Is it possible to measure the welfare of the ridden horse?

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Sammanfattning

Människan har ända sedan hästen domesticerades tränat hästen i syfte att utföra hennes tjänster. Olika metoder att träna hästen har utvecklats genom tiderna, vissa metoder med hänsyn till hästens välbefinnande, andra inte. Dagens träning baseras till stor del på att få hästen att utföra ett önskat beteende genom dominans och underkastelse. Trots att träningstekniker baserade på samspel har ökat i popularitet, tillämpas sällan de teorier som finns om hästens inlärning i den dagliga träningen, eller så bortser man från hästens inlärningskapacitet och deras arts specifika beteende. Av den anledningen kan därmed hästens välfärd äventyras.

Syftet med denna litteraturstudie var att gå igenom metoder som tillåter att objektivt kunna mäta hästens välfärd under träning. Litteraturstudien ger först en kort inblick i hantering och träning av hästen genom tiderna. Därefter diskuteras hästens inlärningsförmåga som anses vara viktig för en effektiv träning. Arbetet ger också en beskrivning av några utvalda träningsmetoder som används idag, baserade på negativ och positiv förstärkning, samt diskuterar olika parametrar som skulle kunna användas för att mäta välfärd under träning av den ridna hästen. Arbetet avslutas med att sammanfatta förslag till fortsatta studier inom ämnet.

Abstract

Since the time of domestication, humans have trained horses for the purpose of serving man. Different training methods have been developed throughout the centuries; some were developed with consideration for the horse's welfare, while others disregarded welfare to a great extent. Most present day training is based upon making the horse perform a desired behaviour through dominance and subordination. Although cooperative training techniques have gained popularity, everyday training lacks the application of learning theory or neglects the horse's learning capacities and their species' specific behaviour. Thus, the horse's welfare may be jeopardised.

The aim with this review is to consider methods that allow an objective assessment of the welfare of horses undergoing training. The review gives a brief insight into the history of horse training and handling. It proceeds with an overview of the horse's learning abilities which is argued to be of paramount importance for effective training. The review then describes a few selected training techniques that are used today, based on negative and positive reinforcement, and discusses parameters from which it could be possible to assess the welfare of the ridden horse. The work concludes with suggestion for future research.

Introduction

The relationship between horses and humans covers a long era of time, from the early days when horses were used as a food resource for consumption and survival, through the times when the horse served in military, transport and agricultural needs, until today where horses play a key role in leisure and sport. As the professional and recreational interaction with horses has grown, so have the concerns of the horses' welfare during training. In response, this has encouraged many horse enthusiasts and professional horse trainers to question and revise existing training methods. Many popular articles and books have been published promoting different ways of communicating with the horse.

However, compared to the amount of popular literature available, horse training has rarely been in the focus of scientific evaluation. This is surprising since it would allow for objective investigation into the efficiency of specific training techniques and their impacts on the horses' welfare. It was only recently that a new scientific discipline has emerged, called 'equitation science'. Equitation science addresses and combines topics such as ethology, physiology and learning in order to assess the welfare of the horse undergoing training and to expand the understanding of the dyadic relationship between horse and rider (McGreevy, 2006). A group of equine scientists and veterinarians shared the idea that many problems involving the ridden horses were difficult to address due to current lack of science in equitation.

Waran et al. (2002) claim that any effective horse training should be based on clear and consistent signals from the trainer as well as a proper understanding of the horse's behaviour and learning capacities. This is argued to be fundamental in terms of reducing the horses' confusion and the development of conflict behaviours. However, if training goes wrong, the welfare of the horse may be jeopardised and the question arises of how one can reliably measure the welfare of the horse. Up to now, arguments concerning the horses's welfare largely rely upon subjective judgements. Would it be possible to find tools to objectively measure the welfare of the horse to avoid anthropomorphism and misinterpretation?

