

TRAINING RESPONSES OF TWO-YEAR-OLD QUARTER HORSES FED RAPIDLY
FERMENTABLE CARBOHYDRATES

by

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of the requirements for the degree

of

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ABSTRACT

Two replicated experiments (Exp. 1: May 14 to June 8; Exp.2: June 25 to July 20) evaluated effects of feeding grain to 2-yr-old Quarter horses on behavior and physiological parameters during early stages of training. In each experiment, 6 different horses were allotted by sex and weight to 2 diets; hay only or hay plus 2.3 kg/d grain. Horses were group-housed with ad libitum access to grass/alfalfa hay and water, and were individually fed 1.15 kg grain or 40 g salt (placebo) at 0800 and 1600 for 7 d prior to and during training. The trainer was blind to diet assignments. Horses were trained 5 d/wk for 3 wk and scored (1 to 5) by the trainer daily on obedience (willingness to ride with a loose rein and little leg pressure), life (willingness to move at any desired speed), and direction (suppleness in the poll and loin), while an observer scored fearfulness. A heart monitor recorded minimum, maximum, and mean heart rate daily during training. Categorical data were transformed by subtracting the daily median as each horse's score was relative to the other horses on that day. Data were analyzed as repeated measures (Proc Mixed of SAS) with horse as the experimental unit. In Exp. 1 grain did not affect ($P = 0.83$) obedience, while horses fed grain in Exp. 2 were less obedient during training ($P = 0.02$) than those not receiving grain. Horses fed grain showed greater ($P = 0.05$) fearfulness than horses fed hay alone. Life:direction (ideal is 1.0, > 1.0 indicates high self-preservation) was higher ($P = 0.04$) in horses fed grain than in those fed hay alone (1.29 vs. 1.08, respectively). Maximum heart rate was not affected ($P = 0.21$) by grain, while mean heart rate was higher ($P = 0.03$) for horses fed grain than hay alone (126 vs. 119 beats/min, respectively). Horses fed grain during training exhibited more self-preservation behavior, increased mean heart rate, and an unbalanced life to direction ratio, which could inhibit training effectiveness.

CHAPTER 1

INTRODUCTION

The primary purpose for horses in our society is to do a job. This job may include: Ranch work such as sorting and moving cows; competition such as team roping, reining, and western equitation; or pleasure and therapeutic riding. If the only job our horse has to do is look pretty standing in the pasture and let us pet him from time to time, then that is the horse's job; that is his purpose for being in our possession.

Often our objective is to use the horse to accomplish a job; this is "our will" for the horse. However, horses have their own will and their will or behavior is influenced by their driving factors. Horses have three primary driving factors, comfort, companionship (McGreevey and Boakes, 2006; McGreevey, 2007) and self-preservation (Boissy, 1995; Christensen et al., 2005), and one variable driving factor, hormones (Colborn et al., 1991; Mostl and Palme, 2002; McGreevy, 2007). Horses also have two underlying factors which contribute to the primary driving factors; confidence and energy. It is the horse's natural instinct of self-preservation that a person needs to understand in order to gain their confidence (Dorrance, 1987). The confidence that a rider gives the horse will make all the difference in their ability to accomplish a job (Hunt, 1978).

Successful training in young horses depends on the trainer's ability to use the horse's primary driving factors to the trainer's advantage. Studies of a number of agricultural species show a negative relationship between an animal's fear of humans and

their productivity (Rushen et al., 1999). Training institutes novel responses by drawing out desirable innate behaviors and suppressing undesirable ones (McGreevy and Boakes, 2006). Comfort and companionship are considered desirable innate behaviors, and self-preservation is considered an undesirable innate behavior. Most effective training methods rely on building the horse's confidence through offering the horse comfort. Immediate comfort or immediate relief from discomfort, are very effective training tools for horses (McGreevy and Boakes, 2006).

When the horse's driving factors are not used to the trainer's advantage, the horse develops resistance, and it is resistance that keeps the trainer from accomplishing the job (McLean, 2005). Resistance arises as a result of three sources: self-preservation (due to lack of confidence), lack of communication (horse needs more time, patience and teaching; Hausberger et al., 2008) and disobedience (due to unwilling submission). To prevent resistance the trainer must have four variables working to their advantage: willing submission, good communication, solid foundation of maneuvers, and a balanced life to direction ratio.

Willing submission is defined as the ability to ride the horse on a loose rein with no leg pressure, "it's the horse's idea." If it is truly the horse's idea a rider should not have to drive him to do the job. Ray Hunt describes willing submission as the ability to have the horse and person moving together as one. The horse does not drag the rider and the rider does not have to push the horse along (Hunt, 1998). Tom Dorrance states that good communication between horse and man comes from empirical knowledge and feel, timing and balance (Dorrance, 1987). A person also communicates with horses by using

their driving factors. A solid foundation of maneuvers is the ability to move the three parts of the horse (head and neck, front quarters and hindquarters) in any direction to accomplish any job. Direction is when the slack is taken out of the rein the horse puts the slack back in the rein with a suppleness through the poll and loin and life is the ability to move the horse with any given speed at any given time.

It is my theory that excess energy (an underlying driving factor) leads to an increase in motivation and determination. This increase in motivation and determination is expressed through whichever driving factor a horse is displaying at any given time. If a horse is driven by self-preservation (fight or flight) the amount of energy fueling the horse will determine how motivated and determined it will be to fight or flight. A lean horse with a body condition score of two or three (below maintenance) will have little motivation and determination to fuel their driving factors. However, a horse with a body condition score of six or seven (above maintenance), or high quantities of rapidly fermentable carbohydrates, will be highly motivated and determined in their driving factors. This high level of motivation and determination is useful as long as it is driven in a positive manner.

If the horse is positively driven towards the rider's will through comfort and companionship (two of the driving factors), there will likely be few problems. However, if the horse is driven by self-preservation or seeking comfort and companionship with other horses, we can run into problems while trying to accomplish the job. If the horse is negatively driven by self-preservation, causing the horse to lose confidence in a person or situation, the ability to accomplish the job is very limited and the person's and horse's

safety may be at stake (McLean, 2005; Warren-Smith and McGreevy, 2005; Malmkvist and Christensen, 2006).

When a horse is started correctly, as the training progresses the horse should increase its level of comfort and companionship with the person and situations where the person leads them, and decrease the level of self-preservation (Rietman et al. 2004). As the training progresses the horse should also develop a solid foundation of maneuvers which enables the person to balance the direction to life ratio by directing the life and decreasing the energy. Once the energy decreases, self-preservation starts to decrease and the person can offer the horse comfort and companionship, increasing the level of communication, willing submission (Nicol et al., 2005) and positive results in accomplishing the job (Baragli et al., 2006).

However, if the rider does not decrease the energy (decreasing self-preservation) before he tries to accomplish the job, then the horse will have an unbalanced life to direction ratio. This can lead to poor communication, unwillingness, disobedience, and negative results in accomplishing the job (McGreevy, 2007).

As the horse begins to develop a solid foundation of maneuvers, balances the life to direction ratio and gains confidence in the person, a high energy level in the horse is not as important. If the horse is not driven by self-preservation and the person can direct the energy (life), then the person can use the horse's motivation and determination to accomplish more in the job (Nicol, 2002; Hausberger et al., 2006). The key is to be able to direct the life. If a rider cannot direct the life, and the horse has a high level of self-preservation, then we are doomed for failure. Due to the high level of self-preservation

and lack of direction, self-preservation will take over and the horse's confidence will be shattered. Similar to people, the horse's confidence can only be shattered so many times and the horse will learn that we are untrustworthy.

It is because of this concept that I believe excess energy should have a negative impact on the early stages of training (horses with a high self-preservation level, no direction, and not having a foundation of maneuvers). If my theory is true, increasing the dietary energy while starting young horses will lengthen the time, or limit the ability to achieve willing submission, a solid foundation of maneuvers, and to balance the life to direction ratio. The horses with more dietary energy should also have increased levels of self-preservation, and disobedience. The purpose of this study was to measure the effects of rapidly fermentable carbohydrates (excess energy) on the early stages of training.

CHAPTER 2

LITERATURE REVIEW

Introduction

The horse has played a major role in the advancement of the American people and is still widely used today. The economic impact of the American horse industry has grown to over \$39 billion annually, and the horse population has increased to 9.2 million horses (American Horse Council, 2005). Horses in the past were primarily used for work and were ridden by experienced riders. However, the equine industry's focus has shifted to recreational and sport activities, and over 4.6 million people are involved in the industry (Lansade et al., 2005). The foundation of the horse industry in United States has shifted to less experienced riders. These owners may have little formal knowledge of equine behavior and learning theory research results. However, as a whole they are eager to learn methods which would decrease training frustration, increase the efficacy of their training time, and enhance the welfare of their horses (McCall, 2007).

Horses, being ridden by less experienced riders, need to be calm and easy to handle, characteristics that may be enhanced by more effective early training (Lansade et al., 2005). Early stages of training and handling of horses are critical to their success as both working and recreational partners (Lansade et al., 2005). Equine learning ability is a primary factor in the economics of the horse industry because the horse's value increases with its acceptance of training (Heird et al., 1986). Many horses that do not receive

proper training become disobedient, dangerous to be ridden and are slaughtered because of behavior problems (Odberg and Bouissou, 1999; Warren-Smith and McGreevy, 2005).

Extensive research has been conducted during the past decades on the behavior of feral and domestic horses. However, there have been limited studies testing the interactions between these studies and equine learning studies. Most equine learning studies have been conducted under artificial experimental conditions to measure specific abilities or to test the relationship between learning abilities, manageability, and performance during training (Heitor and Vicente, 2007). Many factors that might affect equine learning ability and be applicable to training practices in the horse industry have not been thoroughly investigated; for example, interactions between nutrition and learning, between exercise and learning, and the use of negative and secondary reinforcements in horse training (McCall, 1989).

Although there is a large demand for information on successful equine training methods, little research has been conducted. It has been reported that little scientific research has been done on equine learning despite the importance of horses in our society (Nicol, 2002; Murphy and Arkins, 2007). A major challenge when considering the topic of equine learning and behavior is distinguishing between anecdotal reports, and actual research-based evidence (Cooper, 2007). Much of our view of the mental abilities of horses is based on anecdotal evidence (Ladwig, 2007). More research on the benefits of training, training methods, how horses learn, and the factors affecting learning is required (Murphy and Arkins, 2007).

Factors Affecting Equine Behavior During Training

Positive vs. Negative Reinforcement Methods

Most equine learning studies to date have utilized learning tasks depending on positive reinforcement. However, the majority of trainers use negative reinforcement in their training programs. As a result, past research has not had a direct application to training methods commonly used in the horse industry (McCall, 1989). Positive reinforcement may be defined as the addition of a stimulus that results in a behavioral change, whereas negative reinforcement is defined as the subtraction of a stimulus that results in a behavioral change (Chance, 1983). An example of positive reinforcement would be rewarding a horse with a bite of grain after performing a task, while an example of negative reinforcement would be applying pressure to a lead rope until the horse decides to give to the pressure, at which time the horse is rewarded with relief.

McLean (2005) described aspects of training reinforcement that need additional research and justification for the research: 1) mechanics of negative reinforcement because it is poorly researched compared to positive reinforcement; 2) learning theory and the principles that surround negative reinforcement because many qualified animal trainers confuse it with punishment; and 3) relative benefits of positive and negative reinforcement because horse trainers increasingly seek knowledge from the growing number of “horse whisperers” and unqualified “horse psychologists.” Lack of understanding of the relationship between horse behavior and training methods is potentially detrimental for the welfare of the horse. There is an urgent need for

universities to serve as the knowledge bases for sound training and behavior research (McLean, 2005).

Considering the importance of negative reinforcement and its universal use in horse training and riding, it is disappointing how poorly understood it is among today's riders (Ladwig, 2007). People understand how to apply pressure to the horse to try to make them complete a task. However, the average person does not understand the importance of rewarding the horse with relief for the "smallest change and the slightest try" (Hunt, 1978). Inappropriate training practices can lead to conflict behaviors that jeopardize the safety of riders and handlers and can have a negative impact on the horse's welfare (McGreevy, 2007). These inappropriate uses of negative reinforcement may result in horses that become disobedient, dangerous to be ridden, or slaughtered because of behavior problems (Odberg and Bouissou, 1999).

The subtleties of negative reinforcement in horses are very poorly understood, mainly because data derived from the traditional species (primarily rats) used for leaning studies in psychology and the contexts are of such limited use in equitation (McGreevy 2007). Although, negative reinforcement is applied easily in training, finding the right negative reinforcers for research experiments on equine learning is much more difficult (McCall, 2007). Additionally, it is important that researchers become familiar with horse handling methods and skills, and with using negative reinforcement as a means of training. Failure to release pressure when using negative reinforcement can cause conflict behaviors in horses, and have behavioral and physiological effects that shorten the horse's useful working life (McGreevy, 2007).

