.

Key words: Human-horse communication, Pointing, Training methods, Horsemanship

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Contributed Presentation

Influence of the recipient mare on character traits of adult offspring in a Warmblood embryo transfer program – preliminary results

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The influence of recipient mares in commercial embryo transfer (ET) programs on behavior of the ET foals is a matter of great interest and controversial discussion. Presently, no interdisciplinary ethological and reproductive studies on this topic exist. However, empirical experience suggests that behavioral traits of the recipient mare do not influence those of the foal, thus implying a predominantly genetic origin of a horse's basic character. Aim: The aim of the present study was to investigate the influence of recipient mares on behavioural traits of their ET products.
Materials and Methods: Based on records of the embryo transfer program in Warmblood horses since 1990 at the Swiss National Stud, questionnaires concerning behavior, stereotypies and mother-foal-relationship were designed and completed by telephone interview: 18 scientifically assessed questions provided the basis for a linear description (Equine Personality Assessment Questionnaire, Lloyd *et al.*, 2007). They were grouped in a) emotivity, b) social motivation, c) general level of activity, d) stress behavior, e) learning capacity and f) reactions towards humans. Questionnaires were designed for the owners of the ET offspring (minimum of three years of age), the sires, donor mares and the recipient mares. Out of 200 questionnaires, 25 complete ET families have emerged so far and were analysed. All genetic parents were Warmblood horses, as were 23 of the recipient mares, the other two were Franches-Montagnes horses.
Results: Comparing the mean values of the four groups (genetic dam and sire, recipient mare and ET product), significant differences were found for the parameters emotivity (sires lower, $p<0.001$), learning behaviour (recipient mares lower, $p<0.05$) and activity (recipient mares lower, $p<0.05$). With only one exception, the multiple variable regression analysis found no significant influence of the recipient mare on the ET product. The only significant effect observed, was that of the social motivation of the recipient mare on the learning capacity of the ET offspring ($r2= -0.421$, $p<0.05$). In contrast, numerous significant effects of behavioural traits of the genetic dams and sires on their ET offspring (10 and 8, respectively) were observed.
Conclusions: These preliminary results confirm field observations that the influence of the recipient mare does not play an important role in character development of the ET offspring. However, the investigated parameters indicate that the behavioural traits of the genetic parents appear to have a strong influence on the offspring's behaviour.. This study model promises new achievements in the evaluation of genetic and environmental effects on the behavior of a horse.

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Contributed Presentation

Delayed search for non-social goals by Equids(*Equus caballus* and *Equus asinus*)

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Delayed-responses have been traditionally employed to investigate the temporal characteristics of animals' ability to represent and recall objects that have disappeared. In the typical condition, the animal, usually a mammal, observes the experimenter hiding an interesting goal (e.g. some food) in a certain location. A delayed-response task (DRT) was administered to 4 female Esperia pony (2 years old) coming from a free-range breed (Frosinone, Italy) and to 7 female Amiata donkeys (4.2±2 years old) coming from a conservation stock (University of Pisa, Italy). The DRT's apparatus was located in a square fence. A single „U-shaped" screen (330x160x140 cm) made by wood shavings blocks was positioned in the centre of the fence. A gap (40x50 cm) on the ground was in the middle of the central side of the U-shaped-screen and served to make the food-attractor disappear. The food-attractor consisted in cereal flakes and fresh grass for ponies and cereal flakes for donkeys. A bucket full of food was placed on a dolly tied on a rope which could be pulled by an experimenter. In a preliminary training each animal was allowed to eat food from the bucket and, while the animal was eating, the dolly was gently pulled away from the animal, and beyond the screen through the gap. The subjects needed to move around of the screen in order to retrieve the food. As a reinforcement, they were allowed to eat some food from the bucket once behind the screen. From trial to trial, the bucket was presented farther and farther (starting with a distance of 1 m in front of the screen to reach 7 m). Therefore subjects were tested in the DRT requiring them to rejoin the bucket with the goal-food disappearing behind the screen as in the preliminary training but following a 10 s delay. For the DRT, the bucket was placed 7 m in front of the screen, 3 m away from the animal's starting area. Then the dolly was pulled away from the animal. Ten seconds after the disappearance of the dolly behind the screen the animal was released from the starting area. The DRT ended when the subject had reached the attractor behind the screen on 3 consecutive trials. Results showed that all animals were able to rejoin the food behind the screen after 10 s delay. The mean time of the delayed-response (mean±sd, in s) in the ponies (1^{st}: 19.8±8; 2^{nd}: 10.8±2.2; 3^{rd}: 12.8±2.8) and in the donkeys (1^{st}: 28.4±10; 2^{nd}: 26.9±13; 3^{rd}: 24.3±16.6) showed a trend to decrease from first trial to third. These preliminary results suggest that like other mammals our ponies and donkeys can maintain a working memory trace of the location where biologically attractive objects have been seen to disappear. In conclusion, this study paves the way to set up a viable model system for the investigation of the more sophisticated aspects of Equids' cognitive abilities such as working memory.

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Contributed Presentation

The influence of the enriched environment on the reactivity of the precociously handled foals (*Equus caballus L.*).

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In a preliminary study, we evaluated the effect of precocious handling (at birth, 10, 30 and 60 days) and enriched environment on foal. Two experimental groups were created:

- 3 foals not handled and stabled in semi-enriched environment (Group A).
- 6 foals handled and stabled in an enriched environment (Group B).

All nine foals were tested with a novel object test (umbrella) at three months of age, to assess the Heart Rate (HR) values measured by a telemetric heart rate monitor (Polar Horse Trainer®), during opening, touching and closing of the umbrella.
The statistical analysis carried out by means of the Mann-Whitney test showed lower HR values of the foals of group B ($P<0.05$).
Furthermore we have investigated 10 foals born between 2006 and 2008 to study the influence of enriched environment and precocious handling on behavioural responsiveness. The foals were housed on a farm which ensured an enriched environment and made social intra and interspecific interactions easier, *alias* autoshaping. They were submitted to:

- Handling within 24 hours from birth.
- Handling and reactivity test (arena test) executed at 10, 30 and 60 days.

The temporal correlation was studied among ages and baseline HR values, using the Spearman's test, to assess the beginning of neurovegetative HR control.
In fact statistically significant differences were obtained ($r = -0.431$; $P<0,02$). Temporal values of obtained HR baseline, using the Wilcoxon test, showed lower values at 60 days. The comparison was significant among mean and max baseline HR values of 30 *vs* 60 and 10 *vs* 60 ($P<0.05$), while no differences were observed during the reactivity test. This shows that adequate conditions of management associated to a precocious and continuous handling allow the foals to maintain their natural investigative behaviour disappearing fear and flight reactions.

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Contributed Presentation
Horses: Companions for Life

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In 2005, the horse population in the United States was estimated at 9.5 million horses, the majority of which are used for recreational purposes. This represents a 50% increase in the total horse population in just ten years. This growth in the U.S. equine population represents both opportunity and challenge: it speaks to the growing popularity of horses among recreational riders but also raises questions about the quantity and quality of the horses being bred.

Very few horses spend their entire lives with one owner. Every time a horse changes hands, his fate is closely tied to the level of knowledge, skill and commitment his new owner has to providing him with the best possible life. Too often, a horse with a behavior issue that can be easily mitigated with the right training is instead sold or traded, changing hands many times over the course of its life. Rampant over breeding has allowed a cavalier attitude to prevail in the horse industry, which promotes trading over training with the horse sometimes suffering dire consequences as a result.

The majority of horses in the United States are companion animals, who are used primarily for as pleasure and recreational animals. They excel in a variety of venues: in the show ring, on the trail, as therapy for disabled children, as partners with law enforcement officers and in the highest level of sport. Yet, at any stage of its life, a horse can fall victim to decision making and cruel treatment that its owner would never think of inflicting on other companion animals like dogs and cats. This dichotomy, coupled with a horse industry that actively promotes and rewards over breeding, has fostered an attitude that horses should be traded not trained. This has resulted in many horses being treated as disposable commodities to be dumped at the local auction for reasons that could easily be rectified if his owner had the proper knowledge and skills.

In order for a horse and human to have a successful relationship, they must be well matched in personality, ability, interest, age and temperament. Any time one of these factors is not considered, there is the possibility of failure, frustration, and ultimately, of the horse ending up being traded or sold. In an effort to help new, current and potential horse owners have successful, long-term relationships with their horses, the Humane Society of the United States (HSUS) has launched its Horses: Companions for Life Program. This program will help horse owners have access to the knowledge and information necessary to make good decisions for their horses at all stages of their life.

The keystone of this program is our recently released book, “The HSUS Complete Guide to Horse Care“. With this program we hope to educate and inspire horse owners to make responsible and realistic decisions before and while a horse is in their lives so that horse ownership is a positive and life-long experience for both the horse and her guardian.

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Contributed Presentation

The Assategue of the West Project: An introduction to a 5-year logitudinal study of Immunocontraceptive use on America's Wild Horses

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The Humane Society United States (HSUS) has been partnering with several prominent researchers for over 20 years to assess the potential use of Porcine Zona Pellucida (PZP), a protein used as a fertility control vaccine for wild horses. Past studies on herds located on barrier islands of the eastern United States have demonstrated that PZP prevented pregnancies and was a valuable tool for population management. With the generous support of the Annenberg Foundation and in partnership with the Science and Conservation Center, Tufts University and The University of Toledo, HSUS is conducting a 5-year longitudinal study to assess the effectiveness of immunocontraception on over 600 wild horses in the western United States.

This project involves 2 herds of over 300 wild horses each located in Utah and Colorado. We began gathering pre treatment data in April 2008. Birth rates, band size, and individual horse identifications were recorded. In the winter of 2008/2009 both herds will be captured and all mares that are released will be treated with a 2-year-duration PZP vaccine. Both herds will be closely monitored for reproduction and behavior changes for 3 years. We will record the differences in reproductive success of treated and untreated (not captured) females.

HSUS is also seeking to develop refinements to the PZP vaccine and delivery technologies. HSUS is currently trying to improve the production of the PZP vaccine by producing it with techniques that are more efficient and less costly. Improving delivery methods for the 2 year drug is another goal of this research that may allow herd managers the flexibility of treating mares year round without having to capture it. HSUS also hopes to demonstrate that incorporating this new delivery method and proactively managing wild horse herds will assist in maintaining wild horse populations at a level that is sustainable and manageable.

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Contributed Presentation

Preliminary studies on visuo-spatial cue use in horses

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A number of discrimination learning studies suggest that horses attend to spatial cues in preference to visual ones. However, global and relative spatial cues have generally been confounded so it is not clear what information horses actually used. There has also been no study of whether one cue is learnt at the expense of another, or whether multiple cues are encoded but prioritised differently. We therefore carried out a series of studies examining how horses use different cues in learning a food-finding discrimination task. All studies used a criterion for success of 7/10 on two consecutive days (binomial test, $p=0.0004$).

A pilot study showed that horses could discriminate between three buckets using visual cues (striped, chequered or plain patterns). All four subjects performed significantly above chance levels, although one horse's performance did not meet the criterion. Three others completed the task in between two and 12 sessions. There were some indications that horses tried to solve the task using irrelevant spatial information.

Nine foals were then taught to find a food reward using the same three patterned buckets placed in a row in any corner of a test arena. In Stage 1 the rewarded bucket was signified both by visual cues (pattern) and by relative spatial cues (left, middle or right position). Foals took between 2 and 10 days to complete the task , whereupon the cues were separated. Foals then had to ignore the inappropriate cue in Stage 2. For the Spatial group (n=5), only relative position remained relevant; for the Visual Group (n=4) bucket pattern indicated the rewarded bucket. Spatial group foals completed Stage 2 faster than Visual group foals (Mann Whitney U, $z=-2.71$, $p=0.008$). Position cues seemed to overshadow learning about visual cues: Visual group foals persisted in responding to the previously correct position and none reached criterion within the maximum available time (15 days to complete both stages).

Finally, five adult horses and one 10 month old filly learnt to find a reward in one of three identical yellow buckets whose position in an array (left, middle or right) and location within the test arena were consistent. On reaching criterion, responses were recorded in two unrewarded probe trials where the buckets were either shifted along the same axis or rotated by 90º. When the array was shifted, five out of six horses chose the previously correct position (binomial test, $p=0.018$) that was now in a new location within the school. Choices were not significantly different from random when the array was rotated, suggesting that the horses had learnt something about global cues even if they did not use them in selecting a bucket.

At the small scale tested, relative spatial cues (position with regard to other goals) seemed to be more important to horses than either visual cues or global spatial cues, though the latter appeared to be encoded to some extent. Reliance on spatial cues may reflect their usefulness in the horse's natural lifestyle in navigating over long distances and feeding on visually similar plants.

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Contributed Presentation

Social interactions and spacing in horses (*Equus caballus*) grouped according to gender

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The aim of this study was to investigate the social behaviour and spacing between horses when grouped according to gender in homogeneous- or heterogeneous groups, and to see if the amount and severity of aggression differed in relation to gender composition.

A total of 66 horses divided in six batches were used. In each batch, horses were allotted into one mare group, one gelding group and one mixed gender group, with most groups consisting of three or four animals. Three batches were performed on Icelandic horses and three batches on riding horses and -ponies. After 4-6 weeks of acclimatisation, a trained observer recorded all social interactions using direct, continuous observation one hour in the morning and one hour in the afternoon for three consecutive days. In addition, the nearest neighbour of each horse was recorded using instantaneous sampling every 10 minutes. The horses were inspected for injuries before grouping, day one after grouping and after 4-6 weeks. Furthermore, a novel object test and a handling test (taking horse out of group) were conducted after the behavioural observations were completed.

No significant effect of gender composition was found on social interactions, spacing or injuries. Most of the aggressive interactions recorded were threats, and not aggressive interactions involving physical contact. Aggression seemed to increase with decreased space per animal and more horses per feeding place. Very few injuries were found and most were superficial. Horses showed a low degree of fearfulness in the novel object test and most horses were easy to handle in the „horse out of group test“.