Horse training and handling throughout history

The first signs of horse human relationship were 15 000 year old cave paintings in France and Spain (Clutton-Brock, 1992). Domestication of the horse took place around 6000 years ago. The horse was first used as a draught animal and equipment from handling draught cattle was used to control the horse. Bits were introduced 3600 years ago and horseback riding is said to be ubiquitous 3000 years ago. Until the early middle-ages, horseback riding was performed with only a bridle and a bit. In Egypt and Scythia (Asia) in the 400 BC, the bits were reinforced with spikes on each side of the horses' lips to compress the lips from the outside (Anderson, 1961). The stirrups and girth were developed to steady the rider during warfare, and probably stirrups were introduced in Europe 1200 years ago (Clutton-Brock, 1992).

Starting in the 16th century in the kingdom of Naples, equitation developed to become an art (Ödberg & Bouissou, 1999). When realising the importance of suppleness in horses during war, the seat was improved to give subtle and correct signals, instead of using harsh equipment. During the 18th century this philosophy reached its peak by the Great Stables of Versailles in France. The French approach was that the horses' performance should be obtained in a slow developmental process without any violence or physical force.

Today, the emphasis in European training mainly relies upon negative reinforcement, and that every movement of the horse is under the trainers/riders control (Waran & Casey, 2005). A more comprehensive approach that allows trainers to interact with the horse with respect for the individual by acknowledging equine behaviour, is taking shares in trainers programs. The concern of the horses' welfare has reached international attention. The Fédération Equestrian Internationale (2006), the international governing body of equestrian sports requires in their 'rules of dressage' that the horses' welfare shall be paramount and "must never be subordinated to competitive or commercial influences".

Horse learning

Principles of learning can be applied to all species, including horses (McCall, 1989). Learning "allows animals to use information about the world to tailor their responses to environmental changes" (McGreevy, 2006, p. 2). The learning mechanisms most relevant to training horses are habituation, classical and operant conditioning.

Habituation is the simplest form of learning where the animal is gradually getting used to certain stimuli. It is applied in initial training when the horse needs to adapt to e.g. riding equipment such as the girth or the bridle (McLean, 2004). Associative learning consists of classical and operant conditioning whereby operant conditioning is predominant when training horses (McGreevy, 2006).

Operant conditioning is divided into negative and positive reinforcement. Negative reinforcement is what horse training focuses on today, where the correct behaviour is rewarded by removal of pressure applied through reins or legs. Positive reinforcement involves the addition of something such as food which is used in clicker training. Here, the horse has learned to associate the clicker sound with the presentation of a food reward. The seat, voice and weight signals are most often classically conditioned (McLean, 2003). A previously meaningless stimulus, e.g. voice command for 'stop' given just before the rein signals, becomes associated to an established behaviour.

Training techniques

According to McGreevy (2004, p. 95), "the aim of training is to install signals (cues) that result in predictable behaviour patterns". Two main approaches to training can be seen: One which is based on the human being the leader while the horse has to show submission and obedience. Then there is a more cooperative approach aiming for a mutual rewarding relationship (Jonge & Bos, 2005). Waran et al. (2002) have listed some of the techniques that are currently popular among many horse owners.

Imprint training

Training horses from an early age is known as 'imprint training' (Lansade et al., 2004). It is argued to give permanent effects that would be beneficial for the manageability of the horse later in life. Miller (2001) advocates habituating the newborn foal to the human presence by a specific program, which will produce a desensitized and respectful grown-up horse. The associations the foal is experiencing when so young are irreversible, and the animal will always consider the stimuli as normal (Waran et al., 2002).

Several investigations of imprint training have been made (Heird et al., 1985; Simpson, 2002; Williams et al., 2002; Spier et al., 2004; Lansade et al., 2004; Henry et al., 2005; Henry et al., 2006), with contradicting results.

