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The Use of a Five Factor Model in Equine Personality Research

Rachel E. Kristiansen
Sheridan College, U.S.A.

Stan A. Kuczaj II
University of Southern Mississippi, U.S.A.

In order to test the validity of a Five Factor Model of personality on horses, a questionnaire was replicated from a previous study, with an added option of *don't know* to the traditional 5-point Likert scale. Raters responded to seventeen items of the 60-item scale with *don't know* responses greater than 10% of the time and these seventeen items were subsequently removed from the study. A Principal Components Analysis was used with the remaining items, resulting in eight factors: Neuroticism, Active, Conscientiousness, Agreeableness, Openness, Social Extraversion, Temperamental, and Disciplined. These components correspond well to the five components extracted in the original study, indicating good reliability of the scale. However, 17 items from the original questionnaire were deemed irrelevant by raters, indicating a threat to validity. Though the remaining items were able to be used in analyses, further studies should examine if these are in fact the most effective items to use in the investigation of equine personality.

The study of animal personality increases our understanding of a species. 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, Capitanio, & Gosling, 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, Rentfrow, & Swan, 2003). The FFM has been applied to several species, including dolphins (*Tursiops truncatus;* Highfill & Kuczaj, 2007), chimpanzees (*Pan troglodytes*; King & Figuerdo, 1997), dogs (*canis familaris*), cats (*Felis catus*), and ferrets (*Mustela putorius furo*; Gosling & Bonnenburg, 1998).

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 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).

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, Martin, Bornett-Gauci, & Wilkinson, 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). Personality traits

Correspondence concerning this article should be addressed to Rachel Kristiansen, Sheridan College, 3059 Coffeen Avenue, Sheridan, WY, 82801, USA. (rkristiansen@sheridan.edu)

may be able to predict a considerable part of performance such as show-jumping, although Visser et al. (2003) found that the prediction of show-jumping performance by personality traits was most accurate when horses were analyzed in a learning test rather than a personality survey. 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).

The most comprehensive study to relate the human Big Five model to equines was conducted by Morris, Gale, and Howe (2002). A 5-point Likert scale questionnaire was created using the original NEO Five Factor Inventory (NEO-PI-FFI), a shortened version of the NEO Personality Inventory Revised (NEO-PI-R; Costa & McCrae, 1992). The questionnaire included 60 items (12 items for each of the five personality scales). 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. 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 (Morris et al., 2002).

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 et al. (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." The questionnaire was approved by the IRB of the University of Southern Mississippi before any potential raters were contacted.

Participants

Participants were contacted via email based on their experience with horses. Specifically, instructors, stable managers, and ranch owners were contacted with a 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 2 of the survey consisted of the actual survey items (see Table 1). The answer options appeared beneath each item. For all 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. Upon completion of the study, participants were thanked and debriefed on the full nature and hypotheses of the current study.

Table 1
FFM Questionnaire (Items are presented in the order they appeared in the online questionnaire.)

1. If he/she doesn't like you, you soon know it
2. He/she is indifferent to other people's or horse's feelings
3. He/she thinks about ideas and abstract thoughts
4. He/she is excited by the beauty of his/her surroundings
5. He/she is methodical
6. He/she is well organized in getting things done
7. He/she can get into arguments
8. He/she has a good sense of humor
9. He/she prefers to do things on his/her own
10. He/she is cheerful and high-spirited
11. He/she enjoys new places to go
12. He/she sticks to established habits
13. He/she is likely to get discouraged and give up
14. He/she is better at cooperation than competition
15. He/she daydreams, but does not like daydreaming
16. He/she has inferiority feelings
17. He/she is thoughtful and considerate
18. He/she can get sad and depressed
19. He/she is well-mannered
20. He/she is selfish and egotistical
21. He/she takes a long time to settle down to the task at hand
22. He/she keeps a neat and clean stable
23. He/she often seems to be bursting with energy
24. He/she is rather lighthearted and cheerful
25. He/she is popular with others
26. He/she often feels helpless and needs the support of others
27. He/she worries a lot
28. He/she likes to be where the action is

Table 1 (cont.)

29. He/she is rather cold and calculating
30. He/she has very low self-esteem
31. He/she is a hard worker
32. He/she is reliable and won't let you down
33. He/she is conscientious
34. He/she will try new foods
35. He/she can use others to get what he/she wants
36. He/she likes poetry
37. He/she is dependable and reliable
38. He/she is rather disorganized
39. He/she is an optimist
40. When stressed he/she can be very anxious
41. He/she feels anxious and fearful quite a lot
42. He/she gets angry with the way people treat him/her
43. He/she is often tense and jittery
44. He/she can experience shame and can want to hide
45. He/she gets enchanted with the natural world
46. He/she has a strong moral sense
47. Life for him/her is fast paced
48. He/she is not a horse to feel lonely
49. He/she spends time speculating about the nature of the universe
50. He/she would rather go his/her own way than be a leader of others
51. He/she is hard-headed and tough-minded
52. He/she will always get the job done
53. He/she is orderly and systematic
54. He/she strives for excellence in everything he/she does
55. He/she feels that others will take advantage if they can
56. He/she is suspicious of others
57. He/she prefers to be on his/her own
58. He/she is very active
59. He/she is very curious and likes to explore
60. He/she enjoys interacting with others

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.

