



## Original Research

## Equine Personality: Association With Breed, Use, and Husbandry Factors

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## ARTICLE INFO

## Article history:

Received 20 March 2018

Received in revised form

9 October 2018

Accepted 13 October 2018

Available online 21 October 2018

## Keywords:

Horse

Personality

Behavior

Breed

Use

Survey

## ABSTRACT

Temperament can be defined as innate properties of the nervous system, whereas personality includes the complex behavioral traits acquired through life. Association between personality and behavior is important for breeding, selection, and training of horses. For the first time, we evaluated if equine personality components previously identified in Japan and Europe were consistent when applied to American horses. We examined the association of personality with breed, age, sex, management, training, stereotypies, and misbehaviors. The owner directed personality survey consisted of 25 questions. An online version of the survey was created. The principal component analysis method was used to associate behavioral traits with personality components. Factor analysis with orthogonal transformation was performed on scores for personality-related questions. A total of 847 survey responses were used. Quarter Horses, “other” breed, and Thoroughbred were the most common breeds. Three principal personality components were extracted as each behavioral trait belonged to one of these three components. Arabians, Thoroughbreds, Saddlebreds, and Walking horses were the most nervous and Quarter Horses, and Paints, Appaloosas, and Drafts were the least nervous. No trained discipline was significantly associated with any personality component. There were no significant associations between stereotypies and misbehaviors and nervous or curious personality. For the first time in predominantly American horses, we have evaluated personality components and their association with breed, age, sex, training discipline, and stereotypies. We refute links between personality and trained discipline and confirm the lack of association between nervous personality and stereotypies and misbehaviors.

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## 1. Introduction

Personality, the term used here, is defined as a set of behavioral tendencies referred to as traits or dimensions which are present early in life and are relatively stable across various situations and over time [1,2] and include reactivity and self-regulation [3]. Reactivity refers to arousability of motor activity, affect, autonomic, and endocrine response [3]. Personality can cover traits such as aggressiveness, avoidance of novelty, risk-taking, exploration, and sociality [4]. A number of research studies have emphasized the

influence of environmental factors such as housing, diet, weaning, or training methods as well as human–horse interactions on expression of behavioral traits in horses [5–8]. Visser et al [8] demonstrated a significant relationship between response to a novel object test and introduction to a novel stable environment. The finding that responses of horses to a novel object was correlated with their behavior in a stall suggests the utility of using a behavioral test to predict personality characteristics in other settings.

Because of the genetic component to temperament, it is not surprising that individual breeds demonstrate varying temperament types. Excitable or anxious traits were highly associated with Thoroughbreds, Arabians, and Welsh cobs, whereas Irish Draught and Highland ponies exhibited the least association [9]. Sociability and Inquisitiveness were also assessed and were the highest in Arabians and Thoroughbreds and lowest in Irish Draught Horses and American Quarter Horses [9].

*Animal welfare/ethical statement:* The research described in this article does not contain any studies with animals performed by any of the authors.

*Conflict of interest statement:* The authors declare no conflicts of interest.

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Performance of horses, whether for sport or pleasure, depends heavily on physical abilities, as well as personality and temperament. Studies have also evaluated neuroticism and pain tolerance in horses [10]. Horses demonstrating higher stress levels and anxiety have also been shown to have poorer short-term memory [11]. Young horses demonstrate greater inquisitiveness and less fear. In a study involving horses from varying backgrounds, it was found that the younger horses of the group had a smaller latency of approach toward a person or a novel object [12]. Understanding the association between personality and temperament and undesirable behaviors is important for breeding, selection, housing, and training of horses. Association between crib-biting and temperament has been evaluated [7]. Arousal behavior and crib-biting intensity were studied using plasma cortisol concentration, heart rate, and heart rate variability [13]. Crib-biting horses had significantly less anxiety than control horses as did horses that were exposed to high level of competition [7].