Housing and Management

To have a successful training program resulting in the best economic return, a person must not only have an understanding of the horse's driving factors, they must also realize the impact that the housing and feeding program has on the horse's driving factors. While horses are generally housed and managed under what would be considered superior conditions to farm animals, it is debatable whether such conditions are the best situation for the horse (Harewood et al., 2005). Martin Black is a rancher, horse trainer and clinician working with over 500 horses a year, in varying breeds and disciplines, in the U.S., South America, Canada, Europe, and Australia. Black has appeared in several national magazines giving his observations of housing and feeding and their effects on training and behavior. Black (2007) states that free roaming grazers spend the biggest percent of their time relaxed and quiet, but when confined and fed high-energy feed they can develop physical and mental issues.

Commonly used housing and management practices in the equine industry such as box stall confinement, limited and controlled exercise, and highly concentrated feeding regimens are probably not ideal for a social herd animal that is naturally free roaming and pasture-grazing (Harewood et al., 2005). We have taken an animal that has been bred for centuries to work and be fit, and in only a few decades, fed and confined them like an animal for slaughter (Black, 2006). Over-feeding and under-working horses creates stored energy and many behavioral problems during training (Black, 2007). Limited opportunity to graze has been linked to increased spontaneous activity in horses (Hogan et al., 1988). When compared with pastured horses, horses housed in stalls adapted less

readily to training and had higher frequencies of unwanted behaviors such as bucking and jumping (Rivera et al., 2002). What most people identify as disciplinary problems with their horse may be due to too much stored energy (Black, 2006).

A study conducted to measure the response of horses to confinement and isolation in a stable showed that when housed in a stall all horses (six 2-year-old stock horse fillies) became agitated and demonstrated increased vocalization and movement (Harewood et al., 2005). The researchers concluded that horses housed in confinement wanted to return to the large outdoor paddock that they were taken from. When a person starts riding and working confined horses it seems that the inability to control the energy level is at the root of many problems people have with their horses (Black, 2007). Horses turned out to exercise for 2 h/wk were more likely to trot, canter, and buck when turned out, than those turned out for 12 h/wk. Horses react to confinement with increased activity when not confined (Chaya et al., 2006). Without the excess energy, more training could be done without extreme training methods, which could result in happier, more willing horses (Black, 2006).

Not only does confining horses result in excess behavioral energy leading to possible behavior problems that affect training, but it can also lead to “stereotypic” behavior in horses. Stereotypic behavior has been described as horses displaying repetitive movement without any specific goal (Haupt and McDonnell, 1993), and tends to appear in unfavorable conditions (McGreevy et al., 1995). Stereotypic behavior includes; weaving, cribbing, windsucking, head shaking, nodding, and tongue play. Hausberger (2006) found that more horses that exhibited stereotypic behavior were

unsuccessful in learning a task than non-stereotypic horses. When stereotypic horses were successful, they required a longer time in order to perform the task. By not confining and overfeeding our horses, less time and money would have to be spent on behavioral, training, and health problems.

Diet Composition and Amount

Increasing dietary energy has been shown to have a negative impact on handling horses. Efficiency in training (achieving learning criteria in as few sessions as possible), which is important to the horseman, can be reduced when horses are pushed to work too hard (Rubin et al., 1980). Holland (1996) found horses fed rapidly fermentable carbohydrates had higher spontaneous activity, and greater reactivity to stimuli than horses fed energy in the form of fat. Spontaneous activity was measured using a pedometer and horses fed energy in the form of fat were less active. Reactivity was measured through an apple penetrometer recording the amount of pressure it took to move the horse. Horses receiving rapidly fermentable carbohydrates required less pressure to move signifying that they were more sensitive to pressure (Holland et al., 1996). The average horse owner is inexperienced (McCall, 2007) and would have fewer behavior problems during training if their horses were less active and less sensitive to pressure.

Horses fed a fat and fiber diet showed a more desirable temperament with decreased flightiness, appearing more willing to perform, and were calmer during a stressful event than those fed grain (Nicol et al., 2005). Cortisol levels, often used as an indicator of self-preservation and stress, were higher in foals supplemented with a corn-

based diet before and after weaning compared to foals supplemented with fat-and-fiber (Holland et al., 1996). Horses under less stress had lower heart rates and showed an increase in learning performance (Visser et al., 2001). Better learning performance due to less interference in the learning process was reported in horses that were calm (Nicol, 2002). Training efficiency has been linked to the level of learning performance and learning performance has been higher in calm horses (Krusunose and Yamanobe, 2002). Rapidly fermentable carbohydrates have been suggested to cause so called “hot” or excitable behavior (Greiwe et al., 1989). It is common in today’s equine industry to feed young and growing horses grain once or twice a day (Steelman et al., 2006). Feeding grain during the early stages of training may reduce learning performance and training efficiency.

Body Condition

Increasing the horse’s energy stores through body condition has also been shown to have negative effects on learning and behavior. Horses with a higher body condition score (7 to 9), scored lower on discrimination learning abilities than horses with moderate (4 to 6) and thin (1 to 3) body condition scores (McCall, 1989). Body condition has also been shown to increase self-preservation (fight or flight), measured through dominance, in 1-yr-old Icelandic Horses (Vervaecke et al., 2006). Acts of dominance were measured through signs of aggression including ears laid back, bite threat, bite, kick threat, kick, attack, chase, fight, shouldering (pushing receiver aside with shoulder), push back (pushing receiver with hindquarters) and strike. Researchers found that body condition was significantly positively correlated with dominance in the female herd (Vervaecke et

al., 2006). Results from Vervaecke's study were supported by studies with other ungulates where a higher agonistic dominance rank was correlated with better body condition (e.g. *Bos taurus*: Reinhardt and Reinhardt 1975; *Capra hircus*: Barosso et al. 2000; *Bison bison*: Vervaecke et al. 2005). It is to the horseman's advantage to train animals by the most efficient, least time-consuming method (Rubin, 1980). Increased dietary energy during the early stages of training, resulting in increased body condition in young horses, may lengthen the time to achieve learning or limit the training efficacy due to increased self-preservation behavior.

Physiological Parameters of Self-Preservation

To use the horse's driving factors to the trainer's advantage, the horse's comfort and companionship must increase and the level of self-preservation must decrease. If the horse's self-preservation instinct is not engaged, he will reason things out, resulting in effective training. When the level of intimidation or fear rises, then the mind's reasoning ability starts shutting down and defensive reactions start to surface (Black, 2005). Self-preservation is the defense mechanism in animals' "fight-or-flight" response and can also be described as fear or stress. A "stress response" is defined as the defense reaction of an animal (Mostl and Palme, 2002). To improve oxygen delivery for the working muscles in a fight-or-flight situation, two major stress activated systems—the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis—are activated. The activation of these systems is demonstrated by rapid increase in the circulating level of adrenocorticotropin (ACTH), adrenaline, noradrenaline, and cortisol (Hyypä, 2005).

Cortisol and Cortisol Sampling

Glucocorticoid hormone cortisol affects numerous cognitive domains including attention, perception, memory, and emotional processing (Erickson et al., 2002). Exposure to a stress- or fear-eliciting stimulus is associated with increased plasma cortisol concentrations (Erickson et al., 2002). The concentration of cortisol in blood is widely used as an indicator of stress, although a potential confounding factor that has to be considered is that sample collection, which often involves confinement or handling of animals, may by itself be stressful and may elicit elevated cortisol levels (Mostl et al., 2002). A major challenge to studying self-preservation behavior via cortisol is sample collection. The collection method must be reliable, safe, acceptable, easy to perform, and ensure sample integrity (Kelly et al., 1997; Wadsworth et al., 2003)

Human saliva has been analyzed for a long time because its composition of numerous components resembles that of blood. Saliva can be collected non-invasively in horses at rest (Lindner et al., 2000). It is less intrusive and easier to collect than urine or blood, and can be used to measure important biochemical and immunological markers, including cortisol (Strazdins et al., 2005). Measuring changes in salivary cortisol levels in normal horses and horses with Cushing's disease demonstrated the validity of saliva to assess adrenal function (Van der Kolk et al., 2001). In several species, levels of cortisol in plasma and saliva are highly correlated (Fenske, 1996).

Heart Rate and Heart Rate Variability

The body has two principal pathways of reaction to perceived danger: the slower endocrine secretion of cortisol and the immediate reaction of the sympathetic nervous system (Guyton and Hall, 1997). Sympathetic stimulation increases both the rate and force of contraction of the heart, preparing the organism for flight (Christensen et al., 2005). Mean heart rate and heart rate variability measurements used during a novel object test and a handling test in young horses, strongly suggested that heart rate variables are useful in differentiating between horses and in quantifying different aspects of equine temperament (Visser et al., 2002). The horse's temperament, including manageability, reactivity, and fearfulness, is important because it can result in handling problems and can make horses unsuitable for inexperienced riders (Lansade et al., 2003). Visser et al. (2002) found large changes in heart rate and heart rate variability when horses were presented with changes in the environment, and they demonstrated that heart rate was higher for untrained horses compared to trained horses. These results suggest that self-preservation and fear responses cause an increase in heart rate. Nervous horses were shown to have an increased heart rate compared with calmer horses (McCann et al., 1988). More highly reactive horses, often termed "nervous" horses, are typically less trainable, as indicated by the negative correlation between higher level of emotionality and the number of trials to criterion in a learning study (Heird et al., 1981). Fiske and Potter (1979) found a negative correlation between emotionality (based on a scale of 1 tranquil, to 6 very excitable) and trainability in yearling horses.

Variability in heart rate has been shown to be a good indicator of autonomic nervous system activity in response to stress (von Borell et al., 2007). Heart rate variability, as measured by the standard deviation of heart rate, has been shown to be negatively correlated with stress even when no relationship was found between stress and heart rate (von Borell et al., 2007). Reduced heart rate variability has been reported for more reactive horses, young subjects and hot-blooded breeds (von Borell et al., 2007).

Hypothesis and Study Objectives

To address the lack of scientific research on successful training methods and equine behavior, I developed a working hypothesis and a formula that I believe can help eliminate resistance encountered in training horses. Using negative reinforcement and following the teachings of Tom Dorrance, Ray Hunt, and Martin Black, along with my own personal experience, I have developed a formula for “Building a Foundation for Perfection.” Using empirical data, I have tested the formula with every horse that I have started and with every student that I have taught in my colt training classes the past two years. So far, through empirical observation, the formula has proven to be effective. To further evaluate the formula we designed an experiment to test one aspect of the formula.

McCall (1990) stated that many factors that may influence the horse’s learning ability have not yet been investigated, such as interactions between exercise and learning abilities. In this study, we evaluated the impact that excess energy, one of the horse’s underlying factors, may have on the training and learning of 2-yr-old Quarter horses. Measurements were taken to determine the level of willing submission, good

communication, foundation of maneuvers, and the life to direction ratio. Self-preservation levels were measured through heart rate (McCann et al., 1988; Visser et al., 2002), step count (Holland et al., 1996) and salivary cortisol (Erickson et al., 2003). My hypothesis is increasing the dietary energy while starting young horses will lengthen the time, or limit the ability to achieve training efficiency and prevent resistance from developing. Horses with more energy should also have an increased level of self-preservation. As the energy level decreases however, self-preservation decreases, which opens the door to increase comfort and companionship when presented in the correct manner. The focus of this study was to evaluate the effects of increased energy on the early stages of training.

CHAPTER 3

TRAINING RESPONSES IN 2-YEAR-OLD QUARTER HORSES FED RAPIDLY
FERMENTABLE CARBOHYDRATESMaterials and MethodsExperimental Animals and Management

Procedures were approved by the Montana State University Agricultural Animal Care and Use Committee. Experiments were carried out in the spring and summer of 2007 at the Montana State University Towne Farm. Twelve cutting-bred Quarter horses ranging from 24 to 28 months of age were used for this study. The group consisted of 4 geldings and 8 fillies born and raised together in Eagle, Idaho. The foals used in the study were raised on their mothers and allowed to roam freely on large pastures. After weaning, all 12 horses were housed together in a large pasture with approximately 25 other weanlings. The weanlings were allowed free-choice pasture and fed grain (corn, oats, barley) once a day.

As yearlings, the horses received 4 days training at which time they were trained to the halter, vaccinated, and the males were neutered. Horses were halter broken by running them through a narrow, single file chute which enabled the owners to stand on a ramp above the horses. The horses could then be touched all over and fitted with halters without escaping. Once the horse had accepted the halter and being touched by the owner, the horse was then let out of the chute. The horse was then trained to give to the

pressure of the halter, to lead and to stand tied to a fence. Following this process, the yearlings were then turned back out into large pastures.

The yearlings were not handled again until their 2-yr-old year. In April of 2007, the 12 project horses were loaded loose into a 30-foot trailer and hauled to Montana State University Towne Farm. The 12 horses were turned loose into a 30.5 m x 45.7 m pen and allowed free-choice access to grass/alfalfa hay provided in a large round bale feeder. Animals were given a 1-month acclimation period before starting the experiment, to become familiar with the surroundings. Following the acclimation period horses received 4 days of handling to enable the project feeders to catch the horses.