Heird et al. (1985) concluded that handling horses at an early age increases learning performance and reduces emotionality. This is supported in a study done by Simpson (2002), where she found that neonatal handled foals are more tractable and less reactive than the control group. Early handled foals in a study by Spier et al. (2004) showed less resistance at three months of age to touching the limbs and picking up the feet than did foals that were not handled. After three months of not having been touched by humans, the early handled foals in general seemed to be more easily handled than the control group.

However, Williams et al. (2002) investigated whether early handled foals showed different heart rates or performed differently when exposed to a stimulus, such as rub the entire foal with hands, pick up the foal's feet or rub the inside and outside of the foal's ears, than non-handled foals. They concluded that there was no such correlation and therefore stated that early handling did not have a significant effect. This is supported by an investigation done by Lansade et al. (2004), where short-term as well as long-term effects of neonatal human contact were explored. Early handling was effective on a temporary basis but it did not improve learning abilities at 14 months of age.

Henry et al. (2006) concluded that forced handling, by bringing foals to the mother's teat, had a clear negative effect on the foal-human relationship. The good relationship between mare and human though, was concluded to be important for establishing a positive foal-human relationship, lasting at least up to the age of one year (Henry et al., 2005).

The approach and retreat method

Based on negative reinforcement where an unpleasant stimulus is applied, the approach and retreat technique is performed in a rectangular pen with a loose rope around the horses' neck (Blackshaw et al., 1983). When the horse is moving away from the trainer the rope is tightened. If the horse comes nearer, the rope slackens. The horse sees the advantage of being closer to the trainer and will gradually habituate to being groomed and handled.

Round pen technique

The round pen technique, also referred to 'join up', is popular among so called 'horse whisperers' (Waran et al., 2002). It is based upon the idea that the horse should regard the trainer as the leader. The trainer chases the horse away and appears like a 'threat', thus an unpleasant stimulus. When the trainer stops, the 'threat' disappears, and the horse will have the option to flee or to follow. This procedure continues until the horse follows and shows adequate signs of submission, and accepts the trainer as a leader.

The round pen technique was studied by Kreuger (2007). One of the purposes was to investigate whether the follow behaviour of the horse varied between different surroundings during repeated interactions. The result showed that the follow behaviour was a learned behaviour, supported by the fact that the horses responded faster to the trainer's invitation every time it was exposed to the round pen. The horses did not follow the trainer when the horse had a chance to escape, like on pasture. When the technique was performed in a closed paddock, the horses did to a large extent follow the trainer. Evidently, the result suggests that the learned follow behaviour was bound to the surroundings of the enclosure.

Positive reinforcement

Positive reinforcement benefits the relationship between the horse and its owner (Waran et al., 2002). The rewards are either food or meeting with the horse's conspecifics. Neither of those is easy to apply in practice. Additively, for the method to be worth using and for the horse to understand why it is rewarded, the positive reinforcement must happen immediately. When training the horse it is suggested to use a secondary reinforcer, associated to a primary one, for the training session to be more efficient.

Conditioned positive reinforcement is a technique where the animal associates the condition with the delivery of a food reward (Waran et al., 2002). The horse has been taught that a specific condition, often a clicker sound or a voice command, is connected to food. Therefore

the horse will experience the sound as a reward. A primary reinforcer needs to be given immediately after the clicker sound. It is an enormous value to be able to reward behaviours that otherwise are hard to reward, and also rewarding training from a distance (McGreevy, 2004).

McCall & Burgin (2002) evaluated the effectiveness of using a secondary reinforcer in horse training. The primary reinforcer was 60 g of the horses' normal feed. A buzzer was the secondary. Their conclusion was that secondary reinforcers are practical when training horses to learn new tasks, though it should be repeated with primary reinforcers for the effectiveness to be maintained.