Personality and temperament testing over a short period of time may be misleading because individuals may be experiencing fluctuating physiology (such as reproductive state) or environmental shifts (new housing, change in human interaction, etc.) at the time of testing [10]. Personality testing using objective, quantifiable parameters requires skilled scientists and can be time-consuming [10]. As an alternative to objective testing, subjective assessments involving questionnaires have been used [9]. Using a questionnaire requires that the rater be familiar with the subject over time and context. Benefits of this approach include the ease with which information can be gained from people familiar with an individual animal. To ensure valid conclusions, subjective assessment tools must be validated [9,10,14].

In horses, personality traits frequently evaluated include fearfulness (measured as flight distance and latency to approach a novel object) [15], reactivity to humans (exploration of a passive human and ease of handling) [1], and reaction to separation and isolation [15]. Although evaluation by a human with long association with the horse improves knowledge of consistent behaviors, there may be inherent biases in the observer as well. Although temperament and personality remain relatively stable over time, responses to various tests are not always consistent. Clearly, experience (e.g., training) and desensitization also impacts behavioral traits and must be considered in the evaluation of personality [16].

Equine temperament assessments have generally followed evaluation of (1) an individual's behavioral reaction to a stimulus [8,17–20]; and (2) assessment of physiological parameters such as heart rate, heart rate variability, and plasma concentration of stress hormones [5] and/or monoamines [17,21]. Questionnaire surveys completed by caretakers or handlers/trainers familiar with the horse [20,22] have been done. In work by Momozawa et al, researchers validated a survey completed by handlers with an objective reactivity (balloon) test [14] demonstrating that individuals familiar with a horse could reliably evaluate temperament.

The primary objective of this study was to obtain measures of behavioral traits of a varied population of predominantly North American horses, then to develop a smaller number of variables (principal components) that would account for most of the variance in the number of personality components. The secondary objective was to develop a score for each principal component of each horse; these scores would then be compared between factors such as feeding, housing, and use.

## 2. Materials and Methods

### 2.1. Questionnaire Design

The questionnaire consisted of 25 questions based on those previously designed and validated by Momozawa et al. [14].

Questions included owner assessment of degree of playfulness, curiosity, friendliness, nervousness, excitability, stubbornness, attachment to humans, and sensory understanding of the environment (see Table 1).

### 2.2. Data Collection

An online version of the survey was created using customizable survey development, cloud-based software (Survey Monkey, San Mateo, CA) that included data analysis and data representation tools. Participants were assigned a unique ID and were able to complete the survey for multiple horses. The intended participants were horse owners. Before beginning the survey, participants were informed about the purpose of the research, and that data would be treated anonymously and confidentially. The target population was horses in the United States of any breed, age, sex, or use.

The survey was distributed to equine extension service faculty in US agricultural university animal science departments, a national multidisciplinary equine magazine (Equus), and breed associations (i.e., Quarter Horse Association, Morgan Horse Association, etc.) It was requested that the link to the survey be posted on their Web pages. The survey was available from December 1, 2016, through February 1, 2017. Data of the participants who gave incomplete answers (only partially answered a question) were deleted. Not entering country of origin was not considered an incomplete survey.

### 2.3. Statistical Analysis

Sixteen behavior traits were assessed. The principal component analysis method was used to associate those traits with personality components. The number of components (factors) retained was based on the eigenvalue criterion  $>1$  (indicating how much variance there was in the data) and scree test (Table 2). An eigenvalue  $>1$  was used to ensure factor reliability. Varimax rotation for orthogonal transformation was performed [23]. Behavior traits that had a high loading value (absolute value  $>0.40$ ) after rotation were associated with personality components. Behavior traits that were loaded on more than one personality component were removed from the analysis [24]. Factor scores (age, sex, breed, etc.) associated with each principal component were calculated [24].

A one-way analysis of variance was performed to test if the factor scores of each component were different between questions in part B, specifically (1) age; (2) sex; (3) breed; (4) housing; (5) turn out; (6) feeding; (7) discipline trained; (8) competition amount; (9) competition level; and (10) misbehaviors or stereotypies.

Normality of the errors was assessed by means of a normality probability plot. Homogeneity of variance was assessed by means of a Levene's test. Post-hoc comparisons were by means of a Bonferroni's test for multiple comparisons. A  $P$  value of  $<.05$  was considered significant. All calculations were by means of SAS 9.3 statistical software (SAS Institute, Inc. Cary, NC).

