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The use of positive reinforcement in horse training

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ABSTRACT

The welfare of horses and the safety of riders are central concerns in equestrianism, particularly as traditional training methods often rely on aversive stimuli, resulting in welfare challenges and increased risks to human safety. Recent improvements in equitation science call attention to the importance of applying principles of learning theory, in order to develop ethical and effective horse training practices. This study analyzes the transformative potential of using positive reinforcement in horse training, by examining its role in improving horses' emotional well-being, behavioral flexibility, and responsiveness while reducing risks associated with aversive contexts, such as stress, conflict behaviors, and learned helplessness. Additionally, the thesis critiques traditional dominance and leadership models, highlighting their limits in interpreting equine behavior, and proposes an holistic approach to bridge the gap between theoretical knowledge and practical application. So that, to illustrate the practical application of positive reinforcement, a case study of one horse was conducted within the thesis.

INTRODUCTION

The relationship between humans and horses, developed through centuries of tradition, is now undergoing a transformative shift as modern understanding of equine cognition, emotion, and welfare necessitates a re-evaluation of training and management practices. Horses, as highly intelligent and sensitive animals, have a remarkable capacity to learn and adapt through their interactions with humans and their environment. However, traditional equestrian practices often give priority to control over well-being, relying heavily on aversive stimuli such as negative reinforcement to achieve compliance, resulting in stress, learned helplessness and behavioral conflicts (Hall et al., 2008; McGreevy & McLean, 2009). These concerns are addressed in this thesis by exploring the application of positive reinforcement and other innovative training methods, promoting a more ethical and scientifically informed approach to equitation.

The use of positive reinforcement, which aims rewarding desired behaviors, would represent a fundamental change in horse training toward welfare-centered practices. Unlike traditional methods that rely on pressure or discomfort, the use of positive reinforcement emphasizes emotional well-being, promotes behavioral adaptability, and reinforces the bond between horse and handler (Sankey et al., 2010; McLean & Christensen, 2017). This approach is in line with the latest developments in equitation science, which prioritize evidence-based practices for understanding equine behavior. The principle that “what we can measure, we can manage” highlights the importance of using robust welfare indicators, such as heart rate variability, cortisol levels, and behavioral expressions, to evaluate and improve the horse’s physical and emotional states during training and handling (Waran & Randle, 2017). By utilizing these tools, trainers can make decisions that take into account the horse’s needs.

This thesis also critiques dominance-based paradigms that have historically influenced human-horse interactions, by misinterpreting natural equine behaviors, like flight responses or conflict behaviors, as defiance or disobedience. Instead, this work advocates for a more empathic understanding of equine ethology, recognizing horses as sentient beings with specific needs and preferences. Learning theory, which incorporates both classical and operant conditioning, is the basis for the proposed methods, which aim to ensure clear, consistent and humane communication between horses and handlers (McGreevy & McLean, 2007; Proops & McComb, 2010). Thus, techniques such as the

use of positive reinforcement, combined reinforcement, and systematic desensitization are presented as practical and effective tools for achieving training goals without compromising welfare or relationship.

The thesis also explores innovative training tools and techniques for identifying pain and cognitive bias tests for assessing emotional states, which not only enhance understanding of equine behavior but also open the path for ethical practices in equestrian sports and leisure activities (Ladewig et al., 2022).

By analyzing the limitations of traditional methods and offering evidence-based alternatives, this work aims at contributing to the growing movement toward ethical equitation. It combines scientific research and practical aspects to promote a more humane and respectful relationship between humans and horses. Ultimately, it supports a future where equine welfare is prioritized alongside performance, promoting a more ethical and sustainable approach to equestrianism (McLean & McGreevy, 2010; Furtado et al., 2021).

1. HISTORY OF HORSE TRAINING

1.1 Early History and Trends in Human-Horse Interaction

Horses have played a pivotal role in shaping human societies and cultures throughout history. Initially valued for their meat, milk, and hides, their utility expanded over time, becoming essential as pack and draught animals, and by the first millennium BC, aiding in transportation, agriculture, and warfare. This marked the beginning of a deep bond between humans and horses that evolved together with social progress.

Historically, there have been two categories of human approaches to horse training: dominance, which emphasizes using force and submission, and cooperation, which prioritizes understanding equine behavior and needs. This latter approach corresponds with modern ethological principles that advocate for respecting horses' natural behaviors to enhance interactions (Goodwin et al., 1999). However, the welfare of horses has been secondary to practical goals since history, during which, horses were mainly seen as tools or symbols of power and prestige. Instead nowadays, even if horses are mainly appreciated as companions and partners in sports and therapeutic activities, the pressures of competition and performance can overshadow humane treatment (Carroll et al., 2022).

Despite centuries of domestication, horses' basic learning mechanisms, such as classical and operant conditioning, have remained unchanged. However, their capacity for habituation, that is the ability to adapt to repeated neutral stimuli without emotional or behavioral reactions, has significantly improved, making them more adaptable to human-imposed contexts (McGreevy & McLean, 2007).

Assessing the welfare of non-verbal animals like horses poses distinct challenges, consequently, effective welfare assessment depends on identifying measurable indicators that precisely reflect the horse's subjective experience, particularly in chronic conditions. These indicators must meet three key criteria: validity (they must accurately reflect the actual welfare states), reliability (they must produce consistent results across observers and situations), and feasibility (they must be practical to be used in different settings).

A benchmarking approach, as described by Veasey and colleagues (1996), is based on the comparison of an individual horse's welfare to that of a standard population living under optimal conditions, in order to identify whether a horse is experiencing positive welfare or displaying signs of compromised well-being. Such principles underpin science-based

efforts to evaluate and enhance equine welfare (Veasey et al., 1996; Lesimple et al., 2020).

