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EQUINE PERSONALITY STRUCTURE

by

Rachel Etta Kristiansen

Abstract of a Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

May 2011
ABSTRACT

EQUINE PERSONALITY STRUCTURE

by Rachel Etta Kristiansen

May 2011

The current study was designed to investigate the structure of equine personality. Two personality questionnaires were replicated from previous studies and implemented simultaneously to test the theory that different questionnaires may extract different personality structures. Breed and sex differences were also hypothesized to be significantly different for some personality dimensions. A total of 827 horses were rated on a 90-item personality questionnaire. Participants were recruited online via email and completed the survey at their own convenience. An additional 121 respondents rated a horse that had already been rated; these results were used to calculate inter-rater reliability.

After data collection was complete, the two questionnaires were separated for individual analyses. The first, a five-factor model (FFM) adapted by Morris et al. (2002) from the short form NEO-PI-FFI, consisted of 60 items. Seventeen of these items were removed in the current study due to a large percentage of people who responded “don’t know” to the item. The FFM questionnaire was put through a Principal Components Analysis, which extracted eight factors: Neuroticism, Active, Conscientiousness, Agreeableness, Openness, Social Extraversion, Temperamental, and Disciplined. Significant sex differences were found in the components Neuroticism, Openness, Social Extraversion, and Temperamental. Breed differences were found in the component Active.

The second questionnaire (the Horse Personality Questionnaire; HPQ) consisted of 30 Behaviorally Defined Adjectives, adapted by Lloyd et al. (2007) from Stevenson-Hinde et al. (1978). Six of these items were removed from the current study when they either failed to load
significantly onto any component in the PCA or reduced the alpha level of the component onto which they loaded. The final PCA resulted in six personality components: Anxiousness, Dominance, Sociability, Protection, Excitability, and Inquisitiveness. Sex differences were found in Protection and Sociability. Excitability was the only component with significant breed differences.

Each FFM component correlated well with at least one HPQ component except for Inquisitiveness on the HPQ, indicating convergent validity of the scales. The HPQ component Anxiousness was significantly correlated with the FFM components Neuroticism and Conscientiousness. Both Dominance and Protection from the HPQ correlated with Agreeableness on the FFM. Sociability on the HPQ correlated negatively with Social Extraversion on the FFM. The second-highest correlation among the paired components was between Excitability on the HPQ and Active on the FFM.

Limitations of the current study included low diversity of horses with different uses, as well as low diversity of different relationships between horse and rater. The removal of 17 items from the FFM may have significantly altered the outcome of the PCA, and the sample size for stallions and individual breeds was low. Future work should focus on correcting these limitations and comparing personality results to genetic and behavioral research.
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THE STRUCTURE OF EQUINE PERSONALITY

by

Rachel Etta Kristiansen

A Dissertation
Submitted to the Graduate School
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

Approved:

Stan A. Kuczaj III
Director

Virgil Zeigler-Hill

John Harsh

Tammy Greer

Lauren Highfill

Susan A. Siltanen
Dean of the Graduate School

May 2011
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CHAPTER I
INTRODUCTION

The study of personality focuses prominently on individual differences (Buss, 2008). However, the definition of personality is somewhat hazy. For example, in the early 20th Century the Harvard Psychological Laboratory used the following scheme to describe personality: Intelligence, Temperament (emotional breadth and emotional strength), Self-Expression (extro-introversion, ascendance-submission, expansion-reclusion, compensation, and insight and self-evaluation), and Sociality (social participation, self-seeking and aggressive self-seeking, and susceptibility to social stimuli; Allport & Allport, 1921). Conversely, Carl Jung (1936) defined two psychological types, extraversion and introversion.

The use of a single word to define a personality trait is called the lexical approach, which assumes that the individual differences that are most socially prominent in people’s lives will ultimately become encoded into their language (John, Angleitner, & Ostendorf, 1988). Because lexical factor dimensions are rooted in everyday language, they correspond to the basic descriptions people make for personality traits (Tellegen & Waller, 2008).

According to Allport (1927), a “trait” may be defined in three ways, where (a) a trait is the tendency of an individual to react to a situation, and is independent of other variables when measured with reliability; (b) a trait is characteristic of an individual’s reaction to the environment, and results from the integration of various specific behaviors; and (c) a trait is a mode of adjustment, both general and habitual, that directly influences a specific response. Tellegen (1991) defined a trait as “an inferred relatively enduring organismic (psychological, psychobiological) structure underlying an extended family of behavioral dispositions… [A trait] can be inferred from particular behaviors and on the basis of that inference additional behavioral and other phenomena can be predicted” (p. 13). Tellegen (1991) also described the dimensional trait, which accommodates individual differences while treating data on individuals collectively.
Any given dimensional trait will contain trait or trait-level indicators, which are variables that mirror individual differences.

Previously, personality has been considered unique to humans. However, the field of animal behavior now widely accepts that non-human animals possess personality characteristics. One advantage of determining personality type in individual animals is that the results may be used to identify training tools necessary for each animal. For example, an inhibited animal may require more time or different reward stimuli to learn the task than a relatively more extraverted animal. Coleman, Tully, and McMillan (2005) suggest that researchers should determine which animals do not respond as well to conventional training and instead adapt a training protocol that meets the needs of that animal. In their study, they found that only 22% of inhibited rhesus monkeys were able to learn a targeting task, as opposed to the 75% of the total monkeys that learned to perform the task. These results suggest that previous studies that have reported an inability to learn among some species or individuals may not have fully appreciated the underlying causes of the animals’ behavior.

Foundations of the Current Study

Purpose statement

The purpose of the current study was to determine the personality structure of horses. Several independent studies have evaluated horses on personality structure, but none are in complete agreement with one another (e.g., LeScolan, Hausberger, & Wolff, 1997; Momozawa et al., 2003; Visser et al., 2001). Two separate survey types have been used in previous literature, one based on the human five-factor model (FFM), and the other based on behaviorally defined adjectives (BDA’s) representative of horse behavior. These questionnaires were both implemented in the current study in order to determine if a human factor model of personality is relevant in the measurement of horse personality.
Primary Research Question

What is the personality structure of horses?

Secondary Research Questions

1. Do different personality surveys extract different personality structures?
2. Are breed differences apparent within the personality structure?
3. Does sex have any influence on individual personality?

Need for the Study

The purpose of most horse personality research is to further training and use. A potential buyer, for example, may want information on whether or not a particular horse will make a good show jumper or a good therapy horse; both will need to show low reactivity levels to novel stimuli. In a study by Anderson, Friend, Evans, and Bushong (1999), horses were scored on reactivity based on their reactions to three different novel stimuli. Of the therapy horses studied, 64% scored high on reactivity, indicating that the horses had been selected for characteristics such as smoothness of gait rather than calm, stable temperaments. A more informed selection of horses should lead not only to better performance for the handler, but also improved welfare for the individual horse (Lloyd, Martin, Bornett-Gauci, & Wilkinson, 2008). In addition, the comparison of behavior to personality is important to handlers and owners that may need a horse for a specific task. If the horse has been rated as Extraverted, it has the potential to make a great training horse. On the other hand, a horse rated as Neurotic might be considered for work that does not involve potential harm to novice horsemen.

Knowledge of personality characteristics is also beneficial for the welfare and general well-being of animals. A change in environment may induce stress in an animal prone to neurotic tendencies; recognizing this ahead of time would allow the owner, handler, or researcher to make special provisions to prevent a stressful experience. Capitanio, Kyes, and Fairbanks (2006) reviewed several studies and concluded that even after three months of adaptation time to a new
environment, several species of Old World monkeys still exhibited bio-behavioral changes that affected the data of the experiments. The authors recommend being conscious of individual differences among animals in order to be aware of potential reactions to novel environments or stimuli and to be attentive to the use of counterbalancing in the research design to stratify individual differences across all treatment conditions.
CHAPTER II

REVIEW OF THE LITERATURE

History of Animal Personality

Personality became an interest of behavioral psychologists in the early 1900’s. John Watson was the first person to apply behaviorism to psychology (Pervin, 1984). Watson (1930) believed personality to be a legitimate area of study in the field of psychology. He considered that by observing behavior over a period of time he could determine personality as the sum of activities (Lundin, 1963). Watson conducted a great amount of research on animals and was the forefront of an effort to apply objective methods in the study of psychology (Pervin, 1984).

The early studies of personality in animals were largely based in physiology. Ivan Pavlov developed the concept of “type of nervous system,” which referred to the individual differences in conditioned reflexes of the dogs in his laboratory. Four central nervous system (CNS) properties were proposed: strength of excitation (regarded as the most important), strength of inhibition, equilibrium of nervous processes, and mobility of nervous processes. He believed that these properties could be extended to humans, relating to what we would call “temperament” (Strelau, 1997), and published several papers on the subject between 1930 and 1935. He later published in 1952 the following argument:

From the moment an animal is born, it is subject to a variety of environmental influences to which it must respond by certain actions, and those actions often become ultimately consolidated for the rest of the animal’s life – therefore, the ultimate type of the animal’s nervous activity is a composition of the properties of its type and changes elicited by the environment – it is the phenotype, the character (p. 594).

While Pavlov (1952) used classical conditioning with his study animals, the technique of operant conditioning was developed by Skinner (1932). Because this type of conditioning involves responding to a stimulus and then acting on the environment, it can demonstrate the
acquisition of personality (Lundin, 1963). Skinner, unlike many personality theorists, did not agree with structural variables in psychology, recognizing instead dynamic or motivational concepts. He used these concepts to account for the variability of behavior in a constant environment. Skinner’s system was organized so that groups of responses relate to associated operations (Hall & Lindzey, 1978).

Robert Yerkes (1939) firmly believed that the animal mind was similar to that of humans, stating “indeed, in my present thinking there is no question about the reality of chimpanzee mind, individuality, personality” (p. 97). Yerkes followed the life history of individual chimpanzees in his laboratory. He determined two types of ape personality: one constituted to command, the other to obey. He also believed that the chimpanzee is similar to humans in development, physiological processes, behavior, and social relations (Yerkes, 1939). Hebb (1949) employed two test situations for the study of personality in chimpanzees. In the first test the animal responded to a human as stimuli. The second test involved the animal responding to inanimate objects. The tests showed large individual differences, but, more importantly, showed a stability of personality across time (Hebb, 1949), marking an essential contribution to the further study of personality.

During the 1930s and 1940s research in animal personality was abundant; however, by the mid-1950s published research had declined significantly (Weinstein, Capitano, & Gosling, 2008). In 1969, Zajonc published Animal Social Psychology, which highlighted a large range of animal personality studies. In the subsequent decades, however, little research was published on nonhuman personality (Weinstein, Capitano, & Gosling, 2008). Recent work on personality in animals has highlighted the importance of these studies to address human studies. The past several years has seen a large increase in the number of comparative studies, providing a basis to study aspects of personality such as biology, genetics, and environment (Gosling & Vazire, 2002).
Animal Personality Studies

A large number of animal species have been tested for evidence of personality. Gosling’s (2001) comprehensive review of 187 personality studies included 64 different species: 29% primates; 55% non-primate mammals; 8% fish; 4% birds; and 4% reptiles, amphibians, arthropods, and mollusks (Weinstein, Capitanio, & Gosling, 2008). Marine invertebrates studied include brown trout (Sundström, Petersson, Höjesjö, Johnsson, & Järvi, 2004), lion-headed cichlid (Budaev, Zworykin, & Mochek, 1999a), convict cichlid (Budaev, Zworykin, & Mochek, 1999b), dumpling squid (Sinn & Moltschaniwskyj, 2005), guppies (Budaev, 1997), octopi (Mather & Anderson, 1993; Sinn, Perrin, Mather, & Anderson, 2001), pumpkinseed sunfish (Wilson, Coleman, Clark, & Biederman, 1993), sticklebacks (Bell & Stamps, 2004; Dingemanse et al., 2007), and tropical poeciliid (Brown, Jones, & Braithwaite, 2005).