## 3. Results

### 3.1. Survey Population

Nine hundred sixteen surveys were submitted by owners. Eight hundred forty-seven complete surveys were used in the analysis. Surveys were completed from 46 of 50 states in the United States (76%), Canada (5.5%), Australia, and New Zealand (3%), with remaining surveys ( $<5$  completed surveys per country or region) from the United Kingdom, South Africa, Malaysia, and Jordan. Twelve percent of the surveys did not indicate country of origin.

**Table 1**  
Questionnaire.

1	Many horses exhibit playfulness while they are in their stall, paddock, or interacting with other horses. A horse may toss toys, run, jump, or frolic in solitary play or encourage play with others. When you think about your horse how would describe his/her playfulness? 1 = not playful; 2 = rarely playful; 3 = occasionally playful; 4 = frequently playful; 5 = very playful
2	Most horses are naturally curious, especially if they are given the time and space to explore something new. When you think about your horse and his/her interest in exploring new things in the barn, stall, or pasture, how would you describe his/her behavior? 1 = not curious; 2 = rarely curious; 3 = occasionally curious; 4 = frequently curious; 5 = very curious
3	Horses differ considerably with how comfortable they are with being approached or touched by people. Some horses interact with people with vocal welcoming noises and an interest in interacting with others, including people, other horses, dogs, and cats. When you think about your horse and his/her friendliness, how would you describe his/her behavior? 1 = not friendly; 2 = rarely friendly; 3 = occasionally friendly; 4 = frequently friendly; 5 = very friendly
4	Some horses are naturally calm about any and all situations they encounter and other horses are less calm. Behavior of a nervous horse can range from becoming tense in the muscles, to stopping abruptly to look and snort at a scary object, to wheeling and bolting in the opposite direction. When you think about your horse, how would you describe his/her nervousness? 1 = not nervous; 2 = rarely nervous; 3 = occasionally nervous; 4 = frequently nervous; 5 = very nervous
5	Hot, fizzy, excitable horses can be hard to focus during training and competition and may be easily distracted. These horses can also be enthusiastic or eager and when managed appropriately, brilliant performers. When you think about your horse, how would you describe his/her excitability? 1 = not excitable; 2 = rarely excitable; 3 = occasionally excitable; 4 = frequently excitable; 5 = very excitable
6	Horses who refuse to comply with requests are at the opposite end of being compliant. Many seem to “march to their own drummer” and are noted for being notoriously willful and disobedient. When you think about your horse, how would you describe his/her stubbornness? 1 = not stubborn; 2 = rarely stubborn; 3 = occasionally stubborn; 4 = frequently stubborn; 5 = very stubborn
7	Some horses are very attached to and seek attention from humans. When you think about your horse, how would you describe his/her attachment to people? 1 = not attached; 2 = rarely attached; 3 = occasionally attached; 4 = frequently attached; 5 = very attached
8	Horses inherently have sensitivity to even the most subtle eye and body movements. Some visual or auditory cues are more easily deciphered by some horses than others. Some horses know immediately what is going to happen next. When you think about your horse, how would you describe his/her sensory understanding? 1 = none at all; 2 = rarely; 3 = occasionally; 4 = frequently; 5 = very
9	How curious is your horse in watching people and activities? 1 = never; 2 = sometimes; 3 = frequently
10	How much time does it take for your horse to adapt to novel objects? 1 = short; 2 = normal; 3 = long
11	How agitated is your horse when left alone? 1 = as usual; 2 = slightly agitated; 3 = greatly agitated
12	How does your horse response to body brushing? 1 = willingly; 2 = slightly restless; 3 = restless
13	Does your horse ever experience “panic attacks” (melt down, complete panic)? 1 = never; 2 = sometimes; 3 = frequently
14	How would you describe your horse's demeanor at competition or trail ride events? 1 = composed; 2 = slightly excited; 3 = excited
15	How frequently has your horse acted threateningly to other horses? 1 = never; 2 = sometimes; 3 = frequently
16	How frequently has your horse acted threateningly to unknown people? 1 = never; 2 = sometimes; 3 = frequently
17	What age is your horse? 1 = 1–5 y; 2 = 6–10 y; 3 = 11–15 y; 4 = 16–20 y; 5 = greater than 20 y
18	What sex is your horse? 1 = mare; 2 = gelding; 3 = stallion
19	What breed is your horse? 1 = Arabian; 2 = Thoroughbred; 3 = Quarter Horse; 4 = Draft breed; 5 =