1.2 Evolution of Horse Training Techniques

Initially, horse training techniques were designed for practical purposes, equipping horses for transportation, agriculture, and war, but by the Middle Ages, training evolved giving rise to classical dressage, a discipline that became a symbol of nobility, serving as entertainment in royal courts and demonstrating the elegance and mastery of horsemanship (McLean & Christensen, 2017), proving its inadequacy for high-stress situations like war.

As previously mentioned, historical horse training practices, however, have prioritized control over the horse's behavior, employing unpleasant stimuli, such as applying pressure to the bit through reins or using whips to discourage undesirable behaviors, in order to enforce compliance and transfer authority to the trainer (Luke et al., 2023).

One of the severest forms of traditional training was “horse breaking,” which involved cruel restraint techniques like hobbles to immobilize horses and prevent escape. A horse was considered trained once it stopped resisting, typically after entering a state of learned helplessness, a condition in which the horse stops attempting to avoid aversive stimuli because it learns that is useless (Hall et al., 2008). While effective in achieving surrender and obedience, these methods often compromised equine welfare and psychological health.

1.3 Influence of Learning Theory in Equitation

In the mid-20th century, the scientific exploration of animal learning began to gain notability, establishing a framework for understanding how animals, including horses, acquire new behaviors. A notable early case that aroused interest in equine cognition occurred over a century ago with “Clever Hans,” a horse believed to solve arithmetic problems, like calculations. After investigations, it has been revealed that Hans was instead responding to subtle, unintentional cues from his trainer, demonstrating the horse's remarkable sensitivity to human body language and capacity for conditioning (Proops & McComb, 2010; McLean & Christensen, 2017).

This case not only emphasized the relevance of clear and consistent cues in training, but also the horse's sophisticated communication system. Horses primarily communicate through body language, using movements of their head, ears, and eyes to express emotions and intentions, and vocalizations, though less frequent. This ability to interpret human signals, as evidenced by the previous case, highlights the need for trainers to refine their understanding of equine behavior to favor effective and humane interactions (Proops & McComb, 2010; McLean & Christensen, 2017).

Improving upon these early insights, modern research on equine learning focuses on associative learning mechanisms, especially the stimulus-response-reinforcement chain, known as trial-and-error learning. This framework explains how horses perceive stimuli, such as a rider's leg pressure, seat adjustment, or visual cues (e.g., a colored bucket), and respond with various behaviors, that only if these match the trainer's goal, are reinforced either positively or negatively (McCall et al., 1990).

Positive reinforcement rewards the horse for a correct response using treats, scratching, or verbal praise, in order to encourage the behavior performed. Contrarily, negative reinforcement involves removing an aversive stimulus, such as releasing leg pressure or loosening reins, to achieve the same result. Additionally, another option is based on the ability of the trainer to ignore the incorrect behavior performed by the horse, and repeat the cue until the correct performance is achieved (i.e. negative punishment). Over time, this process strengthens the horse's association between the stimulus and the correct action (McCall, 1990; McLean & Christensen, 2017).

1.4 Dominance Theory in Training

Horses naturally create structured social hierarchies within their groups, in order to maintain cohesion and minimize conflict. This characteristic has led to the widespread application of the so called "dominance theory" in human-horse interactions, with the belief, that mimicking horse-horse dynamics not only allows humans to establish themselves as the "dominant" figure, but also improves control and compliance during handling and training (Goodwin et al., 1999; Hartmann et al., 2017).

In horses, dominance hierarchies can be considered linear. Indeed, in a group of four horses, horse A may dominate horses B, C, and D; horse B dominates C and D; and horse C dominates D (Hartmann et al., 2017). An influencing factor of their rank is age, with older horses often occupying higher positions due to their experience and social

knowledge. However, the rank of stallions is context-dependent and not necessarily higher than that of mares, because, especially outside of mating scenarios, stallions generally have fewer social interactions, while mares play a more active role in maintaining group cohesion (Hartmann et al., 2017).

About this topic, Bourjade and colleagues (2009) observed groups of Przewalski horses and documented instances of shared leadership, where multiple individuals initiated group movements simultaneously, revealing that decisions about group movement were often collaborative, influenced by pre-departure behaviors exhibited by various members. These findings highlight the flexible and shared nature of leadership in equine societies, challenging traditional views of dominance-based linear hierarchies (Bourjade et al., 2009; Hartmann et al., 2017).

Although dominance theory remains a popular way to interpret equine social behavior, its application to human-horse relationships is increasingly disputed, due to the fact that horses do not perceive humans as part of their social organization in the same way they relate to other horses. This raises concerns about the validity and welfare implications of dominance-based training methods, emphasizing the need for evidence-based, welfare-oriented approaches (Hartmann et al., 2017).

In conclusion, it is important to remember that horses are naturally social animals, a trait that has been vital for their survival in the wild and is still evident in their behavior as domesticated animals. Living in groups provides protection from predators, supports efficient foraging, and promotes strong social bonds, all behaviors that are still observed in domestic herds today. Recognizing these social characteristics is extremely important, especially when designing management and training practices to meet horses' natural needs (Goodwin et al., 1999).

2. CONSEQUENCES OF USING NEGATIVE REINFORCEMENTS WITH HORSES

2.1 Introduction

The use of aversive stimuli in horse training – through negative reinforcement or punishment – raises relevant concerns for both the welfare of horses and the safety of their handlers. While these methods may achieve short-term compliance, they often compromise the horse's physical and psychological well-being (McLean & Christensen, 2017), leading to stress responses, behavioral issues and potentially to learned helplessness (Hall et al., 2008; McGreevy & McLean, 2009). Chronic exposure to such stimuli not only compromises the horse's welfare, but also increases risks for human handlers, due to the fact that stressed or fearful horses are more likely to exhibit conflict behaviors, such as bucking, rearing, or bolting, which pose serious safety threats (McGreevy & McLean, 2007; Sankey et al., 2010; Hartmann et al., 2021). Furthermore, poorly timed or inconsistently applied aversive stimuli can confuse horses, intensify conflict behaviors, and reduce their responsiveness, making training more unsafe and less effective (McLean & McGreevy, 2010).