Horses were chased into a small pen, lassoed around the neck, and trained to turn and face the trainer to be caught. Once the horses were caught, they were tied to a fence. The trainer then rotated between all the horses in the herd, petting each horse to gain trust and lower their self-preservation level. After 4 days of building confidence in the horses, they could be caught from the ground and were ready to start the experiment.

The horses' teeth were checked 3 days prior to the experiment, and each received the appropriate pre-training dental preparations as needed. All sharp enamel was removed from the pre-molars and molars, wolf teeth and retained deciduous teeth were removed to ensure pain-free training and a uniform response to the bit. It was determined that due to the amount of data to be collected on each individual horse, that only 6 horses would be trained at one time. Therefore, the horses were weighed and divided into 2 equal average weight groups, to ensure uniformity between the groups. Half of the horses (6; 2 geldings and 4 fillies) were placed back into the original large pen (30.5 m x

45.7 m) and were started on the assigned research treatment diets 2 weeks prior to the beginning of the study. The second group of horses were returned to a separate large pen (30.5 m x 45.7 m) and continued to have free-choice access to a large round bale feeder containing grass/alfalfa hay.

Two experiments, replicated in time (Exp. 1: May 14 to June 8, 2007; Exp. 2: June 25 to July 20, 2008), were conducted. Each experiment utilized 6 different horses (2 geldings and 4 fillies), and the same experimental procedures were followed in each experiment. Horses were subjected to the same husbandry procedures and kept in mixed sex groups in the 30.5 m x 45.7 m pen. Horses were caught or driven at 0800 and 1600 from the 30.5 m x 45.7 m pen into individual 3.1 m x 3.1 m pens to receive their assigned dietary treatment. The 3.1 m x 3.1 m pens consisted of 3.1 m panels wired together on one side of the 30 m x 30 m pen. Each experiment lasted 26 days, with 7 days for diet adaptation followed by 19 days of data collection. Horses were ridden and trained for a total of 15 days, according to a schedule of 5 days training (Monday through Friday) followed by a 2-day break (Saturday and Sunday). The daily order of training each horse was randomized. The experimental schedule was:

Days 1 to 7 – Diet adaptation

Days 8 to 12 – Week 1 of training/data collection

Days 13 to 14 – Days off

Days 15 to 19 – Week 2 of training/data collection

Days 20 to 21 – Days off

Days 22 to 26 – Week 3 of training/data collection

Dietary Treatments

Six horses (2 geldings and 4 fillies) were allocated based on sex and body weight, to either a grass/alfalfa hay diet or a diet of grass/alfalfa hay plus added rapidly fermentable carbohydrate (grain). Diets were formulated to meet or exceed nutrient requirements for 2-yr-old light horses (NRC, 2007). Horses on the added grain diet were individually fed 2.3 kg of a mixed commercial grain (corn, oats, barley, and molasses) daily; 1.15 kg fed in the morning and 1.15 kg in the evening. The trainer was blind to the treatment assignments to insure that every horse was treated without bias during training. A large round bale feeder was placed in the large pen and all the horses were allowed to eat hay free choice. Horses were also allowed water ad libitum. Grab samples of hay and grain were taken weekly, and composited for nutrient analysis. The hay and grain samples were dried for 48 h in a forced-air oven, and ground through a 1-mm screen in a Wylie mill. Feed samples were analyzed for DM, (AOAC, Method 934.01, 1999) and N (Leco Corporation, St. Joseph, MI), and NDF and ADF (Van Soest et al., 1991). Digestible energy (DE) of the hay was determined using the following formula (NRC, 2007): $DE, \text{Mcal/kg} = 4.22 - 0.11(\%ADF) + 0.0332(\%CP) + 0.00112(\%ADF^2)$.

Training Procedures and Data Collection

For horses, the “starting” process involves building a foundation. The specific type of foundation can vary depending on the future use of the horse. A foundation in the race horse industry differs from one in the reining or cow horse industry. The goal for this study was to give the horses a solid foundation for any area of future use. The

foundation level for this study was defined as the rider's ability to keep the horse on a set line and speed. The line may be straight or curved; the speed may be walking or running.

Regardless of the line of work, a horse must be able to stay on a set line and speed. A race horse must run at top speed on straight and curved lines around a track. It is also beneficial for the safety of the horse and jockey, if they can travel on straight and curved lines to be ridden into the starting gate. A reining cow horse must learn to stay on straight lines to complete a run down for a sliding stop and curved lines to complete figure eights and spins. A reining cow horse must also learn to stay on straight and curved lines set by a cow, in order to follow and rate the cow. The goal for this study was to be able to keep the horse on a set line and speed. Measurements were taken by the trainer to determine the level of resistance in accomplishing the goal.

Training Effectiveness: Effective training for this study was defined as when the horse had attained: 1) a solid foundation of maneuvers, 2) a balanced life to direction ratio, 3) good communication, 4) willing submission, and 5) low levels of self-preservation.

Solid Foundation of Maneuvers – Definition and Scoring: Solid foundation of maneuvers was defined as the ability to move the 3 parts of the horse (head and neck, front quarters, and hindquarters) in any direction to accomplish any job. Developing a solid foundation of maneuvers involved 3 stages and was achieved by gaining control of the head and neck, front quarters (shoulders), and hindquarter. Horses have 3 parts, and if any 2 parts are in line, the horse will travel in the direction of the 2 parts that are in

line. For example, if the horse's front quarters and hindquarters are in line, regardless of the direction of the head and neck, the horse will travel on the line set by the front quarters and hindquarters. The method of keeping the horse on a set line varied depending on what stage the horse was in. Stage 1 involved directing the head and neck, then moving the hindquarters in the opposite direction to bring the 3 parts of the horse in line. Stage 2 involved moving the front quarters laterally to prepare the horse for stage 3. Stage 3 involved directing the head and neck, then bringing the front quarters the same direction to bring the 3 parts of the horse in line.

For this study horses were trained to stay on a set line and speed by learning stage 1, stage 3 and the intermediary step of stage 2. Each week the rider trained the horses to move their hind feet and front feet giving them a foundation to accomplish any future job a person would expect them to perform. The focus of week 1 was stage 1, the focus of week 2 was stage 2, and the focus of week 3 was stage 3.

The trainer scored the horse's foundation of maneuvers by the ability to move the front quarters (front feet) and hindquarters (hind feet) by directing the head and neck to accomplish a job. On days 15 to 19 and days 22 to 26, the trainer scored each horse on a scale from 1 to 5 on the willingness to move the front feet and the hind feet. Horses front feet and hind feet were each scored separately. The scoring system was: 1 = Very unwilling to directing feet; 2 = Reluctant in directing feet; 3 = Fairly willing in directing feet; 4 = Willing in directing feet; and 5 = Very willing in directing feet. A solid foundation of maneuvers deals with directing the head and neck to move the feet in the

direction that we want; forward, backward and lateral. In order to have any success in accomplishing this task, there must be a balanced life to direction ratio.

Direction – Definition and Scoring: Direction was defined as when the slack was taken out of the rein, the horse put the slack back in the rein for horizontal (axis vertebrae) and vertical flexion (atlas vertebrae), with suppleness through the poll and loin. When the horse becomes supple through the poll and loin, the 3 parts of the horse will be perfectly in line. The trainer scored each horse for direction on days 15 to 19, and days 22 to 26 on a scale from 1 to 5. The scoring system was: 1 = Fighting, when slack was taken out of the rein, the horse flipped or shook his head during the ride; 2 = Argument, when the slack was taken out of the rein the horse's head came up, and he was stiff through the poll and loin at times; 3 = Disagreement, when the slack was taken out of the rein the horse hesitated at times before putting slack back in the rein; 4 = Agreement, when the slack was taken out of the rein the horse put slack back into the rein for the majority of the ride; and 5 = Total agreement, when the slack was taken out of the rein the horse always and immediately put the slack back in the rein seeking relief.

Life – Definition and Scoring: Life was defined as the ability to move the horse's feet with any speed at any time. When the rider's legs were lightly fanned, the horse should move its feet with the speed wanted. The trainer scored life on days 15 to 19, and days 22 to 26 on a scale of 1 to 5 on the rider's ability to bring the life into the horse. The scoring system was: 1 = Drive spurs into belly to get to move, inflict pain, constant pressure; 2 = Hard kicks, semi-constant pressure; 3 = Moves off calf pressure, occasional

spur; 4 = Moves fairly freely, requires light pressure with legs; and 5 = Very free, fan legs or light pressure with calves.

Life to Direction Ratio – Definition and Calculation: The life to direction ratio was calculated by dividing the daily score for life by the daily score for direction. A balanced life to direction ratio was defined as being able to willingly bring the life up and willingly direct it on set line, with suppleness through the poll and loin. A balanced life to direction ratio was considered numerically close to 1.0. A ratio greater than 1.0 indicated that the life was greater than the ability to direct it, and signified lack of control of the horse.

Balancing the life to direction ratio and gaining a solid foundation of maneuvers gives a person the mechanics necessary to accomplish a job. Gaining knowledge into the mechanics of *how* a horse moves can help a person determine *how* to fix any problem that arises. However, if the person never takes notice of the mental aspect of the horse, they will never be able to determine *why* the problem developed in the first place (See appendix – psychological/physiological). To determine why there is a problem, a person must look at the level of communication between the horse and rider, and determine if the horse is willingly submitted.

Good Communication – Definition and Scoring: Good communication was defined as reading, feeling, and understanding what the horse was saying in response to a request (communication involves two individuals, what is the horse saying?). We communicate through the horse's driving and underlying factors along with feel, timing,

and balance. McGreevy (2007) explains, to be effective and humane, horse training must involve subtle application of pressure and its immediate removal once an animal complies. When applying pressure and relief in training it is important that the trainer has the empirical knowledge in operating through feel, timing, and balance (Dorrance, 1987). Feel, timing, and balance can only come through empirical knowledge and experience in working with horses. For the sake of this study we assumed that the trainer had the experience necessary to communicate with the horses through feel, timing, and balance.

The level of communication was measured through the horse's driving factors on days 16, 17, and 19 by scoring the security level of the horse during social separation. Days 16, 17, and 19 were the first solo rides for an extended period of time outside the arena. Horses were ridden in a pasture and a plowed field away from the other horses and without the company of another horse on these days. A horse operating with good communication will show low signs of self-preservation, have confidence in the rider and will experience comfort and companionship with the rider. This may be observed by a high security level with the rider when ridden away from the other horses. A horse operating with poor communication will have low confidence in the rider, show signs of self-preservation and will not experience comfort and companionship with the rider. These horses will have a low security level and will seek comfort and companionship with other horses by constant vocalizations. The trainer scored each horse on its reaction to social separation on a scale of 1 to 5. The scoring system was: 1 = Constant nickering, desperately looking for other horses; 2 = Frequent nickering, wanting to return

to the other horses; 3 = Little nickering, looking for other horses, but fairly confident in rider; 4 = Occasional nickering, mostly confident in rider, occasionally looking for other horses; 5 = No nickering, confident in rider not concerned with other horses.

Willing Submission – Definition and Scoring: Willing submission was defined as when a request was made the horse willingly performed the task requiring little to no pressure; it was the horse's idea. After initial contact, the horse performed the task on a loose rein and with no leg pressure. The trainer scored each horse on the level of willingness displayed during the ride on days 11 to 12, days 15 to 19, and days 22 to 26 on a scale of 1 to 5. The level of willingness demonstrated during a ride can interchangeably be described as willing submission. The scoring system was: 1 = Displayed willingness 0 to 10% of the time during the ride; 2 = Displayed willingness 20 to 40% of the time; 3 = Displayed willingness 40 to 60% of the time; 4 = Displayed willingness 60 = 80% of the time; and 5 = Displayed willingness 80 to 100% of the time.

Willing submission was also measured by the amount of time it took to reach training satisfaction for that day. The trainer worked with each horse for a target amount of approximately 45 minutes for the first 5 rides, and a target amount of approximately 30 minutes the following 10 rides. Training satisfaction was defined as when the horse had improved from the day before in building a solid foundation of maneuvers, showing signs of good communication, attaining willing submission, and balancing the life to direction ratio. The amount of time to actually reach training satisfaction was recorded daily.

Actual time spent working the horse on the ground, and time to saddle the horse before riding were also recorded.

Self-Preservation- Scoring: Horses have 2 underlying factors which drive the 3 primary driving factors; self-preservation, comfort, and companionship. The 2 underlying factors are confidence and energy. As the horse's confidence increases, self-preservation decreases. The horses' self-preservation level was measured the first day of training (day 8) by their response to a novel stimulus, in this case a flag. The flag consisted of a plastic bag placed on a stick and then shaken in the horse's blind spot above its withers. The horses were scored by an observer on a scale of 1 to 5 on the level of showing signs of self-preservation, sensitivity, and restlessness in response to the flag. A horse showing low signs of self-preservation, sensitivity, and restlessness in response to the flag was defined as having a high level of confidence. A horse showing high signs of self-preservation, sensitivity, and restlessness in response to the flag was defined as having a low level of confidence.