Primates

Factor analysis of primate data has revealed several consistent dimensions, some of which are comparable to traits identified in human research, including the Big Five (Gosling et al., 2003). Primate species on which personality research has been conducted include chimpanzees (e.g., Bard & Gardner, 1996; King & Figueredo, 1997), gorillas (Gold & Maple, 1994), vervet monkeys (Fairbanks & McGuire, 1993), macaques (e.g., French, 1981; Nash & Chamove, 1981; Clark & Lindburg, 1993; Reite & Short, 1980; and Capitanio, 1999), baboons (Heath-Lange, Ha, and Sackett, 1999), capuchins (Byrne & Suomi, 1995), squirrel monkeys (Martau, Caine, & Candland, 1985), and bushbabies (Watson & Ward, 1996).

Personality structure is difficult to interpret between-species as well as within-species due to methodological and analytical differences. One study examined five social contexts in chimpanzees and calculated their associations with six personality factors: Dominance, Extraversion, Agreeableness, Dependability, Emotionality, and Openness (Pederson, King, & Landau, 2005). Rhesus monkey populations demonstrated three dimensions in one study,
(Confident, Excitable, and Sociable; Stevenson-Hinde, Stillwell-Barnes, & Zunz, 1980), while another study on rhesus monkeys found four dimensions: Sociability, Confidence, Excitability, and Equability (Capitanio, 1999).

Many studies do not attempt to extract a full personality structure, but instead measure for specific individual differences. Heath-Lange, Ha, and Sackett (1999) found that baboons were more active than macaques in both establishing and terminating interactions with the observer, although as the animals grew older, they became bolder and less reactive toward the observer. Emotionality in rhesus macaques was measured by the frequency of scratching; scratching rates were higher in the birth season than the mating season, indicating that that infant presence may increase levels of emotionality (Maestripieri, 2000). In another study, gorillas were considered to be Extraverted if they ranked high on traits such as sociable, playful, and popular (Gold & Maple, 1994).

Dogs and Cats

Almost all canine personality research has focused on temperament. The studies that have been conducted were not intended as comparative studies, but instead as methods to determine the suitability of a dog for guide-work, selection for police dog training centers, and assessing fearfulness levels in pet dogs (Jones & Gosling, 2005). Some research has also examined the heritability of temperament traits (Goddard & Beilharz, 1984). In a comprehensive review of dog personality research, Jones and Gosling (2005) determined that 96% of study animals were purebred; 32% of this was represented by Labrador Retrievers and German Shepherds. The most common traits studied were Reactivity, Fearfulness, Activity, Sociability, Responsiveness in Training, Submissiveness, Aggression, and None/Other. Assessment methods were able to be grouped into four categories: test batteries, ratings of individual dogs, expert ratings of breed prototypes, and observational tests.

In a study by Svartberg and Forkman (2002), over 15,000 dogs from 164 breeds were utilized to investigate personality traits. Factor analysis revealed five traits: Playfulness,
Curiosity/Fearlessness, Chase-proneness, Sociability, and Aggressiveness. All of the factors with the exception of Aggressiveness were related and appeared to generalize to all breeds. These results were later broken into three components of dog personality: (a) interest in playing with humans; (b) attitude towards strangers; and (c) non-social fearfulness (Svartberg, 2005). The general attributes of dog temperament have been demonstrated to be a reflection of how individuals play (Rooney & Bradshaw, 2003).

Cats have been found to possess clearly defined individual differences that remain stable throughout changes in the environment (Durr & Smith, 1997). Four components of behavior have been extracted for the cat: Staying Indoors, Rubbing, Investigative, and Boldness (Lowe & Bradshaw, 2001). Preferences in predation show remarkable differences in disposition. Cats prone to rat-killing respond more aggressively to environmental threats than cats that are not prone to killing rats (Adamec, 1975). Littersmates tend to rank similarly on some behavioral dimensions up until at least one year of age (Lowe & Bradshaw, 2001).

**Horses**

Specific breeds of horse have been selected for particular purposes across the domestication of the species and breed societies often promote certain breeds by describing the breed-typical behaviors (Lloyd et al., 2008). Offspring of a stallion have demonstrated similar behavior patterns, and full sisters have shown less variability in behavioral indices than half-sisters (Wolff, Hausberger, & Le Scolan, 1997). Lloyd et al. (2008) found 48 significant differences in personality scores between breeds. Excitability and Anxiousness had the highest level of variability, with 14 out of 28 breed pairs being significantly different. The lowest variability was found in Dominance and Protection, with only four out of 28 and two out of 28 being significantly different, respectively. However, Morris, Gale, and Howe (2002) found no breed differences on any of their behavioral scales, and so the question of breed differences remains open.
Personality traits may be able to predict a considerable part of performance when measured earlier in life, although the prediction of show-jumping performance by personality traits was most accurate when only show jumping horses were analyzed in a learning test (Visser et al., 2003). Visser et al. (2001) were able to identify individual differences in personality traits, but were unable to demonstrate a long-term consistency. In contrast, personality tests utilizing facets of sensation provided evidence of stability both over time and across situations (Lansade, Pichard, & Leconte, 2008).

Emotionality, or reactivity, in the horse is a heightened state of arousal; therefore, the extent of emotionality in an individual may influence its manageability and usefulness in certain tasks (McCall, Hall, McElhenney, & Cummins, 2006). It is also one of the most researched traits in the horse personality literature. Le Scolan, Hausberger, and Wolff (1997) found a negative correlation between emotivity and learning abilities. In this study, more reactive horses were described by handlers as being most socially dependent. Wolff et al. (1997) found that horses that expressed higher emotionality showed more avoidance of novel objects and had longer latency times to cross an unfamiliar obstacle. Tests of reactivity have included novel stimuli, isolation, and runway (McCall et al., 2006) as well as sensory tests using odors, food, visual stimuli, sounds, and touch (Lansade et al., 2008). Isolation of a social species may cause reactivity due to confinement and isolation, while the novel stimulus test results may reflect neophobia, thereby making the latter a more accurate predictor of the horse’s reactivity level outside the test environment (McCall et al., 2006). Sensory tests have demonstrated that horses may have a higher sensitivity for some types of sensory input (Lansade et al., 2008).

Another well-studied dimension of horse personality is Extraversion. Morris et al. (2002) conducted a study of horse personality using the human Big Five factors of Extraversion, Neuroticism, Openness to Experience, Agreeableness, and Conscientiousness. The authors found a highly significant effect of trait, with Extraversion and Neuroticism being the highest rated. They also discovered that horses became progressively less extraverted and more conscientious.
the higher their level of use. For example, horses used for show jumping were more extraverted and open to experience than horses used for teaching and ceremonials. Additionally, ceremonial horses were significantly less sociable than show jumpers and event horses, and event horses were more open to experience than horses used in teaching. Other dimensions established in horse personality research include Dominance, Anxiousness, Excitability, Protection, Sociability, and Inquisitiveness (Lloyd et al., 2008); Fearfulness, Social Motivation, Locomotor Activity, and Reactivity to Humans (Lansade et al., 2008); and Anxiety, Novelty Seeking, and Understanding (Momozawa et al., 2003).

**Personality Assessment Method**

Surveys, or questionnaires, are implemented in an attempt to identify the personality traits of individuals, in hope that the analysis of these traits will explain what individuals have done in their past, as well as predict what they may do in the future (Funder, 1991). Rating scales can assume several specific forms. In general, the rater is asked to make an assessment about some feature or quality of an individual by assigning it a score on a scale that is defined in terms of the particular feature (Tinsley & Weiss, 1975). In the current study, online data collection was implemented in order to reach a wider range of raters. This method proved advantageous in its ease and efficiency for both the raters and the experimenter. Raters were able to complete the survey in their own homes on their own time schedule, and did not have to physically return anything upon completion. In addition, the data was automatically entered into an online database, which eliminated data entry errors by the experimenter. Gosling et al. (2004) found that internet samples tend to be more diverse than traditional samples in many domains. In addition, internet methods can be replicated across presentation formats and provide immediate feedback to the user, increasing motivation (Gosling et al., 2004).
CHAPTER III
THE FFM QUESTIONNAIRE

Introduction

Animal personality is often studied in order to better understand a species. Fundamentally, personality structure can indicate the types of life strategies that a species has evolved, such as anti-predator behavior, competition for mates, reproductive success, and dominance hierarchies (Weinstein et al., 2008). Within the study area of animal personality, there is extensive disagreement among researchers as to which trait terms best describe animal subjects (Gosling, Lilienfield, & Marino, 2003). However, some recent research has applied a five-factor model (FFM) used in human research, sometimes called the Big Five (Costa & McCrae, 1992).

The FFM is convenient for animal research because it translates well across samples and cultures and is widely accepted and researched. It has also been found to be readily applicable to primates while remaining fairly comprehensive in extracting high-order personality traits. If the relations between traits reflected only collective word meanings, the same personality structure should be found across all species (Gosling et al., 2003). However, because of the diversity of the species studied, methodologies and analyses, and traits examined, a quantifiable cross-species comparison is nearly impossible to construct. A focus on comparability would hamper the ability to get a comprehensive analysis of the idiosyncratic traits of different species. Thus, traits are often used that may not be applicable to other species. In a more positive note, the cross-species comparison of social systems and development may reveal more information about the mechanisms responsible for sociability than would the study of a single species (Gosling, 2001).

The framework of the Big Five model is a hierarchy of personality traits broken into five broad factors. Each of the main factors has an inverse (e.g., Neuroticism vs. Emotional Stability), and these bipolar pairs each summarize six specific components, such as anxiety. These components further specify even more detailed traits, such as “calm” and “not easily upset” (Gosling, Rentfrow, & Swann, 2003). The FFM is not a theory of personality, but rather a trait
theory which recognizes the essence of human nature in individual differences; specifically, knowability, rationality, variability, and proactivity (McCrae & Costa, 2008; McCrae & John, 1992). Every component of each of the five factors is considered a basic tendency. For example, “compliance,” a component of Agreeableness, is defined as “a willingness to defer to others during interpersonal conflict” (McCrae & Costa, 2008, p. 164).

The five factors were named by Norman (1963) and have remained essentially the same. They are: I. Extraversion (alternatively, Surgency); II. Agreeableness; III. Conscientiousness; IV. Emotional Stability (alternatively, Neuroticism); and V. Culture (alternatively, Openness to Experience). Neuroticism (N) is the least debated dimension in regard to its definition. In basic terms, it is representative of individual differences in a person’s tendency to experience distress (McCrae & John, 1992). Facets of N include recurrent nervous tension, depression, frustration, guilt, irrational thinking, low self-esteem, and ineffective coping (McCrae & Costa, 1987).