2.2 Recognizing and Mitigating Human Influence on Equine Stress

Riders and trainers often struggle to identify when a horse is experiencing pain or discomfort, because instead of performing overt signs such as bucking, having a “cold back,” or rushing fences, horses exhibit subtle behaviors, like teeth grinding, reluctance to move forward, pinned ears, or disinterest in the environment, which are frequently overlooked or misinterpreted. If left unrecognized, these signals can lead to undiagnosed issues that get worse over time, compromising the horse's welfare and increasing risks to the safety of riders, handlers, and trainers (Waran & Randle, 2017).

Progresses in equitation science have highlighted the importance of recognizing pain through observable behavioral changes, particularly during ridden activities. For example, the Ridden Horse Pain Ethogram (RHPE) identifies 24 distinct behavioral indicators linked to musculoskeletal pain, including tail swishing, irregular head movements, pinned ears, and abnormal gait patterns. Researches showed that the presence of eight or more of these behaviors during ridden work is correlated with underlying pain or discomfort, and passing over these subtle signs not only prolongs a horse's suffering

but also promotes poor performance, increased stress, and potential safety hazards (Ladewig et al., 2022). For this reason, greater education and awareness among equestrians is essential in order to prevent all of this.

Horses are also sensitive to human arousal levels, indeed an increase in a rider's heart rate, often due to the anticipation of a negative event, can lead to a corresponding rise in the horse's heart rate. This type of sensitivity represents a survival trait that attunes horses to detect subtle cues from other species that may indicate potential danger (Hartmann et al., 2017). Similarly, approaching a horse in a quick or vigorous manner, rather than calmly, can amplify these physiological reactions in the horse, potentially triggering a flight response.

2.3 Stress, Fear, and Welfare Challenges of Aversive Reinforcement

Interactions between humans and horses, even the simple or routine ones, can lead to stress and fear responses in horses. This derives from the modality of human communication, which relies on pressure-based cues delivered through devices such as reins, bits, or leg aids. As prey animals, horses are highly responsive to aversive stimuli and instinctively respond with flight or defensive behaviors in order to protect themselves and ensure their survival. Over time, this can escalate into anxiety and tension, which are clear indicators of compromised welfare (Waran & Randle, 2017).

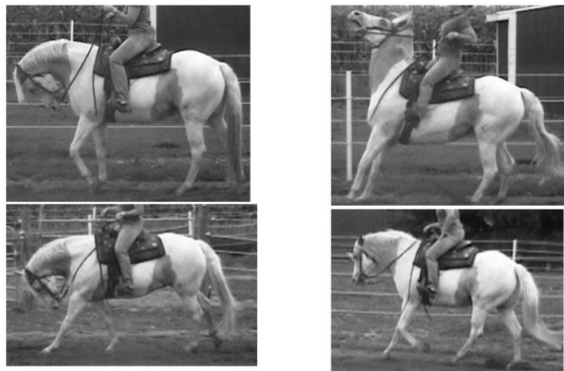
When facing a novel or a challenging situation, horses adopt different coping strategies, such as proactive behaviors – avoiding, escaping, or acting defensively – and passive behaviors – freezing or displacement behaviors (Carroll et al., 2022). Unfortunately, the use of negative reinforcement and punishment can worsen these dynamics, as horses associate aversive stimuli with negative emotional states, resulting in anxiety-driven responses rather than understanding (McGreevy & McLean, 2009). Some problematic practices aggravate these issues, such as hyperflexion, which forces the horse's neck into an unnatural and extreme position, causing significant physical discomfort and psychological stress. Similarly, inconsistent rein signals or contradictory pressures, where the horse receives conflicting cues, confuse the animal and impede its ability to respond effectively. Such techniques prioritize enforcement over welfare, ignoring the ethical considerations that support modern equitation (McLean & McGreevy, 2010). Additionally, placing horses in conflict situations where they must choose between

maintaining the undesired pressure or responding to remove it, increases stress and undermines welfare (Carroll et al., 2022).

2.4 Poor Training Practices and Their Consequences

Traditional horse training methods often turn human-animal interactions (HAIs) during training into negative experiences for the horse, favoring fear, anxiety, and stress (Carroll et al., 2022). Improper or unethical training techniques, especially when inconsistent, are a principal cause of behavioral problems, such as resistance or aggression, that can sometime make horses unrideable, contributing significantly to wastage rates. Unethical practices like soring (inflicting pain to exaggerate movements), rapping (striking legs to encourage higher jumps), and using overly restrictive equipment, such as tight nosebands, further confirm the indifference for equine welfare in some competitive disciplines, where performance takes priority over training deficiencies (McLean & McGreevy, 2010). Figure 1 presents four photographic examples which represent four different behavioral responses potentially linked to aversive training methods (Hall et al., 2008).

Figure 1. Examples of crank and yank, photos on left; conflict behaviour, photo upper right; complacent photo lower right.



The top-left image shows a horse in forced hyperflexion – commonly known as “rollkur” – a posture induced through continuous rein pressure, often associated with discomfort and reduced freedom of movement. The bottom-left image illustrates the use of the “crack and yank” technique, where strong rein tension is combined with restrictive tack, such as spurring action, potentially causing confusion and frustration. The top-right image captures a rearing horse, a common conflict behavior that can arise from stress or contradictory signals. Meanwhile, the bottom-right image shows a horse in a subdued and withdrawn posture, with a low head position and a dull expression, which may reflect a passive coping strategy or a state of learned helplessness.