In conclusion, gender composition does not seem to have any effect on aggression level, spacing or injuries in social groups of horses.

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Contributed Presentation

Przewalski's horses (*Equus ferus przewalskii*) and Asiatic wild asses (*Equus hemionus*): Similar Species, Same Habitat – Same Use?

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Historic overlap zones of wild equids were small in Africa but extensive for Przewalski's horses and Asiatic wild asses in Asia. Currently the Great Gobi B Strictly Protected Area in SW Mongolia is the only place where sympatric, free-ranging populations of these equids occur. This provides an unique opportunity to examine the co-existence of these little studied species and test the hypothesis that Przewalski's horses are primarily adapted to mesic steppe habitats, whereas Asiatic wild asses are adapted to arid desert steppes and semi-deserts.
We monitored 9 Przewalski's horses and 7 wild asses with satellite telemetry and superimposed the data on a habitat map derived from remote sensing (LANDSAT TM & ETM+-data) and ground sample plots. We tested for habitat preferences comparing use and availability with a logistic regression mixed model approach. Individuals were treated as random factors. Factor variables were tested for significant differences in subsequent Tukey post-hoc tests. Przewalski's horses had non-exclusive home ranges of 152-826 km² and heavily selected for the most productive riparian plant communities. Asiatic wild asses also had non-exclusive home ranges, but with 4,449-6,835 km² they were 10 times larger than those of Przewalski's horses. Asiatic wild asses seem to use plant communities more or less relative to their availability. Our results provide evidence for two parallel resource selection strategies. Our findings indicate that the Gobi areas provide an edge, rather than an optimal habitat for Przewalski's horses. This leaves only small and isolated pockets of suitable habitat for future re-introductions. Asiatic wild asses, on the other hand, need access to large tracts of land to cope with the unpredictable resource distribution of the Gobi. Thus, Asiatic wild ass conservation requires a large scale approach.

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Contributed Presentation

The response of horses to predator stimuli.

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Abstract

It is unknown whether or not wild horses' instincts have remained strong during their centuries of being domesticated. The knowledge of this matter gives rider's the opportunity of knowing more, not only about horse behavior but also about horse and rider safety. In this current research we studied the behavior of the Caspian miniature horse in confrontation with stimuli from predators. We explored which kind of stimuli (olfactory stimuli and auditory stimuli) affects horses more. The test arena was a grass paddock that was equipped with the necessary facilities. The time spent in the test area varied between 5-8 min .The experiments were designed to investigate behavioral responses (locomotive activity (alertness, standing, walk , trot , exploration etc), eliminatory behavior (defecation, urination)) and physiological responses (measure of heart rates before and after facing the predator stimuli) of horses to novel auditory and olfactory stimuli. We explored which kind of stimuli (olfactory stimuli or auditory stimuli) affects horses more. The experiments were carried out under standardized conditions on a total of 15 Caspian ponies of different ages and gender.We investigated how horses respond to lion olfactory and auditory stimulus. The stimuli were: A: The olfactory stimulus: lion feces, B: The auditory stimulus: a lion's roar. In the olfactory experiment we found that the horses showed more behavioral reactions (table 1) compared to the control experiment (Test 1). The only behavioural reaction the horses didn't show was flight reaction. In addition olfactory stimuli caused significantly increased heart rate responses compared to test 1(Fig1). In the auditory experiment (Test 3) we found that horses showed more behavioral reactions (table 1) compared to olfactory experiment. They showed flight reactions in response to the lion roar. Additionally, auditory stimuli caused significantly higher heart rate responses compared to test 2(Fig1).

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Contributed Presentation

Factors affecting suckling behaviour in loose housed domestic horses

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Suckling, the main part of maternal investment in equids, is crucial for development and social success of the foal. As such it is of great importance in horse breeding. We examined effect of following factors mentioned in literature on behavioural parameters of suckling in loose housed domestic horses: age and sex of the suckling foal, age, parity (primiparous/multiparous), pregnancy (yes/no) and rank of the mother and sex of the foetus if the mother was pregnant.
Four variables describing suckling behaviour were modelled: proportion of suckling attempts rejected by the mother, suckling duration, frequency of suckling and proportion of suckling terminated by the mother. Further, suckling terminated by another mare were analyzed. Behavioural observations were conducted at the National Stud Kladruby nad Labem (Czech Republic). Eight groups of loose housed Oldkladruby horse mares with foals (from 5 to 14 pairs per group) were observed from deliveries to abrupt weaning (four to six months of age). Horses were studied with ad libitum sampling for 6 hours per group each 14 days. Dominance status of the mother was assessed using the Clutton-Brock index (Clutton-Brock et al. 1982, Nature 350:178-180), adjusted to the number of mares in each group, and dyadic dominance-submission relationships between all group members (mares) were determined.
No significant effect of mother's parity and sex of the foetus on suckling behaviour were found, except the tendency of mothers bearing female foetuses to terminate more suckling. These findings are opposite to literature, where male foetuses were connected with higher rejection rates (Duncan et al. 1984, Anim Behav 32:255-263). However, incidence of suckling attempts rejected by the mother was very low. Neither sex of the suckling foal, nor age of the mother did significantly affect any of the studied variables. It could be caused by the stud management; horses are well fed and do not suffer for nutrition stress as horses in the wild may. All variables were negatively affected by increasing foals age (as expected). The higher dominance rank a mare achieved the higher frequency of other group member suckling she terminated. From suckling terminated by another mare in the most cases it is a dominant mare which ends the suckling. Despite these significant results, suckling terminated by another mare were negligible and agonistic interactions between dominant and submissive mares seemed not to compromise foal development. In conclusion, in loose housed mares of domestic horse with foals we have found no detrimental effect of any of literally cited factors on suckling behaviour.

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Contributed Presentation

Social cognition and social learning in horses

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In comparison to other social animals it appears to be far more difficult to show social learning in horses, although the social background of the animals prompts the prediction that social learning should be verifiable. This demands for a thorough analysis of conditions, context and effects of social learning which might not be as obvious in horses than in other social animals. Moreover, the horse's social cognition in general, i.e. the processing, encoding, storage, retrieval, and application of social information, needs to be examined. In previous studies we addressed the horse's perception of it's social environment. Our results indicate that domestic horses are not only capable of distinguishing between familiar and unfamiliar horses but also of recognizing the social status of familiar horses relative to their own. Furthermore, they extract information from observing interactions between a familiar horse and a human experimenter, and adjust their behaviour according to the observed horse's reaction and relative dominance status when they are themselves later confronted with the experimenter in a similar situation. Additionally, we showed in pilot experiments that horses paid more attention to the gaze of dominant horses from their own social group than to that of unknown or subordinate horses. In another study we suggested that horses of both sexes are capable of determining the social affiliation, the sex and, for their own group members, the identity of individuals, by sniffing their faeces. Hence, social affiliation and dominance relationships seemed to have a major influence on the horses, motivation to pay attention to their conspecifics. In the future we will take another step towards linking the horse's social cognitive capacities with its social ecology, social structure, and individuality. In the context of comparative cognition research on the socially complex primates, or on a range of carnivores such as corvids, canids or dolphins, horses are particularly interesting, because they are highly social, but do not rely on social hunting or cooperative raising of offspring. Also foraging is simple for horses, predator avoidance is demanding and this may be the main reason for the horse's complex social lives and their choice of learning tactics. Hence, we will investigate the horse's investigative behaviour towards neutral, fear-eliciting and food related novel objects. We propose that, as in other species, sociality and distinct personalities are key features for the understanding of cognitive capacities and the choice of learning strategies.

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Contributed Presentation

A new, non-invasive method to assess specific strain in horses

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Horses' reactions to normal environmental and training situations play an important role the human-horse relationship. These demands on horses can either lead some individuals to withdrawal, immobility or aggressive defence. However, the reaction to such situations varies greatly among horses, which is reflected in individual differences in sympathetic, parasympathetic and muscular reactivity. The observable behavioural responses of the horses seem to be qualitatively related to the internal state of physiological arousal. In future it should be possible to identify behavioural signs which really do reflect internal states of the autonomic nervous system to provide general advice concerning human handling and training in view of reducing stress in horses.

For these purposes, we have determined responses of the vegetative nervous system based on variation in skin potential, skin resistance and electromyogram using non-invasive real-time measurements. All these parameters can be measured by a SMARD-Watch®-System (System of non-invasive Measurement and Analysis for Regulatory Diagnostics), which can be externally attached to the horses using a harness.

The physiological data will assess using a time series analysis. Thereby the changes in the regulatory processes in each of the three physiological systems can be determined in detail. Based on this analysis characteristic behaviour patterns will be analysed by the variability of the regulatory processes. According to temporary shifts in regulatory processes, stable and unstable regulation states will be determined. Depending on the proportions of unstable regulation processes during and after external threat, four types of regulation can be defined: the Control, Cope, Compensate and Non-cope- type. Defined time-windows, for example a ten minutes lasting pre- and post-test phase and a ten or twenty minutes lasting time-window for the execution of the specific stimulus have to be chosen to decide these regulation types.

These four regulation types and the preferred individual behaviour strategies have to be compared to evaluate the relative frequency of occurrence of a behaviour strategy depending on responses of the vegetative nervous system. In view of validating behavioural indicators of emotional reactivity, the aim of this new method is to characterize individual differences in the behavioural and physiological responses of horses to normal environmental and training stimuli. Evidence is provided by human and animal data that the non-invasive real-time measurement of the vegetative nervous system based on variation in skin potential, skin resistance etc. is a promising approach for evaluating stress and emotional states in vertebrates. It will be explained that the chronobiological evaluation of physiological parameters has the potential to contribute much to our understanding and assessment of the underlying physiological processes of stress responses in horses.

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Contributed Presentation

Possible indicators of the human-horse relationship among adult horses

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Introduction

Various scientific tests have been designed to measure the human-horse relationship, such as the motionless person test, also known as voluntary animal approach test, in which the test person stands still a few meters from the animal and remains still (e.g. Visser et al., 2001; Seaman et al., 2002; Simpson, 2002; Williams et al., 2002; Søndergaard and Halekoh, 2003; Henry et al., 2005; Lansade and Bouissou, 2008). There are tests, in which the human appears suddenly e.g. at the door of the stall-box (e.g. Hausberger and Muller, 2002) or in which the human approaches the horse (forced human approach test) (e.g. Jezierski et al., 1999, Simpson, 2002; Søndergaard and Halekoh, 2003; Henry et al., 2005; Lansade and Bouissou, 2008). In other tests, the human tries to create physical contact with the horse, for instance tries to touch or stroke the animal (e.g. Søndergaard and Halekoh, 2003; Henry et al., 2005; Lansade and Bouissou, 2008), fits the horse with equipment (e.g. Feh de Maziéres, 1993; Williams et al., 2002; Henry et al., 2005; Lansade et al., 2004, 2005), picks up its feet, or exposes it to veterinary inspection (e.g. Jezierski et al., 1999; Spier et al., 2004; Lansade et al., 2004, 2005). Handling procedure may also involve leading the horse away from and towards the stable (e.g. Jezierski et al., 1999; Visser et al., 2001; Lansade et al., 2004). In the bridge test (e.g. Wolff et al., 1997; Visser et al., 2001; Simpson, 2002) the reluctance of the horse to be led over an unfamiliar obstacle can be measured. Various factors are believed to influence the human-horse relationship. These factors might be early experiences, e.g. imprint training (e.g. Williams et al., 2002; Lansade et al., 2005), early handling (e.g. Jezierski et al., 1999, Ligout et al., 2008), handling at weaning (e.g. Lansade et al., 2004; Ligout et al., 2008) and mare handling (e.g. Henry et al, 2005). In addition, the effects of temperament (e.g. Le Scolan et al., 1997; Visser et al., 2001; Morris et al., 2002; Seaman et al., 2002), breed, age, gender (e.g. Le Scolan et al., 1997; Wolff et al., 1997; Hausberger and Muller 2002) and the housing system (e.g. Jezierski et al., 1999; Søndergaard and Halekoh, 2003) may also be of importance. The influence of a caretaker on horses' behaviour towards humans has also been detected (e.g. Hausberger and Muller, 2002). Overall, there are a number of tests which enable us to assess the human-horse relationship.

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Objectives

The aims of our study were to observe beahvioural responses of horses to their particular familiar handlers („users“) and to find factors that may affect these responses: horse related factors (gender and age of the animals) and human-related factors (familiarity of the human, the type and amount of training and the number of handlers).

Materials and methods

We carried out an arena test and a person test. In the arena test, the horse was put alone into the test arena for five minutes (arena test). In the person test the human entered the arena (person test) and interacted with the horse according to a predetermined protocol. He was not allowed to use any tack or food revard during the whole experiment.

The *person test* consisted of 3 or 4 different phases, depending on the horse's reactions. The phases were: (1) „the voluntary approach“ phase (Appr-Vol*)*, in which the test person stood still in the middle of the test arena and the horse had two minutes to approach the human voluntarily. If the horse had not gone to the test person within the three minutes, (2) „the after calling approach“ phase (Appr-Call) followed, in which the person had to call the horse to himself. The test person had two minutes to make the horse go up to him. If the horse had gone to the human in the first pahse within three minutes, (3) „the standing beside the test person“ phase (Stand-Still) came next, in which the human had to make the horse stay beside him without holding the animal. This test lasted for two minutes. The last phase was the (4) „the following of test person“ phase (Follow) for three minutes, in which the human had to make the horse follow him, without leading it.

We tested fifty-one horses with their familiar handlers and retested thirty-nine with thirteen unfamiliar test persons within more than one week.