Extraversion (E) has less of a consensus regarding its definition due to the extent of its content. Adjectives such as talkative, expressive, assertive, and gregarious are often found, but terms like ambition may be classified by some authors under Conscientiousness. Many differences stem from the fact that both E and Agreeableness (A) combine to define the Interpersonal Circumplex, in which many interpersonal terms are spread evenly (McCrae & John, 1992). The more “humane aspects of humanity” (Digman, 1990, p. 422) are represented by A. These include altruism and emotional support at one end of the spectrum, and hostility and spitefulness at the other (Digman, 1990). In fact, both A and Conscientiousness (C) may be considered timeless elements of character, such as good vs. evil. C may describe individuals who are thorough, organized, and diligent, all of which are observable aspects of individual differences.

Openness to Experience (O) is the most controversial factor (Costa & McCrae, 1992). In the past it has been interpreted as Culture (Norman, 1963), Intellect (Goldberg, 1981), Intelligence (Borgatta, 1964), and Openness (Costa & McCrae, 1987). A significant problem in
lexically categorizing O into six elements is that individuals differ so broadly within the dimension, it is impossible to register all the important aspects. For example, the English language does not have a single adjective descriptive of “wide interests” or “prefers variety.” “Artistic” may describe receptiveness to aesthetic experiences, or it could mean artistically talented. The term sensitive may be used to describe openness to feelings, but sensitivity is associated with touchy or defensive, which are elements of N (McCrae, 1990).

One of the most comprehensive instruments to measure personality is Costa and McCrae’s (1992) NEO Personality Inventory, Revised (NEO-PI-R) (Gosling et al., 2003). However, there have also been several other rating instruments developed to measure the Big Five, designed to be shorter and therefore quicker to complete compared to the 240-item NEO inventory. These include, but are not limited to, the Hogan Personality Inventory, California Psychological Inventory, Multidimensional Personality Questionnaire, Adjective Check List, MMPI Personality Disorder scales, Guilford-Zimmerman Temperament Survey, Myers-Briggs Type Indicator, Personality Research Form, and Interpersonal Adjective Scales (McCrae & John, 1992). The FFM has been used in many contexts, including job performance analysis (Barrick & Mount, 1991), general mental ability and career success (Hunter, 1983; Judge, Higgins, Thoresen, & Barrick, 1999), and personnel selection (Ghisello, 1973; Guion & Gottier, 1965). In the field of psychology, the FFM may be applied in clinical research, counseling, and educational, forensic, health, and evolutionary psychology (McCrae & John, 1992).

Not all personality researchers are supportive of the FFM Approach. Hough (1992) suggested that the Big Five is an inadequate taxonomy because its constructs are too heterogeneous and incomplete; he instead proposes a nine-factor model. Similarly, Block (1995) believes that questionnaires implementing the Big Five model are insufficient and questionable. Uncertainties have been established for methodological assumptions and the authors state that the proposed meaning of each factor may not be substantive. After a review of conflicting FFM results, Kline (2000) determined the model to be unsatisfactory. His observation included
research from Endler, Rutherford, and Denisoff (1997), who were unable to replicate the N
dimension of the NEO-PI-R, and Vassend and Skrondal (1997), who could not extract the five-
factor structure using confirmatory factor analysis. Kline (2000) pointed out that factors should be
selected rationally, and not reported only because they fit the expected structure.

The Big Five and Horses

The most comprehensive study to relate the human Big Five model to equines was
carried out by Morris, Gale, and Howe (2002). Using the original short form NEO-PI-FFI (Costa
& McCrae, 1992) of 60 items (12 items for each of the five personality scales) a 5-point Likert
scale questionnaire was created. Raters were asked to judge animals on each behavior with 1
being strongly agree and 5 being strongly disagree. Some wording was altered to make the
statements more applicable to horses.

Principal Component Analysis (PCA) resulted in five factors that accounted for 41.5% of
the total variance: Neuroticism, Agreeableness, Social Extraversion (or Sociability), Activity, and
Conscientiousness. To test the hypothesis that three factors are more accurate personality
descriptors (Eysenck, 1967), component analysis was also run to extract three factors.
Neuroticism, Extraversion, and Psychoticism accounted for 32.1% of the total variance. The
authors suggested that the results of their study indicated that the NEO personality scales can be
applied to horses, and demonstrated that their findings are similar to those obtained on human
participants. In addition, it appears that mean personality scores may help to predict the best
working roles for individual horses according to temperament.

The purpose of the current study was to replicate the Morris et al. (2002) study, with the
addition of a “don’t know” option to the 5-point Likert scale. It was hypothesized that some of the
items used by Morris et al. from the original NEO-PI-FFI were irrelevant to horse personality.
These items have not been previously identified because past studies have forced raters to choose
a score. By giving raters another option, the current study sought to extract equine personality
structure based on items appropriate for horses, as determined by the raters.
Method

Design

The current study implemented the NEO-PI-FFI exactly as it was presented by Morris, Gale, and Howe (2002) in order to allow for a direct comparison with the original study. Two changes were made from the original presentation. First, in addition to the five choices along the Likert scale, raters also had the option to mark “Don’t know.” Second, a mistake was found in the published 2002 study. The item “he/she enjoys new places to go” is listed twice, and it loaded differently each time. The principle researcher was contacted but was unable to provide a solution (Paul Morris, personal communication, May 17, 2010). Upon examination of the NEO-PI-FFI, the only item not included from the original NEO-PI-FFI by Morris et al. was “he/she likes poetry.” This item was substituted for the second instance of “enjoys new places to go.”

Participants

Participants were contacted via email based on their experience with horses. Specifically, instructors, stable managers, and ranch owners were contacted with a form letter briefly explaining the project and asking for their help in recruiting further participants, including colleagues, friends, and students. Participant emails were collected from online public databases on which participants had willingly listed themselves. The email included the link to complete the survey online. As a result, the survey link was posted on several horse forums, chat rooms, and e-newsletters by participants wishing to assist in the data collection of the project.

Materials and Procedures

Before beginning the survey, participants were shown a screen of informed consent which they were asked to read. Participants then signed their name indicating that they understood the study and were at least 18 years of age. Participants were also asked to check a box if they wished to be contacted in the future with the results of the study, and were given an option to provide an email address.
The online survey consisted of two parts. Part 1 required participants to provide information about the particular horse being rated, including age, sex, breed, and home environment. Part 1 can be found in its entirety in Appendix B. Part 2 of the survey consisted of the actual survey items. The answer options appeared beneath each item. For the 60 NEO-PI-FFI items, the options were strongly agree, somewhat agree, neutral, somewhat disagree, strongly disagree, and don’t know. Participants could only select one option and every item had to be answered in order for the survey to be submitted. Part 2 can be seen in its entirety in Appendix C. Upon completion of the study, participants were thanked and debriefed on the full nature and hypotheses of the current study (see Appendix A). Several participants emailed feedback and questions about the survey.

Results

Sample Demographics

A total of 994 respondents completed the questionnaire. Of these, 121 rated a horse that had already been rated. These duplicates were used for a reliability analysis and removed from the main analysis. An additional 46 respondents were removed from the analysis for having a response rate of don’t know greater than 10%, leaving a final sample size of 827 horses.

Horses were of three sex types: gelding \((N = 496)\), mare \((N = 305)\), and stallion \((N = 26)\). The vast majority of respondents were owners of the horse being rated \((N = 673)\) and strongly like the horse they chose to rate \((N = 775)\). Approximately 29% of the horses resided in the Midwest of the United States, and 44.6% were used primarily as trail horses. Raters reported that 606 of the horses primarily lived at pasture, while 221 lived in a stable/barn environment. Ninety-one percent \((N = 753)\) of respondents reported that their horse has never performed stereotypic behaviors. Most horses lived with at least one other horse. For complete demographic information, see Appendix D.
The mean age of rated horses was 12.67 years (SD = 6.19), with a range of 1 year to 37 years. Horses had lived in their current home for an average of 5.39 years (SD = 4.73), with a range of 0 (less than 1 year) to 30 years. Respondents had known rated horses between 1 and 30 years (M = 7.21; SD = 5.30).

**Analyses**

One goal of the current study was to assess the validity of applying the human NEO-PI-FFI to non-human animals, specifically, horses. To this end, an option of *don’t know* was included in the answers for each item. For an item to be considered valid a cut-off of 10% was used. A total of 17 items met this criterion and were removed from further analysis (see Table 1). In addition, any respondent that responded *don’t know* to greater than 10% of the questionnaire items was removed from analysis (N = 46).

For the analysis, any item marked as *don’t know* was entered as a missing value and a mean imputation was calculated. A Principal Component Analysis (PCA) was conducted on the remaining 43 items of the FFM with varimax orthogonal rotation. Any items that loaded on three or more components were removed from the analysis, as well as any item that loaded onto two components with a less than 0.05 difference. PCA’s were run until the matrix included none of these items; this resulted in the removal of 11 items: he/she likes to be where the action is; he/she is popular with others; he/she takes a long time to settle down to the task at hand; he/she like to go new places; he/she is easily discouraged; he/she keeps a neat and clean stable; he/she is cooperative; he/she likes to be around others; he/she can often feel lonely and depressed; he/she is often sad; and he/she likes to argue.

The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO = .86. Bartlett’s Test of sphericity \( \chi^2 (496) = 8845.64, p < .001 \), indicated that correlations between items were sufficiently large for PCA. An initial analysis was run to obtain eigenvalues for each component in the data. Eight components had eigenvalues over Kaiser’s criterion of 1.0 and in combination explained 59.67% of the variance.
### Table 1

*Items Removed from First Analysis Due to Large (> 10%) “Don’t Know” (DK) Response*

<table>
<thead>
<tr>
<th>FFM Dimension</th>
<th>Item</th>
<th>DK%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conscientiousness</td>
<td>He/she is well organized in getting things done.</td>
<td>10.4</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>He/she strives for excellence in everything he/she does.</td>
<td>10.8</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>He/she has inferiority feelings.</td>
<td>12.6</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>He/she can use others to get them to do what he/she wants.</td>
<td>13.3</td>
</tr>
<tr>
<td>Openness</td>
<td>He/she is excited by the beauty of his/her surroundings.</td>
<td>13.7</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>He/she is conscientious.</td>
<td>14.1</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>He/she is orderly and systematic.</td>
<td>14.9</td>
</tr>
<tr>
<td>Openness</td>
<td>He/she thinks about ideas and abstract thoughts.</td>
<td>17.4</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>He/she is rather disorganized.</td>
<td>18.8</td>
</tr>
<tr>
<td>Extraversion</td>
<td>He/she is optimistic.</td>
<td>21.0</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>He/she can experience shame and can want to hide.</td>
<td>21.6</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>He/she feels that others will take advantage if they can.</td>
<td>24.6</td>
</tr>
<tr>
<td>Openness</td>
<td>He/she gets enchanted with the natural world.</td>
<td>24.7</td>
</tr>
<tr>
<td>Openness</td>
<td>He/she has a strong moral sense.</td>
<td>30.5</td>
</tr>
<tr>
<td>Openness</td>
<td>He/she daydreams, but doesn’t like daydreaming.</td>
<td>36.3</td>
</tr>
<tr>
<td>Openness</td>
<td>He/she spends time speculating about the nature of the universe.</td>
<td>45.8</td>
</tr>
<tr>
<td>Openness</td>
<td>He/she likes poetry.</td>
<td>55.4</td>
</tr>
</tbody>
</table>

This was in agreement with the scree plot, and eight components were retained (see Figure 1). Table 2 shows the final rotated component matrix. All α’s were significant, *p < .001.* The components were labeled as follows: (I) Neuroticism, (II) Active, (III) Conscientiousness,
(IV) Agreeableness, (V) Openness, (VI) Social Extraversion, (VII) Temperamental, and (VIII) Disciplined.