3. INNOVATIVE IDEAS AND EMERGING METHODS

3.1 Using Behavioral Indicators for Welfare Assessment

Progresses in behavioral science have introduced techniques to understand how horses perceive and respond to different situations. One such method uses an operant learning approach to interpret horses' emotional responses based on how they interact with positive or negative consequences (Waran & Randle, 2017). To precisely assess equine welfare, it is essential to take a multifaceted approach, evaluating different indicators across different contexts – during training, when using specific equipment, or while performing – using both behavioral observations and physiological measurements, like heart rate and cortisol levels. However, these metrics can be influenced by multiple factors – e.g., heart rate changes may reflect physical exertion as well as emotional states, making it difficult to isolate the exact motive cause (Waran & Randle, 2017). Behavioral cues – such as ear position, eye aperture, movement of the nostrils, and lip position – play a critical role in understanding a horse's emotional state. However, horses may suppress clear signs of pain or distress when in the presence of humans, complicating the interpretation of these indicators (Waran & Randle, 2017).

To address these challenges, qualitative analysis of behavioral expression has emerged as a promising tool, by combining owner-reported observations of a horse's demeanor with objective data, such as heart rate and stress hormone levels, in order to provide a more comprehensive picture of the animal welfare (Waran & Randle, 2017).

3.2 Promoting Positive Human-Animal Interactions (HAIs)

The primary goal of human-animal interactions (HAIs), especially during veterinary visits and husbandry practices, should be to minimize stress and encourage cooperation in horses, in order to improve equine welfare and lower safety risks for handlers and veterinarians. However, as mentioned before, horses' natural survival mechanisms can be often triggered by confusion, fear, pain, conflict, or may be influenced by negative past experiences (Carroll et al., 2022)

Consequently, to create a stress-free experience during HAIs, it is important to positively influence the horse's emotional state, for example by implementing processes like preconditioning and training, which focus on reinforcing desirable behaviors, such as standing still or yielding to pressure, while discouraging undesirable reactions (Fenner et

al., 2017). Effective strategies include pausing procedures before the horse's stress levels rise, using food-based licking products to create positive associations, and providing calming tactile stimulation, like scratching the withers. According to this, studies show that food-based rewards are highly effective and preferred by most horses, while tactile rewards like wither scratching are especially beneficial for foals or when food rewards are impracticable (Carroll et al., 2022).

3.3 Fostering Attachment in Human-Horse Relationships

The concept of attachment in horses raises an interesting question: do horses exhibit the same four attachment-related behaviors commonly observed in animals like dogs? These behaviors include: proximity seeking (staying close to an attachment figure during stressful events), safe haven (seeking comfort from the attachment figure to alleviate stress), secure base (feeling safe enough to explore their environment while the attachment figure is nearby), and separation distress (showing signs of distress when separated from the attachment figure). If horses exhibit these behaviors, it could enhance their relationship with humans, reduce arousal levels in stressful situations, and ultimately improve their welfare and safety (Lundberg et al., 2020).

In order to explore this, researchers adapted the Strange Situation Procedure (SSP), a widely used method in attachment studies, especially applied to infants and dogs, to assess whether horses show attachment behaviors toward their owners compared to strangers and how different training styles may influence these bonds (Lundberg et al., 2020). These studies showed that horses perform certain attachment-related behaviors, such as seeking proximity to their owners and showing stress reduction in their presence, but, unlike dogs, horses did not clearly demonstrate the secure base effect, where an attachment figure provides confidence for increased exploration (Visser & van Wijk-Jansen, 2012). This suggests that despite horses form close bonds with humans, their attachment behaviors differ from those observed in other domesticated species.

3.4 Technological and Methodological Innovations

The Ridden Horse Pain Ethogram (RHpE), as early mentioned, still has some limitations that need to be addressed for wider acceptance and application. These include the subjectivity aspect, as interpretations of behaviors can differ between observers, and the environmental factors, such as training conditions or rider's influence, which complicate

the assessment of behaviors. Additionally, this tool gives equal weight to all behaviors expressed by the horse, which could not accurately depict the severity and significance of certain pain-related actions (Ladewig et al., 2022).

So, to increase the reliability and utility of the RHpE, future research should focus on interdisciplinary collaboration among equitation scientists, ethologists, veterinarians and experts in technological innovation to reduce subjectivity and improve consistency. For instance, integrating automated behavioral analysis, wearable sensors for real-time monitoring, and machine learning technologies could provide more objective and precise pain assessments and support wider adoption of the RHpE, raising welfare standards in equestrian sports (Ladewig et al., 2022).

3.5 Leveraging Natural Horsemanship and Sympathetic Training

Emerging as a highly effective alternative to traditional equine training methods, the Sympathetic Training (ST), based on natural horsemanship, reduces stress and improves welfare without compromising performance, promoting a more comprehensive understanding of equine natural behaviors and psychological requirements (Visser et al., 2009).

The focus of ST lies in the use of clear, non-coercive communication between the horse and trainer, based on body language, subtle cues and positive reinforcement rather than force or intimidation. Techniques such as desensitization, the use of positive reinforcement and customized training schedules enable horses to adapt to new tasks and environments in a controlled, low-stress manner, promoting a cooperative relationship, reducing conflict behaviors and encouraging emotional stability in horses (Visser et al., 2009).

Research shows that ST maintains or improves performance, with horses displaying reduced body tension, lower stress markers, while achieving equal or superior technical results compared to those trained conventionally.

3.6 Addressing Learning Theory for Ethical Training

Learning theory highlights the importance of primary reinforcers such as food, comfort, and companionship in encouraging desired behaviors and building positive associations, to foster a stronger bond between horse and trainer (McGreevy & McLean, 2007). Seven

principles have been proposed to guide ethical and effective training practices, combining learning theory with an understanding of natural horse behavior (McGreevy & McLean, 2007; McLean & Christensen, 2017). These key principles include:

- a) correct use of negative reinforcement, by ensuring that aversive stimuli are applied and removed consistently to avoid inducing fear and communicate clear expectations;
- b) providing clear signals, in order to prevent confusion, and reduce stress and frustration for the horse;
- c) focusing on one response at a time, by maintaining consistency and clarity during training sessions in order to help the horse learn effectively.