**Table 1 (continued)**

	Morgan; 6 = Paint; 7 = Warmblood (Hanoverian, Trakehner, Oldenburg, Dutch Warmblood, etc.); 8 = Saddlebred; 9 = Pony; 10 = Appaloosa; 11 = Standardbred; 12 = Walking horse; 13 = Other
20	How is your horse housed (by percent time per day)? 1 = 100% stall; 2 = 75% stall/25% paddock/pasture; 3 = 50% stall/50% paddock/pasture; 4 = 25% stall/75% paddock/pasture; 5 = 100% pasture
21	What type of feed does your horse eat? 1 = hay/pasture only; 2 = concentrate and hay; 3 = concentrate and pasture; 4 = concentrate, hay, and pasture
22	Is your horse trained in a specific discipline? 1 = pleasure/trail; 2 = Western pleasure; 3 = roping, reining; 4 = hunter/jumper; 5 = eventing; 6 = dressage; 7 = driving; 8 = other; 9 = none
23	Does your horse compete in this specific discipline? 1 = never; 2 = occasionally (1–3 times per year); 3 = frequently (4–10 times per year); 4 = full time (>10 times per year)
24	What level of competitive performance has this horse achieved in the discipline? 1 = beginner; 2 = intermediate; 3 = advanced; 4 = international level; 5 = none, just enjoy at home
25	Does this horse exhibit any misbehaviors or behavior stereotypes? 1 = none; 2 = cribbing; 3 = winducking; 4 = weaving; 5 = pawing; 6 = door kicking; 7 = biting; 8 = other

According to the US Department of Agriculture, there were 7.2 million horses in the United States in 2015 [25]. In a 2015 equine population census, the Quarter Horse is the most common breed with Thoroughbreds second, and all other breeds represented at <10% of the population [26]. Over 65% of horses were aged >5 and <20 years, and 47% are used for pleasure riding [26]. Our survey population was considered reflective of the US horse population.

Sex of horses represented in the survey was divided primarily between mares (41%) and geldings (57%) with a small number of stallions (2%). Ages spanned from 1 to 5 years (9%), 6 to 10 years (31%), 11 to 15 years (27%), 16 to 20 years (21%), and >20 years (12%). Quarter Horses (29%), “other” breed (22%), and Thoroughbred (11%) represented the most common breeds of horses identified in the survey (Table 3).

Forty-two percent of horses were housed using turnout in a paddock or pasture all the time or spent a mixed amount of time between stall and paddock or pasture (56%). Few horses spent all their time in a stall (2%) or by themselves (16%), and over half of the horses spent more than 75% of their time turned out with other horses. Over half (58%) of the horses were fed a mixture of concentrate with pasture and hay.

Pleasure and trail riding exclusively was the most frequent use of the horses in the survey (28%). Other disciplines were represented in single-digit percentages. More than 30% of the horses were used in more than one discipline. Most horses were used in competition only occasionally or never. Among those who competed at least occasionally, level of competition was predominantly beginner or intermediate (50%) with advanced and international representing 20% of the total horses in the survey. Horses were ridden or driven mostly between 3 and 10 h/wk, indicating that they were active animals.

Owners were asked to list any behavior problems that their horse exhibited. More than 60% indicated that their horse had none. All other behavior problems were in single-digit percentages with pawing the highest at 8%. Fourteen percent of the horses had more than one behavior problem described.