The results of the questionnaire enabled us to measure human-related factors e.g. the age and gender of the animal, the amount of time spent per week handling the horse (HANDLING; less than 7 hours vs. more than 7 hours per week), the number of handlers (HANDLER; one vs. more than one) and the horse's training in followership, which showed whether the horse is trained to follow the human without using any kind of tack (without a halter, leadrope, bridle, rein and without leading the horse) (FREE-WALK; yes vs. no).

Results

As for the results of the arena test, horses' behaviour was affected neither by their age nor by their gender. In the retest the animals stood significantly more and walked significantly less on group level, which may reflect some signs of habituation to the situation. On individual level, the behaviour variables (standing, walking, sniffing, rolling) were consistent over time.

With regard to the results of the person test, on group level, horses followed the familiar test persons significanltly longer than the unfamiliar ones, which suggested that horses distinguished the familiar human from the unfamiliar one. On individual level, horses' behaviour in the Stand-Still and the Follow phase were consistent over time. Beahvioural variables were not influenced significantly either by gender or by age. A three-way ANOVA statistical analysis was performed to receive information about the effects of human-related factors (HANDLING, HANDLER and FREE-WALK) on the behavioural variables in the phases of the person test. In the Appr-Vol phase and in the Appr-Call phase, horses trained by only one handler approached the test person significantly sooner, than horses trained by more than one handlers. None of the observed human-related factors affected the horses' behaviour in the Stand-Still phase significantly. As for the Follow phase, HANDLING, HANDLER and FREE-WALK had a clear effect on behavioural responses: horses trained more than 7 hours per week followed the human significantly longer, than horses trained less than 7 hours a week. Additionally, horses trained by only one handler followed the test person significantly longer, than horses trained by more than one trainer. Finally, horses trained to follow the human without being led followed the human significantly longer, than horses which did not received this kind of training. All of three human-related factors (HANDLING, HANDLER, FREE-WALK) influenced the followership independently.
We also compared the two types of approaches to see whether it mattered if the horse approached the test person voluntarily (group A; n=28) or only after being called (group B; n=23). No significant differences were observed between group A and B with regard to the behavioural responses shown in the Stand-Still and Follow phase. We found a significant negative correlation between the latency of approach and the time of follow in group A and B, as well.

Conclusion

In our experiment followership seemed to be the most precise behavioural indicator of the human-horse relationship. In addition, the time of approach (in the Appr-Vol / Appr-Call phase) seemed to be an accurate indicator, as well. The follow response seemed to be a consequence of the training method applied, which included the horse showing learnt responses (Krueger, 2007), and/or having an improved communication with a particular familiar human, and/or having social affiliations.

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Contributed Presentation

Is modified Forssell's operation superior to cribbing collar in preventing crib-biting in horses?

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Crib-biting (wind-sucking) might be a coping response of the horses to the challenges of uncontrolled environmental events. Prevention of this stereotypic behaviour evokes physiological responses consistent with increased stress. Reducing the incidence of cribbiting, however, is important in order to prevent undesirable physical and behavioural consequences (tooth erosion, altered gut function, gastric inflammation/ulceration, colic, etc.).
Common treatment of crib-biting is the application of a cribbing collar, which limits the flexion of the neck making this stereotypic movement uncomfortable and difficult. Another method, the modified Forssell's operation, is becoming more and more popular amongst the horse owners. It is based on the removal of the muscles used in crib-biting (m.omohyoideus, m.sternohyoideus, m.sternothyrohyoideus) and the ventral branches of the spinal accessory nerves. Surveys on the success of this surgical procedure have revealed inconsistent results, and, contrary to the cribbing collar, its effect on the stress level have not been studied either.
The aim of our study was to determine whether the modified Forssell's procedure is superior to the cribbing collar treatment. Differences in stress management was tested by a crib-biting provoking test, in which
surgically treated horses, crib-biting horses, crib-biting horses with cribbing collar, and normal horses (those showing no stereotypies), altogether 56 horses were compared. In this test, a food bucket had been placed out of the reach of the animal, from which titbits were given 3 times. Behaviour and heart rate variability (HRV) of the horses were recorded and analysed throughout the test. Hypotheses were tested by linear mixed model.
According to our results, both prevention methods (collar or surgery) inhibited crib-biting successfully though not totally. Regarding behaviour and heart rate variability, horses prevented from crib-biting (by collar or surgery) differed significantly from crib-biting and normal horses but not from each other. Normal horses were usually trying to reach the food-bucket while present and were standing still afterwards, whereas the other three groups had not really made efforts to reach the bucket, spent less time with resting, and performed or tried crib-biting. During the stress-test, normal and crib-biting horses had shown good stress-adaptation to the challenge since their HRV, after an initial increase, returned to the basal value by the end. On the contrary, HRV of the two prevented groups remained elevated and showed large oscillations throughout. They
had not found a successful coping behaviour either. Our results suggest that since prevention may significantly increase distress, the treatment in itself, without changing the motivation of the horse to perform the replacement behaviour - it seems to be unsatisfactory and insufficient. After prevention the motivation of the horse to perform crib-biting should be addressed. In addition, considering that prevention by collar and
surgery had not resulted in any significant behavioural or physiological differences, the superiority of the modified Forssell's procedure might be questioned. However, the surgery might be recommended if treatment with collar is ineffective.

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Contributed Presentation

Cross-modal individual vocal recognition in the domestic horse (*Equus caballus*).

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Horses fulfill many of the criteria for a species in which it would be adaptive to be capable of individual recognition: they are highly social, form strong and long lasting bonds, their affiliations are rarely kin based, they have a fission-fusion social structure and they possess inter and intra-group dominance hierarchies.

We used a novel cross-modal, expectancy violation paradigm to provide the first systematic evidence that a non-human animal - the domestic horse- is capable of cross modal recognition. We believe this paradigm could provide an ideal way to study individual recognition across a wide range of species.

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Contributed Presentation

Influences of immunocontraception on intraband social behavior in free-ranging feral horses, *Equus caballus*

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Contraception is often considered for population control of wildlife that is otherwise protected from more traditional management strategies, though little is known about the behavioral consequences of contraception in wild populations of socially complex animals. Feral horses, *Equus caballus,* in the western United States are ideal candidates for contraceptive management due to broad scale federal protection, reported herd growth rates of 15-25% per year, and finite public land allocated for them. We investigated influences of the immunocontraceptive porcine zona pellucida (PZP) on social behavior within bands of feral horses in three discrete populations for 4 years. Each band consisted of a single stallion and a harem of adult females (e“2 years old) and their foals, as well as associated yearling males and females. Four mutually exclusive behaviors (herding, reproductive, harem tending, and agonism) were analyzed to investigate the difference between behaviors initiated by band stallions toward control mares and contracepted mares within the bands. Additionally, spatial relationships between each stallion and each harem female were analyzed to assess possible passive interactions.

A candidate set of 22 hierarchical mixed effects models, using the discrete populations as a random effect on various fixed effects, was analyzed by restricted maximum likelihood estimation. The most supported models were selected by corrected Akaike’s Information Criteria (AICc). Analyses were done on 3 female age cohorts based on distinct fecundity rates: 2 to 5 year olds, 6 to 14 year olds, and e“ 15 year olds. Stallions herded control mares in the 6 to 14 year cohort more than contracepted mares (n=128, P=0.037) with treatment being the most supported effect, but foal presence (dependent foal) also contributed significantly to the model. Contracepted mares received more reproductive behaviors than control mares in the 6 to 14 year cohort (n = 151, P=0.020). No differences were detected in herding or reproductive behaviors in the least fecund groups, the 2 to 5 year olds and e“ 15 year olds. The only independent variable in the most supported model for reproductive behavior was treatment, and the covariates of foal presence, band residence (resident or transient female), band size, and body condition did not contribute. There were no differences in any age cohort for harem tending or agonism. Spatially, stallions maintained closer relationships with 2 to 5 year old contracepted females than with the same age control females (n=136, $P < 0.001$) while the group was feeding (at its most dispersed structure), but there were no differences while the band was resting or in locomotion. There were no spatial differences detected in the other age cohorts.

Given the polyestrous nature and high fecundstreit
ity of feral horses, the observed difference in reproductive behaviors between treatment groups was not surprising; however, the difference detected in herding rates was an unexpected behavioral modification. This change in herding behavior suggests that further investigation is needed to determine if PZP immunocontraception has an underlying influence on mare social rank, band structure, and band stability, as well as the scope and long-term importance of these behavioral dynamics.

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Contributed Presentation

Changes in heart rate and cortisol release during initial training of three-year-old warmblood sport horse stallions

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The first weeks of training in young sport horses have been suggested to represent a stressful period and training practises for horses have been questioned recently. So far, only limited data on the stress response of young horses to the initial training are available. Heart rate (HR) provides information on fitness of the horse but is also an indicator of stress or pain. Determination of cortisol metabolites in faeces is a non-invasive technique to determine a prolonged stress response. In our study, three-year-old warmblood sport horse stallions (n=8) were followed through a standardised 10-week classical training programme from lunging to first mounting of a rider and progressing to moderate work. Feed, housing and management were similar for all horses. HR was recorded with a mobile recording System (f810i, Polar, Kempele, Finland) fixed to a girth around the thorax of the horse and was monitored twice weekly from 30 min before to 30 min after training, i.e. including the training period. In addition, cortisol concentrations were determined in faecal samples collected three times daily. Overall basal HR before daily training was 39±2 (SEM) beats/min and mean values did not change significantly over the 10-week study period. Average HR during initial lunging (week 1) was 119±14 beats min and decreased to 95±5 beats/min in week 2. Due to individual variations this decrease did not reach statistical significance. Neither first mounting of a rider (89±10 beats/min) nor an in-creasing workload (e.g. week 8: 111±4 beats/min) were associated with prolonged increases in mean HR, but transient increases were recorded and the response to mounting of the rider differed markedly between stallions. After daily training, HR decreased rapidly but was slightly, al-though significantly ($p<0.05$, Friedman-test) higher than pre-work values (46±2 beats/min). Cortisol metabolite concentrations in faeces tended to decrease during the period of lunging, were not increased when the horses were first mounted by a rider but rose slightly with an increasing work load during the last 4 weeks of the 10-week training period. In conclusion, based on HR and faecal cortisol metabolite concentrations, the initial training of sport horse stallions in the classical German training system is not associated with major stress for the horse. The increase in HR during training is due to physical exercise itself and not associated with specific situations of the training programme.

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Contributed Presentation

Social structure and interactions within groups of horses containing a stallion

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Abstract

Earlier research indicates that stallions might either prevent social interactions between mares in their herds directly or indirectly by their presence (Feist and McCullough, 1976; Sigurjonsdottir et al., 2003) The impact of stallions on the social interactions between harem members was studied in 6 groups of Icelandic horses in 2004, 2006 and 2007 for altogether 525 hours. Four of the groups were permanently living together under semi-feral conditions, while two were temporary breeding groups. In addition, temporary and permanent groups were compared and the effect of the stability of the group on the social behaviour of horses was investigated .

The results show that stallions seldom intervene directly in social interactions between harem members. However, the hierarchies were less rigid and fewer friendship bonds were found in the groups compared to what has been found in groups without stallions in Iceland. These results give some support to our prediction that the stallion does indirectly suppress social interactions of herd members.

The stability of the group was found to affect the aggression rate, since a higher aggression rate was found in the temporary groups compared to the permanent groups. The number of preferred allogrooming partners of the horses was also affected to some extent, as a significantly lower number of allogrooming partners was found in the most unstable group compared to all the other groups. The results have significance for further research in the field of social structure of mammals, and may also be applied in the management of horses and other domestic animals.

Introduction

Feist and McCullough (1976) studied several feral harems including stallions. In their study, the stallions were seen to intervene in ongoing interactions between harem members. This might serve the function of controlling their movements and thereby the stallions would be able to keep the harem in an ordered and defendable group. Also, by preventing the horses to move between harems, the stallion would indirectly disrupt allogrooming preferences of the harem members, as they might have chosen to allogroom with an individual in another harem if the stallion had not been present. A significant hierarchy was found only in the bachelor groups in their study. The result of Feist and McCullough (1976) therefore suggests that stallions might either prevent social interactions between mares in their

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harem directly, by intervening in the interactions, or that their presence has this effect. The consequence might be that the harem members forms less stable bonds and have a less rigid social hierarchy than what can be found in groups without stallions. Comparison of data from groups of Icelandic horses without stallions with studies on groups of other breeds containing stallions supports the idea that mares and sub-adults might enjoy more freedom to interact when no stallion is present than in typical harems (Sigurjonsdottir et al., 2003).

The main aim of this study was therefore to find out what impact stallions have on the interactions of the individuals in their harems and to what extent the stallions intervene in the interactions of their group members. The aim was also to deepen the present knowledge about the natural social behaviour of the horse in general, by investigating how stability of a group with respect to how long time the groups have been together, can affect the nature of the social behaviour.

Methods

The nature and rate of social interactions of horses was studied in six groups for all together 525 hours. In 2007, a semi-feral herd of 90 mares and sub-adults was studied. The herd had four stallions, which divided the mares between them into one group (harem) each (H1-H4). The herd was kept together in a 200 ha pasture and had been minimally managed for almost 30 years. A close to natural social system had therefore developed in the herd. The harems were of different sizes, but each harem consisted of adult mares, their newborn foals and some young horses. Most of the horses had lived their whole life in the pasture. These four groups were therefore considered as permanent groups.

We also observed two temporary groups of mares (H5 in 2006 and H6 in 2004), which were put together with a breeding stallion. Most of the mares in those groups were unfamiliar and they were only kept together for six weeks.

All interactions of the horses were recorded, using the method „all occurrence of some behaviour". Interaction matrices were made by The Observer© (Noldus, 2002) and hierarchies were estimated using MatMan© (de Vries *et al*., 1993).

Results

The effect of the stallion:
The stallions in all six groups were seen to herd their harems frequently. In the semi-feral herd, the stallions guarded their harems against the other stallions and interactions of mares or sub-adults between harems were found to be very rare.