Self-preservation was also measured through step count. A horse operating with low confidence and seeking comfort and companionship away from the rider should have a higher step count, than a horse operating with confidence and experiencing comfort and companionship with the rider. Step count was measured by a Horse-O-Meter pedometer placed on the horse's left front forearm (Holland et al., 1996) and recorded at the end of each training day.

Physiological Measures of Stress

During stress and exercise the sympathetic nervous system and the hypothalamic-pituitary-adrenal system are activated. Heart rate was used as a measure of the sympathetic nervous system, and plasma cortisol was used as a measure of the hypothalamic-pituitary-adrenal system (Hyypä, 2005).

Heart rate was recorded on days 8 to 12, days 15 to 19, and days 22 to 26 with a Polar Heart Rate Monitor, Model S810 (Polar Horse Heart Monitors, Corte Madera, CA, 94925) which consisted of 2 electrodes, a built in transmitter, and a wristwatch receiver (Headman, 2003). The electrodes were connected to each other via a rubber-covered wire, and were placed on either side of the girth, under the girth, next to the horse's body. The wire continued from one electrode, over the horse's withers and down to the other side of the girth. The connecting wire contained the transmitter. The transmitter was tied to the saddle, beneath the saddle horn, to the dees designed for a breast collar. The data received was stored and later downloaded via a Polar Interface to a computer, using the software Polar Equine SW, version 4.02.036 H (Polar Electro Oy, Kempele, Finland). Specially manufactured contact gel was used to insure contact between the skin and electrode (Headman, 2003). Data was recorded as average heart rate every 5 seconds during the riding sessions.

Cortisol was measured through saliva (Strazdins et al., 2005) and collected on days 8, 12, 15, 19, 22, and 26. Swabs were placed in the horse's mouth at the end of the training period. Cotton swabs were swept by the trainer's fingers along the horse's tongue and inside of their mouth until saliva-soaked. Samples were frozen immediately after

collection and kept in a freezer until later analysis. The saliva was then thawed at room temperature, transferred to a 10 mL tube and centrifuged for 5 min at 2,000 x g and 4 degrees C to remove debris. The supernatant was kept on ice and used to provide all the test samples of saliva. The supernatants were aliquoted into multiple Eppendorf tubes, and refrozen prior to assay (Strazdins et al., 2005). All samples were assayed in duplicate, using the High Sensitive Salivary Cortisol Enzyme Immunoassay Kit (Salimetrics, LLC).

Panel Scoring

Training productivity (task completion by the horses) and temperament were measured by panel scoring on days 11, 18, and 26. The horses were scored on their ability to complete a series of tasks, and on characteristics that were indicative of their temperament. The panel consisted of 6 individuals involved in the equine industry in varying capacities. All were familiar with negative reinforcement training methods used in the study.

The specific test score sheets are presented in the Appendix. Since establishing a foundation of maneuvers in this training program consisted of 3 stages, each test evaluated a separate stage. Stage 1 was measured on the week 1 test, stage 2 on the week 2 test, and stage 3 on the week 3 test. Horses were scored from 1 to 5 on their ability to perform individual tasks and demonstrate the appropriate stage in relation to the week. The scoring system was: 1 = Very poor; 2 = Poor; 3 = Fair; 4 = Good; and 5 = Excellent.

Each testing day the panel also scored the horses' temperament while performing the tasks. Temperament was measured through signs of self-preservation (gets excited

easily), sensitivity (responds to light pressure), restlessness (can't stand still), and willingness (Visser, 2001). Each temperament variable was scored separately on a scale from 1 to 5. The scoring system was: 1 = No signs of behavior; 2 = Very low frequency of behavior; 3 = Low frequency of behavior; 4 = Intermediate frequency of behavior; and 5 = High frequency of behavior. High levels of self-preservation, sensitiveness, and restlessness during the stages of training in this study were construed as negative behavioral characteristics. High levels of willingness to perform were considered positive behavioral characteristics.

Test 1 – Day 11: Horses were asked to perform 7 tasks and demonstrate a solid foundation in stage 1. The 7 tasks performed were: standing quietly to saddle, accepting the bridle, standing to allow rider to mount, tipping the nose (suppleness through the neck), breaking the hindquarters (walk hind feet around front feet), ability to move out soft in a lope (in the round pen and out in the arena), and backing up by lightly pulling on both reins.

Test 2 – Day 18: Horses were asked to perform 6 tasks and demonstrate a solid foundation in stage 2. The 6 tasks performed were: ability to stand to saddle, accept bridle and stand to get on; lope in a straight line calm and relaxed (ability to lope from point A to point B with little correction by the rider), stop by lightly pulling back on both reins, back up, leg yield (lateral movement of front feet and hindquarters), and trot a circle in both directions.

Test 3 – Day 26: Horses were asked to perform 7 tasks and demonstrate a solid foundation in stage 3. The 7 tasks performed were: open and close a gate (staying close

enough to gate that the rider never had to take his hand off the gate, horse had to side pass next to gate, allow rider to bend down to unlatch gate, open and ride through gate, side pass to close gate and wait for rider to bend down and latch gate), walk the front end around the hindquarters, lope a circle both directions (performing figure eights in the middle of the arena, with no help from the fence); lope in a straight line, stop straight and back straight; roll backs on fence (lope parallel to fence, immediately stopping at rider's cue, using centrifugal force to pull the frontquarters around the hindquarters and jumping into a lope the opposite direction); and accept a rope (allow rider to swing rope, throw loop to the ground in front of the horse, step into the loop and accept the rope up and down the hind legs, allow rider to rope the horse's front feet at a walk).

Detailed Daily Training Methods

The goals of the training methods used were to gain control of the 3 parts of the horse (head and neck, shoulders, and hindquarters) and regulate the speed of the horse to accomplish a job. Every day the trainer tried to achieve willing submission, good communication, balance the life to direction ratio, and build on the foundation of maneuvers. The focus of week 1 was to achieve stage 1 of a solid foundation of maneuvers, the focus of week 2 was stage 2, and week 3 focused on stage 3.

Day 8: The focus of day 8 was to lower the self-preservation level of the horse and build the horse's comfort and companionship with the trainer, learn stage 1 in a crisis situation, and to accept the bridle, saddle, and weight of the rider.

The horse was haltered and led into a set of stocks where a surcingle was placed around the horse's girth to attach the heart monitor. The horse was led out of the stocks and into a 16.6 yard round pen. The round pen was built out of 3.3 yard panels attached together in the corner of a 16.6 x 50 yard arena. The horse was led into the round pen where it was flagged from another horse. During the flagging process the horse learned: 1) stage 1 during a crisis situation; 2) direction, suppleness through poll and loin, and to give to pressure; 3) to stop when tight or bothered; 4) to stand to relieve pressure; 5) to accept being touched by the flag in preparation for saddle and rider; and 5) to accept someone above them.

The trainer wrapped the horse's lead rope around his saddle horn twice and tucked the remaining rope under his leg. This enabled the trainer to ride his saddle horse with one hand and flag the study horse with the other hand, without having to keep the lead rope wrapped around the saddle horn. By wrapping the lead rope around the saddle horn and sitting on the tail, the study horses were securely tied to the saddle horse. However, in case of an emergency the trainer could lift his leg and the lead rope would unwrap from the saddle horn, freeing the study horse from the saddle horse. The lead rope distance from the saddle horn to the halter of the horse did not exceed the distance of the flag held over the horse's withers. Once the lead rope was securely fastened to the horn, the saddle horse was ridden to the study horse's tail and the flag was placed in the horse's blind spot over the withers.

When the horse's driving factor of self-preservation was engaged the horse used its hindquarters to drive forward to escape the perceived danger of the flag. However,

when the lead rope became tight, the horse's hindquarters would be disengaged, taking away the driving factor of self-preservation to run for safety. The hindquarters were disengaged when the horse would run into the lead rope, stopping the forward motion, and causing the hindquarters to pivot around the inside front foot. When the horse pivoted around the inside front foot, the horse would then be facing the saddle horse at which time the pressure of the flag would be taken away briefly and the horse would be given relief. The process was repeated on both sides, until the horse did not fear the flag and when the slack was taken out of the lead rope, the horse would willingly stop the forward motion and pivot around the inside front foot.

As long as the horse was moving the horse experienced the pressure of the flag, however, if the horse slowed down or stopped, the motion of the flag would slow down or stop. The horse learned that its movement was controlling the movement of the flag. As long as the horse stopped the flag would stop. This taught the horse that whenever it felt tight or unconfident in a situation, it could always stop or turn to the trainer for comfort and companionship. As the energy level decreased and confidence was built by facing the trainer, the horse's driving factor of self-preservation was decreased and it began to look to the trainer for comfort and relief. By teaching the horse stage 1 in a high stress situation, the horse learned to submit its driving factors under high levels of self-preservation. This was an extremely important step that carried over to riding the horse. Whenever the horse got tight or bothered and began to be driven by its self-preservation, the trainer could disengage its hindquarters, taking away the power driving its self-preservation.

When the horse learned to stop and accept the flag on both sides, maneuvers to prepare for saddling were conducted. The flag was moved from side to side teaching the horse to be comfortable in transitions; from the left side, to the horse's blind spot, to the right side. The flag was moved down the front and hind legs and down the horse's sides where the girth would go. The flag was slapped down on the horse's back in the same manner as saddle would be, preparing the horse for the saddle. The trainer rode next to the horse and petted the horse on the head, neck, and back. He slapped his arm down on the horse's back, preparing the horse for the saddle. After slapping his arm down on the horse's back, the trainer would wait 2 to 3 seconds before repeating. If the horse moved, the trainer rode next to the horse repeating the process until the horse stopped, at which time the horse would be given relief. The process was repeated until the horse gained confidence in the trainer leaning above it and his hand being slapped down on its back.

The trainer then got off his saddle horse and repeated the flagging process from the ground. Once the horse learned to have confidence on the ground, the horse was saddled and stepped forward. The trainer kept hold of the lead rope and if the horse's self-preservation kicked in causing the horse to buck or run, the trainer pulled on the end of the lead rope disengaging the hindquarters. Once the horse could be led around relaxed, it was bridled and turned loose. The horse was driven around the round pen at a walk, trot, and lope with the flag. If the horse began to be driven by self-preservation, it was stopped by the flag and allowed time to relax and rebuild confidence. This continued teaching the horse that it could stop and find comfort with the trainer, whenever it began

losing confidence. When the horse would willingly lope both directions in a calm and relaxed manner, the trainer caught the horse and prepared it for mounting.

Before getting on the horse, the trainer worked on stage 1 and direction from the ground; the horse learned to be supple through the poll and loin, and to stop the forward motion and pivot around the inside front foot, when the slack was taken out of the rein. The trainer prepared the horse for the weight of the rider. The horse learned to widen its front feet and brace itself. After teaching the horse to brace against the weight of the rider, the trainer stepped up in the stirrup until the horse switched eyes from the left eye to the right eye, and then the trainer stepped back down. Once the horse was comfortable switching eyes, the trainer stepped onto the horse's back and then stepped down. This process was repeated several times until the horse stood comfortable to mount and dismount.

Day 9: The horse was led into the round pen and flagged from the ground. Flagging followed the same procedures as day 8. The horse was prepared to saddle and then saddled. After the horse was saddled, it was turned loose and run around the round pen. The horse was moved with a flag until three objectives were met: 1) Decreased energy, decreasing self-preservation, 2) Gained confidence in saddle and bridle, and 3) Gained confidence in trainer. The horse was moved with a flag until it willingly loped both directions without getting tight or scared, bucking or running. If the horse did get tight or scared it was stopped by the trainer and allowed to regain confidence. This taught the horse if it did get tight or bothered, it could always stop to regain confidence.

Confidence was gained in the trainer by being drawn into the middle of the pen to change directions. The horse received pressure when seeking comfort and companionship outside the pen and pressure was removed when looking or thinking about the trainer. This taught the horse to turn into the trainer instead of into the fence when changing directions. As the horse's energy decreased, self-preservation decreased and the horse learned to find comfort and companionship by turning into the trainer and stopping. Once the horse turned and faced it was comforted with petting by the trainer. The trainer watched for the horse's confidence to shift from self-preservation and companionship with other horses, to finding confidence in the trainer. Flagging stopped when the horse learned to move out soft in a lope both directions and turn to face the trainer for relief.

Following flagging preparations the primary goal was to teach the horse: 1) horizontal direction (when the slack is taken out of the rein, the horse puts the slack back in the rein for horizontal [axis vertebrae] with suppleness through the poll and loin), and 2) stage 1 in the foundation of maneuvers (stop forward motion, pivot around the inside front foot). The horse was directed by the lead rope tied to the halter, not the bridle. On days 8 and 9 the horse was allowed to pack the snaffle bit in its mouth and become familiar with it, before any pressure was put on the snaffle bit reins. The horse was prepared to mount by accepting rider's weight on the side and above the horse. The horse was mounted and ridden at a walk and trot. It was taught horizontal direction and stage 1 from the horse's back.