### 3.2. Personality Components and Association With Behavior Traits

There were 16 behavior traits (playful, curious, friendliness, etc.) quantified in the 847 horses surveyed. According to eigenvalues (Table 3), three principal personality components (nervousness, curiosity, and threatening) were identified as accounting for the

**Table 2**  
Eigenvalues and percent variance.

Components	Eigenvalue	Percent Variance
1	3.321	0.208
2	2.491	0.156
3	1.359	0.085
4	1.133	0.071
5	1.052	0.066
6	0.873	0.055
7	0.771	0.048
8	0.717	0.045
9	0.704	0.044
10	0.686	0.043
11	0.633	0.040
12	0.586	0.037
13	0.482	0.030
14	0.442	0.028
15	0.391	0.024
16	0.359	0.022

majority of the 16 behavior traits. Of the 16 behavior traits, two (friendliness and attachment to humans) were loaded on (associated with) more than one component (Table 4); both curiosity and threatening); they were deleted from further analysis. One behavior trait (sensitivity) was not loaded on (associated with) any personality component (Table 4). The remaining 13 behavior traits were loaded on the three personality components (nervousness, curiosity, and threatening) listed in Table 4.

The number of components was identified by evaluating Eigenvalues. Three components were selected because they were the most meaningful and related to the three components in previous literature (Table 4).

A score (response variable) was calculated for each horse that indicated where each individual stood on each of the three personality components (nervousness, curiosity, and threatening behavior). The levels of 10 factors (age, sex, breed, housing, turnout, feeding, discipline trained, competition amount, competition level, and misbehaviors or stereotypies) were compared for each personality component (nervousness, curiosity, and threatening). Results, showing the association of these 10 factors with personality components, are listed in Tables 5–14 in the following.

#### 4. Discussion

##### 4.1. Personality Assessment

Our research sought to evaluate if the personality survey validated in four stables of riding horses in an equestrian park in Japan could be used effectively to assess personality in a much larger and

**Table 3**  
Breeds.

Breed	Percentage <sup>a</sup>
Arabian	7
Thoroughbred	11
Quarter Horse	29
Draft	2
Morgan	5
Paint	9
Warmblood	6
Saddlebred	1
Pony	2
Appaloosa	3
Standardbred	1
Walking horse	2
Other	22

<sup>a</sup> Rounded to nearest whole number.

**Table 4**  
Rotated factor patterns (loadings) for the 16 behavior traits evaluated<sup>a</sup>.

Trait Number	Behavior Traits	Nervousness	Curiosity	Threatening
1	Playful	0.017	<b>0.694</b>	0.078
2	Curious	0.000	<b>0.761</b>	0.104
3	Friendliness	−0.134	<b>0.587</b>	−0.485
4	Nervous	<b>0.837</b>	0.006	0.090
5	Excitability	<b>0.750</b>	0.155	0.116
6	Stubborn	0.172	0.128	<b>0.557</b>
7	Attachment to people	−0.012	<b>0.591</b>	−0.429
8	Sensitivity/understanding	0.058	0.255	−0.029
9	Curiosity	0.043	<b>0.681</b>	0.045
10	Adaption to novelty	<b>0.664</b>	−0.171	0.033
11	Agitation when alone	<b>0.531</b>	0.072	−0.002
12	Response to body brushing	0.098	−0.093	<b>0.605</b>
13	Panic	<b>0.607</b>	0.010	0.219
14	Demeanor at events	<b>0.692</b>	0.085	0.227
15	Threatening behavior to horses	0.096	0.000	<b>0.413</b>
16	Threatening behavior to people	0.031	−0.028	<b>0.693</b>

Bolded values indicate behavior traits loaded on the personality component.  
<sup>a</sup> If the absolute value of loading >0.4, then that trait is associated with that principal component (nervousness, curiosity, and threatening). If >1 trait had absolute value >0.4, then that trait was excluded from further analysis.

diverse group of horses and owners and whether these factors were associated with breed, age, use, and management factors of the horses evaluated.