The stallions rarely intervened in ongoing interactions between members of their own herds, neither in the semi-feral herd, nor in the two temporary groups. In two of the groups (H1 and H2) the stallions were never seen to intervene. The interactions that stallions of the other four groups were seen to intervene in were allogrooming and when two horses were involved in an agonistic interaction.

Significant linear hierarchy was only found in 3 of the 6 groups and the linearity of the hierarchies was lower than what have been found in groups without stallions.

The allogrooming rates in the six groups were similar to the rate observed in groups without

stallions, but the number of preferred allogrooming partners (friends) was lower than what was found in groups without stallions.

The effect of the stability of the group:
There was a significant difference in aggression rate between the six groups, due to a higher rate in the two temporary groups compared to the permanent groups, except for the smallest permanent group (H3).

The allogrooming rate was not significantly higher in the temporary groups than in the permanent ones, but the average number of preferred allogrooming partners was significantly lower in one of the temporary groups (H5) than in all the other groups. In the temporary groups, we found that horses that were familiar from before allogroomed significantly more than others, but relatedness also mattered to some extent.

Conclusion

The results show that the stallions did not intervene as much in interactions between their harem members as expected. Still, the stallions had some direct effect on the interactions, by not allowing interactions with individuals from other harems. The results from this study also give some support to the hypothesis that stallions have an indirect effect on the interactions of others. Thus, a lack of or less rigid dominance hierarchies in the groups suggest that the presence of a stallion gives the other harem members less freedom to interact. Also, a lower number of preferred allogrooming partners were found in the groups in this study compared to other, similar groups not including a stallion, supporting this prediction even further (Sigurjonsdottir *et al.*, 2003). To interpret this finding from a functional perspective is complex. Perhaps it has an adaptive significance for the stallion that the mares in his harem do not have a clear dominance relations if that increases the probability that more mares give birth to a foal (because of more even access to resources).

The findings that there might be a significant difference in the social behaviour of horses, depending on if they experience the social structure which characterizes wild and feral groups (harems) or the group structure in which domesticated horses are normally kept in (groups without stallions), calls for further investigations and has relevance for the management of other species. Findings from such research could be of value for farmers and others when planning how to manage groups and plan enclosure size of domestic animals, as well as for conservation agencies who work in the field of reintroducing endangered species back into the wild.

Earlier studies in Iceland show that interaction rates, both positive (allogrooming) and negative (aggressions) increase when group composition changes (Hrefna Sigurjónsdóttir and Anna G. Thórhallsdóttir, 2006). This is thought to be because horses are getting to know each other and new bonds and hierarchies are being formed. In accordance with this, a significant difference in aggression rate was found between the permanent groups of the semi-feral herd, compared to the temporary and unstable groups (the temporary groups having higher rates, as expected), while the difference was not as clear in rates of positive interactions. In addition, the number of preferred allogrooming partners was significantly fewer in one of the temporary groups than in all of the other groups.

It has been shown among other domestic animals (pigs, sheep and goats) that the instability in a group can affect the stress level in the animals, since a high aggression level is often found in unstable groups

(Andersen *et al*, 1999; Boe *et al*, 2006; Joergensen *et al*, 2006; Andersen *et al*, 2008). The fact that a higher aggression rate was found in the temporary groups in this study, indicates that frequent man-made changes in group compositions, as often occurs in the management of domesticated horses, can have a bad influence and be stressful for the animals, since the horses need to form new bonds and a new hierarchy each time that the group composition changes.

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Automatic feeding systems versus feeding stalls for horses kept in groups: visiting frequency, stress situations and risk of injury

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Summary
The threatening and avoiding behaviour, the visiting frequency, the stress situations, the situations with risk of injury and the displacement activities of 260 horses living in run-out sheds were observed at 10 stables with feeding stalls and at 11 stables with automatic feeding systems for hay and concentrates. Every group of horses was observed on five succeeding days visually and immediately for 6 sessions, each of 4 hours. These 6 slices form together 24 hours, a complete day.
Altogether, 1540 threatening and submissive behaviour patterns were registered in the feeding area (in front of, inside and behind the feeding equipments) of feeding stalls and 3928 in that of automatic feeding systems. Feeding stalls were visited 45.5 times per horse and day, automatic feeding systems 93.1 times per horse and day. 3.7 stress situations per stable and day, 1.3 situations with risk of injury per stable and day and 0.3 displacement activities per stable and day were observed in the feeding area of feeding stalls. Automatic feeding systems caused 17.0 stress situations per stable and day, 8.6 situations with risk of injury per stable and day and 12.9 displacement activities per stable in the feeding area.
The individual farm and the individual horse showed significant influence on the modes of agonistic behaviour in the feeding area. All together the number of negative interactions in the feeding area at both feeding systems was relatively low.
Because of the management of the individual stable exercises the most substantial influence on the behaviour of the horses, it can be said, that, correct group keeping with professional management provided, both feeding systems are suitable for horses in run-in sheds.

1 Introduction

When keeping horses in run-out sheds, feeding stalls are usually recommended for individual feeding; which allows equine typical simultaneous eating. However, automatic feeding devices for hay and concentrates are being increasingly used, and these do not allow simultaneous eating. This research aims to compare threatening and submissive gestures, visiting frequency, stress situations, situations with risk of injury and displacement activities in the area of automatic feeding systems with those at feeding stalls.

2 Material and Methods

The studies were carried out at 10 stables with feeding stalls and at 11 with automatic feeding systems for hay and concentrates. These stables were otherwise similar regarding the keeping of the horses and the management of the facilities. Each group consisted of 8 to 21 horses, with 260 horses taking part in total. The observed areas around the feeding equipments were defined beforehand (they nearly had the

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same size). To compare the different farms they had to comply with a lot of criterions (e.g. mares and geldings together in a herd, different ages, straw ad libitum, at least 2 feeding times per day at feeding stalls and 10 feeding times for hay and concentrates at automatic feeding systems).
Before beginning the experiment at each farm a certain period of time was used to familiarize with the horses and to accustom the horses to the observer. The observations were carried out in winter and included visual and continuous observations of every group of horses. So the actions of all horses could be regarded synchronously. Every group was observed for 6 sessions, each of 4 hours. These 6 sessions together made 24 hours, a complete day.
In the feeding area every visit by each horse was recorded, as well as all avoidance behaviours, all threatening gestures with risk of injury (biting, rear leg kicking and charging) and all threatening gestures without risk of injury (threatening, biting threats, threatening swinging and rear leg kicking threats), all stress situations, all situations with risk of injury and all displacement activities.
For analyzing the results mainly the statistic SAS program package (proc glm, proc corr) was used. In addition the statistic program „WinStat® for excel“ was employed too.

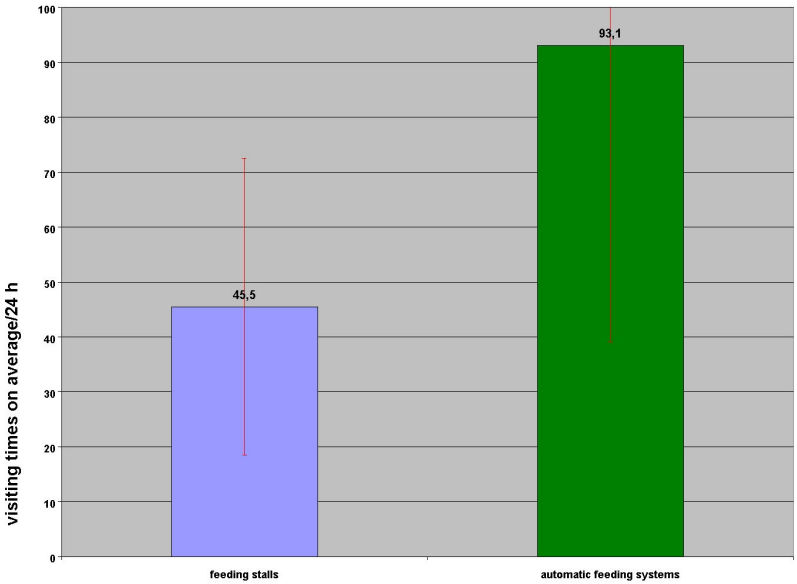

Diagram 1: Average frequency and standard deviation of visits per day and horse (n=260) as a function of feeding system ($p<0,001$)

3 Results

3.1 Visiting frequency

On an average the horses in stables with feeding stalls visited the feeding area (waiting area, the station, exit area) 45.5 ± 27.3 times in 24 hours, and in stables with automatic feeders for hay and concentrates 93.1 ± 53.5 times (diagram 1). This difference was significant.

3.2 Threatening and submissive gestures

In the 10 stables with feeding stalls 1540 threatening and submissive gestures in the feeding area could be observed together, in the 11 stables with automatic feeding systems 3928. In the stables with feeding stalls 50 % of the observed threatening and submissive gestures were threatening gestures without risk of injury, 12 % threatening gestures with risk of injury and 38 % avoidance. In stables with automatic feeding systems 35 % of all actions in the feeding area were threatening gestures without risk of injury, 15 % threatening gestures with risk of injury and 50 % avoidance (diagram 2).

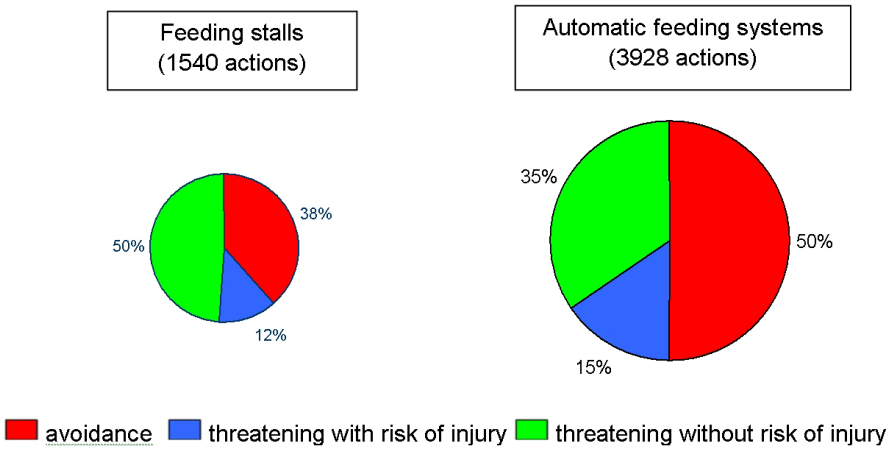

Diagram 2: Percentage of the threatening and submissive behaviour in the feeding area as a function of feeding system (260 horses)

Table 1 shows the average numbers of threatening gestures and avoidance per day and horse in both feeding systems. Threatening behaviour, without risk of injury or with risk of injury, occurred significantly more frequently in stables with automatic feeders (9.6 ± 12.9 times and 4.2 ± 5.5 times respectively per 24 hours and horse) than in stables with feeding stalls (6.0 ± 10.4 times and 1.5 ± 3.3 times respectively per 24 hours and horse). These differences were not significant. Avoidance gestures were observed 4.7 times per day and horse in stables with feeding stalls and 13.8 times in stables with automatic feeding systems. This contrast was significant.
The management of the stable, however, proved to have the most important influence on the behaviour of the horses.

Table 1: Average numbers of the threatening gestures (th.) with and without risk of injury (n.s.) and avoidance (p=0,008) as a function of feeding system per day and horse (n=260)

Variable	mean	standard deviation	max	min	mean	standard deviation	max	min
	feeding stalls				automatic feeding systems			
th. with risk of injury	1,5	3,3	30	0	4,2	5,5	33	0
th. without risk of injury	6,0	10,4	71	0	9,6	12,9	91	0
avoidance behaviour	4,7	8,3	76	0	13,8	17,5	96	0

Considering the above given visiting frequency you see that there was not one threatening gesture and avoidance per visit.
Additionally there are very big individual differences between the horses too.

3.3 Stress situations, situations with risk of injury and displacement activities
On an average, situations that could cause either stress or injuries to the horses occurred in stables with feeding stalls only 3.7 ± 13.1 and 1.3 ± 4.8 times per stable and day respectively. Such situations were to be seen in stables with automatic feeder 17.0 ± 33.4 and 8.6 ± 15.3 times per stable and day respectively - clearly more often (table 2).
Displacement activities were observed in stables with feeding stalls 0.3 ± 1.0 times per horse and 24 hours and in stables with automatic feeders for hay and concentrates 12.9 ± 23.3 times (table 2).
In both feeding systems the standard deviation was high.

Table 2: Average numbers and standard deviation of stress situations, situations with risk of injury and displacement activities per stable and day (21 stables)

Variable	mean	standard deviation	mean	standard deviation
	feeding stalls		automatic feeding systems	
stress situations	3,7	13,1	17,0	33,4
situations with risk of injury	1,3	4,8	8,6	15,3
displacement activities	0,3	1,0	12,9	23,3

4 Discussion and conclusion

For horses kept in groups the German ministry of agriculture (BMELV 1995) recommends, with regard to animal's well-being, conventional feeding stalls for the individual feeding of hay and concentrates, there should be as many stalls as horses. These systems allow the horses to eat simultaneously. This meets their typical behaviour. The automatic feeding systems only permit non-simultaneous feeding. The advantage, however, of these systems is that they make it is possible to feed the horses a lot of small portions spread over the whole day. This is according to ULLSTEIN (1996) and ZEITLER-FEICHT (2008) good for the ingestion. Furthermore these systems stimulate the horses to move, which is very important for their health too. This stimulation to move is verified by this study: Horses in stables with automatic feeders for hay and concentrates visited the feeding area with 93.1 visits per day almost twice often than horses in stables with feeding stalls. Automatic feeding systems for concentrates as well as those for hay came to market increasingly in the last years. The early systems showed several weak points. Only PIRKELMANN (1990a), FLEEGE (1992) as well as PIRKELMANN et al. (1993) carried out scientific studies about these automatic feeding systems under the aspect of animal welfare. Further development and improvements of the systems were performed nearly exclusively empirical by the manufacturers. In their study at two stables GIELING et al. (2007) came to the result that automatic feeding systems of today support the animal´s wellbeing. The feeding area is a sensitive one that rises the threatening behaviours as well as the discrimination of the lower ranking horses by a wrong conception; especially when the feeding is not simultaneously or the feeding places are limited (PIRKELMANN 1990b, FLEEGE 1992, PIRKELMANN et al. 1993, TVT 2005, ZEITLER-FEICHT 2008). By ZEITLER-FEICHT (2005 and 2008) next to automatic feeding stations for concentrates it often comes to threatening behaviours because of jealousy about food. In this study this could not be proved. In stables with automatic feeding systems were observed more threatening behaviours per day and horse (13.8) than in stables with feeding stalls (7.5) but this difference was not significant.