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 did not meet this criterion and were removed from further analysis (see Table 2). 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.

Principal Components Analysis (PCA) was used in the current study for the purposes of direct comparison to the original replicated study. One criticism of PCA is that is 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). Therefore, the use of PCA in the current study should have similar results to those produce by a factor analysis.

A 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 likes 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 = 0.86. Bartlett's Test of sphericity $\chi^2(496) = 8845.64$, $p < 0.001$, 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.

This was in agreement with the scree plot, and eight components were retained (see Figure 1). Table 3 shows the final rotated component matrix. All α's were significant, $p < 0.001$. 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 α = 0.57. Reliability analyses for the items of each component were as follows: Neuroticism, α = 0.83; Active, α = 0.78; Conscientiousness, α = 0.81; Agreeableness, α = 0.73; Openness, α = 0.61; Social Extraversion, α = 0.63, Temperamental, α = 0.48, and Disciplined, α = 0.30.

Table 2
Items removed from first analysis due to large (>10%) "Don't Know" (DK) response

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

Inter-Rater Reliability. The average inter-rater reliability across the 121 rater pairs was $R = 0.56$, $p < 0.001$. Inter-rater agreement was measured using the Intraclass Correlation Coefficient (ICC), and was significant for both single measures ($\omega^2 = 0.56$; $F(5973) = 3.54$, $p < 0.001$) and average measures ($\omega^2 = 0.72$; $F(5973) = 3.54$, $p < 0.001$). These analyses were computed using all 60 items of the questionnaire.

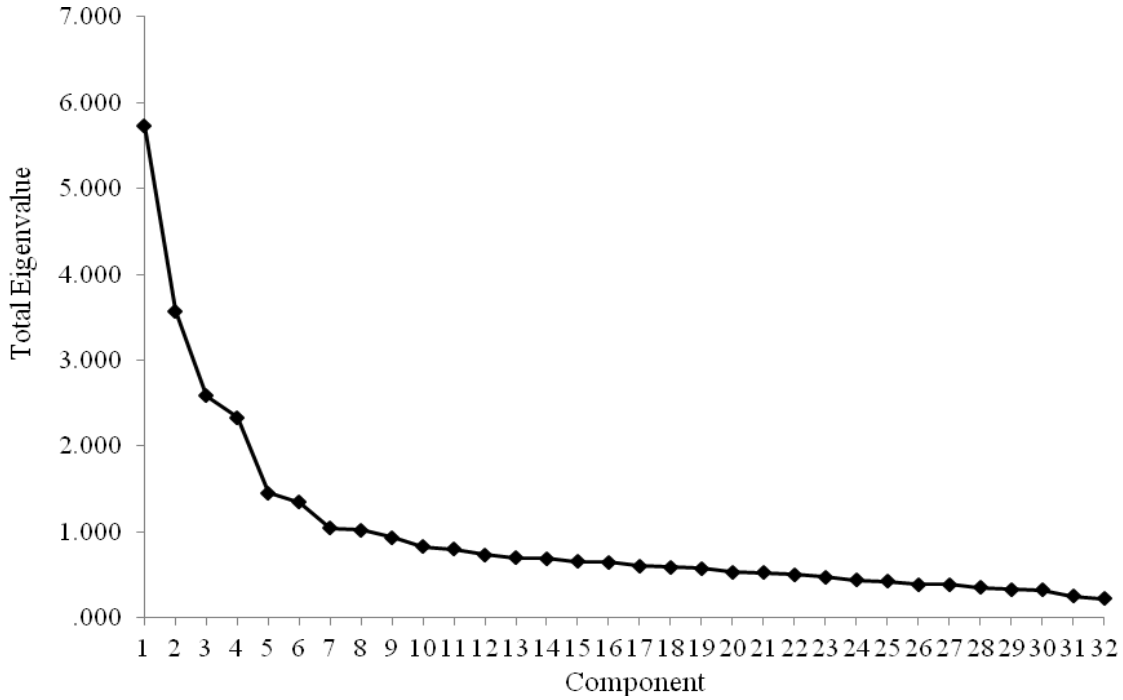

Figure 1. Scree plot of final PCA for the FFM questionnaire.