Results from the evaluation yielded remarkably similar results to the research by Momozawa et al. [14]. We found that the questions related to personality could be explained by three components through component analysis; these components—nervousness, curiosity, and threatening—were similar to those found by Momozawa [14]. Our results further demonstrate the reliability of impressions of horse handlers/owners familiar with their horses, even using the size and diversity of the sample in this study. Limitations to comparing this study's results to those of Momozawa include the inherent challenges in interpreting the meaning and use of behavioral traits and terms across languages and culture (i.e., Japanese to English). We also confirmed from the factor analysis evidence for personality traits in horses with cross-situational (location, discipline, management) stability. Personality has a heritable component and is consistent over time and situation relative to the individual (and population) evaluated [24,27]. Despite heritability, environment, including socialization, training, handling, and association with humans and other life experiences, plays an important role in modifying observable expression of temperament defined as personality and behavior traits. Because of this variability, personality can be difficult to measure as it requires observation of specific behaviors over a variety of situations and times [28].

Use of questionnaire surveys is a popular way to gain information on companion and working animal behaviors. Surveys have

**Table 5**  
Factor association with personality component—age.

Age (y)	n	Nervousness		Curiosity		Threatening	
		Mean	SD	Mean	SD	Mean	SD
1 (1–5)	78	−0.144	0.956	0.569	0.815	0.016	0.840
2 (6–10)	264	−0.078	1.024	0.177	0.906	0.085	1.082
3 (11–15)	229	0.189	0.925	−0.163	0.969	0.033	1.014
4 (16–20)	175	0.072	1.046	−0.177	1.027	−0.127	0.975
5 (>20)	101	−0.235	0.982	−0.209	1.127	−0.090	0.897
Significant at P < .05		2 versus 3		1 versus 2, 3, 4, 5		ND <sup>a</sup>	
				2 versus 3, 4, 5			

Abbreviation: SD, standard deviation.

<sup>a</sup> No significant differences.

**Table 6**  
Factor association with personality component—sex.

Sex	n	Nervousness		Curiosity		Threatening	
		Mean	SD	Mean	SD	Mean	SD
1 (Mare)	352	0.097	1.037	-0.208	1.020	0.035	1.006
2 (Gelding)	479	-0.064	0.960	0.140	0.968	-0.020	1.001
3 (Stallion)	16	-0.308	1.134	0.306	0.707	-0.215	0.846
Significant at $P < .05$	ND <sup>a</sup>			1 versus 2		ND	

Abbreviation: SD, standard deviation.

<sup>a</sup> No significant differences.

been used in many species including cats [29,30], dogs [31], and horses [14,21,22,32,33]. Expansion of Web- and cloud-based surveys and social media sites has made the use of online surveys a valuable source of rapid, diverse, and inexpensive information [34]. Advantages of online surveys include access to unique groups that may not be accessible by other means, short acquisition time, and cost savings. Disadvantages include sampling bias associated with using virtual groups, organizations, and other individuals that have access and motivation to use to online resources, whereas those either without access or motivation are excluded. Our sample population, although only 847 horses, was similar in composition to the target US population regarding breed, age, and discipline [24,25], and sampling bias in the use of the online survey was considered small.

#### 4.2. Personality and Breed

We evaluated the association of the three personality components with various individual factors including those considered genetic (e.g., breed) and those that are environmental (e.g., discipline trained, housing, and expression of various “misbehaviors” or stereotypes).

There have been numerous studies evaluating breeds of animals with personality, including horses [9,33,35,36], dogs [37,38], cats [39], and cattle [40]. Temperament can be defined as innate properties of the nervous system, whereas personality includes the complex features acquired through life [33]. In horses, there has been significant restriction of genetic diversity starting around 5,500 years ago [41,42]. Most “modern” breeds of horses are the