If the space around the feeding stations is too small and if there have been made mistakes in the conception, horses might be injured (FLEEGE 1992, ZEITLER-FEICHT 2005 and 2008). PIRKELMANN (2008) and ZEITLER-FEICHT (2008) demand, to form the feeding stations so that low ranking horses were not discriminated. This study shows that the systems used today satisfy this demand.
Horses have fine tuned threatening and avoiding gestures with the aim to avoid injuries (SCHÄFER 1993, ZEITLER-FEICHT 2008). In the course of this study we found out that the mostly registered interactions in the feeding area were threatening gestures without risk of injury (40 %) and only 14 % threatening with risk of injury. Even more often the horses showed their inferiority by avoidance. This indicates clearly that the horses try to avoid severe confrontations with risk of injury. The part of avoidance behaviour observed in this study lay between the percentage that had been observed by ZEITLER-FEICHT et al. (2006) and by RISCHBIETER (2001). ZEITLER-FEICHT et al. (2006) examined the threatening and avoidance gestures of 54 horses in three run-out sheds during a period of 480 Minutes (240 minutes with shortage of fodder, 240 minutes without shortage of fodder). They registered that avoidance had a part of 24.3 % of all agonistic behaviour. RISCHBIETER (2001) examined just one herd with 15 horses. Her result: 72 % of the agonistic behaviour patterns were avoiding behaviours.
Regarding the threatening behaviour the results of ZEITLER-FEICHT et al. (2006) were not confirmed by the present study. In this study only situations with shortage of fodder were observed and it were found clearly less threatening gestures with risk of injury (14 % in this study, 32.2% in the observations by ZEITLER-FEICHT et al. 2006).
In the stables with feeding stalls there were recorded in the feeding area an average number of 7.5 negative interactions per day and horse (threatening with and without risk of injury) and 4.7 avoidances per day and horse. In stables with automatic feeding systems for hay and concentrates in this area there were 13.8 negative interactions per day and horse and 13.8 avoidances per day and horse. The number of negative interactions is in accordance with the examination by FADER (1993), who recorded 12 negative interactions per day and horse. FADER (1993) investigated the effects of automatic feeding stations on the behaviour of 10 horses. In the examination by ZEITLER-FEICHT et al. (2006) 20 threatening gestures and 7 avoidances per horse were observed within 4 hours in the situation with shortage of fodder. These observations are comparable with the observations in the feeding areas in the course of this study; here the number of the detected actions was clearly higher.

Concluding remarks: The more often the feeding area is visited, the more frequently threatening gestures without and with risk of injury occur. The same goes for the number of situations that may result in stress or injuries. Therefore to sum up it can be said that feeding in feedings stalls leads to less risk of stress and injuries compared with feeding by computer controlled systems. While assessing this study it should be taken into account that there were very big individual differences between the horses. The result of the statistical evaluation was that the management of the stable has a decisive influence on the observed features. Therefore both feeding systems can be recommended, especially as the number of conflicts in the feeding area in all stables was relatively low and no injuries were observed in connection with the feeding.

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Interaction with horses (*equus*): Assessment with a circumplex based questionnaire

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According to Interpersonal Theory every interaction is motivated by efforts to achieve and maintain self-esteem and to avoid anxiety. People's characteristic ways of accomplishing these ends are called interpersonal reflexes. Those interpersonal reflexes are evident in interaction with animals, since they are determined by the interpersonal traits of personality. We wanted to catch the typical interpersonal reflexes in between humans and horses compared to pet animals.

We used the self rating assessment instrument „Inventory of Problematic Interactions with Animals" (IPI – Animals), which bases on a Interpersonal Circumplex Model (Human Animal Circumplex; HAC) and was constructed to catch specific dispositions of distress caused by animals using two dimensions (too dominant vrs too submissive and too warm versus too cold). Data of 233 male adolescents (93 of them actual pet owners, from that 12 horse owners) were collected.

We found that different pet preferences holds distinct locations in the HAC. Horse persons differ from dog and cat persons within the dimension dominance (dog: $chi^2_{(df126)}$ =161.54 p= .018; cat: $chi^2_{(df126)}$ =199.95 p= .045). Persons, who own a horse or would wish to own one, describe themselves as dominant, but warm interactors. They report that they want horses to notice them. They tend do too much for them and behave very effusively with them. On the other hand they feel that the animal takes too much advantage of the relationship.

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Contributed Presentation

Timeframe for a novel horse to become familiar in a group

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The case of familiarity in equine husbandry is not a topic that has suffered vast amounts of examination. During their lifetime domestic horses will most likely experience multiple changes in their social environment such as being sold, moved, and sent to training amongst other things. In recent years a considerable amount of studies have shown the benefits of group-housing on horses, and familiarity timeframes are of genuine importance in management of such systems.
It is our intension to determine the timeframe a novel horse faces before it is recognized as being familiar in an already established group, what factors are of importance and the level of injuries sustained in the introduction period.

24 2-year old Danish Warmblood fillies were used for this study in two blocks of 12 horses. The familiar horses, titled the K-group, consisted of 16 horses and the U-group, the unfamiliar horses, of 8. The horses came from different studs to ensure no prior contact between the two groups of test animals. They were all raised in stable group-housing systems and thereby accustomed to social interactions between conspecifics.

Prior to pairing the K-horses up, nearest-neighbour observations was performed in the holding paddock to ensure the two horses were in fact familiar and would act as an established group.
8 groups of 3 individuals, 2 familiar and 1 unfamiliar, were held in separate paddocks measuring 80x80m. The horses were within eyesight of the other groups but were not able to have any physical contact.

Behavioural observations were performed for 20 minutes per group upon letting the U-horse enter, and then for one hour per group (3x20mins) every Monday, Wednesday and Friday the following 16 days. On day 0, 1, 2, 4, 8 and 16 they were tested for individual preference within the group, and on test day 1 and 16 any injuries sustained were also noted. Harmony within the groups was determined by a group-feeding test on the last day of observation.

Preliminary analyses of the results indicate that familiarity develop rapidly, established by observational data such as increasing friendly behaviour and decrease in distance between the three horses in the respective groups.

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Contributed Presentation

Photopic Spectral Sensitivity and Wavelength Discrimination in the Horse (*Equus caballus*)

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A number of studies have demonstrated that horses have chromatic vision and are able to distinguish colours from grey, independent of brightness. Anatomical and physiological data support the view that they are dichromats. In two experiments we provide behavioural evidence for their dichromacy. In the first we measured photopic spectral sensitivity. Using a spatial two alternative forced choice task, two horses were required to discriminate a coloured circular patch on an achromatic background from a blank field over a range of wavelengths .

The obtained spectral sensitivity function was consistent with the presence of two cone classes with predicted spectral peaks at 429 nm and 545 nm, respectively. In the second experiment we obtained wavelength discrimination functions. The same animals were required to make discriminations between a series of standard wavelengths and a series of comparison wavelengths across the spectrum. The resultant wavelength discrimination function showed a single minimum at approximately 480 nm, which is also consistent with the view that horses are dichromats. Key Words: Horse, colour vision, spectral sensitivity, wavelength discrimination

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Contributed Presentation

International Society of Equitation Science- an outline

Machteld van Dierendonck

The International Society for Equitation Science is a not-for-profit International scientific organisation with the primary function of facilitating research into the training and welfare of horses. The mission of the ISES is to promote and encourage the application of objective research and advanced practice which will ultimately improve the welfare of horses in their associations with humans.

ISES provides an international forum in which scientists can communicate their most recent findings by organising annual scientific meetings and by encouraging scientific publications. Furthermore, the Society offers a pool of expertise to national governments, international bodies, industry and equine welfare organisations. The idea of founding a Society devoted to equitation science had first been raised during discussions following the Havemeyer Foundation Workshop on Horse Behaviour and Welfare in Iceland in 2002.

Since then, equitation science has developed rapidly. The discipline combines learning theory, psychology, ecology, biology and ethology in order to objectively examine the efficiency of different equine training methods. The society is open for people with scientific, scholarly or professional qualifications: equine scientists, ethologists, veterinarians, behaviour therapists or qualified trainers and riders.

ISES membership gives the opportunity of joining a network of internationally renowned equine scientists and advanced practitioners. Members save on registration fees for international conferences and stay informed about research and its application in practice through two newsletters per year. For further information and membership issues please visit www.equitationscience.com. During the presentation an overview will be given about the history and goals of ISES, the meetings since 2001, the current organisation- and membership structure and the future plans. Also a summary of the presentations given at the 4th International Equitation Science Conference August 2-4, 2008 in Dublin will be presented.

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Contributed Presentation

An overview of educational offerings in equine science and -management in Canada

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Canada has a variety of educational offerings in equine management at the diploma and certificate level offered by universities and colleges, as well as by industry supported centres. However, it was not until 2007 that the first degree-based program in equine science was launched. Offered by the University of Guelph, the Bachelor of Bio- Resource Management - Equine Management program is designed for students who do not intend to pursue post-graduate studies and are strongly focused on securing employment that makes use of the knowledge acquired in their bachelor's degree. The courses in the BSc-program include basic natural sciences as well as equine-specific courses with a focus on management of equine related businesses and events. Diploma and certificate programs usually include only specifically equine-related courses e.g. in anatomy and physiology, health, business, facility management and nutrition. All diploma and certificate programs, and to a slightly lesser extent the BSc program, have a strong focus on applied learning with the intent to provide highly trained workers for the industry. Unique in Canada are the entirely online-taught Diploma in Equine Studies, the Certificate in Equine Business Management and the Equine Science Certificate offered by Equine Guelph and the University of Guelph's continuing education. Students of these programs have access to a virtual classroom via the internet, and therefore access to instructors and guest speakers from the industry throughout the course. The Canadian certificate programs typically take one year (two semesters), the diploma programs two years (four semesters), while the BSc program takes four years (eight semesters). The BSc program requires approximately 2000 hours of in-class time plus roughly twice the amount spent on assignments and studying, totalling to an overall workload of roughly 6000 hours. Most programs require the completion of Grade 12 or equivalent for admission, and in all programs a background and experience with horses is not required for admission, however it is usually deemed beneficial. Career options for BSc-graduates include barn management, riding instructor or coach, professional rider, judge, steward, course designer, equine-assisted therapy, veterinary assistant, event manager, nutrition consultant, retail sales in tack and equipment, equine sales and marketing, agriculture extension services, college lecturer, consultant and technical advisor, and media relations. Career options for the diploma and certificate program graduates generally include similar areas, with a focus on hands-on work and direct interaction with horses such as employment as grooms, trainers and barn managers.

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Contributed Presentation

An overview of the MSc-program in equine science at the University of Göttingen

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The MSc-program in Equine Science, initiated in 2006 in response to needs for scientific support of the growing equine sector, is the first of its kind in Germany. It is offered by the Faculty of Agriculture Science, Department of Animal Breeding and Genetics at the University of Göttingen, Germany, however courses are delivered in cooperation with the University of Veterinary Medicine Hannover and the German Equestrian Federation (FN). The courses are concerned with the scientific basis of horse breeding, husbandry, nutrition, physiology, behaviour, and health, as well as with aspects of business administration and management of equine facilities and their impact on society, economy and the environment. Courses are delivered in German and – in the case of some guest speakers - English language in form of lectures, laboratories, seminars, group-projects, internships and a combination thereof. Currently, the program is limited to 30 students per year and requirements for admittance are a BSc (or equivalent) degree in animal science or related subjects. However, graduates of programs e.g. in business administration, economics, or veterinary or law schools, are also accepted. The program takes two years (four semesters), and requires the completion of 120 European Credit Transfer System points, i.e. a workload of approximately 3000 hours. This timeframe includes the preparation of a thesis based upon research in topics related to equine science, demonstrating the candidate's capacity for original and independent work. Further information about the program can be obtained from the official website: http://www.pferde.uni-goettingen.de . Career options for graduates include equine facilities management, consulting services, agriculture extension services, feed industry, agricultural ministry and related civil service, universities and research institutions.