The overall reliability of the 32 items was moderately good, Cronbach’s $\alpha = .57$.

Reliability analyses for the items of each component were as follows: Neuroticism, $\alpha = .83$; Active, $\alpha = .78$; Conscientiousness, $\alpha = .81$; Agreeableness, $\alpha = .73$; Openness, $\alpha = .61$; Social Extraversion, $\alpha = .63$, Temperamental, $\alpha = .48$, and Disciplined, $\alpha = .30$.

Figure 1. Scree plot of final PCA for the FFM questionnaire.
Table 2

*Rotated Component Matrix of 32 Items with Communalities (h²) for the FFM Questionnaire*

<table>
<thead>
<tr>
<th>FFM Dimension</th>
<th>Item</th>
<th>Component</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>h²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>He/she worries a lot</td>
<td></td>
<td>.783</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.647</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>He/she feels anxious and fearful quite a lot</td>
<td></td>
<td>.769</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.717</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>He/she often feels helpless &amp; needs support</td>
<td></td>
<td>.717</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.590</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>He/she is often tense and jittery</td>
<td></td>
<td>.694</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.690</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>He/she has very low self-esteem</td>
<td></td>
<td>.670</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.564</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>When stressed he/she can be very anxious</td>
<td></td>
<td>.529</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.466</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>He/she is suspicious of others</td>
<td></td>
<td>.503</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.471</td>
</tr>
<tr>
<td>Extraversion</td>
<td>He/she often seems to be bursting with energy</td>
<td></td>
<td>.810</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.688</td>
</tr>
<tr>
<td>Extraversion</td>
<td>He/she is very active</td>
<td></td>
<td>.797</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.678</td>
</tr>
<tr>
<td>Extraversion</td>
<td>Life for him/her is fast paced</td>
<td></td>
<td>.665</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.519</td>
</tr>
<tr>
<td>Extraversion</td>
<td>He/she is cheerful and high-spirited</td>
<td></td>
<td>.659</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.645</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>He/she is reliable and won’t let you down</td>
<td></td>
<td>.784</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.732</td>
</tr>
</tbody>
</table>
Table 2 (continued).

<table>
<thead>
<tr>
<th>FFM Dimension</th>
<th>Item</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>He/she will always get the job done</td>
<td>.767</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>He/she is dependable and reliable</td>
<td>.718</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>He/she is a hard worker</td>
<td>.669</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>He/she is selfish and egotistical</td>
<td>.709</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>He/she is thoughtful and considerate</td>
<td>-.659</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>He/she is rather cold and calculating</td>
<td>.610</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>He/she is well-mannered</td>
<td>-.602</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>He/she is hard-headed and tough-minded</td>
<td>.580</td>
</tr>
<tr>
<td>Extraversion</td>
<td>He/she has a good sense of humor</td>
<td>.741</td>
</tr>
<tr>
<td>Extraversion</td>
<td>He/she is rather lighthearted and cheerful</td>
<td>.644</td>
</tr>
<tr>
<td>Openness</td>
<td>He/she is very curious and likes to explore</td>
<td>.627</td>
</tr>
<tr>
<td>Openness</td>
<td>He/she will try new foods</td>
<td>.497</td>
</tr>
<tr>
<td>Extraversion</td>
<td>He/she enjoys interacting with others</td>
<td>.803</td>
</tr>
</tbody>
</table>
Table 2 (continued).

<table>
<thead>
<tr>
<th>FFM Dimension</th>
<th>Item</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Extraversion</td>
<td>He/she would rather go his/her own way</td>
<td>.656</td>
</tr>
<tr>
<td>Extraversion</td>
<td>He/she prefers to do things on his/her own</td>
<td>.603</td>
</tr>
<tr>
<td>Extraversion</td>
<td>He/she prefers to be on his/her own</td>
<td>-.598</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>If he/she doesn’t like you, you soon know it</td>
<td>.745</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>He/she gets angry with the way people treat him/her</td>
<td>.731</td>
</tr>
<tr>
<td>Openness</td>
<td>He/she sticks to established habits</td>
<td>.801</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>He/she is methodical</td>
<td>.597</td>
</tr>
</tbody>
</table>

|                           | Total Eigenvalue | 3.60 | 2.96 | 2.68 | 2.68 | 2.28 | 1.97 | 1.66 | 1.26 |
|                           | % of Variance    | 11.23| 9.25 | 8.38 | 8.37 | 7.14 | 6.16 | 5.20 | 3.94 |
|                           | α                | .83  | .78  | .81  | .73  | .61  | .63  | .48  | .30  |
Categorical Differences

A One-Way ANOVA explored differences in scores between geldings (N = 496), mares (N = 305), and stallions (N = 26). Sex differences were found in the components Neuroticism (F(2, 824) = 3.16, p < .05), Openness (F(2, 824) = 2.11, p < .0001, Social Extraversion (F(2, 824) = 8.89, p < .0001, and Temperamental (F(2, 824) = 3.54, p < .05. See Table 3 for means and standard deviations.

Post-hoc analyses (Tukey) were run to assess specific differences. Neuroticism showed stallions as having significantly higher scores relative to mares, p < .05. In Openness, mares had significantly higher scores than geldings (p < .001) and stallions (p < .05). Conversely, stallions had significantly higher scores than mares (p = .001) and geldings (p < .05) in Social Extraversion, with geldings also scoring significantly higher than mares (p < .05) in this component. The Temperamental component revealed geldings as having significantly higher scores than mares (p < .05).

A total of 124 unique breed combinations were reported. Regional breeds were combined into the major breed for clarity; for example Russian Arabians and Shagya Arabians were classified as “Arabian.” For the current analysis, only breeds with a sample size of 20 or more were included. This left 10 breeds that were analyzed with the component scores: Appaloosa (N = 27), Appendix (N = 25), Arabian (N = 67), Morgan (N = 34), Mustang (N = 20), Paint (N = 61), Paso Fino (N = 22), Quarter Horse (N = 187), Tennessee Walker (N = 52), and Thoroughbred (N = 59).

A One-Way ANOVA found significant breed differences in Active, F(9, 544) = 3.72, p < .001. Tukey post-hoc tests revealed significant differences between Paso Fino and Quarter Horse (p < .01); Paso Fino and Paint (p < .01); and Paso Fino and Mustang (p < .01). The Paso Fino had significantly lower scores than each of the other three breeds. For means and standard deviations, see Table 4.
Table 3  
*Means and Standard Deviations for Gender across Personality Components*

<table>
<thead>
<tr>
<th>Component</th>
<th>Gender</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroticism</td>
<td>Mare</td>
<td>3.57*</td>
<td>.832</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>3.63</td>
<td>.893</td>
</tr>
<tr>
<td></td>
<td>Stallion</td>
<td>4.00*</td>
<td>.690</td>
</tr>
<tr>
<td>Active</td>
<td>Mare</td>
<td>2.76</td>
<td>.980</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>2.71</td>
<td>.933</td>
</tr>
<tr>
<td></td>
<td>Stallion</td>
<td>2.38</td>
<td>.840</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>Mare</td>
<td>1.71</td>
<td>.714</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>1.71</td>
<td>.730</td>
</tr>
<tr>
<td></td>
<td>Stallion</td>
<td>1.68</td>
<td>.658</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>Mare</td>
<td>3.75</td>
<td>.811</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>3.85</td>
<td>.810</td>
</tr>
<tr>
<td></td>
<td>Stallion</td>
<td>3.92</td>
<td>.792</td>
</tr>
<tr>
<td>Openness</td>
<td>Mare</td>
<td>2.22*</td>
<td>.713</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>1.99*</td>
<td>.703</td>
</tr>
<tr>
<td></td>
<td>Stallion</td>
<td>1.82*</td>
<td>.632</td>
</tr>
<tr>
<td>Social Extraversion</td>
<td>Mare</td>
<td>3.38*</td>
<td>.853</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>3.55*</td>
<td>.801</td>
</tr>
<tr>
<td></td>
<td>Stallion</td>
<td>3.99*</td>
<td>.642</td>
</tr>
<tr>
<td>Temperamental</td>
<td>Mare</td>
<td>2.69*</td>
<td>1.02</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>2.89*</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>Stallion</td>
<td>2.76</td>
<td>1.26</td>
</tr>
<tr>
<td>Disciplined</td>
<td>Mare</td>
<td>2.14</td>
<td>.751</td>
</tr>
<tr>
<td></td>
<td>Gelding</td>
<td>2.15</td>
<td>.778</td>
</tr>
<tr>
<td></td>
<td>Stallion</td>
<td>2.42</td>
<td>.890</td>
</tr>
</tbody>
</table>
Table 4  

*Means and Standard Deviations for Breeds That Showed Significant Differences in Active*

<table>
<thead>
<tr>
<th>Breed</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paso Fino</td>
<td>1.99</td>
<td>.871</td>
</tr>
<tr>
<td>Quarter Horse</td>
<td>2.84</td>
<td>.990</td>
</tr>
<tr>
<td>Paint</td>
<td>2.98</td>
<td>1.03</td>
</tr>
<tr>
<td>Mustang</td>
<td>3.18</td>
<td>.957</td>
</tr>
</tbody>
</table>

*Inter-Rater Reliability*

The average inter-rater reliability across the 121 rater pairs was $R = .56$, $p < .001$. Inter-rater agreement was measured using the Intraclass Correlation Coefficient (ICC), and was significant for both single measures ($\omega^2 = .56$; $F (5973) = 3.54$, $p < .001$) and average measures ($\omega^2 = .72$; $F (5973) = 3.54$, $p < .001$). These analyses were computed using all 60 items of the questionnaire.

**Discussion**

One aspect of the current study was designed to determine the feasibility of accurately measuring horse personality using a human five-factor model (FFM). To do this, a personality study conducted by Morris, Gale, and Howe (2002) was replicated. The authors used the short form of the original NEO-PI-FFI (Costa & McCrae, 1992) and applied the items, slightly altered for ease of use, to horses. These 60 items were identically replicated in the current study, with the addition of a *don’t know* option. The sample size of the current study was also much larger than Morris et al. (827 vs. 210 horses). These two differences are likely responsible for any discrepancies in the results.

Morris et al. retained five factors, accounting for 41.5% of the variance. The current study extracted eight factors, which accounted for 59.67% of the variance. Including a *don’t know* option eliminated 28.3% of the questionnaire items, indicating that at least 17 items of the short
form NEO-PI-FFI do not reflect equine personality. Funder (1991) proposes that a trait must produce a behavioral effect in some context which must be available, as well as detectable, to the rater. The current results suggest that many human traits are not comparable to equines. Table 5 shows a comparison between the components extracted in Costa & McCrae’s (1992) study, the components extracted in the Morris et al. (2002) study, and the components extracted in the current study.