Williams et al. (2004) investigated the difference between using a primary reinforcer alone and using a secondary reinforcer followed by a primary reinforcer. Alfalfa cubes were used as a primary reinforcer and a clicker sound as the secondary. They could agree upon the conclusions drawn by McCall & Burgin (2002) that secondary reinforcers during training of horses can be considered as useful. They could also state that a more effective training and a better performance could be achieved when practising with a secondary reinforcer, as the trainer experience this technique to be easier to understand.

Innes & McBride (2007) investigated whether rescued horses would respond differently to negative versus positive reinforcement training strategy programmes. They could see a significant difference where horses were more motivated and less fearful using the positive reinforcement schedule.

Assessing welfare

It is important to consider the horses' natural behaviour, physiological factors as well as its learning abilities in order to assess welfare during training (McGreevy, 2006). According to that, we need to study feral horses to get insights into horses' behaviour under natural conditions (Boyd & Keiper, 2005), and to investigate the horse's learning processes and motivational forces (Waran et al., 2002). Good welfare today is proclaimed to consist of five freedoms, declared by the Farm Animal Welfare Council, an independent advisory body of Great Britain Government (http://www.fawc.org.uk/freedoms.htm). According to this, good welfare is freedom from hunger and thirst, freedom from discomfort, freedom from pain, injury or disease, freedom to express normal behaviour, freedom from fear and distress. Some of the paragraphs below cover some of the defined welfare freedoms.

Behavioural parameters

Behaviour is the result of the interaction between the environment and genetics and comprises all activities that species engage in (Claesson Lundin, 2006), for instance play, investigative behaviour, flight or fight, instinctive and learned behaviour. The horse's behaviour has evolved in response to the challenges they faced when forming herds and finding shelter and food (Cooper & Albentosa, 2005). Even today, when former threats no longer exist for captive horses, the psychological needs to respond to these threats may persist. This might lead to behavioural responses quite difficult to explain.

According to McLean (2004), problem behaviour such as bucking, rearing or shying, arises either due to the trainers' lack in learning theory, or due to poor riding technique, e.g. unbalanced seat. Instead of actually solving the problem by analysing the causes and

readjusting the training, trainers often advocate to increase pressure, to use whips, spurs or stronger bits.

The most common and natural reaction to any painful or dangerous situation for the horse is to flee (Waran et al., 2002). In terms of taming the horse and increasing safety, humans have always tried to eliminate behaviours considered as a problem.

According to McGreevy (2004) the following behaviours are considered as problem behaviours:

- Inappropriate obstacle avoidance due to innate self-preservation responses, e.g. refusal of water jumps or fences.
- Fear reactions due to innate self-preservation responses, e.g. flight responses, shying (leaping laterally away from visual or olfactory stimuli), bolting (galloping away with no response to rein pressure), jogging (unresponsive to signal to walk) or pulling (undesirable speed).
- Conflict responses due to discomfort or threat, e.g. rearing, bucking, baulking or bolting home.

Learned helplessness is a state that occurs when a horse seems tolerant to a rider's pressure even if it finds the pressure highly aversive (McLean, 2004). This behaviour evolves when horses learn that escaping from pain or discomfort or threat is pointless. It could result in e.g. hard mouth (habituation to rein pressure), unresponsiveness to leg and low motivation to work (resistance to signals from rider) (McGreevy, 2004).

Physiological parameters

Heart rate variability can be used as a measurement of the physiological factor stress (Rietmann et al., 2004). Stress has many definitions, and can be generated by external factors like cold, physical injury etc. or internal factors such as pain or psychological pressure (Sjaastad et al., 2003). The body's reaction to stress results in activation of the sympathetic nervous system which leads to increased heart rate and increased levels of cortisol. By identifying stress, thus avoiding and reducing it during training, the welfare of the horse can be improved (McLean, 2004).

In a study done by Lanneborn (2003), the heart rate of both rider and horse were measured to see whether a correlation could be found between them. Part one aimed to calculate the standard deviation and the mean heart rate from each riding session. Part two aimed to see whether one rider had a similar influence on different horses, and whether one horse influenced different riders. The conclusion from this investigation was that different riders and horses probably are influencing each other. There were also individual differences where some were influenced more than others.