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Contributed Presentation

Heart rate and cortisol release in horses during road transport of one, 3.5 and 8 hours duration

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In sport horses, equestrian competitions may lead to increased cortisol release. The competition itself but also a new environment or transport to the events can be considered as stressors. In this study, warm-blood sport horses (4-16 years, 4 mares, 2 stallions, 18 geldings) were transported by road for one (t1), 3.5 (t3.5) and 8 hours (t8), (n=8 per group). Heart rate (HR) is an indicator of stress and correlates with cortisol release. Heart rate was recorded with a mobile recording system (f810i, Polar, Kempele, Finland), fixed to a girth around the thorax of the horse and was monitored the day before transport, during transport and 12 hours thereafter. In addition, cortisol metabolite con-centrations in faeces were determined in order to analyse adrenocortical activation during transport. Faecal samples were collected three times per day. Cortisol metabolite concentrations in faeces are increased approximately 24 hours after an elevation in plasma cortisol concentrations. Basal HR before transport did not differ between groups (45±2 (SEM) beats/min). During the first 30 min of transport, HR increased significantly (84±6, $p<0.001$, Kruskal-Wallis-H-test) but did not differ between groups. During the remaining part of the transport, HR was 61±6 beats/min ($p<0.001$ vs. first 30 min). When HR was analysed for the last 30 min of transport, values for groups t1 and t8 were significantly ($p<0.05$) higher than in group t3.5. HR decreased to baseline values within less than 30 min after transport and did not differ between groups (30-60 min after transport: 44±3 beats/min). Faecal cortisol metabolite concentrations on the day after transport were elevated compared to pre-transport baseline values in all three groups of horses. Significant differences existed between groups (e.g. 18 hours after transport t1: 91±5, t3.5: 110±18, t8: 136±27 ng/g; $p<0.05$). Based on HR analysis, horses of group t3.5 had adapted to transport, while the prolonged transport in group t8 again was a stressor. In group t1, which was transported only for one hour, the higher heart during the last 3 min of transport was still part of the initial rise in HR. After an initial increase, heart decreases indicating adaptation of the horse to transport. Cortisol metabolite concentrations in faeces indicate that transport causes adrenocortical activation with the amount of cortisol released depending on the duration of transport. Transport over medium distances appears to no major stressor and a negative impact on the performance of the horse is unlikely. Transport over 8 hours caused the most pronounced cortisol release and HR increases again during the last hours of an 8-hour transport. Transports exceeding this time may temporarily affect the subsequent performance of the horse in equestrian sports.

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Contributed Presentation

Behavioural patterns of pony foals after simultaneous and consecutive weaning

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In this study, the behaviour of Shetland pony foals after weaning was analysed. Foals were either weaned simultaneously (group SW; n=7) by removing all mares at the same time and leaving the foals as a group or foals were weaned consecutively (group CW; n=4) by removing one mare per day on consecutive days. Behaviour of the foals was observed 3 times per day (6:00-8:00, 12:00-14:00 and 18:00-20:00) from one day before weaning to 7 days (group SW) or 10 days (group CW) after removing the first mare.

Vocalisation after removal mares was more frequent in foals weaned simultaneously (d 1: SW 66±37 per 2 hrs) than when mares were removed consecutively at one-day intervals (d1, i.e. removal of first mare: CW 3±2 per 2 hrs). In CW foals, vocalisation was most frequent on the day after removal of the last mare (day 5: 18±6 per 2 hrs), although it was lower than in SW foals on day 1 after weaning.

Locomotor activity was highest in SW foals on days 1 and 2 after weaning (maximum 17±6 movements per 2 hrs, $p<0.05$ vs. CW: <2 movements per 2 hrs at all times). Frequency of defaecation increased to 7±1 per 2 hrs on day 1 after SW ($p<0.05$ vs. group CW), it was 3±2 per 2 hrs in group CW at the time 3 mares had been removed and was below 2 at all other times in both groups. The time, foals spent in lateral recumbency and in sternal recumbency was reduced to near zero during the two days following weaning (group SW) and the period during which mares were removed consecutively (group CW).

Tactile contact between foals was increased in SW foals after weaning compared to CW foals during the period of consecutive weaning. Suckling on other foals increased in both groups for several days after weaning but did not differ between groups. No major changes over time or differences between groups were found for other behaviour parameters. Foals weaned simultaneously lost weight slightly but significantly ($p<0.05$) within two days after weaning (from 78±11 to 75±10) while no weight loss occurred in CW foals. In conclusion, SW elicited more pronounced behavioural changes than CW in pony foals. Consecutive weaning can be considered a more gentle method than SW and thus may be associated with lower risks and less stress for the foals.

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Contributed Presentation

Polysonographic studies, about sleeping behaviour of horses

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Objective: In the context of the ongoing discussion about keeping horses in individual stable boxes vs. in herds the lack of relaxation of the horse as a flight animal is an argument often put forward against individual housing. The long-term objective of our investigations is to determine the sleep phases in various housing systems in order to find a substantiated answer to that issue. For that purpose, the sleep waves measured by EEG have to be defined beforehand and allocated to the individual stages of sleep. The experiments described here are intended to support this effort. The objective is to establish a method which by means of a portable polysomnograph allows to capture the sleeping behaviour of horses for the purpose of defining the individual stages of sleep. It was investigated which stages of sleep horses undergo, and to what extent they may be comparable to those of humans.

Animals/materials/methods: Given the high technical effort involved, somnographic examination of large animals has so far been difficult and mostly required the animals to be sedated. Meanwhile, however, instruments such as the Somnoscreen™ by Somnomedics have become available. This is a completely portable polysomnograph with up to 28 channels and wireless online signal transmission and synchronous video transmission to a PC.

Using this instrument, the sleep profile of 5 Icelandic ponies and 10 horses (different race) aged 5-10 years was recorded and evaluated for 4 or 5 nights per horse. The following parameters were assessed: EEG (electroencephalogram), EOG (electrooculogram), EMG (electromyogram), ECG (electrocardiogram), thoracic and abdominal breathing motions as well as identification of the body posture. Synchronous video recordings were made. EEG recordings were obtained through gold-coated disk electrodes with long flexible cables, applied and secured to the scalp.

Results: As with humans, various stages of sleep can also be defined for horses using the above methods of recording. The waking condition is characterised by alpha waves, which just like in humans are within a range of 8-12 Hz. Typical REM phases as in humans were also detected, although not only when stretched completely on their side, as has hitherto always been described, but also when lying on their chest. Phases of deep sleep (stage 4) can also be measured, with the animals mostly in a standing position. The multi-stage human sleeping pattern, which is made up of 4-6 repeat phases of sleep (waking stage eyes open – waking stage eyes closed – REM phase – stage 1 – stage 2 – stage 3 – stage 4 – return to REM phase etc.) was found to be similar in horses in individual sequences. However, the sleep phases are shorter and more frequently interrupted by waking phases.

Conclusions: Horses are flight animals, which is why they have to be „on eye“ in every situation so as to be able to flee in the face of danger. In a natural herd lying positions are only assumed if one or more members watch over the herd. In some publications the REM phase is treated as equivalent to the deep sleep phase. Although the REM phase is a phase of total muscle relaxation it is at the same time the dream phase and due to the high frequencies and the low amplitudes in the EOG resembles Stage I. This means that the sleeping horse can be awakened very quickly from this REM phase so as to be able to react to any dangerous situation. It therefore makes sense for the horses to assume a lying position during REM phases as the muscles are relaxed, yet a waking condition can be reached very quickly. A standing position seems to be preferred during deep sleep phases, where waking takes rather long, so that at least the position will not have to be changed. Whether the sleeping behaviour changes depending on age and race has yet to be investigated.

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Poster

Effect of Short-Distance Road Transport on Thyroid Function, Rectal Temperature, Body Weight and Heart Rate of Stallions

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Aim of study was to investigate the effects of transport stress on thyroid response, body weight, rectal temperature and heart rate changes in one hundred twenty-six healthy stallions in basal conditions, before and after short road transport. One hundred twenty-six Thoroughbreds and crossbreds stallions with previous travelling experience, aged 4 to 15 yr, were transported by road in a commercial trailer for a period of 3 h (distance <300 km). Blood samples and physiological parameters were collected at 0800 (basal I) and at 1100 (basal II), in each horse's box, one week before the loading and transport in basal conditions, and one week later, at 0800 immediately before loading (pre-transport), and after 3 h period of transport and unloading, on their arrival at the breeding stations (post-transport), in each new horse's box, within 30 min. Increases in circulating T_3, T_4 and fT_4 levels ($P < 0.01$), but not for fT_3 levels, were observed after transport, as compared to before loading values, irrespective of different breed. Lower T_4 and fT_4 levels were observed in basal II ($P < 0.01$) than basal I and before loading values (pre-transport). After transport Thoroughbreds showed higher fT_3 ($P < 0.05$) and fT_4 ($P < 0.01$) levels than crossbred stallions. No significant differences for T_3 and T_4 changes were observed. A significant increase in rectal temperature ($P < 0.01$) and heart rate ($P < 0.05$) was observed after transport, as compared to before loading values (pre-transport). No differences between basal I, basal II and before loading values (pre-transport) for physiological parameters were observed.
The highest T_3, T_4 and fT_4 levels recorded after short transport seem to suggest a preferential release from the thyroid gland. The results indicate that short road transport stress contributes significantly to thyroid hormone changes, according to different breed, and to the increase in rectal temperature and heart rate. No differences related to different age were observed.

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International Equine Science Meeting 2008
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Poster

Ecology and evolution of equine cognitive abilities

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The cognitive abilities of social ungulates, in particular horses, have widely been neglected. Preliminary results suggest that horses are capable of social cognition which they acquire through social learning. They gain information from the observation of the interaction of a conspecific and a human experimenter, and adjust their own behaviour towards the experimenter with respect to the observed horse's reaction and relative dominance status (Krueger and Heinze, 2007). Horses are a highly social species that still exists in different evolutionary stages: domestic horses, feral horses and wild horses (Przewalski horses). Additionally, domestic and wild horses differ in their individual social behaviour. For example, in social interactions Przewalski horses appear to act significantly more aggressively than domestic horses. Therefore studies on horses are particularly suitable to investigate whether convergent social evolution favours convergent cognitive evolution. By a comparative study concerning their reasoning abilities in a specific situation, we will attempt to determine the influence of domestication and feralisation on the evolution of social cognition and to investigate possible differences in their abilities to cope with stressful situations. We started to observe the behaviour of domestic and wild horses, in particular during the integration into new social groups, especially in relation with their knowledge of the social structure of new groups and their own relative social status. Selected agonistic interactions will be measured and statistically evaluated. Additionally, the stress level of the horses will be determined by an analysis of stress hormone levels, particularly cortisol metabolites, in plasma, saliva and faeces.

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Poster

Day-Time Budgets of Konik Polski Horses (*Equus caballus*) Maintained in two Housing Systems

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A comparison of day-time time budgets of the konik polski horses kept in two different housing systems: free-roaming and in a limited area, was the aim of the study. The observations were carried out in the Biebrza National Park from January to June 2006 on a total of 12 horses (7 females and 5 males) aged from 2 to 5 years. The horses were kept for one year in a free-roaming system on a area of 200 ha where they formed two family bands. Later, during the winter the horses were grouped together in 1 ha enclosure with free access to water, hay given 3 times per day and oats given irregularly mainly in the winter. In the spring horses were let out again into the free-roaming system. A comparison was made of the horses' behavior characterizing their daily activity in both housing systems. Behavioral data were collected during 122 h of direct observations in 1 hour focal samples in three periods of the day: morning (from dawn to 11:00 am), afternoon (from 11:00 am to 4:00 pm) and in the evening (from 4:00 pm until dusk).

The proportion of time spent on feeding and resting behavior and locomotion activity in the total time of the observations, depending on the time of day and sex of the horses, was determined. For the evaluation of the frequency of drinking, comfort, eliminative, sexual and exploratory behavior the number of appeared cases in all horses was added up and divided by the number of observation hours. In spite of significant differences in the intensity of feeding and in the time spent on recumbency found in both housing systems depending on the time of day and sex of the horses, it seems that konik polski horses kept in different housing systems have a tendency to maintain the stable day-time time budgets, which was demonstrated by the similar time of their daily activity spent on feeding (75.9 % of total time in limited area and 71,2 % free–roaming) and resting upright (respectively 16.9 % and 15.8%) as well as cases of urination (0.18 cases/1 hour of observation in limited area and 0.17 in free–roaming in total), self- grooming (respectively 0.40 and 0.56) and mutual-grooming (0.17 and 0.12). But other signs of comfort behavior were observed nearly twice as often in the horses in the limited area (0,42) than in the free roaming system (0,22).

The patterns of exploratory behavior were observed decisively more often in the case of horses in limited area (0,5 cases/1 hour of observation) than in the free-roaming system (0,07). The different housing system affected the konik polski horses' time-budget, with decreased time spent in limited area as compared to free-roaming horses in recumbent rest (respectively 2.5 % and 7,0 % of total time), locomotion activity in walk (4.9 % and 8,2 %) and trot (0.006 % and 2,3 %). Due to delivering forage to the paddock the locomotion of the horses related with searching, choosing and eating also decreased. Key words: housing systems, day-time time budgets, konik polski horses

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Poster

The influence of management on horse behavioural reactivity in therapeutic riding programs.

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We investigated 8 horses in five therapeutic riding centres situated in San Cataldo (Caltanissetta - I), Nicosia (Catania - II), Pellaro (Reggio Calabria - III), San Gregorio (Catania - IV), Niguarda Hospitals (Milan - V). The managements of the animals were of different typologies: Type 1, Type 2 and Type 3. In type 1 the horses were used for therapeutic riding only. Furthermore intra and interspecific social interactions were not allowed. In type 2 the horses played kinetic activities and made social interactions. In type 3 the horses were free in paddock, as intra and interspecific social interactions were allowed. The centre I, with a management of type 1, housed 1 horse (A1); the centre II, with a management of type 2, housed 1 horse (B2); the centre III, with a management of type 1, housed 1 horse (C1); the centre IV, with a management of type 2, housed 2 horses (D2 and E2); the centre V, with a management of type 3, housed 3 horses (F3, G3 and H3). Breeds of horses were: Anglo-Arab (n°1), Avelignese (n°3), Italian Selle (n°3), draught-horse crossbreed (n°1). They were 2 geldings and 6 females. Their ages ranged from 12 to 23 years. We observed a total of 64 patients affected by different pathologies: autism, motory handicap, blindness and deafness, children's cerebral paralysis, relational problems, mental deficiency, Down's syndrome.

The horses' behaviour was observed at rest and during therapeutic activities with these patients. The Heart Rate (HR) was used as physiological parameter for an ethological evaluation, measured by a telemetric heart rate monitor (Polar Horse Trainer®). Horses were analysed with a reactivity test for emotional homeostasis evaluation, too. Heart rate values were studied with non parametrical statistical analysis methods.