Day 10: Procedures from days 8 and 9 were repeated; flagging from the ground (preparations for saddling) and flagging loose with the saddle (to decrease self-preservation and increase confidence). Time spent flagging decreased everyday as the horse's self-preservation decreased and the horse learned to find confidence in the trainer. Following the flagging procedures, the horse was taught direction and stage 1 from the ground using the snaffle bit reins. The horse was ridden at a walk, trot and lope, and the reins were used to "double" (stage 1) the horse (see Appendix). The horse was trained to double for the safety of the horse and rider. Before leaving the safety of the round pen, the horse had to learn how to disengage its hindquarters to prevent the horse from running off or bucking if it got scared or bothered.

Day 11: Flagging procedures and previous groundwork was repeated to prepare the horse. The horse was turned out of the 16.6 yard round pen into a 16.6 yard x 50 yard arena. The horse was flagged from another horse and taught to find relief at end of the arena. After the horse was turned loose into the arena, it immediately ran to the head of the arena to be close to the other colts tied to a rail outside the gate. Pressure was put on the horse until it left the head of the arena and ran to the end of the arena. The horse learned to find comfort and security within itself at the end of the arena, instead of trying to rely on its companions. The horse learned that it had to sacrifice the companionship with the other horses in order to find comfort at the end of the arena. This valuable lesson played a major role when the trainer began to teach the horse from its back. If the horse's primary driving factor is pushing the horse to seek companionship with its companions, the trainer is limited in training productivity. Teaching the horse this

valuable lesson on day 11 not only prepared the horse for future training, but also decreased the energy, decreasing self-preservation and preparing the horse's mind to learn for the day.

After flagging in the large arena, the horse was brought back into the round pen where it received a brief review in direction and stage 1 from the ground. The horse was then mounted, ridden in the round pen at a walk, trot and lope, and then turned out into the large arena. The primary goals for day 11 were to: 1) teach the horse direction, 2) develop a solid foundation in stage 1, and 3) decrease the horse's driving factor of seeking companionship with other horses. The pre-ride exercise of teaching the horse to find comfort at the end of the arena was repeated from the horse's back. Whenever the horse was at the head of the arena and thinking about the other horses, the horse received pressure making it feel uncomfortable. Whenever the horse left the head of the arena, or thought about the end of the arena, the pressure was removed and the horse received comfort. Eventually the horse learned that it was more comfortable to be with the rider at the end of the arena, then to think about its companions at the head of the arena.

Day 12: The horse received the same pre-riding procedures of days 9 and 10. The horse was ridden in the round pen and in the arena where the trainer built on direction and stage 1 of a solid foundation of maneuvers. When the horse could perform stage 1 at a lope in the arena, the gate was opened to the arena and it was ridden outside. The horse was ridden outside of the east end of the pavilion, ridden around the pavilion and back into the west end of the pavilion. The horse was ridden into the pavilion and

into the arena where it had to ride in-between a set of stocks and the tie racks, where the remaining 5 horses were tied. The horse was then ridden back into the round pen.

Day 15: The horse received the same pre-riding procedures as days 9 and 10, and was ridden inside the round pen and arena. The horse was refreshed on direction and stage 1 at a lope in the arena, and then was ridden outside. The horse left the pavilion and was ridden along various roads of the MSU Towne farm. An older trained horse was ridden by another person to offer the colt companionship, in the event that the horse's self-preservation started to take over its driving factors. The study horse followed the older horse trotting and loping along various roads. Once the study horse began to move out freely, the trainer rode the study horse in the lead and the horse learned to move out in a lope, without following another horse.

The horse was then ridden back into the pavilion and into the arena where it was taught stage 2 (leg yield/side pass – lateral movement of front quarters and hindquarters together). The horse was positioned parallel to the fence and was asked to perform stage 1 (stopping forward motion, pivoting around the inside front foot) until it reached a 45-degree angle with the fence. Once the horse was positioned at a 45-degree angle with the fence, it was asked to move forward. When the horse moved at a 45-degree angle with forward motion, its front feet and hind feet crossed moving in a lateral motion, at which time it was given relief. Once the horse learned to willingly move the front quarters and hindquarters in a lateral motion using the fence, it was asked to perform the same task without using the fence in the center of the round pen.

Day 16: Procedures from day 15 were repeated in the arena. The horse was ridden out of the pavilion and around an MSU pasture by itself. The horse was taught how to direct its life on a straight line and gain confidence riding by itself. The horse was ridden next to the fence around the inside of a square pasture. If it did not want to stay on the fence, it was allowed to come off the fence and learned that it was more work on the inside of the pasture than next to the fence. If the horse did not want to lope around the fence, it was allowed to drift to the inside of the pasture where it was doubled (stage 1) and hustled back to the fence, where it received relief. The hindquarters are the powerhouse that drives the horse's driving factors. Instead of containing the horse's driving factors by holding the head and neck on the fence, the trainer turned loose of the reins and let its hindquarters drive it to the inside of the pasture. After making the decision to seek comfort and companionship away from the fence, the horse's hindquarters (driving factors) were redirected (stage 1) and then it received relief when its driving factor was pointed at the fence. When the horse's driving factors (hindquarters) were pointed at the fence or next to the fence, the horse received relief. Eventually the horse learned it was more comfortable to lope next to the fence than to lean to the inside of the pasture. The horse was taught collection while riding from the pasture to the pavilion. The horse was then ridden back into the pavilion and into the round pen where it was trained further in stage 2.

Day 17: Procedures from day 15 were repeated in the arena. The horse was ridden out of the pavilion and down a MSU Towne farm road. The horse was loped down the road away from the pavilion and trotted back, stopping roughly 200 yards away

from the pavilion. The horse was then walked the remaining distance to the pavilion where it was trained in vertical direction and stage 2. It was ridden into the arena where it was taught how to trot circles. Training procedures followed the Foundation for Perfection Handout (Appendix) part titled Cutting the Circle in Half.

Day 18: The horse was saddled and ridden in the round pen, and then out in the arena. The horse continued to be taught how to trot circles following the Foundation for Perfection Handout (Appendix), and received further training in stage 2.

Day 19: The horse did not receive groundwork. It was led into the round pen, saddled, mounted, and ridden out of the pen. The horse was ridden out of the pavilion and down an MSU Towne farm road. It was ridden back to the pavilion and was taught how to open and close a gate into an outside arena. The horse learned that it was more comfortable to stand next to the gate than to seek comfort and companionship away from the gate. The horse had to work harder when it walked away from the gate and received comfort whenever it was standing parallel with the gate. Eventually the horse learned to seek comfort in the gate. Then the horse was asked to perform stage 2 to move parallel with the gate to open and close the gate.

Day 22: The horse was saddled at the tie rack inside the pavilion, but ridden outside of the arena for the remainder of the day. The horse was mounted in the arena, ridden out of the pavilion and down an MSU Towne farm road. The horse then received further teaching about opening and closing gates and loping circles in the outside arena.

Day 23: The horse was mounted in the arena and ridden outside in a plowed field where it was taught further how to willingly lope circles. Training procedures were according to “loping circles in a field” in the Foundation for Perfection handout (Appendix). The horse was further taught how to open and close a gate. The horse was also taught the beginning of stage 3 (walk front feet around hind feet, pivoting around the inside hind foot).

Day 24: The horse was mounted and ridden in the arena. The horse was further taught how to lope circles in the indoor arena according to “circle to the inside or ride them higher” and “cutting the circle in half” in the Foundation for Perfection handout (Appendix). The horse was further trained in stage 3.

Day 25: The horse was led into the arena and worked with to learn to accept a rope. The trainer swung a rope from the ground over the horse’s withers and roped its legs. The horse learned to seek comfort standing and accepting the rope. As the horse’s confidence level in the rope increased, self-preservation decreased and the horse learned to accept the rope. The trainer then mounted the horse and further increased the horse’s confidence with the rope. The horse was ridden loping circles and was taught how to do roll backs on the fence. It was also further trained in stage 3.

Day 26: The horse was led into the arena and gained further confidence with the rope on the ground and on the horse’s back. The horse was ridden through the gate, side passing to open and close the gate, and outside in the plowed field. The horse was further

taught to willingly lope round circles. It was ridden back through the gate into the arena where it received additional training in roll backs on the fence and stage 3.

Statistical Analysis

The study was a replicated, completely randomized design with repeated measures. Individual horse was the experimental unit. Categorical data (all scoring variables) were transformed by calculating each individual daily score as a deviation from the daily median score of that parameter as each horse's score was relative to the other horses on that day. Panel scoring data were not transformed to deviations, and were analyzed using the scorer as the repeated factor in place of day. All data were analyzed using repeated measures analysis (Littell et al., 1998) with the Mixed procedure of SAS (SAS Inst. Inc., Cary, NC). The covariance structure was modeled, and the autoregressive within animals and random between animals structure was used (Littell et al., 1998). The model included effects of experiment, treatment, day, and all possible interactions. Data are presented as least squares means with differences considered significant at $P < 0.10$.

The SAS statements used for analysis of scoring data were:

```
Proc mixed;  
Classes per trtmt id day;  
Model variable_deviation_name = per|trtmt|day;  
Random id(trtmt);  
Repeated day / sub=id(trtmt) type = ar(1);
```

Lsmeans per|trtmt / bylevel om pdiff;

The SAS statements used for analysis of continuous data (heart rate, pedometer, times) were:

Proc mixed;

Classes per trtmt id day;

Model list_of_variables = per|trtmt|day;

Random id(trtmt);

Repeated day / sub=id(trtmt) type = ar(1);

Lsmeans per|trtmt / bylevel om pdiff;

The SAS statements used for analysis of panel scoring data were:

Proc mixed;

Classes per trtmt id scorer;

Model variable_name = per trtmt per*trtmt scorer;

Random id(per);

Repeated scorer / sub=id(per) type = ar(1);

Lsmeans per|trtmt / bylevel om pdiff;

Results and Discussion

Table 1 presents the nutrient content of the hay fed to 2-yr-old Quarter horses during early training. With an estimated ad libitum dry matter intake (DMI) of 2.75% BW, DMI would have been 11.7 kg/d (425 kg BW x 0.0275). This would have resulted in an intake of 21.9 Mcal DE and 863 g CP, meeting the requirements of 21.5 Mcal DE

and 823 g CP, as set forth by the NRC (2007) for 26-mo-old horses performing light work. These requirements include a weight gain of 0.15 kg/d, while the horses in our study had an average gain of 0.29 kg/d (Table 2). Clearly, the level of intake of hay alone was adequate to meet or exceed nutrient requirements.

Solid Foundation of Maneuvers

The ability to move the horse's front feet or hind feet in the foundation of maneuvers was not affected ($P > 0.17$) by diet or by experiment ($P > 0.40$; Table 2). When a horse's self-preservation is high they become stiff through the poll and loin, which can cause poor direction. However, although the poll and loin may be stiff, the horse's feet can still be directed in the foundation of maneuvers; forward, backward, and laterally. The foundation of maneuvers is the ability to move 3 parts of the horse in any direction to accomplish any job. These findings imply that if a horse has a solid foundation of maneuvers, then a person can get that horse to accomplish a job. However, whenever a person is focused only on the outside of the horse, instead of the inside of the horse, the likelihood of problems greatly increases. Focusing on job completion instead of good communication and willing submission, is the primary cause of horse misbehavior and injuries among horse and rider. McGreevy (2007) reported that horses are being confused on a very regular basis and as a result become unusable or, worse, downright dangerous.

Horses are driven by pressure and relief (McGreevy, 2007), however there is a difference between a horse "giving to pressure and seeking relief" (Black, 2004). A

horse may learn to give to pressure in order to accomplish a job, but if it is not seeking relief and operating with a supple poll and loin, the rider will inevitably experience resistance while doing the job. The resistance can be as mild as having to ride with constant pressure in order for the horse to perform, to the horse elevating or flipping its head in response to direction, to extreme measures of resistance such as bucking and running. Resistance and conflict can render a horse sour, unresponsive and dangerous (McGreevy, 2007). Although a person may be able to get the job done, whenever a horse is ridden with unwilling submission and a stiff poll and loin, the horse is operating as a slave. A slave may be obedient at times, but if they are not willingly submitted, a horse will always run the risk of rebellion. When a horse cannot consistently receive relief from pressures such as the bit, reins, legs, and spurs, chronic and damaging fighting may result (McGreevy and McLean, 2005).

Life and Direction

Life was greater ($P = 0.09$) for horses fed grain compared with horses fed only hay (Table 2). Diet or experiment did not affect ($P > 0.93$) direction. However, the life to direction ratio was more ($P = 0.07$) unbalanced (defined as > 1.0) in grained horses than in horses fed hay alone (average 1.28 vs. 1.08, respectively). An unbalanced ratio indicates poor control in relation to life and can cause numerous problems during training. The further a horse's life to direction ratio exceeds 1.0, the more self-preservation increases, and behavior problems may surface.