Additionally, horses are expected to sustain learned behaviors – maintaining a steady rhythm or direction – until signaled otherwise, allowing them to develop predictable and reliable responses to stimuli.

Training typically progresses through three key phases:

- a) operant learning: teaching horses to respond to pressure through negative reinforcement, where the removal of an aversive stimulus reinforces the desired behavior;
- b) cue refinement: gradually replacing initial cues with lighter, more subtle signals to improve precision and reduce reliance on physical stimuli;
- c) classical conditioning: pairing additional cues, like voice commands or specific gestures/postures, with trained behaviors to enhance understanding and responsiveness (McGreevy & McLean, 2007; McLean & Christensen, 2017).

By applying these principles, trainers can create a framework that respects the horse's natural behaviors and cognitive abilities while promoting humane and effective practices.

3.7 Positive Training Methods and Reinforcement Blending

In recent years, horse training has increasingly moved towards methods aimed at reducing or eliminating the use of aversive stimuli, which include innovations such as the introduction of bitless bridles and the rebranding of certain aversive tools, like “carrot sticks” (McLean & Christensen, 2017). Among these evolving approaches, positive reinforcement training has gained importance as a highly effective and welfare-oriented

training technique, since horses trained with this method exhibit stronger memory retention, increased motivation and improved relationships with their trainers, as they associate the training process with positive experiences (Sankey et al., 2010).

However, despite its advantages, some trainers prefer blended reinforcement approaches which combine positive reinforcement with minimally aversive negative reinforcement, favoring practical training outcomes while improving the horse's emotional state. This type of method is considered effective in specific training situations, such as transitional training phases, when introducing young or inexperienced horses to new tasks. A gradual shift from light pressure cues to purely reward-based responses can create a smoother learning experience, while maintaining reliability without causing unnecessary stress. Nevertheless, it is essential that negative reinforcement is applied with care and precision, by avoiding excessive pressure or inconsistent cues that can lead to confusion, stress and even a breakdown in trust between the horse and handler. Ultimately, the goal is to reduce dependence on aversive methods over time, progressively reinforcing behaviors through a positive, reward-driven approach (McLean & Christensen, 2017).

Two innovative desensitization techniques have also emerged as humane alternatives to traditional methods:

- a) Approach Conditioning: this method focuses on a horse's natural curiosity and uses systematic desensitization. The handler encourages the horse to approach a fear-inducing object, which is then gradually moved away as the horse comes closer. In this case, negative reinforcement is applied by retreating the stimulus, rewarding the horse's approach behavior. This technique helps build confidence and overcome fears in a controlled, low-stress environment (McLean & Christensen, 2017).
- b) Stimulus Blending: this approach combines a non-threatening familiar stimulus with a feared stimulus to ease desensitization. For example, a horse comfortable with water from a hose but fearful of aerosol sprays might be exposed to both simultaneously. Over time, the horse associates the spray with the familiar, non-threatening stimulus, gradually becoming desensitized as the hose is phased out. This technique is particularly effective for introducing horses to new or potentially stressful stimuli in a positive, gradual manner (McLean & Christensen, 2017).

Given the increasing evidence supporting positive reinforcement training, it is crucial to investigate its practical applications in real-life training contexts. Chapter 4 will present a structured training protocol conducted with five horses, designed to evaluate the efficacy of target training using positive reinforcement.

3.8 Ethical Considerations

Horse riding represents a unique form of animal use because it involves humans exerting complete control over the horse's movements, both on the ground and under saddle, placing the animal under direct human leadership. For this reason, this type of relationship raises significant ethical concerns, as horses are sentient beings capable of experiencing both physical and emotional suffering, and as such, humans have a moral obligation to prioritize the welfare of horses in all equestrian activities (McLean & McGreevy, 2010).

Equestrian sports introduce a particular incentive for animal use, driven by the psychological satisfaction humans derive from training and riding, especially in competitive equestrian disciplines, where the desire to “win” is often more important than mere enjoyment or personal satisfaction. Critics argue that terms like “equine athlete” are misleading, as they imply that horses voluntarily participate in the physical demands and sacrifices of training and competition, but unlike human athletes, horses lack agency and the ability to choose, making this comparison ethically problematic. The Fédération Equestre Internationale (FEI), which governs global equestrian sports such as Jumping, Dressage, Eventing, and Endurance, highlights in its Code of Conduct that the welfare of the horse must always come first, above competitive or commercial pressures, reflecting the importance of aligning equestrian sports with ethical standards to protect horses' physical and emotional well-being (Furtado et al., 2021).

4. TARGET TRAINING CASE STUDY

4.1. MATERIALS AND METHODS

4.1.1 Subjects

Five horses participated in the training, each with varying backgrounds, training experiences, and age (Table 1). All horses lived outdoors full-time in designated pairs, Black and Festa, Sara and Teresa, and Josey with a pony not involved in the training, in order to allow them to socialize and engage in natural behaviors. All horses had unlimited access to hay, and received mineral supplements daily. No other food was provided to the horses, except for Black, who was the only one receiving additional feed beyond mineral supplements due to his age and dental condition, which resulted in special adjustments in order to meet his nutritional needs.