Table 5


<table>
<thead>
<tr>
<th>NEO-PI-FFI</th>
<th>Morris et al.</th>
<th>Current study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraversion</td>
<td>Neuroticism</td>
<td>Neuroticism</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>Social Extraversion</td>
<td>Active</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>Activity</td>
<td>Conscientiousness</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>Conscientiousness</td>
<td>Agreeableness</td>
</tr>
<tr>
<td>Openness to Experience</td>
<td>Agreeableness</td>
<td>Openness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social Extraversion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Temperamental</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disciplined</td>
</tr>
</tbody>
</table>

One of the eight extracted components showed significant gender differences, and a second had significant breed differences. Stallions scored significantly higher than mares in Neuroticism. This may be an evolutionary strategy in which these behaviors created an increased vigilance in the stallion, allowing it to protect its harem. This is supported by the fact that many of these behaviors diminish after castration (Budiansky, 1997).
No sex or breed differences were found in the component Social Extraversion. However, the discrepancies of the items composing the component are worth mentioning. The first two items both loaded positively: he/she enjoys interacting with others and he/she would rather go his/her own way rather than be a leader of others. While these two items seem at first to contradict each other, it would appear that a horse may enjoy being a part of a group, but only as a member, not a leader. The third item (he/she prefers to do things on his/her own) loaded positively, while the final item (he/she prefers to be on his/her own) loaded negatively. These two items also offer an interesting duality. It could be concluded that a horse may not like to be isolated from others, but prefers to do certain tasks individually. These results indicate a complex social structure, and more research should be done with additional items.

Summary and Conclusions

The current study replicated Morris et al.’s (2002) study using the 60-item shortened NEO-PI-FFI (Costa & McCrae, 1992). A sample size of 827 horses was analyzed to extract a personality structure consisting of seven components from 32 items.

The results of the current study differed slightly from those of Morris et al., who extracted five components. One possible reason for this discrepancy is the difference in sample size; the current student utilized a sample over twice as large as that of the original authors. A second possibility is the removal of 17 items in the current study that raters deemed irrelevant to equine personality (as indicated by a don’t know response greater than 10% for each item). This difference in the number of items analyzed likely had a large influence on the creation of principal components. However, five of the seven components in the current study could be directly compared to the five factors proposed by Morris et al., which suggests that the results of the studies were similar.

The results of the current study provide important information to the field of equine personality research. Morris et al.’s (2002) study was successfully replicated. However, by giving raters a choice of don’t know, it was discovered that 17 items on the FFM questionnaire were
irrelevant to horse personality. In addition, these results uncovered the possibility of a complex social structure, which may affect behavior at a higher level than previously believed. Further research should examine these results using more items on the questionnaire related to sociability. The current study was limited in its sample sizes of stallions and some breeds. In order to more effectively determine personality differences, these samples should be increased.
CHAPTER IV
THE HORSE PERSONALITY QUESTIONNAIRE

Introduction

Animal personality has always been limited by its restrictions on cross-species comparisons. The use of pre-determined adjective lists, such as those used to evaluate the Big Five, has the potential to bias the results of the personality structure towards the original species the list had evaluated (McGrogan, Hutchinson, & King, 2008). An alternative method is to create an adjective list using traits specific to the species in question. Stevenson-Hinde et al. (1980) developed a rating assessment for rhesus monkeys that has since been applied to several other species such as chimpanzees (Martin, 2005), gorillas (Gold & Maple, 1994), cats (Feaver et al., 1986), cheetahs (Wielebnowski, 1999), and spotted hyenas (Gosling, 1998). The use of these full lists might lead to more salient results of the emerging factor structure, as the adjectives are selected based on the perceptions of people familiar with the particular species (McGrogan et al., 2008).

Lloyd et al. (2007) also utilized this behavior rating questionnaire and applied it to horses, allowing equines to join the ranks of species that may be measured comparatively. The researchers named their rating assessment the Horse Personality Questionnaire (HPQ). The HPQ consisted of 30 behaviorally defined adjectives (BDAs), 25 of which were adapted from Stevenson-Hinde et al. (1980). The five additional adjectives were added by the authors, with the belief that these items further tailored the questionnaire for horses. Three of these additional adjectives were derived from Morris et al. (2002), namely: suspicious, hardworking, and reliable. The remaining two adjectives, stubborn and intelligent, were added based on their common use among horse handlers and owners. The complete list of 30 adjectives can be found in Table 6.
Table 6

Thirty Behaviorally Defined Adjectives of the HPQ

<table>
<thead>
<tr>
<th>Active</th>
<th>Eccentric</th>
<th>Insecure</th>
<th>Playful</th>
<th>Solitary</th>
<th>Suspicious</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggressive</td>
<td>Effective</td>
<td>Irritable</td>
<td>Popular</td>
<td>Subordinate</td>
<td>Reliable</td>
</tr>
<tr>
<td>Apprehensive</td>
<td>Equable</td>
<td>Motherly</td>
<td>Protective</td>
<td>Strong</td>
<td>Hardworking</td>
</tr>
<tr>
<td>Confident</td>
<td>Excitable</td>
<td>Opportunistic</td>
<td>Slow</td>
<td>Tense</td>
<td>Stubborn</td>
</tr>
<tr>
<td>Curious</td>
<td>Fearful</td>
<td>Permissive</td>
<td>Sociable</td>
<td>Understanding</td>
<td>Intelligent</td>
</tr>
</tbody>
</table>

The total length of the HPQ was four pages. Five of the BDAs resulted in no significant positive correlation across any rater pairs and were removed from further analyses: hardworking, confident, permissive, solitary, and strong. Principle component analysis revealed seven components which together explained 83.6% of the total variance. The seventh component only accounted for 4.4% of the total variance and was later rejected. The remaining six components were labeled Dominance, Anxiousness, Excitability, Protection, Sociability, and Inquisitiveness, and together accounted for 79.3% of the total variance. Reliability results were found to be on par with those acceptable in human research.

McGrogan et al. (2008) followed Lloyd et al.’s study with their own list of 36 adjectives gathered from owners, trainers, and stable managers. Factor analysis extracted three personality dimensions: Agreeableness, Extraversion, and Neuroticism. Of the 36 adjectives, only four matched up directly with the adjectives used in the HPQ: aggressive, stubborn, intelligent, and curious. Other adjectives could be assumed to be similar; however, McGrogan et al. did not provide operational definitions for their descriptors to be compared to those of the HPQ, and the authors made only a brief mention of the Lloyd et al. study. The absence of operational definitions make McGrogan et al.’s list of species-specific adjectives impossible to replicate. Therefore, the main focus of the current study will rely on the adjectives used in the HPQ.
The purpose of the current study was to replicate Lloyd et al.’s (2007) research. An additional option of don’t know was included with each item below the 5-point Likert scale in order to determine if any of the items were irrelevant to horse personality. It was hypothesized that the current study would produce results similar to those of the original study, with slight differences accounted for by the large difference in sample sizes.

Method

Design

The 30 items of the HPQ were replicated from Lloyd et al. (2007). Each behaviorally-defined adjective was defined exactly as they were by Lloyd et al., but were randomized and presented to raters in a different order from that of the original study.

Participants

Participants were contacted via email based on their experience with horses. Specifically, instructors, stable managers, and ranch owners were contacted with a form letter briefly explaining the project and asking for their help in recruiting further participants, including colleagues, friends, and students. Participant emails were collected from online public databases on which participants had willingly listed themselves. The email included the link to complete the survey online. As a result, the survey link was posted on several horse forums, chat rooms, and e-newsletters by participants wishing to assist in the data collection of the project.

Materials and Procedures

Each of the 30 items included answer choices directly below the item. The answer options were slightly different from those of the NEO-PI-FFI, in that they included the actual adjective being defined. For example, choices for the adjective playful ranged from very playful to very un-playful. In addition to the five choices along the Likert scale, raters also had the option to mark don’t know.
Results

Sample Demographics

A total of 994 respondents completed the questionnaire. Of these, 121 rated a horse that
had already been rated. These duplicates were used for a reliability analysis and removed from
the main analysis. An additional 46 respondents were removed from the analysis for having a
response rate of don’t know greater than 10%, leaving a final sample size of 827 horses.

Horses were of three sex types: gelding (N = 496), mare (N = 305), and stallion (N = 26).
The vast majority of respondents were owners of the horse being rated (N = 673) and strongly like
the horse they chose to rate (N = 775). Approximately 29% of the horses resided in the Midwest
of the United States, and 44.6% were used primarily as trail horses. Raters reported that 606 of
the horses primarily lived at pasture, while 221 lived in a stable/barn environment. Ninety-one
percent (N = 753) of respondents reported that their horse has never performed stereotypic
behaviors. Most horses lived with at least one other horse. For complete demographic
information, see Appendix E.

The mean age of rated horses was 12.67 years (SD = 6.19), with a range of 1 year to 37
years. Horses had lived in their current home for an average of 5.39 years (SD = 4.73), with a
range of 0 (less than 1 year) to 30 years. Respondents had known rated horses between 1 and 30
years (M = 7.21; SD = 5.30).

Analyses

For the analysis, any item marked as don’t know was entered as a missing value and a
mean imputation was calculated. A Principal Component Analysis (PCA) was conducted on the
30 items of the HPQ with varimax orthogonal rotation. An initial review of the rotated component
matrix indicated that the item “strong” did not load onto any of the components (using a criterion
of .3). Five additional items were removed if they loaded onto three or more factors or loaded on
two factors with a less than .05 difference: Irritable, Playful, Stubborn, Reliable, and Curious. The PCA was run again on the remaining 24 items.

The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO = .85. Bartlett’s Test of sphericity $\chi^2 (276) = 6420.24, p < .001$, indicated that correlations between items were sufficiently large for PCA. An initial analysis was run to obtain eigenvalues for each component in the data. Six components had eigenvalues over Kaiser’s criterion of 1.0 and in combination explained 59.95% of the variance. This concurred with the scree plot (Figure 2) and six components were retained (see Table 7).

![Scree plot of final PCA for the HPQ questionnaire.](image)

The overall reliability of the 24 items was moderately good, Cronbach’s $\alpha = .58$.

Reliability analyses for the items of each component were as follows: component I, $\alpha = .86$; component II, $\alpha = .75$; component III, $\alpha = .70$; component IV, $\alpha = .61$; component V, $\alpha = .56$; component VI, $\alpha = .34$. The components were labeled as follows: (I) Anxiousness; (II) Dominance; (III) Sociability; (IV) Protection; (V) Excitability; (VI) Inquisitiveness.
<table>
<thead>
<tr>
<th>Item</th>
<th>Component I</th>
<th>Component II</th>
<th>Component III</th>
<th>Component IV</th>
<th>Component V</th>
<th>Component VI</th>
<th>$h^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apprehensive</td>
<td>.853</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.735</td>
</tr>
<tr>
<td>Fearful</td>
<td>.767</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.619</td>
</tr>
<tr>
<td>Confident</td>
<td>-.767</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.650</td>
</tr>
<tr>
<td>Insecure</td>
<td>.751</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.668</td>
</tr>
<tr>
<td>Tense</td>
<td>.683</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.596</td>
</tr>
<tr>
<td>Excitable</td>
<td>.620</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.627</td>
</tr>
<tr>
<td>Suspicious</td>
<td>.573</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.536</td>
</tr>
<tr>
<td>Equable</td>
<td>-.572</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.559</td>
</tr>
<tr>
<td>Subordinate</td>
<td>.824</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.688</td>
</tr>
<tr>
<td>Effective</td>
<td>-.789</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.662</td>
</tr>
<tr>
<td>Aggressive</td>
<td>-.647</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.537</td>
</tr>
<tr>
<td>Permissive</td>
<td>.638</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.472</td>
</tr>
<tr>
<td>Solitary</td>
<td>-.825</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.708</td>
</tr>
<tr>
<td>Sociable</td>
<td>.810</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.684</td>
</tr>
<tr>
<td>Popular</td>
<td>.530</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.521</td>
</tr>
<tr>
<td>Protective</td>
<td>.774</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.630</td>
</tr>
<tr>
<td>Understanding</td>
<td>.664</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.486</td>
</tr>
<tr>
<td>Motherly</td>
<td>.654</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.553</td>
</tr>
<tr>
<td>Active</td>
<td></td>
<td>.720</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.615</td>
</tr>
<tr>
<td>Slow</td>
<td></td>
<td>-.705</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.653</td>
</tr>
</tbody>
</table>
Table 7 (continued).