When a horse is being ridden with more life in relation to direction, the horse is operating with a low confidence level. As the ratio increases, the amount of confidence

decreases for the horse. In relation to confidence, the horse either needs to fill in for the rider, or the rider needs to fill in for the horse. If the rider is confident riding a horse with a low confidence level and can ride the horse bucking and running, the rider can fill in for the horse's lack of confidence. If the rider can ride the horse long enough until the horse's energy level decreases, lowering the self-preservation, then the rider can build the horse's confidence once the energy is low. After several long rides, the horse's energy reaches a point that it is no longer driving the self-preservation and confidence can be made. This "wet saddle blanket" mentality works well for cowboys that have long days and lots of miles for the horse.

However, the average horse owner is inexperienced (McCall, 2007) and lacks the skills to ride a horse with low confidence and the miles needed to lower the energy. To prevent behavior problems in young horses and possible injuries for unconfident riders, the ideal situation would be to have a balanced life to direction ratio. Our study suggests that feeding grain to horses resulted in a more unbalanced life to direction ratio compared to horses fed hay only.

Willing Submission

Experiment x treatment interactions were observed for willingness ($P = 0.02$), total time to achieve training satisfaction ($P = 0.005$), and ground time ($P = 0.02$; Table 2). In Exp. 1, grain did not affect ($P > 0.10$) willingness, while horses fed grain in Exp. 2 were less willing during training ($P = 0.02$) than those not receiving grain. Total time to achieve training satisfaction was increased ($P = 0.005$) by 20%, and time spent training on the ground before riding was increased ($P = 0.02$) by 40% by feeding grain in Exp. 2,

but were not different ($P > 0.10$) due to diet in Exp. 1. The time it took to saddle the horses was increased ($P = 0.07$) by 42% in Exp. 2 compared with Exp. 1, indicating more time was required before the horses' self-preservation levels were decreased enough to proceed with mounted training.

It was highly unlikely that the experiment x treatment interaction was due to variance in weather conditions. Table 4 shows temperatures from Exp. 1 and Exp. 2. The mean and maximum temperatures for Exp. 1 (5/21/07 to 6/08/07) were 52.2°F and 64.6°F, respectively, and weather conditions during this time period were on average cold, rainy and cloudy. The mean and maximum temperatures for Exp. 2 (7/02/07 to 7/20/07) were 76.6°F and 92.2°F, respectively, and this time period was on average sunny and hot to very hot (National Weather Service Data). Jorgensen and Boe (2007) observed 9 adult horses in a paddock and found that with low temperatures and rain, horses were more restless, and walked significantly more than in warmer weather.

Horses in Exp. 1 were ridden in cold, wet and cloudy conditions while horses in Exp. 2 were ridden in hot and sunny conditions. If weather had been a factor influencing behavior, the opposite results would have been expected. Horses in Exp. 2, ridden in hot and sunny weather, should have been less restless and easier to train than horses ridden in Exp. 1, however, the opposite was observed. For this reason we conclude that weather was not a factor causing the interaction between treatment and experiment.

The experiment x treatment interactions may have been due to an increased body condition score in horses in Exp. 2 compared with horses in Exp. 1. When the horses were initially allotted to their assigned treatments, the groups weighed the same.

However, by the time Exp. 2 was conducted, the second group of horses, who had been eating hay ad libitum and were not being ridden, weighed 19 kg more ($P < 0.001$) than the horses in Exp 1, approximately equivalent to 1 body condition score (NRC, 2007). Average daily gain during Exp. 1 was not different ($P > 0.10$) between diets (average 0.58 kg), whereas ADG during Exp. 2 was less ($P = 0.004$) for horses fed hay alone compared with those fed grain (-0.08 vs. 0.08 kg, respectively), and less ($P < 0.001$) than ADG in Exp. 1. This suggests that horses in Exp. 2 worked harder or expended more energy than horses in Exp. 1, resulting in a longer time to achieve training satisfaction. McCall (1989) found that horses with a higher body condition score were distracted more easily during discrimination testing than horses with a lower body condition score.

Dietary energy fuels the horse and can be construed as the horse's motivation and determination. Energy fuels the horse's driving factors and can be positive or negative, depending on the confidence level of the horse. A horse that is not being driven by self-preservation and is seeking comfort and companionship with the rider will be more motivated and determined to do a job as the energy increases. For example, a performance horse that has confidence in the job and the rider is able to perform at a very high level. However, a horse that is being driven by self-preservation (fight or flight) and seeking comfort and companionship away from the rider will be more motivated and determined to rebel against the rider. An example of this might be a young horse that has not been handled or ridden. As training progresses and the horse gains more confidence in the trainer and the jobs the trainer asks the horse to perform, the horse's driving factors can be used to the trainer's advantage with the increase of dietary energy.

However, these results suggest that increasing the dietary energy level during the early stages of training, lower the level of willingness, and lengthen the time to achieve training satisfaction. Lengthening the time to achieve training satisfaction puts more work on the horse and can be costly to trainers. It is to the horseman's advantage to train animals by the most efficient, least time-consuming method (Rubin et al., 1980). The increased time necessary to achieve training satisfaction could result from the increase in energy fueling the horse's self-preservation. As a result, lengthening the time required to decrease the energy, and decrease the self-preservation to a level so confidence and training satisfaction can be gained. Vervaecke (2006) found that horses with a higher body condition had higher levels of self-preservation shown by acts of dominance including biting, kicking, chasing, and fighting in the herd.

Self-Preservation

Minimum heart rate (HR) during training was greater in grained horses ($P = 0.003$) during Exp. 2 (Table 2), suggesting a higher level of self-preservation compared with horses fed only hay. No difference ($P > 0.10$) in minimum HR was seen due to diet in Exp. 1. This could possibly be explained by the increase in body condition between horses in Exp. 1 and Exp. 2. Grained horses in Exp. 2 had higher levels of dietary energy fueling their driving factors through body condition, than grained horses in Exp. 1. Due to an increase in dietary energy and not taking more time to increase confidence, the increased energy may have fueled the horse's self-preservation increasing their minimum HR. Heart rate was shown to be highly correlated with behavioral and physiological estimates of self-preservation (McCall et al., 2006).

There are two ways to remove the horse's self-preservation: 1) increase confidence, or 2) decrease energy. Energy is motivation and determination and fuels the driving factors. If the horse does not have a high level of confidence in the trainer and the energy is increased, the increased energy will fuel the horse's self-preservation. This concept was supported by the increase in minimum HR shown by grain-fed horses in Exp. 2.

Horses in Exp. 2 had a higher ($P = 0.01$) mean HR during training than horses in Exp. 1 (average 127 vs. 117 beat/min, respectively), another indication that horses in Exp. 2 worked harder than those in Exp. 1. This increase in HR may have also been due to the increase in body condition from Exp. 1 to Exp. 2. Maximum HR during training was not affected ($P > 0.21$) by diet or experiment (average 208 beats/min).

The step count or locomotor activity during training sessions was 20% greater ($P = 0.008$) for horses fed grain compared to those fed only hay in Exp. 2, while no difference ($P > 0.10$) in steps per session was seen due to diet in Exp. 1. The increase in locomotor activity from Exp. 1 to Exp. 2 could have been due to the increase in body condition. Horses with a higher body condition and receiving grain had to be ridden 20% harder than horses that did not receive grain. Horses had to take 20% more steps to decrease the energy, decreasing self-preservation, so confidence could be gained with the trainer and the jobs in which the trainer asked the horse to perform. Efficiency in training can be reduced when horses are pushed to work too hard (Rubin et al., 1980). An alternate method to pushing young horses harder to decrease the energy, decreasing the self-preservation, could be to lower the dietary energy. Horses would have to be worked

less and less time and money would have to be spent by trainers and owners. In addition, increased step count suggests a great level of nervousness during training, and nervous horses have been shown to be less trainable (Heird et al., 1981).

An experiment x treatment interaction was observed for the response to a flag ($P = 0.07$). Horses fed grain in Exp. 2 demonstrated more self-preservation behavior during exposure to a flag on the first day of training compared with horses consuming hay only, while no difference was observed due to diet in Exp. 1. Grained horses in Exp. 2 likely showed more signs of self-preservation due to the increase in BCS. Grained horses in Exp. 2 had more energy to fuel their driving factors resulting in higher self-preservation. Holland et al. (1996) found horses fed energy in the form of fat rather than grain had lower reactivity in a startle test, measured by abruptly opening a brightly colored umbrella.

We were not able to measure self-preservation through salivary cortisol. Similar problems were encountered in volume adequacy as Blackshaw and Blackshaw (1989) and Yates et al. (2008). Work done by Dr. Berardinelli's lab, Montana State University, determined that salivary samples collected from Quarter horses did a poor job in adequately reflecting blood cortisol concentrations (Hendry et al., 2009). Mean cortisol concentration in saliva was 3.44 ng/mL and average percent recovery was $78.5\% \pm 19.4\%$. Hendry et al. (2009) also found no correlation between cortisol concentrations in blood and saliva. These findings contradict Yates et al. (2008) in their support of salivary cortisol as an alternative method of stress determination.

Good Communication

There was an experiment x treatment interaction ($P = 0.09$) for reaction to social separation (Table 2). Horses fed grain in Exp. 2 showed more signs of whinnying and desperately wanting to return to the other horses, indicating a lack of communication compared with horses fed hay alone. This lack of communication is likely due to the increase in dietary energy in the form of body condition from Exp. 1 to Exp. 2.

Increasing the energy possibly increased the horse's motivation and determination to seek comfort and companionship away from the rider. Horses without security in the rider are more difficult to train because they are not focused on the rider's cues; instead they are focused on seeking comfort and companionship with other horses. These results suggest that increased dietary energy in the form of body condition lowers the communication level.

Correlations Between Objective and Subjective Measurements

We were interested in seeing if our subjective behavior scoring measurements were reflective of our objective measurements. Objective measurements were measurements that were not subject to human bias such as heart rate and time worked. Subjective measurements were scores of behavior given by the trainer such as life, direction, and willing submission.

Experiment 1: Life was correlated with maximum HR and ground time worked ($P \leq 0.08$; Table 3). This indicates that horses subjectively scored as having higher life also

had higher ($P = 0.01$) maximum HR. Heart rate has been reported to be a good indicator of temperament in horses (Visser et al., 2002) with more nervous horses having higher HR (McCann et al., 1988). Horses with a higher subjective score for life were worked for a longer time on the ground ($P = 0.08$). Horses that had higher life had to be worked longer on the ground, lowering the energy fueling self-preservation until the rider felt they were safe to get on. There was a tendency ($P = 0.15$) for horses with a higher score for life to have a lower standard deviation (SD) of HR. Variability in HR has been reported to be inversely related to stress in horses (von Borell et al., 2007).

Direction was negatively correlated with total time and ground time worked ($P \leq 0.001$). These results show that as the score for direction increased total time worked and time worked on the ground decreased. Direction is defined as when the slack is taken out of the rein, the horse puts the slack back in the rein with suppleness through the poll and loin. A horse that is ridden with high levels of self-preservation will have a stiff poll and loin and will be less likely to receive direction from the rider. The negative correlation of direction to time worked shows that horses that received higher direction scores were less likely to be driven by their self-preservation and as a result were easier to train and completed daily tasks sooner.

Life:Direction was positively correlated with ground time worked and maximum HR, and negatively correlated with SD HR ($P \leq 0.08$). This shows that as the life to direction ratio increased, maximum heart rate increased and the SD of the heart rate (how much variation in heart rate in one horse on one day) decreased. Heart rate was shown to be highly correlated with behavioral and physiological estimates of self-preservation

(McCall et al., 2006). Horse with higher heart rates had higher levels of self-preservation supporting the life to direction ratio score that was given by the trainer. As the life to direction ratio increased, ground time also increased, showing that horse that had more life in relation to direction had to be worked longer on the ground to lower the energy before they could be ridden.

Obedience was negatively correlated with total time and ground time worked ($P \leq 0.04$). Objective measurements of total time and ground time support the subjective scoring of obedience. Horses that were less willing to submit to the will of the rider, had to be worked longer on the ground to prepare the horse to ride and had to be ridden longer to achieve training satisfaction.

Experiment 2: The subjective score for life was positively correlated ($P \leq 0.09$) with ground time worked, minimum, mean, and maximum HR, and negatively correlated with SD HR ($P = 0.0$). Horses that received a higher life score had to be worked longer on the ground to reduce the energy before they could be ridden. The subjective life score given by the trainer was also supported by the objective HR measurements. Horses that received higher life scores had higher hearts rates showing that as the score for life went up their HR went up as well.

Direction was negatively correlated with total time worked ($P = 0.05$). As direction scores increased, the time the horse was ridden decreased. This correlation implied that horses receiving higher direction scores likely had lower levels of self-preservation, were easier to train, and reached training satisfaction sooner for the day.

Life:direction was positively correlated with total time and ground time worked ($P \leq 0.04$). Horses that had more life in relation to direction had to be worked longer on the ground to lower the energy, before they could be ridden, and had to be worked longer in total before training satisfaction could be achieved.