Table 1 - Horses' Characteristics and Training History

Horse Name	Sex	Year of Birth	Characteristics	Previous Training
BLACK	M	1994	Nonius horse, a breed originally from Hungary; he underwent surgery in January 2025 to have its right eye removed	Trained: he was used by mounted police forces until 2008, after which he was trained for show jumping competitions until 2010
FESTA	F	2002	Estonian riding pony (father is an Arabian, mother is a mixed-breed pony)	Trained: she competed in show jumping and was used in a riding school; she is accustomed to training with positive reinforcement
JOSEY	F	2004 (est.)	She was rescued from a seizure, so few precise information is available about her; she is a mini pony that has only 1 eye due to an accident involving other horses	Untrained
SARA	F	2001	She is Teresa's mother, and they are always kept together; Shetland pony, coming from Alessandria	Untrained
TERESA	F	2008	She is Sara's daughter, and they are always kept together; Shetland pony, coming from Alessandria	Untrained

4.1.2 Experimental Location

The training was conducted on February 8th and March 22nd 2025 at EZ's Place - Rifugio del Cavallo (Montereale Valcellina, Italy), a sanctuary dedicated to rescuing and rehabilitating abused or abandoned horses, especially older ones. All horses were trained in the paddocks they regularly live.

4.1.3 Procedure

The training followed a structured protocol designed to teach horses to follow a target using positive reinforcement over a two-day intensive training period, with the goal of each horse being able to reliably follow the target across different distances and directions by the end of the training. The protocol began with an initial assessment to evaluate each horse's food motivation. Next, the horses were introduced to the target and encouraged to interact with it. From there, progressive distance training was implemented to encourage movement toward the target, and as they became more familiar with the task, they were gradually encouraged to follow the target over longer distances. During the last stage of the training protocol, additional tasks were included with the aim of testing their generalization of the learnt behavior in facing common tasks in equitation. These included encouraging them to walk over a plastic mat placed on the ground – an unfamiliar surface meant to test their confidence and adaptability – and guiding the horses through small lateral steps with their front legs. The training concluded with a final assessment to evaluate each horse's overall progress and adaptability to the trained behaviors.

4.1.4 Materials

Specific materials were used to effectively implement the target training protocol, as well as for ensuring consistency, clarity and efficient reinforcement. Each item has contributed in enhancing the horse's learning experience while minimizing distractions and maintaining motivation. The materials used in the procedure included:

- target: a fly swatter, used as a visual and physical cue for the horse, initially to be touched, and later on to be followed;
- primary reinforcement (treats): small carrot/apple pieces or hay pellets. The type of primary reinforcement was individually chosen based on the dietary restrictions, health conditions, and the preference of each horse. The food pieces were small, easy to chew and to carry, in order to avoid distractions and to reward efficiently;

- verbal marker: the word “yes” was used as a secondary reinforcement to precisely indicate correct behavior.
- novel stimulus: a plastic mat was used in the final stages as an additional element to be walked over, helping to assess the horse’s ability to remain engaged when encountering a novel surface.

4.1.5 Reinforcement Strategy

A reinforcement strategy was essential to ensure the horse clearly associates the correct behavior with the reward, promoting effective learning and motivation throughout the training process. The strategy was based on three key principles:

1. How: use a verbal marker, in this case “yes”, to precisely indicate correct behavior, followed by a treat. Later referred simply as “reward”.
2. How often: Reinforce every correct attempt, in order to build strong associations. In the first phase the attempt was easier, since the horse did not have to move, but in the later phases walking a few steps before being able to touch the target was required.
3. When: reinforce immediately after the desired behavior to maximize the creation of the association between behavior its consequence (the reward).

4.1.6 Step-by-Step Training Plan

The training procedure was implemented in two non-consecutive days. During day 1 the following phases were carried out.

Phase 0: Introduction and Assessment

The trainer approached each horse without the target and initiated interaction by petting the horse, to ensure the horse was not fearful of the trainer. Additionally, the horse was presented with some treats to choose the best reinforcer for each individual and assess their food motivation.

Phase 1: Introduction of the Target

The aim of this phase was that the horse learns to touch the target when presented. The target was held 5/10 cm from the horse's nose and it was rewarded immediately upon touch or sniff. Encouragement techniques, such as wiggling the target or placing it closer,

were used in case the horses were not engaged. When the horse touched the target promptly (within 2 seconds) for 5 consecutive repetitions the following phase started.

Phase 2: Increasing the Distance

The aim of this phase was that the horse moves slightly toward the target to touch it. The target was presented 10/15 cm further away to encourage the horse to step forward and was rewarded immediately after a step was taken. The distance was gradually increased, as well as the position of the target in respect to the horse position was varied (higher, lower, slightly to the left or right). When the horse took at least 2 steps to touch the target in different positions for 5 consecutive times the following phase started.

Phase 3: Following the Target while Moving

The aim of this phase was that the horse starts walking toward and following the moving target. The target was initially presented at a short distance away, about 1 m, to encourage forward movement, and the horse was immediately rewarded after each correct action, such as taking a step toward the target or maintaining focus and following it steadily. Distance was gradually increased before rewarding, but if the horse stopped following the target, the distance was reduced or intermediate rewards were offered to sustain their focus. When the horse followed the target for at least 5 meters continuously for 5 repetitions the following phase started.

Phase 4: Introducing Turns Variation

The aim of this phase was that the horse follows the target in different walk patterns. The horse was guided in gentle turns by moving alongside it, ensuring the target remained reachable and visible at all times. If the horse became confused or stopped following, the exercise was simplified and smaller successes were rewarded to restore confidence and engagement. When the horse followed the target consistently in different directions without hesitation for at least 5 repetitions the following phase started.

During day 2 the following phases were carried out.

The second day started with the review of the ability of horses to follow and touch the target to assess retention. Horses that demonstrate behaviors learned during the Day 1 were rewarded.

Phase 5: Walking Over a Novel Surface (Plastic Mat)

The aim of this phase was that the horse crosses over a novel surface with confidence while following the target. A plastic mat was placed on the ground as a new and unfamiliar element. Using the target as guidance, the horse was led toward the mat and rewarded every time it approached or investigated the novel surface. If the horse showed hesitation, time and space were provided to sniff and explore the surface without any pressure, and only when it was finally relaxed, the horse was encouraged to step onto and walk across the mat, reinforcing each correct step with a reward. When the horse confidently steps over the mat, showing no particular signs of hesitation the following phase started.