Distinct management typologies provided statistically different basal mean values of heart rate (intergroup and intragroup): Type 1 vs Type 2 ($P\sim0.05$) and Type 1 vs Type 3 ($P<0.05$). The comparison of heart rate during therapeutic activities of diverse management showed the following results: A1 vs B2 ($P<0.05$), B2 vs C1 ($P<0.05$), Type 1 vs Type 2 ($P<0.01$). Different managements, both in the same or different typologies, gave significantly diverse results (A1 vs E2: $P\sim0.05$; C1 vs E2: $P\sim0.05$; B2 vs E2: $P\sim0.05$).

This study shows that the statistic differences obtained by therapies with autistic patients derive from management conditions of Type 1. In reactivity test there aren't any significant differences among the three management typologies. However, we recorded strong variation between medium and maximum values of heart rate, especially in Type 1 and Type 2 of management.

These high variations of heart rate indicated fear reaction of the horse to new stimuli.

This reaction could lead to dangerous accidents for patients during therapeutic activities.

Horses used in therapeutic riding programs must be evaluated before this employment. Horse's behaviour can be assessed by an ethological observation and a reactivity test. Furthermore, the horses must be guaranteed welfare conditions and must live in an environment enriched with sensorial stimuli and respectful of their physiological and ethological needs.

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Poster

Horse-human interactions: Attention attribution and the use of human cues by domestic horses (*Equus caballus*).

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Recent research has shown that domestic dogs are particularly good at reading human attentional cues, often outperforming chimpanzees and hand reared wolves [1, 2]. It has been suggested that the close evolutionary relationship between humans and dogs has led to the development of this ability, however very few other species have been studied [3]. We tested the ability of 24 domestic horses to discriminate between an attentive and inattentive person when choosing whom to approach for food. While the attentive person faced forwards, the inattentive person either stood with their body turned 180° away from the subject (body orientation condition), stood with their body facing forwards but their head facing away (head orientation condition) or stood facing forwards but with their eyes closed (eyes closed condition). A fourth, mixed condition was included where the attentive person stood with their body facing away from the subjects but their head turned towards the subject while the inattentive person stood with their body facing the subject but their head turned away. Horses chose the attentive person significantly more often using the body cue ($n = 24$, $k = 19$, $p = 0.003$), the head cue ($n = 24$, $k = 18$, $p = 0.011$), and the eye cue ($n = 24$, $k = 19$, $p = 0.003$) but not the mixed cue ($n = 24$, $k = 13$, $p = 0.42$). In an additional pilot study, horses were tested in an object choice task. A human experimenter cued one of two buckets by either tapping the bucket (tap condition), orienting their body towards the bucket and pointing (body and point condition), pointing while facing forwards (point condition) or orienting their body towards the bucket (body condition). If the subjects chose the correct bucket they were rewarded. Subjects were able to use the tap cue ($n = 31$, $k = 21$, $p = 0.035$), body + point cue ($n= 31$, $k = 21$, $p = 0.035$) and the point cue ($n = 30$, $k = 21$, $p = 0.021$) but not the body cue ($n = 31$, $k = 11$, $p = 0.076$). These results taken together suggest that domestic horses are also very sensitive to human attentional cues, including gaze.

Keywords:
social cognition, animal-human interaction, horses, attention attribution, domestication

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Poster

Are horses (*Equus caballus*) sensitive to human attentional states?

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The ability to reliably detect what others are attending to seems important for social species to interact with their partners. Domestic horses (*Equus caballus*) have lived with humans for over five thousand years, hence they might have developed sensitivity to human attention. In the present study, we investigated whether horses would discriminate the situation in which a human experimenter could see them from the situation in which she could not. Specifically, we tested whether horses understand the role of eyes in human attentional states, produce more visual gestures when the experimenter can see their begging behaviors and produce more auditory or tactile gestures when she can not. We used with a slight modification the paradigm that previously yielded support for chimpanzee understanding of human attention (Hostetter et al. 2007). Twelve horses were offered food by the experimenter who showed various attentional states in front of them. We scored frequency of begging behaviors by the horses. In experiment 1, we set three kinds of condition: hand over the eyes, hand over the mouth and away. In the last condition there was only a food in front of horses, which was a control condition. The results showed that horses produced more auditory or tactile begging behaviors when the experimenter's eyes were not visible than when her eyes were visible, but there was no difference in visual begging behaviors. In experiment 2, we set two kinds of condition: eyes closed and eyes open. The horses also produced more auditory or tactile begging behaviors when the experimenter's eyes were closed than when they were open. However, there was no difference in visual begging behaviors. These results show that horses discriminate the situation in which humans can see from that in which humans can not. Of special interest, horses increased only auditory or tactile behaviors, not all types of communicative behaviors, when the experimenter could not see their begging behaviors. This result suggests that horses are sensitive to human attentional states. Moreover, horses may do recognize the eyes as an important indicator of whether or not humans will respond to their behavior and they may be able to behave flexibly depending upon human attentional states.

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Poster

Effect of an omeprazole (GastroGard™) treatment on cribbiting in horses suffering from gastric ulceration

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Cribbiting is a common stereotypy in domestic horses and is associated with stress and low fibre/high concentrate diets, which are known to cause gastric inflammation and ulceration. Recent studies indicate that antacid supplements can reduce both gastric inflammation and cribbiting. However, stereotypies are also associated with altered brain functions and these are thought to be responsible for emancipation. Emancipation refers to a process by which stereotypies become increasingly independent of the causal factors and may therefore persist with age, regardless of the conditions. Emancipation complicates therapy and points to the importance of prevention.

To further examine the relationship between gastric health and cribbiting and its relation to age at onset, we examined the effect of the proton-pump inhibitor omeprazole (GastroGard™, Merial) on gastric inflammation/ulceration and on cribbiting in a double-blind placebo-controlled study. Thirty-one horses of different sex, breed and age were randomly allocated to treatment and placebo and divided into three groups depending on age: 0-5 years (n=11), 5-10 years (n=11) and >10 years (n=9), whereby age at onset of cribbiting was d“ 5 years for all horses. Treatment and placebo were administered orally by syringe once every day for 28 days by the horse owners. Treatment consisted of 4mg/kg omeprazole for the first four days and 1mg/kg for the following 24days.

Using scan sampling and behaviour sampling, general activity and the number of crib-bites were assessed in the home pens one day before and one day between day 21 and 28 of treatment. Observations were made for three hours each around morning and evening feeding times, respectively. Prior to pre-treatment observations and after post-treatment observations, the horses were transported to the clinic and endoscoped for signs of inflammation and ulceration in the oesophagus, the squamous area, the glandular area and the first part of the duodenum using a common scoring system (Andrews et al. 1999).

All 31 horses showed signs of gastric inflammation/ulceration which decreased significantly from a median score of 1,2 to 0,6 in the treatment group (Wilcoxon signed rank test, z=-3,186, p=0,001), while there was no change in the placebo group (z=-0,577, p=1.0). However, there was no significant difference in cribbiting before and after treatment, neither in the treatment group (z=-1,834, p=0,068), nor in the placebo group (z=-0,415, p=0,734). Moreover, there were no significant effects of age on gastric inflammation/ulceration (2-way ANOVA, F=1,112, p=0,345) or cribbiting (F=1,113, p=0,344).

These results contrast with the recent studies on the effects of antacids on gastric health and cribbiting. There are two possible explanations for this: First, cribbiting may become rapidly established and may thus have persisted even in the youngest age group. Second, omeprazole acts specifically by reducing gastric acid secretion into stomach, while antacids may also have an effect on the intestine. However, these results shed doubts on the hypothesis that cribbiting is caused by gastric inflammation/ulceration.

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Poster

Effect of training method on response of horses to a human approach test

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The human-horse relationship forms an essential component in the diversity of todays use of horses. The reactions of horses to interactions with humans are mostly the result of interplay between their own temperament; the temperament and skills of the human and their previous experience - with humans. Moreover, the understanding of the human-horse relationship may improve the welfare of horses and humans. Nowadays, 'sympathetic' training methods are gaining tremendous attention of horse owners. In the 'sympathetic' training method the focus lies on the use of body language in human-horse communication, as well as respecting the horses natural needs. With 28 horses the effect of a 'sympathetic' training method versus a conventional training method on the horse's response on a human-approach test was studied. Fourteen horses of 3.5 years of age were subjected to a five week training period with a conventional training method, the other fourteen horses were subjected to a 'sympathetic' training method. The overall frequency of snorting during the human approach tests decreased on average from 4.4 (± 1.1) before the training period to 3.1 (± 0.9) after the training period (both groups). However, there was a significant (p=0.006) difference between training methods: the horses trained in the 'sympathetic' method decreased snorting by 4.3 (±1.1) while the horses trained in the conventional method increased with 1.5 (±0.9). While horses trained in the conventional method whinnied less in the second human approach test, horses trained in the 'sympathetic' method whinnied more after the period of training. This difference was found to be significant (p=0.006). Defecating decreased over time, but was not different between training methods. The frequency of touching the unfamiliar handler increased over time for both training methods. The horses trained in a conventional method increased from 1.5 to 2.5 and for the sympathetic trained horses from 1.9 to 3.7. This increase was not significantly different for the training methods. Heart rate showed a minor decrease between the human approach tests (before training period 85.3 bpm, after training period 74.3 bpm) but there were no significant differences between training methods. Similarly, there was a slight increase in heart rate variability (rmssd: from 37.0 to 45.2), but no significant differences between training methods. Overal it was concluded that horses trained with this 'sympathetic' method tended to be more trustful and less stressful in the presence of an (unfamiliar) human compared to horses trained with a conventional method. This may have been due to reduced stress during horse-human contact in the 'sympathetic' training method used. The long term effects on the welfare of the horses, still needs to be investigated.

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Poster

Investigation on standing stalls for horses with regard to animal welfare

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1 Introduction

For centuries, roped husbandry has been the traditional system for keeping horses. Today, this system is still used in practice more or less frequently in various regions. Compared to former times, however, types of horses and their use have undergone some changes over the last centuries. While in earlier days, mainly cold bloods were kept and used for work several hours a day, today's horses are kept for sports and leisure and spend most of their time in the stable. For this reason, mostly warm bloods and thorough breds are used nowadays. Taking today's changed conditions into consideration, the question arises whether this method of equine husbandry may still be applied with a view to animal welfare.

2 Material, Methods and Animals

2.1 Farms and Horses

The study comprised 13 farms on which either all or some of the horses were constantly kept in standing stalls. In total, 65 horses were included in the study. Three farms where horses were kept under near-natural conditions served as a control group. All 52 horses had 24-hour access to the pasture allowing social interaction. All farms were operating businesses and participated in the present study on a voluntary basis.

2.2 Husbandry Data

Husbandry data were collected by means of checklists, partly by interviews and partly by own investigations. Measurements were recorded with regard to stalls (width, length and partitions), tieing systems (material, length, height of tieing device, risk of injury), as well as feeding and watering devices. Information provided with regard to movement was repeatedly checked on each farm. It was further recorded in which way and how frequently horses were used and which opportunities they had to move freely.

2.3 Injuries and Damages

The following criteria were applied to verify health conditions: Feeding status (coat, injuries), appearance of coat, extremities and hoofs, as well as diseases.

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2.4 Observing Behaviour
Behaviour was observed in three horses each per farm, both in standing stalls and in the control group. The animals were selected on a random basis. On two farms, only two horses were housed in standing stalls, so that the study comprised a total of 37 horses in standing stalls and nine control group horses.

Each horse was visually observed for a period of six hours, i.e. three hours in the morning and three hours in the afternoon. In this manner, an overview over usual daily activities in equine husbandry was to be obtained: Feeding, rest times and riding practice. Based on these criteria, the observation period was standardised for all farms as far as possible. The control groups were observed two weeks after they had been out on the pasture for the first time, and the horses were observed at the same times of the day as the stabled horses.

The following behavioural patterns (duration, frequency) were recorded:
1. Social behaviour:
   - Positive interaction (social contact with ears pointing forward towards the neighbouring horse)
   - Negative interaction (threatening swinging, biting threats, rear leg kicking threats, biting, rear leg kicking towards the neighbouring horse)
   - Social play behaviour
2. Resting behaviour: Dozing while standing, resting in sternal or lateral recumbence position
3. Comfort behaviour: Rolling (rolling over the back on both sides; rolling on one side, complete, incomplete, rolling intention = incomplete rolling process < 15 seconds)
4. Investigation behaviour: Turning the head towards the centre of attraction
5. Locomotion behaviour: Walk, trot, gallop in the control groups. Since locomotion is impossible in the standing stalls, the respective data were ascertained by means of checklists (2.2).

In addition, behavioural disorders were recorded which were caused by inadequate management and inappropriate handling of the animals (Zeitler-Feicht, 2004).

3 Analysis
3.1 Standard Values

Assessment of the recorded data has been carried out in accordance with the "Guidelines for Equine Husbandry with a View to Animal Welfare", issued by the Ministry for Food, Agriculture and Consumer Protection (BMELV 1995). These guidelines contain the recommended minimum requirements for equine husbandry in Germany. According to these guidelines, the following measurements have to be complied with:

Length of standing stall: ³ 2 x height of withers
Width of standing stall: ³ Height of withers + 20 cm

No data are given by the BMELV as to the fixing devices. After having checked the tieing systems for 65 horses, the following requirements were established with regard to the free space required below and above the tieing system:

Free space below: Tieing length: tieing height ³ 1.2
Free space above: Tieing height + tieing length/height of withers ³ 1.1

3.2 Statistical Analysis

Frequencies and durations in the form of medium values, standard errors, minimum and maximum values were ascertained. In order to verify significant differences, the Wilcoxon Test or Fisher's Exact Test were applied, according to the respective features.