<table>
<thead>
<tr>
<th>Item</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>$h^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardworking</td>
<td>.659</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.587</td>
</tr>
<tr>
<td>Opportunistic</td>
<td>.695</td>
<td>.594</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intelligent</td>
<td>.652</td>
<td>.565</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eccentric</td>
<td>.553</td>
<td>.440</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Eigenvalue     4.39 2.71 2.08 1.97 1.86 1.37
% of variance  18.30 11.31 8.68 8.23 7.73 5.70
$\alpha$       .86   .75   .70   .61   .56   .34

Categorical Differences

A One-Way ANOVA explored differences in scores between geldings ($N = 496$), mares ($N = 305$), and stallions ($N = 26$). Sex differences were found in two components: Sociability [$F (2, 824) = 10.63, p < .001$] and Protection [$F (2, 824) = 3.08, p < .05$]. Mares had an average Sociability component score of 3.65 (SD = .87), which was significantly lower than the average of both geldings (M = 3.70; SD = .90; $p < .01$) and stallions (M = 4.09; SD = .79; $p < .001$).

Geldings also scored significantly lower than stallions ($p < .05$). Geldings and mares differed significantly in Protection component scores (M = 2.46, SD = .76; M = 2.33, SD = .77; $p < .05$), although no significant differences between mares and stallions were apparent.

A total of 124 unique breed combinations were reported. Regional breeds were combined into the major breed for clarity; for example Russian Arabians and Shagya Arabians were
classified as “Arabian.” For the current analysis, only breeds with a sample size of 20 or more were included. This left 10 breeds that were analyzed with the component scores: Appaloosa ($N = 27$), Appendix ($N = 25$), Arabian ($N = 67$), Morgan ($N = 34$), Mustang ($N = 20$), Paint ($N = 61$), Paso Fino ($N = 22$), Quarter Horse ($N = 187$), Tennessee Walker ($N = 52$), and Thoroughbred ($N = 59$).

A One-Way ANOVA found significant breed differences in Excitability, $F(9, 544) = 3.54, p < .001$. Tukey post-hoc tests revealed significant differences between the Quarter Horse ($M = 2.71, SD = .85$) and three other breeds: the Arabian ($M = 2.26, SD = .76; p < .01$); the Thoroughbred ($M = 2.32, SD = .65; p < .05$); and the Paso Fino ($M = 2.13, SD = .66; p < .05$).

**Inter-Rater Reliability**

The average inter-rater reliability across the 121 rater pairs was $R = .61, p < .001$. Inter-rater agreement was measured using the Intraclass Correlation Coefficient (ICC), and was significant for both single measures ($\omega^2 = .61; F(3500) = 4.13, p < .001$) and average measures ($\omega^2 = .76; F(3500) = 4.13, p < .001$). These analyses were run on all 30 items of the questionnaire.

**Discussion**

As an alternative to the FFM, a questionnaire consisting of 30 behaviorally defined adjectives (BDAs) was presented alongside the 60-item FFM. In theory, the use of BDA’s may be more accurate predictors of equine personality relative to the FFM because the adjectives are selected based on the perceptions of people familiar with horses (McGrogan et al., 2008). Conversely, the FFM includes human descriptors that may or may not apply to horses. The 30-item BDA questionnaire was replicated from Lloyd et al.’s (2007) Horse Personality Questionnaire.

In the original study, the authors had five items that were deemed unreliable and removed from the final analysis: Hardworking, Confident, Permissive, Solitary, and Strong. In the current study, five items were also removed for failing to load significantly onto any component or for
reducing the alpha level of a component: Hardworking, Stubborn, Permissive, Popular, and Strong. Interestingly, Stubborn could be described as an antonym for Permissive, and Popular could be considered an opposite of Solitary, making the original study and the current study convergent on these five item types. Lloyd et al. extracted six components using data from 61 horses: Dominance, Anxiousness, Excitability, Protection, Sociability, and Inquisitiveness. The current study also extracted six components, though these loaded in a slightly different order: Anxiousness, Dominance, Protection, Sociability, Excitability, and Inquisitiveness.

In a follow-up study, Lloyd et al. (2008) examined breed differences using the HPQ. They analyzed eight breeds from a sample of 1223 horses. Four of the breeds were also analyzed in the current study: Arabian, Appaloosa, Quarter Horse, and Thoroughbred. Because Lloyd et al. did not analyze their data with PCA and instead estimated component scores, component scores cannot be directly compared with the current study.

Gender differences were found in two components, and breed differences were found in one component. Mares had significantly lower scores in Protection than geldings, and also scored lower in Protection than stallions, though this difference was non-significant. This result was unexpected given that mares gestate for 11 months and care for foals up until at least one year of age (Budiansky, 1997). There are two possible explanations for this. The first is that mares may only be protective of offspring, and the majority of domestic mares are not used for breeding. Therefore, caretakers and owners would not observe “protective” behaviors from a horse because they do not direct these behaviors towards non-familial horses. Observations of wild horses suggest that mares tend to associate with horses of similar age and hierarchy rank, and younger females are often the recipients of aggression from older mares (Monard & Duncan, 1996). Mares that scored low in this component may live in situations that require they establish their dominance, rather than show protection.

The second possibility involves mares in estrus. Mares that are not bred fluctuate in and out of estrus throughout the year. When in estrus, even timid mares may act aggressive to another
Sociability contained three items in the current study, solitary (-), sociable (+), and popular (+). Mares had significantly higher scores than both geldings and stallions, and geldings scored significantly higher than stallions. Observations of mares within farm herds or wild harems indicate that mares tend to form fixed associations with particular horses, grooming them more often and allowing them to stand closer than others (Budiansky, 1997). These observations are also hard to interpret, as it can be argued that mares are very sociable with some horses, but not others. Observations of wild horses indicate that horses may form temporary groups without forming an attachment while accessing a common resource. Even though the group is not stable, a temporary dominance hierarchy is still formed (Mills & Nankervis, 1999).

Excitability (HPQ) contained three items: Active (+), Slow (-), and Hardworking (+). The Quarter Horse had the highest scores in this component, which were significantly different from the scores of the Arabian, Thoroughbred, and Paso Fino. According to the American Quarter Horse Association (AQHA, 2011), the Quarter Horse is heavily muscled and compact. They are used heavily in rodeo and ranch work, and have the fastest sprint times of any other breed.

The significantly lower scores of the Arabian were surprising; these horses are often known for their high-strung behavior. However, experienced handlers maintain that the breed has a good temperament, and are only aroused by abuse, mistreatment, and insensitive handling (Hendricks, 1995). Because of the modern widespread focus on horsemanship, especially in the United States, it is possible that the Arabian breed has shed its stereotype of being nervous or flighty, and caretakers now only observe the calm and easily-handled natural temperament of the breed.

The lower scores of the Thoroughbred were more consistent with the breed. Although Thoroughbreds are known as hot-blooded animals, well-trained horses are extremely reliable and
easy to handle (Thoroughbred Owners and Breeders Association, 2011). According the Paso Fino Horse Association (2010), the breed is extremely willing, strives to please, and is gentle at hand. The breed is often described as brio condido, meaning energy and spirit, held in-check by intelligence, patience, and self-restraint (Hendricks, 1995).

Summary and Conclusions

The current study replicated the 30-item HPQ developed by Lloyd et al. (2007). The final PCA extracted six factors from 24 items using a sample of 680 horses. Reliability between the scale items ranged from $\alpha = .34$ to $\alpha = .86$, with an overall questionnaire reliability of $\alpha = .58$. The six components were labeled (I) Anxiousness; (II) Dominance; (III) Sociability; (IV) Protection; (V) Excitability; (VI) Inquisitiveness. These components were identical to those extracted by Lloyd et al., albeit they were extracted in a slightly different order. This successful replication of Lloyd et al.’s study gives support toward the validation of the HPQ as an assessment tool for equine personality.

These results were concurrent with Lloyd et al.’s (2007) results, although the components were extracted in a slightly different order. Sex differences were found in Sociability and Protection, with mares scoring significantly higher in Sociability and significantly lower in Protection. Future research should differentiate Protection into separate fields. For example, it is possible that mares are protective off their offspring, but not their territory.

The results of the current study are a successful replication of the Lloyd et al. (2007) study. Although the final 24 items used differed slightly, the same six components were extracted. The significant sex differences found within some components suggest that equine personality may be influenced by sex. Additional studies might provide evidence as to the heritability of personality in horses. The current study had a much higher overall sample size than that of Lloyd et al.; however, this study was limited by the small sample size of stallions and some breeds. Future research should focus on obtaining larger samples of breeds all three sex types.
CHAPTER V
COMPARING THE FFM AND HPQ

Introduction

Personality questionnaires in non-human animal research generally take one of two forms. The first is adapted from the human Five Factor Model (FFM), in which the subject is assumed to possess five main personality dimensions: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness. The FFM has been applied to several species, including dolphins (Highfill & Kuczaj, 2007), chimpanzees (King & Figuerdo, 1997), dogs, cats, and rabbits (Gosling & Bonnenburg, 1998). Use of the FFM allows for a direct cross-species comparison, including humans (Gosling & Bonnenburg, 1998). However, not all traits can be applied to other animal species because of their orientation to human personality (e.g., “disorganized”). In addition, cross-species comparisons may still be inaccurate given that different species engage in varying species-specific behaviors, and these behaviors provide information on personality (Gosling, 2001).

As an alternate to the FFM, a second form of personality questionnaires has evolved using behaviorally-defined adjectives (BDAs). In some studies, BDAs are developed that are specific to the species in questions (e.g., Gosling, 1998). However, many researchers have employed a 30-item assessment tool developed by Stevenson-Hinde and Zunz (1978) and Stevenson-Hinde et al. (1980). This assessment has been applied to rhesus macaques (Stevenson-Hinde & Zunz, 1978), cats (Feaver et al. 1986), gorillas (Gold & Maple, 1994), spotted hyenas (Gosling, 1998), cheetahs (Wielebnowski, 1999), chimpanzees (Martin, 2005), pig-tailed macaques (Caine et al., 1983), and horses (Lloyd et al., 2007). The widespread use of this tool allows for a cross-species comparison similar to that provided by the FFM, but with the absence of what might be considered irrelevant human traits.
In horses, both the FFM and BDA assessment have been applied. Morris, Gale, and Howe (2002) used the shortened form of the NEO-PI-FFI (Costa & McCrae, 1992) and extracted five components of horse personality: Neuroticism, Social Extraversion, Energy/Activity/Novelty Seeking, Conscientiousness, and Agreeableness. These five components accounted for 41.5% of the total variance. This study was replicated using the same item pool, but resulted in seven items: Neuroticism, Extraversion, Active, Agreeableness, Conscientiousness, Temperamental, and Sociability (cf. Chapter III), which explained 55.65% of the total variance.

Lloyd et al. (2007) implemented the assessment developed by Stevenson-Hinde and Zunz (1978) and Stevenson-Hinde et al. (1980). The researchers extracted six equine personality components: Dominance, Anxiousness, Excitability, Protection, Sociability, and Inquisitiveness, which combined to explain 79.3% of the total variance. The items that were retained for the final analysis made up a new assessment tool which the authors named the Horse Personality Questionnaire (HPQ). This study was replicated using the same item pool, and the same six components were extracted (cf. Chapter IV), explaining 59.99% of the total variance.