Table 3
Rotated component matrix of 32 items with communalities for the FFM Questionnaire

		Component								
FFM Dimension	Item	I	II	III	IV	V	VI	VII	VIII	h^2
Neuroticism	He/she worries a lot	0.783								0.647
Neuroticism	He/she feels anxious and fearful quite a lot	0.769								0.717
Neuroticism	He/she often feels helpless & needs support	0.717								0.590
Neuroticism	He/she is often tense and jittery	0.694								0.690
Neuroticism	He/she has very low self-esteem	0.670								0.564
Neuroticism	When stressed he/she can be very anxious	0.529								0.466
Agreeableness	He/she is suspicious of others	0.503								0.471
Extraversion	He/she often seems to be bursting with energy		0.810							0.688
Extraversion	He/she is very active		0.797							0.678
Extraversion	Life for him/her is fast paced		0.665							0.519
Extraversion	He/she is cheerful and high-spirited		0.659							0.645
Conscientiousness	He/she is reliable and won't let you down			0.784						0.732

		Component								
FFM Dimension	Item	I	II	III	IV	V	VI	VII	VIII	h^2
Conscientiousness	He/she will always get the job done			0.767						0.660
Conscientiousness	He/she is dependable and reliable			0.718						0.692
Conscientiousness	He/she is a hard worker			0.669						0.610
Agreeableness	He/she is selfish and egotistical				0.709					0.571
Agreeableness	He/she is thoughtful and considerate				-0.659					0.584
Agreeableness	He/she is rather cold and calculating				0.610					0.459
Agreeableness	He/she is well-mannered				-0.602					0.511
Agreeableness	He/she is hard-headed and tough-minded				0.580					0.529
Extraversion	He/she has a good sense of humor					0.741				0.626
Extraversion	He/she is rather lighthearted and cheerful					0.644				0.694
Openness	He/she is very curious and likes to explore					0.627				0.587
Openness	He/she will try new foods					0.497				0.420
Extraversion	He/she enjoys interacting with others						0.803			0.708

		Component								
FFM Dimension	Item	I	II	III	IV	V	VI	VII	VIII	h^2
Extraversion	He/she would rather go his/her own way						0.656			0.541
Extraversion	He/she prefers to do things on his/her own						0.603			0.526
Extraversion	He/she prefers to be on his/her own						-0.598			0.653
Agreeableness	If he/she doesn't like you, you soon know it							0.745		0.590
[illegible]	[illegible] t him/her							0.731		0.587

Table 3 (cont.)

Openness	He/she sticks to established habits								0.801	0.692
Conscientiousness	He/she is methodical								0.597	0.445
	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	0.83	0.78	0.81	0.73	0.61	0.63	0.48	0.30	

Discussion

The current study was designed to determine the feasibility of accurately measuring horse personality using a human five-factor model (FFM). 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 proposed a nine-factor model. Similarly, Block (1995) believed 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 Personality Inventory Revised (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.

In order to examine the validity of the FFM when applied to equines, a personality study conducted by Morris et al.(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. (2002) 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 4 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.

Reliability for the FFM questionnaire was good. Gosling (2001) found that the mean inter-rater reliability of animal personality studies is around 0.52, and reliability for human personality questionnaires is acceptable at 0.50 (Gosling & Vazire, 2002). The current study had an inter-rater reliability value of 0.57. 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 for both single and average measures. Internal reliability of each component was measured using Cronbach's alpha. An alpha level of 0.70 or 0.80 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 α levels, ranging from 0.30 to 0.83.

The items of the Social Extraversion 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.

Table 4
Comparison of components extracted in the current study, Morris et al.'s (2002) study, and the original short-form NEO-PI-FFI

NEO-PI-FFI	Morris et al. (2002)	Current study
Extraversion	Neuroticism	Neuroticism
Agreeableness	Social Extraversion	Active
Conscientiousness	Activity	Conscientiousness
Neuroticism	Conscientiousness	Agreeableness
Openness to Experience	Agreeableness	Openness
		Social Extraversion
		Temperamental Disciplined

The study of non-human animal personality has been widely accepted by many researchers. Knowledge of personality characteristics is 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 predict 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.

Non-human animal personality research is also useful purely for the intention of better understanding a species. One application of understanding species-specific personality characteristics is in the identification of horse use or training tools and methods. 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.

Emotionality, or reactivity, is one of the most researched traits in the horse personality literature (McCall, Hall, McElhenney, & Cummins, 2006). Le Scolan, Hausberger, and Wolff (1997) found a negative correlation between emotivity and learning abilities. In addition, 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). The current study did not extract a personality component that could be directly named "reactivity" or "emotionality," although some components, such as Agreeableness, Social Extraversion, and Temperamental, could be closely related. Due to the fact that reactivity is such a widely studied facet of equine personality, future personality questionnaires might include more items to highlight individual differences in this area.

Conclusions

The results of the current study differed slightly from those of Morris et al. (2002), 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. Finally, 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. Overall, the full 60-item human FFM includes items irrelevant to horses; however, several of the components extracted in the current study corresponded well to the previously extracted five factors from Morris et al. It remains to be seen if the items used were the most effective for analyzing equine personality. The current study indicates that use of the NEO-PI-FFI is a reliable scale for horses, but the validity of the scale has yet to be determined.

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