Willingness was negatively correlated with total time worked ($P = 0.02$). This result indicated that as the willingness score went up, the time the horse was worked went down, supporting the idea that horses were obedient to commands and training satisfaction was reached sooner. There was a tendency ($P = 0.13$) for willingness scores to be negatively correlated with mean HR, indicating that horses receiving higher scores for willingness were calmer (McCann et al., 1988).

Panel Scoring

The panel scoring resulted in little statistical significance between diets or experiments. In test 1 at the end of week 1, a treatment effect was found for breaking hindquarters ($P = .04$), with horses fed grain being scored higher for this task compared with horses not fed grain (Table 5). More importantly, in test 1 the scorer was found to have an effect on the score received for 5 variables: accept bit ($P = 0.008$), tip nose ($P = .05$), move out at a lope ($P = 0.06$), back up ($P = 0.001$), and self-preservation ($P = 0.03$).

In test 2 at the end of week 2, a treatment effect was found for restlessness ($P = 0.09$) with horses fed grain receiving a higher score compared with horses not fed grain (Table 6). This indicated that the panel perceived that horses fed grain were more restless than horses not fed grain. In test 2 scorer had an effect on the score received for 5

variables: stand to get on ($P = 0.03$), back up ($P = 0.01$), leg yields ($P = 0.001$), self-preservation ($P = 0.09$), and sensitivity ($P = 0.04$).

In test 3 taken at the end of week 3, experiment affected the score received for 4 variables (Table 7). Horses in Exp. 1 received a higher score for completion of the tasks of open and close a gate ($P = 0.01$), moving out at a lope ($P = 0.08$), and accepting a rope ($P = 0.08$) compared with horses in Exp. 2. In addition, horses in Exp. 2 received higher scores for restlessness ($P = 0.03$) compared with horses in Exp. 1. Scorer affected the score received for open and close a gate ($P = 0.06$), stopping ($P = 0.01$), backing up ($P = 0.01$), roll backs ($P = 0.07$), and sensitivity ($P = 0.01$).

Panel data was collected solely on observation and the inconsistency was likely due to insufficient training of the panel, to ensure uniformity. Panel observations on the foundation of maneuvers, temperament, and ability to accomplish a job were made without a set of strict standards employed. The panel was asked to measure temperament through self-preservation, sensitivity, restlessness and willingness. More consistency may have been found if specific criteria had been given to measure these variables, such as self-preservation – judged by the height of the horse's head, signifying the confidence level. Also it was difficult for the panel to judge the first set of horses because they had nothing to compare them to. The panel was uncertain of what the trainer was capable of in fifteen rides.

Making observations on the foundation of maneuvers and ability to accomplish a job was very difficult because the horses were so close in their abilities to perform. The study found no statistical significance in the foundation of maneuvers showing that the

horses were very similar in their training. The trainer tried to demonstrate the horse's ability to perform the foundation of maneuvers and the ability to accomplish a job. Some of the horses did not have as much confidence in these areas. However, the trainer was able to make up for the horses lack of confidence and this could not be detected by the panel.

Summary and Implications

These findings imply that increasing available energy through body condition and feeding grain during the early stages of training decreased training effectiveness in 2-yr-old Quarter horses by increasing self-preservation behavior, lowering communication, decreasing willing submission behavior, and causing an unbalanced life to direction ratio. Willing submission is a key factor in starting young horses. Horses that do not submit willingly may become resentful to commands and dangerous to their riders. Horses in training programs are often ridden for a defined period of time. These results suggest that training satisfaction may be reached sooner if horses have a lower available energy level from both diet and body reserves.

Table 1. Nutrient content (DM basis) of hay fed to 2-year-old Quarter horses during training

Item	Hay
DM, %	93.0
CP, %	7.4
NDF, %	66.1
ADF, %	39.8
DE, Mcal/kg ¹	1.87

¹Calculated as: $DE, \text{Mcal/kg} = 4.22 - 0.11(\%ADF) + 0.0332(\%CP) + 0.00112(\%ADF^2)$
from NRC, 2007.

Table 2. Effects of feeding grain on measures of behavior during early training in 2-year-old Quarter horses

Item	Treatments ¹				SEM	<i>P</i> -values		
	Exp. 1		Exp. 2			Exp	Trt	Exp x Trt
	No grain	Grain	No grain	Grain				
N	3	3	3	3				
Initial wt, kg	405.8	407.5	425.5	426.1	3.87	<0.001	0.76	0.88
Final wt, kg	425.2	426.7	424.2	429.1	3.57	0.83	0.37	0.64
Average wt, kg	415.9	417.6	425.3	428.0	3.71	0.008	0.55	0.88
ADG, kg	0.58 ^c	0.57 ^c	-0.08 ^a	0.08 ^b	0.028	<0.001	0.01	0.004
Foundation of maneuvers								
Front feet ²	-0.49	0.06	-0.06	-0.03	0.196	0.40	0.17	0.22
Hind feet ²	-0.09	0.13	-0.13	-0.03	0.249	0.72	0.54	0.82
Good communication								
Fearfulness ²	0.09	0.36	-0.01	0.34	0.137	0.69	0.05	0.75
Social separation ²	-0.14 ^{ab}	0.31 ^{ab}	1.03 ^b	-0.36 ^a	0.470	0.61	0.34	0.09
Life and direction								
Life ²	-0.19	0.08	-0.43	0.23	0.269	0.88	0.09	0.48
Direction ²	-0.05	0.02	0.04	-0.08	0.286	1.00	0.93	0.75
Life:direction	1.15	1.31	1.01	1.25	0.108	0.40	0.07	0.73
Willing submission								
Willingness ²	-0.24 ^a	0.17 ^{ab}	0.41 ^b	-0.24 ^a	0.22	0.59	0.59	0.02
Total time, min	34.3 ^{ab}	31.4 ^a	31.1 ^a	37.4 ^b	1.60	0.41	0.27	0.005
Ground time, min	11.7 ^a	10.8 ^a	11.2 ^a	15.7 ^b	1.15	0.09	0.13	0.02
Time to saddle, min	5.0	5.5	6.5	8.4	1.06	0.07	0.31	0.53
Self-preservation								
Minimum HR, bpm	53.8 ^a	54.5 ^a	54.4 ^a	69.5 ^b	1.65	0.002	0.002	0.003
Mean HR, bpm	115.5	118.8	121.2	132.6	3.11	0.01	0.02	0.19
Maximum HR, bpm	203.9	208.5	204.9	213.8	4.94	0.54	0.21	0.68
SD HR, bpm	34.7	34.9	34.2	32.3	1.84	0.75	0.56	0.55
Activity, steps	3,239 ^{bc}	2,895 ^{ab}	2,831 ^a	3,391 ^c	166.5	0.80	0.52	0.008
Response to flag ²	0.17 ^{ab}	-0.83 ^a	-0.50 ^a	1.17 ^b	0.646	0.33	0.62	0.07

¹ Two experiments with horses having ad libitum access to hay and supplemented with 0 kg/d (No grain) vs. 2.3 kg/d (Grain) commercial grain mix. Six different horses were used in each experiment. ² Scored as 1 to 5; units are deviations from daily median for that parameter. ^{a,b,c} Within a row, means without a common superscript letter differ ($P < 0.10$).

Table 3. Correlations for observational behavior measures and quantitative measures

Item	Total time worked	Ground time worked	Minimum heart rate	Mean heart rate	Maximum heart rate	SD heart rate
Experiment 1						
Life						
r =	NS	0.19	NS	NS	0.28	-0.16
P-value =		0.08			0.01	0.15
Direction						
r =	-0.36	-0.47	NS	NS	NS	NS
P-value =	0.001	<0.0001				
Life:direction						
r =	NS	0.29	NS	NS	0.20	-0.21
P-value =		0.008			0.08	0.06
Willingness						
r =	-0.21	-0.27	NS	NS	NS	NS
P-value =	0.04	0.01				
Experiment 2						
Life						
r =	NS	0.38	0.23	0.19	0.34	-0.27
P-value =		0.0005	0.04	0.09	0.002	0.02
Direction						
r =	-0.22	NS	NS	NS	NS	NS
P-value =	0.05					
Life:direction						
r =	0.37	0.23	NS	NS	NS	NS
P-value =	0.001	0.04				
Willingness						
r =	-0.23	NS	NS	-0.16	NS	NS
P-value =	0.02			0.13		

* r = Pearson's correlation coefficient.

Table 4. Weather observations during behavioral measurements in Exp. 1 (May 21 to June 8, 2007) and Exp. 2 (July 2 to July 20, 2007)

Date	Observation	National Weather Service data ¹			
		Min temp, °F	Max temp, °F	Mean temp, °F	Precipitation, in
Exp. 1					
5/21/07	Mild	40	60	50	0.24
5/22/07	Mild	37	45	41	0.19
5/23/07	Mild	36	58	47	0.01
5/24/07	Mild	32	62	47	0.43
5/25/07	Mild	39	59	49	0.05
5/28/07	Cold, raining hard	41	60	51	0.48
5/29/07	Cold, drizzle	35	57	46	0.35
5/30/07	Cloudy and cool	36	70	53	Trace
5/31/07	Cloudy and cool	38	72	55	0
6/01/07	Sunny	39	79	59	0
6/04/07	Sunny and warm	46	83	65	0
6/05/07	Cloudy, brief shower	52	75	64	0.38
6/06/07	Cold and rain	43	57	50	1.38
6/07/07	Cold, very wet	42	61	52	0.13
6/08/07	Sunny	37	71	54	0.01
Exp. 2					
7/02/07	Sunny, hot	52	93	73	0
7/03/07	Sunny, hot	50	90	70	0
7/04/07	Sunny, hot	51	95	73	0
7/05/07	Sunny, very hot	56	100	78	0
7/06/07	Sunny, very hot	56	106	81	0
7/09/07	Sunny, hot	53	91	72	0
7/10/07	Sunny, hot	49	87	68	0
7/11/07	Sunny, hot	49	92	71	0
7/12/07	Sunny, hot	51	96	74	0
7/13/07	Sunny, humid	56	99	78	0
7/16/07	Sunny, hot, humid	55	103	79	Trace
7/17/07	Sunny, hot, humid	65	95	80	0.05
7/18/07	Sunny, hot	61	102	82	Trace
7/19/07	Sunny, hot, breeze	62	105	84	0
7/20/07	Sunny, hot	52	104	78	0

¹National Weather Service Forecast Office:

<http://www.weather.gov/climate/index.php?wfo=tfx>

Table 5. Panel scoring of task completion performance and temperament by horses in Test 1 at the end of week 1¹

Item ³						<i>P</i> -values ²			
	No grain	Grain	Exp. 1	Exp. 2	SE	Exp	Trtmt	Exp x trtmt	Scorer
Stand to saddle	4.08	4.19	4.53	3.75	0.429	0.23	0.86	0.92	0.26
Accept bit	4.15	4.10	4.14	4.11	0.265	0.94	0.88	0.99	0.008
Stand to get on	4.81	4.67	4.92	4.56	0.149	0.13	0.51	0.36	0.12
Tip nose	3.36	3.77	3.50	3.64	0.282	0.73	0.30	0.83	0.05
Break hindquarters	3.37	3.85	3.58	3.63	0.164	0.83	0.04	0.69	0.17
Move out at a lope	3.57	3.86	3.92	3.51	0.233	0.26	0.38	0.11	0.06
Back up	3.40	3.61	3.25	3.76	0.278	0.23	0.59	0.31	0.001
Self-preservation	2.75	2.44	2.44	2.75	0.256	0.42	0.40	0.12	0.03
Sensitivity	3.26	3.47	3.25	3.49	0.176	0.37	0.40	0.86	0.31
Restlessness	2.42	2.08	2.03	2.47	0.340	0.38	0.49	0.28	0.21
Willingness	3.19	3.72	3.39	3.53	0.305	0.76	0.23	0.41	0.42

¹ Two experiments with horses having ad libitum access to hay and supplemented with 0 kg/d (No grain) vs. 2.3 kg/d (Grain) commercial grain mix. Six different horses were used in each experiment.

²Treatment x scorer interactions were not significant ($P > 0.15$).

³ Scored as 1 to 5.

Table 6. Panel scoring of task completion performance and temperament by horses in Test 2 at the end of week 2¹

Item ³						<i>P</i> -values ²			
	No grain	Grain	Exp. 1	Exp. 2	SE	Exp	Trtmt	Exp x trtmt	Scorer
Stand to get on	4.32	3.97	4.05	4.22	0.338	0.88	0.50	0.47	0.03
Move out at a lope	4.05	3.60	3.45	4.14	0.277	0.11	0.30	0.52	0.69
Stop	3.52	3.87	3.48	3.88	0.239	0.18	0.30	0.89	0.25
Back up	3.23	3.45	3.14	3.51	0.285	0.31	0.74	0.13	0.01
Leg yields	3.23	3.39	3.23	3.37	0.205	0.72	0.46	0.48	0.001
Trot	3.82	3.59	3.58	3.81	0.189	0.39	0.50	0.42	0.86
Self-preservation	2.07	2.49	2.18	2.36	0.213	0.82	0.15	0.76	0.09
Sensitivity	3.15	3.24	3.05	3.32	0.223	0.37	0.75	0.89	0.04
Restlessness	1.94	2.45	2.18	2.21	0.223	0.91	0.09	0.29	0.21
Willingness	3.26	3.26	3.21	3.30	0.162	0.63	0.90	0.89	0.21

¹ Two experiments with horses having ad libitum access to hay and supplemented with 0 kg/d (No grain) vs. 2.3 kg/d (Grain) commercial grain mix. Six different horses were used in each experiment.