Nervous (stressed) horse handlers can probably transfer nervousness to horses, according to a study done by Jonare (2003). Horses can apprehend the mood through the changed behaviour and motion pattern that is often connected to a nervous state, e.g. increased heart rate. The changed behaviour or motion pattern are very subtle signals difficult to observe by another person. The study included both in-hand handling by leading the horse and under saddle training.

Head and neck position

A common opinion is that the horses' head and neck position influences its movements. Rhodin (2003) investigated whether the horses' head and neck position had influence on the horses back. The conclusion was that the head and neck position did have an effect on the horse's back, especially in walk. The flexion-extension in the back of horses is lower in trot than in walk, due to the natural head movement of the horse in different gaits. In walk the head and neck moves to a greater extent, which means that inhibiting the free movement of the head with e.g. reins, also inhibits the back movement.

"Rollkur", a hyperflexion training method used among a number of riders, has been discussed and evaluated by van Breda (2006). van Breda (2006) compared stress levels between seven warmblood recreational trained horses and five warmblood elite trained dressage horses, by measuring heart rate activity during rest and training. The dressage horses were trained by using the Rollkur method. During training the heart rate activity was lower for the Rollkur trained horses than for the recreational trained horses. The study could conclude that Rollkur trained horses do not suffer more from stress than traditional dressage trained horses.

On the contrary, horses that have the possibility to choose between Rollkur position and regular poll flexion position choose the regular position (von Borstel, 2007). In addition, the horses were tail-swishing, had their mouth open more often and showed a higher level of fear during Rollkur riding than in regular poll flexion. The horses used were not accustomed to Rollkur riding style.

Rein tensions

Riders are often not aware of the tensions they apply to elicit responses. Pressure sensitive devices are now available to reliably quantify pressures applied through reins, (Warren-Smith et al., 2006 & Clayton et al., 2003). Warren-Smith et al. (2006) explored in their study the range of rein tensions necessary to elicit specific movements during riding and long-reining, using embedded load cells to measure tension. The overall mean tension needed in riding was 7.4 ± 0.7 N and in long-reining 10.7 ± 1.0 N.

Clayton et al. (2003) concluded that the strain gage transducer system was valid to measure rein tension. Their future research will cover an application of the technique into practice for the rider to get an immediate feedback.

Saddle pressure

A saddle should cause no pain to the horse or human. Additively, the saddle should fit the horse so that the horse can perform its best with as little disturbance as possible. In order to collect information of back pain induced by bad fitting saddles, several studies have been conducted (Jeffcott et al., 1999; de Cocq et al., 2004; de Cocq et al., 2006; Meschan et al., 2006).

Saddle pressure on horses' back was evaluated by Jeffcott et al. (1999) and de Cocq et al. (2006). The accuracy of the force-sensing array technology was confirmed (Jeffcott et al., 1999). The results showed that different pressure was obtained on different parts of the pad when the horse was moving. The centre of the pressure changed at different gaits, though some differences could be observed between the individuals. Another sensor measuring device was tested for its validity and reliability (de Cocq et al., 2006). De Cocq et al. (2006) classified the device as valid for measuring the total saddle pressure, but the reliability in practice and the differentiating between saddle fits are still uncertain.

To determine the effects of pressure on the back during movement, de Cocq et al. (2004), registered back movement during walk, trot and canter under four different conditions; unloaded, with girth, saddle only and saddle with 75 kg of weight. The results showed that the extension of the back and the fore limb retraction increased with the weighted saddle in walk and trot. In canter both the weight of the saddle and saddle with weight influenced the back extension significantly. de Cocq et al. (2004) conclude that the back extensions during riding may contribute to soft tissue injuries as well as kissing spine syndrome.