The FFM and BDA assessments have never been directly compared using the same subjects and raters. The purpose of the current study was to present these two questionnaires simultaneously, and compare the results of separate principal components analyses. The investigation of the two rating assessments will help to clarify some of the mixed results in the horse personality literature. If both rating methods extract the same personality structure and have good inter-rater reliability, then it is likely that previous studies using the different methods can be compared. However, if they are different, previous studies of horse personality are not comparable. An established personality scale such as those used in human personality research would enhance the ability to compare populations of horses and better understand underlying psychological mechanisms.
Method

Design

The current study implemented the results of two previous studies (Chapter III & Chapter IV). The first was a replication of a study conducted by Morris et al. (2002), while the second was a study replicated from Lloyd et al. (2007). The results of interest to the current study were the mean component scores following a principal components analysis conducted in each study. Mean component scores were saved as variables and compared with a Pearson’s correlation using SPSS 18.0.

Results

Convergent Validity

To test for convergent validity between the FFM and HPQ questionnaires, a Pearson’s correlation was conducted on the average scores for each factor pair. Multiple significant correlations existed; however, most of these correlations were very small (r < .4). This is most likely due to the large sample size, and as such only significant correlations with r > .4 were evaluated. Table 8 shows the significant relationships found between the questionnaires.

Convergent validity for the FFM and HPQ scales was found for all extracted components except Inquisitiveness on the HPQ. The HPQ component Anxiousness was significantly correlated with the FFM components Neuroticism and Conscientiousness. Excitability on the HPQ correlated highly with Active on the FFM, and Sociability on the HPQ correlated negatively with Social Extraversion on the FFM. Finally, both Dominance and Protection correlated negatively with Agreeableness on the FFM.
Table 8

Convergent Validity of FFM and HPQ Factor Scales

<table>
<thead>
<tr>
<th>HPQ Factor</th>
<th>FFM Factor</th>
<th>$r$</th>
<th>$R^2$</th>
<th>Sig.</th>
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<tr>
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<td>Neuroticism</td>
<td>.84</td>
<td>.71</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td></td>
<td>Conscientiousness</td>
<td>-.43</td>
<td>.18</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Excitability</td>
<td>Active</td>
<td>.74</td>
<td>.55</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Sociability</td>
<td>Social Extraversion</td>
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<td>.50</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Dominance</td>
<td>Agreeableness</td>
<td>-.59</td>
<td>.35</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Protection</td>
<td></td>
<td>-.40</td>
<td>.16</td>
<td>$p &lt; .001$</td>
</tr>
</tbody>
</table>

Discussion

The current study was the first of its kind to compare two types of personality questionnaires using the same participants at the same point in time. Previous personality studies on many species, especially horses, have had drastically different designs and methodologies. This made comparisons between studies difficult to interpret. This study was designed to determine if two different personality questionnaires, an FFM and a BDA assessment, were directly comparable when applied to the same sample.

Neuroticism and Anxiousness

The first component extracted for the FFM and HPQ were Neuroticism and Anxiousness, respectively. These components correlated significantly ($r = .84$). Several of the items in each scale were similar. For example, "fearful" on the HPQ could be compared with "he/she feels anxious and fearful quite a lot" on the FFM scale. Similarly, "tense" on the HPQ is comparable to the FFM item "he/she is often tense and jittery." Other items were similar but did not necessarily
contain matching words. For example, the HPQ item "insecure" might be compared to "he/she has very low self-esteem" on the FFM.

Agreeableness and Dominance

Beyond the first component, the FFM and HPQ differed in the order components were extracted. Dominance, the HPQ’s second component, correlated with Agreeableness (fourth component of the FFM) \( r = -.59 \). The Dominance scale contained four items: subordinate (-), effective, aggressive, and permissive. The FFM component had no items that were directly comparable.

Agreeableness and Protection

The HPQ’s fourth component, Protection, also correlated with the FFM component Agreeableness \( r = -.40 \). The correlations between these components were the lowest relative to the other comparisons. Protection was composed of three items: protective, understanding, and motherly. These items have no comparable items on the FFM component. However, the item “he/she is thoughtful and considerate” might be related to “understanding.”

Social Extraversion and Sociability

Interestingly, Sociability on the HPQ (third component extracted) correlated negatively with Social Extraversion on the FFM (seventh component extracted), \( r = -.71 \). Sociability on the HPQ contained three items: Sociable (+), Solitary (-), and Popular (+). The items of the FFM Sociability component presented an interesting duality. The items “he/she would rather go his/her own way than be a leader of others” and “he/she enjoys interacting with others” both loaded positively on the component. Additionally, “he/she prefers to be on his/her own” loaded negatively, while “he/she prefers to do things on his/her own” loaded positively. One possible interpretation of these results is that a horse may enjoy social interaction, but not necessarily as a leader, and prefers to do things alone but not necessarily be alone.
The results of Sociability and Social Extraversion are inconclusive. Further studies need to investigate the complex social nature of horses in regards to personality to determine the meaning of scores and potential applications of these results. It is suggested that social behavior be examined in several different aspects, rather than assuming "social" is all-inclusive.

Active and Excitability

The second-highest correlated components of the HPQ and FFM were Excitability (fifth component on the HPQ) and Active (second component on the FFM), $r = .71$. The FFM component Active consists of four items: "he/she is very active," "he/she often seems to be bursting with energy," "life for him/her is often fast-paced," and "he/she is cheerful and high-spirited." Each item loaded positively onto the component. These relate well to the HPQ items Active (+) and Slow (-), but the item Hardworking (+) is difficult to interpret within this component.

Anxiousness and Conscientiousness

Anxiousness was significantly correlated with the FFM’s Conscientiousness, $r = -.43$. The items of these two components appear unrelated and the significant negative correlation is unexpected. Conscientiousness consisted of four items: he/she is cheerful and high-spirited; he/she is reliable and won’t let you down; he/she will always get the job done; and he/she is a hard worker. It is possible that the behaviors represented in the HPQ (e.g. apprehensive, insecure, tense, etc.) would inhibit good work behavior, thereby creating a significant correlation.
CHAPTER VI

GENERAL DISCUSSION

The current study meets the three criteria proposed by Kenrick & Funder (1988) for the study of personality. First, assessments must be made by independent observers and these assessments must be in agreement. The present study calculated inter-rater reliability for 121 rater pairs, and had significantly high correlations for both questionnaires. Second, the assessment must have the ability to predict future behaviors and situational outcomes. The results of the current study have not been tested with coded behaviors. However, the convergent validity of the two questionnaires is indicative of an accurate structure of horse personality. Finally, assessments must be completely objective, ignoring any implicit theories about personality traits. The FFM questionnaire does not meet this final criterion as it is produced under the assumption of five factors of human personality. The HPQ questionnaire, however, uses only behaviorally defined adjectives, making it objective of preconceived personality theories.

Reliability for both questionnaires was good, with the HPQ having slightly better internal reliability and inter-rater reliability over the FFM. Gosling (2001) found that the mean inter-rater reliability of animal personality studies is around .52, and reliability for human personality questionnaires is acceptable at .50 (Gosling & Vazire, 2002). The current study had inter-rater reliability values of .57 (FFM) and .58 (HPQ). Many researchers advise the presentation of both inter-rater reliability and inter-rater agreement (e.g., Funder & Dobroth, 1987). The current study analyzed this with an Intraclass Correlation Coefficient (ICC), and found that inter-rater agreement was significant on both questionnaires for both single and average measures. The high ratings for both inter-rater reliability and inter-rater agreement indicate that the raters were able to recognize and clearly identify the trait, and in turn apply it to their horses. Internal reliability of each component was measured using Cronbach’s alpha. An alpha level of .70 or .80 is considered reliable in most constructs, although Kline (2000) states that lower values can also be reliable.
given the diversity of the construct being measured. All components in the current study had moderate to high $\alpha$ levels, ranging from .30 to .83 on the FFM and from .34 to .86 on the HPQ.

The study of non-human animal personality has been widely accepted by many researchers. Although non-human animal personality can be studied for its application to human behavior, it is also useful to study purely for the intention of better understanding a species. One application of understanding species-specific personality characteristics is in the identification of training tools and methods. For example, stallions scored very highly in Anxiousness, indicating that variables such as the external environment and the presence of conspecifics may influence training or learning. Indeed, many horses are put through extensive systematic desensitization before they can remain vigilant to what is being asked of them rather than movements and noises nearby (Mills & Nankervis, 1999).

The value of understanding personality can also benefit the well-being of an animal. Although very few respondents in the current study reported stereotypic behavior, knowing how a horse may react to something will allow the handler to prevent as much stress as possible. Many stressors can have long-term consequences, which can be reduced by recognizing individual needs. For example, cattle that are ranked individually as “calm” will gain more weight in one day than a conspecific ranked as “excitable” (Voisinet et al., 1997).

One final note should be made regarding the use of Principal Components Analysis in the current study. One criticism of PCA is that it maximizes the variance explained for any number of factors. As such, many statisticians recommend the use of exploratory factor analysis (e.g. Principal Axis Factoring) to create a factor matrix (Kline, 1994). PCA is often used in personality research because it is a psychometrically sound procedure and bears many similarities to discriminant analysis (Field, 2009). In addition, large matrices have been shown to have negligible differences between principle components and principle axes methods (Harman, 1976).
Future Directions

The current study has shown that equine personality can be measured with items from both a human five-factor model and a non-human animal behaviorally-defined adjective model. Resulting personality components do correlate to each other, and tend to have similar differences in breed and gender. However, to fully understand the complex personality of the domesticated horse, a full inventory needs to be developed, starting with several hundred descriptors which are then triaged for the most relevant descriptors by experts in the field of horses. Each breed needs an effectively large sample to determine differences, and raters must be diversified in their knowledge of horses in general as well as their relationship with the horse being rated. Horse use must also be equally distributed. Full comparisons with the Horse Genome Project should be made to determine the heritability of personality in horses, and behavioral measures including ethograms and cognitive studies should be used as a comparison to personality.

Summary and Conclusions

The main findings of this study indicate the following: (a) A human five-factor model can be used to extract horse personality after the removal of items not relevant to normal equine behavior; (b) Behaviorally-defined adjectives can also extract a personality structure, which correlates to the FFM components; (c) Sex differences exist within certain components, with some unexpected findings; and (d) Breed differences are evident within certain components, and the differences coincide with observed and documented breed behavior.

A total of seventeen items were removed from the original FFM questionnaire created by Morris et al. (2002). Participants in the current study were given the option of “don’t know” for each survey item. For those 17 items, more than 10% of respondents answered as such, indicating that the item is likely not representative of equine personality. After the items were removed, a seven-factor solution was extracted, which corresponded well to both previous literature and the HPQ in the current study. The final HPQ analysis contained 24 items, which extracted six
personality components. All of the components could be correlated to the original HPQ results from Lloyd et al. (2007), although they loaded in a different order. Significant correlations were found between the HPQ and FFM of the current study, indicating good convergent validity.