²Treatment x scorer interactions were not significant ($P > 0.15$).

³ Scored as 1 to 5.

Table 7. Panel scoring of task completion performance and temperament by horses in Test 3 at the end of week 3¹

Item ³						<i>P</i> -values ²			
	No grain	Grain	Exp. 1	Exp. 2	SE	Exp	Trtmt	Exp x trtmt	Scorer
Open and close a gate	4.51	4.49	4.69	4.25	0.102	0.01	0.92	0.29	0.06
Walk	3.82	3.64	3.69	3.77	0.191	0.49	0.47	0.21	0.14
Lope	3.80	4.06	4.26	3.54	0.236	0.08	0.43	0.47	0.47
Stop	3.69	3.83	3.90	3.61	0.164	0.52	0.64	0.007	0.01
Back up	3.43	3.31	3.46	3.26	0.249	0.92	0.72	0.45	0.01
Rollbacks	3.80	3.90	4.06	3.60	0.155	0.11	0.61	0.67	0.07
Accept a rope	4.29	4.24	4.54	3.94	0.234	0.08	0.79	0.11	0.29
Self-preservation	2.03	2.17	1.94	2.29	0.159	0.18	0.37	0.001	0.24
Sensitivity	3.45	3.67	3.60	3.51	0.186	0.95	0.38	0.44	0.01
Restlessness	2.22	1.98	1.78	2.48	0.190	0.03	0.39	0.44	0.55
Willingness	3.54	3.90	3.93	3.46	0.240	0.21	0.36	0.07	0.91

¹ Two experiments with horses having ad libitum access to hay and supplemented with 0 kg/d (No grain) vs. 2.3 kg/d (Grain) commercial grain mix. Six different horses were used in each experiment.

²Treatment x scorer interactions were not significant ($P > 0.15$).

³ Scored as 1 to 5.

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APPENDICES

APPENDIX A

FOUNDATION FOR PERFECTION

Learning How to Eliminate Resistance, When Doing a Job

3 Causes of Resistance

- 1) **Self Preservation**
 - Due to lack of confidence
- 2) **Lack of Communication**
 - Horse needs more time, patience, teaching
- 3) **Disobedience** (Resentment to commands)
 - Due to unwilling submission

4 Factors to Eliminate Resistance

1) Willing Submission- When a request is made the horse willingly performs the task requiring little to no pressure; **it is the horse's idea**. After initial contact the horse performs the task on a loose rein and with no leg pressure.

2) Good Communication- Learning to read, feel, and understand what the horse is saying in response to our request (Communication involves two individuals, what is the horse saying?). We communicate through the horse's driving and underlying factors along with **feel, timing, and balance**.

3 Primary **Driving Factors**: Self-preservation, Comfort and Companionship

1 Valuable Factor: Hormones

2 **Underlying Factors**: Confidence, Energy (motivation and determination)

Increase in **Confidence** = Decrease in **Self-Preservation** (vice versa)

Comfort and Companionship Increase = Increase in **Confidence** (vice versa)

Comfort and Companionship Increase = Decrease in **Self-Preservation** (vice versa)

As the **Energy level** decreases ~ **Self-Preservation** decreases ~ which opens the door to increase **Comfort** and **Companionship** (when presented in the correct manner)

3) Balanced Life to Direction ratio- The ratio is determined by the speed which we can willingly bring the life up and willingly direct it on set line (straight or curved), without losing "direction".

Life - The ability to move the horse, with any given speed at any given time.

Direction- When the slack is taken out of the rein, the horse puts the slack back in the rein with suppleness through the poll and loin.

a) **Vertical Direction-** (Atlas Vertebrae) – Up and down

- Brake in the poll vertically: Nose should be perpendicular to the ground.

b) **Horizontal Direction-** (Axis Vertebrae) - Left to Right

- 6 Signs to Identify Horizontal Direction:

1) Break in the poll horizontally

2) Nose directly underneath the eye

- 3) Should not see any white in the eye (looking back not forward)
- 4) Poll and loin should make a perfect “C”.
- 5) Should be able to ride a perfect circle (“O” is half of a “C”)
- 6) After tipping the nose the front feet and hind feet should travel on the same path as the nose.

Four Levels of Directed Life

- 1) Submit the life (Stage 1 Mechanical Foundation)
- 2) Fill them with life (With no signs of self-preservation)
- 3) Direct the life (1st Straight lines, 2nd Curved lines)
- 4) Led by the life (Stage 2 Mechanical Foundation)

4) Solid Foundation of Maneuvers (2 parts) -

Part 1(Mechanical) - Ability to move the 3 three parts of the horse (head and neck, shoulders and hindquarters) in any direction to accomplish any job

Four stages:

Stage 1- Stopping forward motion, pivoting around the inside front foot.

Stage 2- Hindquarters pulling the horse in a reverse motion.

Stage 3- Lateral movement of front feet and hind feet together.

Stage 4- Stopping forward motion, pivoting around the inside hind foot.

These are the necessary stages of having a solid foundation to do any job.

Part 2 (Mental) – Horse and rider begin to receive insight, into how they can move together in perfect unity to accomplish a job: Horse experiences willing submission, good communication, a balanced direction to life ratio, and part 1 of solid foundation of maneuvers all at the same time.

It’s like you are riding in the dark and somebody switched on a light, all resistance left and it made perfect sense to *you* and the *horse*. The horse becomes as light as a feather, moving in perfect unity with the person; no resistance in doing the job. These are the “ah-ha” moments when riding a horse. It is by multiplying these “ah-ha” moments, that we are able to *build* and *keep* a “foundation for perfection”. The goal is to multiply these “ah-ha” moments from brief seconds, to minutes, to hours; until we are left with no more resistance and find ourselves riding, in absolute perfection.

Three Stages:

Stage 1- Brief seconds during the ride

Stage 2- Minutes during the ride

Stage 3- Consistency during the ride

These are the necessary stages of having a solid foundation “with no resistance” in doing a job.

APPENDIX B

MENTAL VS. MECHANICAL

What is the problem? **Eliminate the resistance and you will eliminate the problem**

Sources of Resistance

- 1) Psychological – relating to the mind or mental processes
- 2) Physiological – relating to the way that living things function

Psychological (Mental) –

**Does the horse want to do what you are asking?
Why does he not want to do what you are asking?**

Willing submission-

Are you riding with a loose rein and no leg pressure?

Yes – You will have no resistance (perfection/ true unity)

No – Are you operating with a good level of communication?

Good Communication (driving and underlying factors)

Does your horse have **confidence** in you (determined by head level)?

Where is your horse's head level?

Is he experiencing **comfort** and **companionship** with you?

Or is he being drawn somewhere else, looking for comfort and companionship?

Where is your horse's **self-preservation** level (high, low)?

Where is your horse's **energy** level (high, low)?

Increase in **Confidence** = Decrease in **Self-Preservation** (vice versa)

Comfort and Companionship Increase = Increase in **Confidence** (vice versa)

Comfort and Companionship Increase = Decrease in **Self-Preservation** (vice versa)

As the **Energy** level decreases ~ **Self-Preservation** decreases ~ which opens the door to increase **Comfort** and **Companionship** (when presented in the correct manner)

Physiological (Mechanical) –

**Does the horse know how to do what you are asking?
Do you know what and how you are asking the horse?**

Willing submission-

Are you riding with a loose rein and no leg pressure?

Yes – You will have no resistance (perfection/ true unity)

No – Do you have; good communication, balanced direction to life ratio, and a solid foundation of maneuvers?

Good Communication (Feel, timing, and balance)

Are you helping the horse or hindering the horse?

Where is your weight (**Balance**)?

How long is your rein?

Can you **feel** when the horse does what you want?
 Do you know when to apply pressure and give relief (**timing**)?

Balanced life to direction ratio

Life-

Do you have to make contact with your feet to get your horse to move?
 How much pressure to you have to apply with your feet (light pressure with calves, hard kick with spurs)?
 In what speed can you jump into from standing, in less than two strides?
 (1-Walking, 2- trotting, 3- extended trot, 4- lope, 5-gallop)

Horizontal Direction-

Does your horse put slack in the rein with suppleness through the poll and loin, when you take the slack out?
 At what speed will your horse put the slack back in the rein with forward motion?
 (1-Walking, 2- trotting, 3- extended trot, 4- lope, 5-gallop)

Do you have a balanced direction to life ratio?
 More life in relation to direction signifies a lack of confidence in the horse.
 More direction in relation to life: If the number for life drops too far from the number for direction, the horse will begin losing direction.

Solid foundation of Maneuvers

What stage is your horse in (1, 2, 3, and 4)?

Are they solid in Stage 1?

When you take the slack out of the rein does your horse willingly stop the inside front foot and walk the other feet around it.
 Can you stop the inside front foot at a lope, in less than three steps from the initial contact?
 After initial contact (quarter turn), will the horse complete a half turn on their own? (Willing submission)

Are they solid in Stage 2?

Does your horse pull with his hindquarters when backing?
 Do they step with the hindquarters first, not the front feet?
 Do you have to pull on your horse to get them to back, or can you lightly take the slack out of the reins?
 Does your horses head go up when you ask him to back?
 Can you speed up your backing by bring the life to the feet, or do you have to pull harder on his head which brings his head up?

Are they solid in Stage 3?

Can you bring your outside leg in at a lope and have them willing move in a lateral motion crossing the front and hind feet without elevating the head?

From standing can you lightly bring your outside calf into your horse and have them step with their inside foot first? (Preparation for step four)

Can you move your horses front feet and hind feet together in a lateral motion?

Are they solid in Stage 4?

Can you bring your outside leg in and have your horse pull (centrifugal force) the front feet around the inside hind foot (holding the pivot foot) on a loose rein?

Can you do this in a quarter turn, half turn, or full turn?

Can you do this in a quarter turn?

If not do not attempt a half turn

Can you do this in a half turn?

If not do not attempt a full turn.

What specifically are you trying to ask your horse to do?

You are not asking your horse to open the gate; you are asking him to operate in Stage 3.

What are you asking his feet to do?

Your reins (direction) just show them where to go (steering wheel), the feet (gas pedals/life) get them there.

Can you tell what your horse's feet are doing?

Can you feel the instant your horse crosses his feet changing a forward to a lateral motion?

Do you relieve the pressure the instant the horse's feet do what you want?

Do the reins control the horse's feet? (Are the reins tied to the feet?)

Or do you pull on the reins and your horse's head goes up?

Are you clear in your mind what you want your horse's feet to do in response to your rein?

Do you know what it will feel like when his feet do what you want?

Can you pick up your horse's feet and set them down one at a time in the direction you want, from the horse's back?

Can you tell me the instant that any given foot leaves the ground and hits the ground?

APPENDIX C

TRADITIONAL VS. ALTERNATIVE THOUGHT PROCESS

What t is the problem?

I can't get my horse to do (A job)

Two ways to solve the problem: 1- Traditional way, 2- Alternative way.

1) **How** can I **make** my horse do the job? 2) **How** can I **help** my horse do the job?

*Slave Mentality

*Partnership Mentality

How can I make him to the job?

Why does he not want to do the job?

Focus on

Focus on

- 1) **Foundation of Maneuvers**
- 2) **Direction and Life**

- 1) **Willing Submission**
- 2) **Good Communication**
- 3) **Driving Factors**

How can I move the horse's head and neck, shoulders, and hindquarters in the direction I want, with the speed that I want; in order to accomplish the job?

Why does the horse not want to do the job and what can I do differently to help him want to do the job?

Focused on **Job Completion**

Focused on **True Unity (perfection)**

Run the risk of **un-willing** submission which leads to.....

How can I help him do the job?

- 1) **Lack of communication**
- 2) **Self-preservation**
- 3) **Disobedience**

Once the horse has **willingly** submitted his will and we are operating with **good communication**....

Guaranteed Resistance

Then we are in a position to **teach** him to do the job. Then we work on building a

Level of Resistance is determined by

- 1) **Solid** Foundation of Maneuvers
- 2) A **balanced** direction to life ratio

- 1) Intensity of Job
- 2) Energy level of horse
- 3) Patience of person

Remember the three stages of training a horse:

- 1) Setting a foundation
- 2) Using jobs to build the foundation
- 3) Using foundation to do a job

***Fewer Problems and No Resistance** because the horse wants to do the job and understands how to do it.

APPENDIX D

PANEL SCORE SHEETS