4 Results

4.1 Husbandry Data

Out of 65 animals, 20 (31%) were thorough breds and 12 (18%) were warm bloods. 28 horses (43%) were cold bloods and 5 (8%) were ponies. None of the 65 horses was used in forestry or agriculture. The major part of the horses was used for riding purposes or as draught animals (58%). The share of breeding animals was surprisingly high with a percentage of 39%. Most of the 65 horses (71%) were between 5 and 20 years old. 13 horses (20%) were younger than 5 years, out of which five animals were younger than three years.

68% of the 65 standing stalls did not comply with the requirements of the BMLEV (1995) with regard to sufficient standing stall width, and one third did not have the required stall length (table 1). Similar conditions were found with regard to the tieing systems. In almost 30% of the tieing systems, the free space available above and/or below the tieing device was too restricted.

Table 1: Standing stall width and length per horse (n = 65) with deviation from medium value (mean) in percentage, standard error (s.e.), minimum and maximum value (%)

Standing stall width	n	%	mean (%)	s.e. (%)	min (%)	max (%)
Requirements fulfilled	21	32	+ 10	0.89	+ 1	+ 29
Requirements not fulfilled	44	68	- 16	1.21	- 1	- 29
Standing stall length						
Requirements fulfilled	40	62	+ 9	0.66	+ 1	+ 22
Requirements not fulfilled	25	38	- 16	1.07	- 1	- 34

4.2 Injuries and Damages
No injuries or damages were ascertained which could be linked to the continuous housing in standing stalls. However, the horses were exclusively tied with chains or ropes which is not in line with the minimum requirements established by the Veterinary Association for Animal Welfare (Zeitler-Feicht and Grauvogl, 1992).

4.3 Observing Behaviour
The number of positive interactions was significantly higher in horses of the control group accounting for an average of 27 times within six hours as compared to the horses in the standing stalls (table 2). Negative interactions were observed less frequently both in the control group and in the horses housed in standing stalls. They were significantly higher in the control group accounting for about six times within six hours as compared to the horses in standing stalls (1.3 times). Social play behaviour was registered much more frequently both in terms of duration and frequency in the control group as compared to the horses housed in standing stalls. As a result, it may be stated that the investigated social interactions proved to occur less frequently in horses housed in standing stalls than in horses kept under near-natural conditions. In comparison, horses in standing stalls showed significantly more and longer investigation behaviour than the horses of the control group (table 2).

Table 2: Time (min) and frequency (n) of social interactions (IA), social play and investigation behaviour of horses in standing stalls and on pasture

Farm	**Standing Stalls**		**Pasture**		**Test*)**
Activity	mean	s.e	mean	s.e	p <
positive IA (n)	4,03	1,55	27,00	9,56	0,01 (F)
negative IA (n)	1,27	0,28	5,89	1,59	0,15 (F)
social play (min)	2,65	1,45	4,56	2,75	0,06 (F)
social play (n)	0,27	0,13	0,78	0,36	0,06 (F)
investigation (min)	14,35	4,63	3,11	0,63	0,13 W)
investigation (n)	22,95	4,37	4,10	0,56	0,01 (W)

*) F = Fisher`s Exact Test; W = Wilcoxon Two-Sample Test

In the standing stalls, not a single complete rolling over the back and not a single complete rolling on one side could be observed (table 3). The horses only showed incomplete rolling on one side and rolling intentions. However, this kind of rolling was not observed in the control group. The horses of the control group only showed complete rolling over the back.

Table 3: Frequency of different rolling methods in standing stalls and on pasture

Farm	**Standing Stalls**		**Pasture**		**Test** (Fisher's Exact)
Rolling method	mean	s.e	mean	s.e	p <
- complete	0	0	0,78	0,22	0,01
- one side complete	0	0	0	0	-
- one side incomplete	0,16	0,06	0	0	n.s.
Intention	0.24	0,07	0	0	0,17

In both groups, the horses spent most of their time eating and resting (fig. 1). The respective share for the period of observation was 82% (standing stalls) and 71% (pasture). The decisive difference between the groups was locomotion. While the horses on the pasture walked slowly forward while grazing (29% of the observation period) and in addition, showed locomotion in the form of walk, trot and gallop during 14% of the observation period, the horses in the standing stalls were not able to move freely. For these horses, this investigation criterion was assessed by means of the collected husbandry data. According to these data, 89% of the horses had no daily exercise in the form of free movement and 77% were not be ridden or used for the carriage (table 4). The overall analysis showed that almost 70% of the horses had no daily exercise.

Fig.1. Distribution of activities (percent) of horses in standing stalls and on pasture during observation

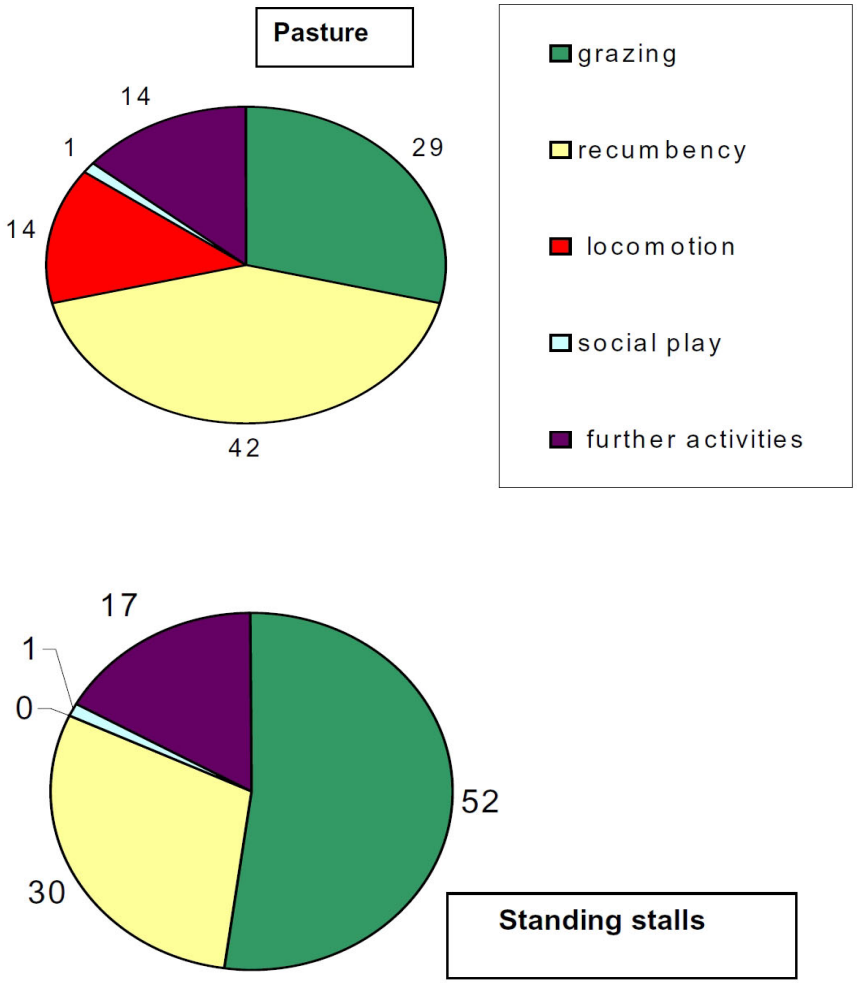

Table 4: Possibilities for movement of the 65 horses in standing stalls (free run and use)

Free run (horses)	Daily	Not daily	Total
n	7	58	65
%	11	89	100
Use (horses)			
n	15	50	65
%	23	77	100
Free run and use (horses)			
n	20	45	65
%	31	69	100

4.4 Behavioural Disorders

51% (19 out of 37) of the investigated horses in standing stalls showed at least one behavioural disorder, but no such disorder was observed in the nine horses kept under near-natural conditions. The observed disorders were crib biting (seven times), crib whetting (once), stereotype licking (three times), weaving (ten times) and other variants of behavioural disorders, such as: Lip sucking (once), stereotype seesawing (two times), standing in the corner (once), hyper nervousness (three times), apathy (once) and extreme aggression (four times). Approximately half of the horses showed more than one behavioural disorder. One horse even showed five different stereotypies (table 5).

Table 5: Number of behavioural disorders per horse (n = 19)

Behavioural disorder	One	Two	Three	Four	Five
Number (horses)	10	6	2	0	1

5. Discussion

The general trend to nowadays keep horses mainly for sports and leisure purposes and the tendency to keep highly bred animals was confirmed by the present study for those horses housed in standing stalls. None of the horses was used in forestry or agriculture. Rather, the horses were kept for sports and breeding purposes which both require daily exercise outside the stable (BMLEV 1995). In addition, half of the horses were warm bloods or thorough breds which compared to cold bloods need a lot of exercise. According to Zeitler-Feicht and Grauvogl (1992), keeping highly bred horses in standing stalls is not in line with animal welfare requirements as these horses need a lot of exercise. Most of the horses kept in standing stalls (70%) did not have the opportunity for daily activities. Keeping foals and young horses in standing stalls is also considered to be against animal welfare requirements (BMELV 1995). 8% of the horses housed in standing stalls were three years and younger. Consequently, more than one third of the investigated horsesshould not have been continuously roped because of their high breed or their age.

Being roped in standing stalls essentially restricts the recumbence and resting behaviour of the horses. 68% of the standing stalls were too narrow for the horses kept therein. They were not able to lie in the typical side position with stretched legs, but had to rest in a kind of squatted position. In cases where standing stalls were too short in length, the resting behaviour was impaired even more. These horses rested far less frequently in a lying position and in addition, showed significantly more behavioural disorders. The minimum requirements issued by the BMELV (1995) for the standing stall length proved to be insufficient as they do neither take into account the roping length nor potential obstacles such as steps or supporting pillars which prevent the horse from stepping backwards.

Inappropriate tieing devices further inhibited the lying and resting behaviour, as well as social contacts and investigation and comfort behaviour. Almost 30% of the horses were affected by the above mentioned criteria.

Social contacts were essentially restricted if high wooden or breast-high partitions with additional railings were used to separate the horses. It was observed that increased isolation resulted in a higher number and degree of negative interactions. Inadequate social contacts are considered to be the predisposing factor for behavioural disorders in horses (Sambraus and Rappold 1992, McGreevy et al. 1995, Zeitler-Feicht 2004). All horses in this study which showed an extremely aggressive behaviour were kept under relatively isolated conditions.

Standing stalls also lead to fundamental restrictions in comfort behaviour. Species-typical rolling as shown by horses under appropriate husbandry conditions cannot be carried out by horses in roped husbandry. The investigation gave rise to the impression that the animals had learned to assess the limitations of the environment they were kept in. In order not to bump into anything, they seemed to have restricted their movements in the standings stalls accordingly. The absence of integument damages or other injuries might be a result of this behaviour.

Furthermore, the investigation behaviour which was frequently observed in the horses is another indication that their well-being was impaired. The difference with regard to the control group may be explained by the restricted range of vision in the standing stall. In comparison, horses on the pasture

have an almost complete panorama vision which does not require frequent turning of the head for investigation purposes. In terms of evolution, horses are flight animals and have to have sight, smell and hearing contact to their conspecifics and their environment in order to feel safe and well. Husbandry systems which do not allow for appropriate investigation leave the animals in a constant state of anxiety in which they are not in a position to psychologically and physically regenerate. Such husbandry systems encourage the occurrence of behavioural disorders (McGreevy et al. 1995, Zeitler-Feicht 2004).

The share of known behavioural disorders such as crib biting and weaving was over proportionally high in horses kept under continuous roped husbandry with 32% compared to the values mentioned in literature with a share of 0.7-14% (Bachmann and Stauffacher 2002, Zeitler-Feicht et al. 2002). Moreover, further behavioural disorders could be observed of which some are not described in the respective literature. Apart from crib whetting, stereotype licking, hyper nervousness, apathy and extreme aggression, these include lip sucking, seesawing and standing in the corner over a longer period of time and in a stereotypic manner. According to Lorz and Metzger (1999), behavioural disorders are an expression of a psychological “damage”. This means that husbandry systems in which behavioural disorders are observed more frequently, are not sufficiently humane and violate animal welfare guidelines. The high percentage of behavioural disorders accounting for 51% leads to the conclusion that continuous roped husbandry of horses in standing stalls as practised today does no longer fulfil equine husbandry requirements.

Summarising the present study, it may be stated that keeping saddle and sports horses in standing stalls as practised in Germany today, do not take animal’s needs into account. The investigation resulted in a ban of continuous roped husbandry of horses in most of the German states. Neighbouring countries such as Austria and Switzerland incorporated a ban of continuous roped husbandry of horses in their Animal Protection Act (2006) and their Animal Protection Regulation (2008). It is hoped that further countries will follow this example.

6. Summary

The aim of the present study was to test the housing conditions of 65 horses in standing stalls on 13 farms with a view to animal welfare. In addition, behavioural observations were made on 39 horses. 52 horses stabled on 3 farms and housed under natural conditions served as a basis for sampling.

The horses included in the study were saddle and breeding horses. The results of the stabling conditions showed that most of the standing stalls fell short of minimum requirements. 68% of the standing stalls were too narrow, 38% were not long enough and 28% of the tieing systems were too short. Important behaviour patterns such as social interaction, recumbence resting, grooming and investigation behaviour are impaired, and particularly movement was extremely reduced in the standing stalls. 70% of the horses had no regular daily exercise. The major part of the horses (51%) showed stereotypies.Half of these horses showed more than one stereotypy. The conclusion of the present study is that under present conditions in Germany, standing stalls for horses do not take animal’s needs into account.

The research resulted in a ban of continuous roped husbandry of horses in most of the German states. Neighbouring countries such as Austria and Switzerland incorporated a ban of continuous roped husbandry of horses in their Animal Protection Act (2006) and their Animal Protection Regulation (2008). It is hoped that further countries will follow this example.

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