Meschan et al. (2006) evaluated if there was a difference in saddle pressure when using different widths in saddle trees. A pad with sensors was used to measure the kinetics and the pressure from the saddle. The pad was divided into different measuring parts to give more precise results. Meschan et al. (2006) concluded that poorly fitting saddles could lead to harmful pressure peaks.

Harmony between horse and rider

The Fédération Equestre Internationale (2006) claims in their general principles of dressage that 'the object of dressage is the development of the horse into a happy athlete through harmonious education'. This will result in making the horse 'calm, supple, loose and flexible, but also confident, attentive and keen, thus achieving perfect understanding with his rider'.

Peham et al. (2001) investigated the possibility to find a suitable method to support education of dressage judges and training of riders with a measurable criterion for harmony when riding in trot. The movements of the rider and the horse influence each other, which can be called a complex coupled system. Different angles were measured by using markers on appropriate places on both rider and horse. The results showed that the system used can act as a quantitative objective method to judge dressage and to assess harmony between rider and horse.

Bridgeman & Pretty (2007) found in their study that heart rates in rider teams were synchronised when performing a set pattern of movements. The same changes of highs and lows in heart rate were observed at the same moment in both rider and horse. They concluded that heart rate could act as an indicator of harmony between horse and rider during a dressage training, or dressage competition.

Discussion

Innes & McBride (2007) stated in their study that using positive reinforcement instead of negative made their horses more compliant and willing to perform. However, since negative reinforcement is predominant in horse training, I suggest designing a series of experiments that compare the efficiency of both reinforcement regimes during training. Furthermore it is of importance for trainers to have a basic knowledge of learning theory to make training efficient without compromising the horse's welfare.

Horses' behaviour and individual abilities are of paramount importance during training. Studying feral horses will give vital information of the natural behaviour from where knowledge pertaining to good welfare can be obtained (Boyd & Keiper, 2005). I think that observing individual movements and reactions of horses when free on pasture will provide valuable information about the performance of the horse when having a rider on its back. We could define specific problem behaviours (see McGreevy, 2004) and use learning theory to

solve these problems in an appropriate way. We could measure the harmony level between different riders and horses (see Peham et al., 2001 & Bridgeman & Pretty, 2007). This could be applied to improve horse welfare as a reduction in a horse's discomfort could be achieved through a higher level of harmony between rider and horse.

With recent technological advances it is possible to measure the strength of the riders' signals needed to elicit a response in the horse (Warren-Smith et al., 2006 & Clayton et al., 2003) and to assess saddle fit to circumvent back problems from ill fitting saddles (Jeffcott et al., 1999; de Cocq et al., 2004; de Cocq et al., 2006; Meschan et al., 2006). In my opinion the information gained should be considered when choosing saddles. Norms of lightest as well as highest pressure of reins and saddle pressure should be considered to achieve good welfare. Future research could also focus on developing techniques that give riders immediate feedback about the pressures applied.

In the Rollkur study done by van Breda (2006) the recreational trained horses and the Rollkur dressage elite horses had different conditions regarding the possibility to stay outdoors. In future studies, I would suggest housing conditions should be kept identical to exclude confounding factors. Furthermore, studies comparing elite trained horses used to regular poll flexion and elite trained Rollkur trained horses would be of interest. And as van Breda (2006) mentions, to optimize the test, the heart rate measurement could also be combined with endocrinal and behavioural tests. Biomechanical and further physical tests are needed as well as ethological tests to differentiate use from abuse.

Conclusions

If you cannot measure it, you cannot manage it. We need to find suitable tools to be able to measure welfare. There are already some interesting studies available, addressing the welfare of horses undergoing training. And the majority of scientists within horse welfare agree upon the importance of continuing equine research, as progress without objective facts would be impossible. We are heading to an interesting future where we will see more of ethological, psychological as well as physiological and equipment studies in order to assess horse welfare.

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