Phase 6: Lateral Forelimb Steps

The aim of this phase was that the horse performs small lateral movements with the front legs while following the target. The target was placed laterally to the horse, either on the left or right side, encouraging it to take two lateral steps with the forelimbs while keeping the hindquarters stationary. The exercise was intended to promote controlled, intentional movement and body awareness. When the horse takes two distinct lateral steps – one with each forelimb – toward the target, maintaining hindquarters stability the phase was considered completed.

4.1.7 Data Collection

During the procedure each horse's progress level has been identified and any adjustments necessary for further hypothetical training have been documented. To ensure a comprehensive evaluation, each training session was also recorded, allowing for a detailed analysis of individual learning speeds, responsiveness to reinforcement and any behavioral challenges, or peculiarities, encountered during the protocol. By comparing the progresses of these horses, it was possible to identify the possible key factors that influenced training success, as well as unsuccess, and adaptability to the target-following technique.

4.2 RESULTS

Table 2 indicates the number of sessions completed, the total training time, the average time of each training session, and the progress throughout the protocol of each horse during the first day. Black participated in two training sessions, for a total of 20 minutes, and he completed the first two phases of the protocol. Festa completed three training sessions over 14 minutes and progressed through all four phases. Josey participated in two sessions, for a total of 18 minutes of training, reaching the second phase. Sara took part in three sessions, with 16 minutes of total training time, and completed all four phases. Teresa completed three sessions, with a total training time of 15 minutes, reaching, as well, the final phase.

Table 2 – Training Progress of Each Horse during Day 1

Horse	Sessions Completed	Total Training Time	Average Session Duration	Phase Reached
BLACK	2	20 min	≈ 9 min	Phase 2
FESTA	3	14 min	≈ 4 min	Phase 4
JOSEY	2	18 min	≈ 8 min	Phase 2
SARA	3	16 min	≈ 5 min	Phase 4
TERESA	3	15 min	≈ 5 min	Phase 4

Table 3 presents the results of the second day of the protocol. Black participated in one training session of 5 minutes, during which he maintained the same level of performance observed on the first day, confirming his achievement of the second phase of the protocol. Festa completed two training sessions for a total of 24 minutes and advanced to the sixth phase, successfully performing more complex tasks such as lateral movements and walking over the plastic mat. Josey took part in one session lasting 10 minutes and progressed up to the third phase of the training protocol, showing improved engagement compared to the first day. Sara participated in two sessions, for a total of 15 minutes, reaching the fifth phase, which involved the crossing of the plastic mat. Lastly, Teresa

completed two training sessions over 11 minutes and reached, as Festa, the sixth phase of the protocol.

Table 3 – Training Progress of Each Horse during Day 2

Horse	Sessions Completed	Total Training Time	Average Session Duration	Phase Reached
BLACK	1	5 min	≈ 5 min	Phase 2
FESTA	2	24 min	≈ 8 min	Phase 6
JOSEY	1	10 min	≈ 10 min	Phase 3
SARA	2	15 min	≈ 7 min	Phase 5
TERESA	2	11 min	≈ 5 min	Phase 6

Comparing the results of the first and second day, it is possible to observe that more or less all the horses continued to make progress through the protocol, reaching higher phases than on the first day. Festa and Teresa, who had both reached the fourth phase on Day 1, completed the entire training protocol by reaching the sixth phase on Day 2, and Sara also progressed, moving from the fourth to the fifth phase. Instead, talking about the older ones, Josey advanced from the second to the third phase, while Black maintained his result at the second phase across both days. In terms of training time, the overall duration of the sessions was similar between the Day 1 and 2, with only slight variations in the average session length for each horse.

4.3 DISCUSSION

The results of this case study highlight the effectiveness of using positive reinforcement in training horses, specifically to follow a target, within a short period of time. Every horse showed some level of progress, but particularly two of them – Festa and Teresa – successfully completed all the training phases of both Day 1 and Day 2. More precisely, at the end of Day 1, Festa was able to follow the target while being guided through a figure-eight pattern, and Teresa, on the other hand, successfully followed the target while transitioning from a walk to a trot along straight lines. Instead, at the end of Day 2, both Festa and Teresa were able to pass over the plastic mat, but Teresa managed to do it at a trot, while Festa was more hesitant and did it at a walk. Even though the entire training protocol was completed over two separate days, horses reached advanced stages within a limited timeframe, suggesting that positive reinforcement can be a practical and efficient method for teaching new behaviors. In addition, on average each session lasted about 7 minutes, with notable behavioral improvements observed across both days, supporting previous research showing that reward-based training improves learning effectiveness and engagement while reducing stress-related behaviors (Sankey et al., 2010). The introduction of two phases 5 and 6 during Day 2 further evidences the potential of target training for teaching more advanced tasks, such as walking over a plastic mat and performing lateral forelimb steps. These exercises not only improved the horses' coordination and responsiveness, but also laid a foundation for performance-oriented training. For example, lateral forelimb movement using the target can support future training goals such as shoulder-in or leg-yielding, exercises that are commonly practiced in dressage and groundwork for show jumping preparation in order to promote relaxation, flexibility and responsiveness of the athletic horses (McGreevy & McLean, 2007). The success of this protocol also shows how, with perseverance and patience, positive reinforcement can be used to teach horses more complex behaviors without causing fear and stress, such as loading onto a trailer, a common source of anxiety for many, and the introduction of obstacles such as ditches beneath jumps, which often cause refusals or hesitation in show jumping (McGreevy & McLean, 2007; Furtado et al., 2021). Findings of this study align with existing research on the use of positive reinforcement in horse training, reinforcing its effectiveness in enhancing learning, reducing stress and strengthening the human-horse relationship. Unlike traditional negative reinforcement training methods, positive ones create a more engaging and stress-free learning situation,