The primary research question of the present study was to determine the structure of horse personality. Analyses of two separate personality questionnaires revealed a common underlying structure with moderate to high significant correlations. This convergent validity provides evidence that the components extracted in the current study are in fact representative of equine personality. The results of the current study are also on par with previous horse personality studies. The first secondary question for the present study inquired as to the different results obtained from the two different questionnaires. As stated above, the results of the questionnaires correlated well; however, these results were obtained after removing 17 irrelevant items from the FFM and five items from the HPQ that did not load significantly or decreased internal reliability.

The second and third secondary research questions related to sex and breed differences. Several significant differences were found in components from both the FFM and HPQ. Unfortunately, the sample sizes for stallions and many of the pure breeds were small, and this may have increased the possibility of Type II error. Several breed differences in the current study contrasted with previous literature, which may be a result of this small sample size.

In conclusion, equine personality is best measured using a list of behaviorally-defined adjectives. However, a human model may also be used if items clearly irrelevant to horses are removed. Significant sex differences clearly exist between mares and geldings, but a larger sample size of stallions is needed to confirm differences found between stallions, geldings, and mares. Similarly, there appear to be many significant breed differences, but larger sample sizes are needed, as well as a close look at the genetic diversity of each breed.
APPENDIX A

INFORMED CONSENT

A Note about The Survey: there are questions throughout the survey that will appear irrelevant to the horse-savvy person. These questions do come from a human-based survey, and their inclusion in this study does serve a purpose. The rationale and importance for including them in the current study will be revealed when you complete the survey. Thank you!

*You may rate more than one horse

Informed Consent:

Authorization to Participate in Research Project

Consent is hereby given to participate in the study titled: Equine Personality Structure

1. **Purpose:** You are invited to participate in a study on horse personality structure. Participation in the study will assist in several efforts to understand, describe, and improve understanding of individual differences in horses. Responses to the survey will help to develop personality profiles for individual horses that can be used to assess the type of training and use that would be most beneficial to the well-being of the horse.

2. **Description of Study:** A doctoral candidate from the University of Southern Mississippi is conducting this study. The survey takes approximately 20 minutes to complete. Throughout the survey you will see two different question formats. Just mark the answer that best describes the horse you are rating.

   **IMPORTANT:** If possible, your horse should be rated by another person that has known the horse for at least 6 months and feel they can accurately assess the horse's personality. This allows me to calculate reliability on the survey itself.

   You can rate as many horses as you would like, but be sure to forward this survey to someone else and ask them to rate the same horse.

3. **Benefits:** Your participation will help improve our understanding of horse personality and the importance of individual differences in training and use. No tangible compensation will be provided. However, results of the study can be emailed to you upon request at the completion of the study.

4. **Risks:** This research involves no risk or discomfort other than the slight possibility associated with the use of a computer.

5. **Confidentiality:** The records of this study will be kept confidential and written documentation will be identified by ID number only. Special care will be taken to preserve anonymity in all data collection. No information which would identify you as a participant, including the name of your horse, will be made available to any person other than the principle researcher.
6. **Participant’s Assurance**: If you agree to participate, you are free to withdraw from the study at any time without penalty. You can also save the survey and finish it at a later time.

If you have any further questions or comments after the completion of the study, you may contact the principal researcher, Rachel Kristiansen, at rachel.krist@gmail.com or by calling (307) 672-8848.

This project and consent form have been reviewed by the Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820. A copy of this form can be emailed to the participant upon request, or can be printed directly from the survey website.

You will be asked to indicate your agreement to this consent form on the proceeding page. Click "Begin Survey" to start.

Your responses to these questions will remain confidential and will be used solely for research analysis.
APPENDIX B

DEMOGRAPHIC QUESTIONNAIRE

If you have read the information on the previous page and consent to participate in the study, you must sign below. Your name will remain confidential and you will not be contacted without your consent.

__________________________

If you have any questions before proceeding, you may contact the principle researcher at rachel.krist@gmail.com. You must be 18 years or older to participate in this study.

I would like the results of this study to be emailed to me upon completion of the project (approximately June, 2011).

Yes!
No, thanks

Email address (optional): ___________________________

What is your primary relationship to the horse you are about to rate?

Owner
Groom
Rider
Friend to owner
Former owner
Trainer
Barn owner/Stable manager
Handler
Other (please specify)

What is the name of the horse's primary owner? ____________________

(NOTE: this information is kept completely confidential and is used solely for the purpose of differentiating horses with identical names.)

What is the horse's name? _____________________

What gender is the horse?

Mare
Gelding
Stallion

What is the age of the horse (in years)? _______

What is the horse's breed? _______

What is the horse's primary home environment?
Pasture
Stable/Barn
Not sure
Other (please specify)

How long has the horse lived in its current home (in years)? ______

How long have you known this horse (in years)? ______

How often does the horse perform stereotypic behaviors such as weaving or cribbing?

Never
1-2 times a month
3-5 times a month
1-2 times a week
Daily
Not sure
Other (please specify)

How many other horses does this horse live with?

None
1-2
3-5
5-10
10-20
More than 20

What region of the United States does this horse live in?

Northwest
South
Southeast
West
Southwest
Midwest
Not sure
Northeast
Other (please specify)

What is the horse primarily used for? If the horse participates in multiple uses, choose the item that the horse spends the majority of his/her time doing.

Endurance
Hunting
Companion animal/Pet
Ceremonials
Show jumping
Trail horse
Racing
Breeding
Training/teaching
Western disciplines
Therapeutic riding
Eventing
Dressage
Ranch work
Other (please specify)

What is your overall opinion of the horse you are rating?

I strongly like this horse
I somewhat like this horse
Neutral
I somewhat dislike this horse
I strongly dislike this horse
APPENDIX C

COMPLETE SURVEY

Items are presented in the order they appeared in the online questionnaire.

HPQ items are marked with a (*).
FFM items are unmarked.

1. If he/she doesn’t like you, you soon know it
2. *Intelligent: Learns new things easily/fast; benefits from mental stimulation
3. He/she is indifferent to other people’s or horse’s feelings
4. He/she thinks about ideas and abstract thoughts
5. He/she is excited by the beauty of his/her surroundings
6. *Aggressive: Causes harm or potential harm to other individuals, both horse and human
7. He/she is methodical
8. He/she is well organized in getting things done
9. He/she can get into arguments
10. He/she has a good sense of humor
11. He/she prefers to do things on his/her own
12. He/she is cheerful and high-spirited
13. *Subordinate: Gives in readily to others, submits easily and does not put up a fight to defend self
14. He/she enjoys new places to go
15. He/she sticks to established habits
16. He/she is likely to get discouraged and give up
17. *Tense: Shows restraint in posture and movement; carries the body stiffly, which suggests a shrinking tendency, as if to pull back and be less conspicuous
18. He/she is better at cooperation than competition
19. He/she daydreams, but does not like daydreaming
20. *Hardworking: Keen to do well, behaves well during "work," and concentrates on what it is being asked to do

21. He/she has inferiority feelings

22. He/she is thoughtful and considerate

23. He/she can get sad and depressed

24. *Playful: Initiates play and joins in when play is solicited

25. He/she is well-mannered

26. *Opportunistic: Seizes a chance as soon as it arises

27. *Irritable: Reacts negatively with little provocation

28. He/she is selfish and egotistical

29. He/she takes a long time to settle down to the task at hand

30. He/she keeps a neat and clean stable

31. He/she often seems to be bursting with energy

32. *Active: Moves around a lot, does not like being still for long

33. *Effective: Gets own way, can control others, fairly dominant individual

34. He/she is rather lighthearted and cheerful

35. He/she is popular with others

36. He/she often feels helpless and needs the support of others *

37. He/she worries a lot

38. He/she likes to be where the action is

39. *Reliable: Can be trusted to do things or behaves well; might also be considered a safe horse to be with

40. He/she is rather cold and calculating

41. He/she has very low self-esteem

42. He/she is a hard worker

43. He/she is reliable and won’t let you down
44. *Slow: Moves and rests in a relaxed manner; moves slowly and deliberately, not easily hurried

45. *Confident: Behaves in a positive, assured manner, not restrained, tentative

46. *Stubborn: Does not give in easily, not very cooperative

47. He/she is conscientious

48. He/she will try new foods

49. *Strong: Depends on sturdiness and muscular strength

50. He/she can use others to get what he/she wants

51. *Suspicious: Does not trust others readily (human and horse), trust few individuals

52. *Protective: Prevents harm or possible harm to others

53. He/she likes poetry

54. He/she is dependable and reliable

55. *Understanding: Responds in a discriminating and appropriate manner to the behavior of others

56. He/she is rather disorganized

57. He/she is an optimist

58. When stressed he/she can be very anxious

59. He/she feels anxious and fearful quite a lot

60. He/she gets angry with the way people treat him/her

61. He/she is often tense and jittery

62. *Permissive: Could, but does not interfere with the behavior of others

63. *Equable: Reacts to others in an even, calm way; not easily disturbed

64. He/she can experience shame and can want to hide

65. *Sociable: Seeks companionship of others

66. He/she gets enchanted with the natural world

67. *Fearful: Retreats readily from others or from outside disturbances

68. *Motherly: Provides warm, receptive, secure base for others; is tender and caring
69. *Apprehensive: Seems to be anxious about everything, fears or avoids any kind of risk
70. He/she has a strong moral sense
71. Life for him/her is fast paced
72. He/she is not a horse to feel lonely
73. He/she spends time speculating about the nature of the universe
74. *Excitable: Over-reacts to any change, easily excited, high strung
75. *Insecure: Hesitates to act alone; seeks reassurance from others
76. He/she would rather go his/her own way than be a leader of others
77. *Solitary: Spends a lot of time alone by choice
78. He/she is hard-headed and tough-minded
79. *Curious: Readily explores new situations
80. He/she will always get the job done
81. He/she is orderly and systematic
82. He/she strives for excellence in everything he/she does
83. He/she feels that others will take advantage if they can
84. He/she is suspicious of others
85. He/she prefers to be on his/her own
86. *Popular: Sought out as a companion by others
87. He/she is very active
88. He/she is very curious and likes to explore
89. He/she enjoys interacting with others
90. *Eccentric: Shows stereotypes, unusual mannerisms and exaggerated behavior
### APPENDIX D

#### SAMPLE DEMOGRAPHICS

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<thead>
<tr>
<th>Relationship</th>
<th>Frequency</th>
<th>Percentage</th>
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<td>.5</td>
</tr>
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<td>Other</td>
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<td>1.3</td>
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<tr>
<td>Friend to Owner</td>
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<tr>
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**Figure D1.** Frequency distribution of age for horses rated.
APPENDIX E

INSTITUTIONAL REVIEW BOARD APPROVAL FORM

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institutional Review Board

118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
Fax: 601.266.5509
www.usm.edu/irb

HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE
NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 10052401
PROJECT TITLE: Equine Personality Structure
PROPOSED PROJECT DATES: 06/01/2010 to 03/31/2011
PROJECT TYPE: Dissertation or Thesis
PRINCIPAL INVESTIGATORS: Rachel Kristiansen
COLLEGE/DIVISION: College of Education & Psychology
DEPARTMENT: Psychology
FUNDING AGENCY: N/A
HSPRC COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 06/01/2010 to 05/31/2011

[Signature]
Lawrence A. Hosman, Ph.D.
HSPRC Chair

[Signature]
Date
REFERENCES


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Momozawa, Y., Ono, T., Sato, F., Kikusui, T., Takeuchi, Y., Mori, Y., & Kusunose, R. (2003). Assessment of equine temperament by a questionnaire survey to caretakers and


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Svartberg, K., & Forkman, B. (2002). Personality traits in the domestic dog (*Canis familiaris*).


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