encouraging voluntary participation (McGreevy & McLean, 2007; Sankey et al., 2010), and demonstrating greater learning efficacy, with horses retaining trained behaviors for a longer period (Sankey et al., 2010; McLean & Christensen, 2017). Furthermore, despite the use of food rewards – a common concern when using positive reinforcement training – none of the horses exhibited invasive or pushy behaviors during the sessions, suggesting that, even with food reinforcement, horses can remain at a distance from the trainer and focused when the training is structured clearly and consistently (Larssen & Roth, 2022). Two significant factors influencing the results of our procedure were age and physical condition, leading to a tendency for reduced behavioral flexibility and engagement to new stimuli, possibly due to cognitive rigidity and decreased physical ability (McLean & McGreevy 2010). Additionally, the vision impairment of Black and Josey, who had only one eye, possibly affected their ability to accurately locate the target, as monocular vision affects depth perception, making evaluation of target position more difficult for them (Hanggi, 2005). This underlines the importance of adapting training protocols to the individual needs of each horse, especially when physical impairments are present. A possible solution to improve training success is the introduction of positive reinforcement techniques early in a horse's life, as the younger the individual, the greater the adaptability to new learning strategies (Lundberg et al., 2020). Nevertheless, this study confirms that even senior horses, such as Black, who is 31 years old, can benefit from positive reinforcement, demonstrating that this training methodology is not limited to young horses but can be successfully applied to older individuals (McLean & Christensen, 2017). Notably, despite the second training day being held more than a month and a half from the first, all horses – including the older ones – clearly remembered the previous learned behaviors, showing increased willingness to participate and greater focus during the tasks. In Particular, Josey made noticeable improvements by successfully performing lateral steps just like Sara, Teresa and Festa. Another crucial point to underline is the welfare benefits associated with the use of positive reinforcement, such as the reduction of cortisol levels and stress responses, and the improvement of horses' perception of human interactions (Sankey et al., 2010; Waran & Randle, 2017). Despite variations in learning speeds, this study supports these conclusions, as all horses respond in a positive way to training without exhibiting stress-related behaviors during the sessions. By interpreting these findings with existing research, this study contributes to the growing movement towards scientifically informed and welfare-oriented training methods, highlighting the importance of adapting ethical and evidence-based approaches to horse

training, and reinforcing the need for further research and refinement of positive reinforcement techniques (McLean & McGreevy, 2010; Furtado et al., 2021).

An important reminder is to conduct short, focused sessions, of about 10/15 minutes per horse per round, rotating between them, and to vary training intensity based on each horse's personality and progress in order to prevent frustration or loss of motivation. Some horses may need extra time, for example if a horse struggles, so return to a previous phase before moving forward; or another situation can be that, if any of the phases takes more than 10 minutes, we have to stop and pick it up later. Additionally, food motivation has an important role in training responsiveness, and the type of reinforcement should be selected very carefully, according to dietary needs and preferences of each horse. For older horses, which usually are the ones with dental issues, treats should be cut into smaller pieces to facilitate chewing and swallowing, ensuring they can consume the reinforcement comfortably. Moreover, it is extremely important to control the portions, particularly for small-sized ponies or Shetlands, which are more prone to weight gain. In this way, by regulating treat distribution, it is ensured the motivating effectiveness of the feed without adversely affecting the health of the horse. The importance of adapting training to individual sensitivities became evident during Phase 5, the one of the plastic mat, with Sara, who even though she had completed the task, she felt more comfortable crossing it diagonally because of her hesitation towards the unfamiliar object. This response can be natural when introducing novel stimuli and, in her case, it was essential to reward each step she took on the mat and to place the target directly in front of her nose to encourage a smooth and confident approach. In conclusion, some horses may be hesitant at first, so it is important to be patient and reward any curiosity; in the opposite situation, if the horse mugs for treats, reinforce only when the correct behavior is performed, in order to prevent the development of unwanted behaviors such as treat-seeking. Lastly, keeping detailed records of each horse's performance is recommended to support future follow-up training and ensure continuous progress.

4.4 Limitations and Future Research

While this study provides valuable insights into the effectiveness of positive reinforcement in horse training, it is important to acknowledge certain limitations, such as the small sample size, which limits the ability to draw broad and generalizable conclusions. To address this, future research should include a larger and more diverse

group of horses, in order to gain a clearer understanding of how different horses respond to this training method. Additionally, researchers should consider factors such as age, breed, prior training experience and temperament to evaluate the adaptability and effectiveness of positive reinforcement across different horse populations. The limited duration of the training, which spanned only two days, could be seen as a constraint, but it effectively highlights the ability to teach new behaviors over a very short time-span. While this raises the question of long-term retention and training efficacy, the study still demonstrated the potential of positive reinforcement, even for horses previously trained with traditional negative reinforcement techniques. Further research would be valuable in assessing the lasting impact of this approach. Age-related factors, as previously mentioned, also played a crucial role in the outcomes, since older horses, such as Black and Josey, faced greater challenges in completing all training phases, mainly due to physical impairments and lower motivation toward food. These findings suggest that despite positive reinforcement being a promising training method, its effectiveness may depend on a horse's physical condition and natural willingness to engage. Looking ahead, it would be helpful to investigate the impact of positive reinforcement training in very young horses, since the introduction of reward-based learning in the early stages of life could help shape their responsiveness and adaptability to training in the long-term. Obviously, to maximize success, it would be necessary to ensure consistency in reinforcement techniques as they grow. Additionally, the understanding of how social interactions and environmental factors may influence training success would be worthwhile in order to get a more comprehensive perspective on how horses learn and respond to positive reinforcement. In conclusion, by addressing these limitations and expanding the scope of research, it will be possible to refine and optimize positive reinforcement techniques, making them a more widely accepted and evidence-based alternative to traditional training methods in the equestrian field.

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