**Table 7**  
Factor association with personality component—breed.

Breed	n	Nervousness		Curiosity		Threatening	
		Mean	SD	Mean	SD	Mean	SD
1 (Arabian)	60	0.536	0.885	0.286	1.074	-0.336	0.786
2 (Thoroughbred)	89	0.291	0.987	-0.010	0.921	0.229	1.059
3 (Quarter Horse)	243	-0.189	0.937	-0.137	0.964	0.017	1.007
4 (Draft)	20	-0.554	0.907	0.134	1.207	-0.110	0.774
Morgan	44	0.121	0.934	0.046	0.830	0.102	1.048
5 (Paint)	76	-0.342	0.893	-0.116	1.022	-0.084	1.034
6 (Warmblood)	52	0.272	0.932	0.081	1.028	-0.218	1.054
7 (Saddlebred)	8	0.872	1.648	-0.587	1.596	-0.336	0.871
8 (Pony)	18	-0.503	1.286	-0.333	0.950	0.176	1.451
Appaloosa	23	-0.381	0.840	-0.125	1.162	0.011	0.908
9 (Standardbred)	9	0.053	1.108	-0.306	0.992	0.605	0.912
10 (Walking horse)	18	0.595	0.996	0.323	0.908	-0.221	0.746
11 (Other)	187	0.019	0.986	0.140	0.990	0.045	0.968
Significant at $P < .05$		1 versus 3, 4, 6, 9, 10, 13		ND <sup>a</sup>		ND	
		2 versus 3, 4, 6					
		4 versus 8, 12					
		6 versus 7, 12					

Abbreviation: SD, standard deviation.

<sup>a</sup> No significant differences.**Table 8**  
Factor association with personality component—housing.

Housing	n	Nervousness		Curiosity		Threatening	
		Mean	SD	Mean	SD	Mean	SD
1 (100% Stall)	28	0.069	1.195	-0.177	0.989	-0.126	1.067
2 (75% Stall)	88	-0.099	1.126	0.087	0.971	-0.083	1.035
3 (50% Stall)	203	0.097	0.988	-0.058	0.984	-0.046	0.975
4 (25% Stall)	176	0.070	0.957	0.044	1.014	-0.025	1.043
5 (100% Pasture)	352	-0.071	0.968	0.010	1.011	0.080	0.987
Significant at $P < .05$	ND <sup>a</sup>			ND		ND	

Abbreviation: SD, standard deviation.

<sup>a</sup> No significant differences.

result of centralized and organized breeding programs over several hundred years [43,44]. The influence of this relatively small pool of influential stallions has had profound genetic influence on temperament and performance on our current breeds. In our study, we found that Arabians' and Thoroughbreds' personalities were significantly more nervous than Quarter Horses, Paints, Appaloosa, Draft, ponies, and other. Quarter Horses, Draft breed, Paints, and Appaloosas were significantly less nervous than Saddlebreds, Walking horses, and Warmbloods. Overall Arabians, Thoroughbreds, Saddlebreds, and Walking horses were the most nervous breeds, and Quarter Horses, Paints, Appaloosas, and Drafts were the least nervous; these associations likely have a strong genetic basis associated with how the breeds were founded and are continually selected for through breeding programs [41]. Arabians have historically been described as “spirited” and exhibiting anxiousness and excitability [9,36]. The close association between Arabian and Thoroughbred nervous personality is likely because of the origins of the Thoroughbred breed in oriental stallions of Arabian, Barb, and Turkomen breeding stock [41,44,45]. Saddlebred horses and Walking horses originated from crosses between Thoroughbred and native North American Pacer crosses [46,47]. Again, the association of these breeds with Thoroughbred and Arabian stock along with selected breeding for behaviors consistent with a “spirited” Saddle horse or walking horse use likely contributed to their genetic association with nervous personality. American Paint horses and Appaloosas have a heavy influence from Quarter Horses [48,49]. The strong influence of the Quarter Horse bloodlines and overall stock horse use likely accounts for these breeds clustering together as among the least nervous. Ponies were among the horses that had the least nervous personality. These results for ponies are also consistent with previous studies where pony/cob types demonstrated lower rank anxiety scores than sport horses [50].

Arabians were significantly more curious than Quarter Horses and Quarter Horses were significantly less curious than other breed categories. Sociability and inquisitiveness were found to be ranked highest in Arabians and Thoroughbred horses and lowest in Quarter Horses and Irish Draught horses in a study looking at personality and variation between breeds [9]. The association between nervous personality and curiosity and/or inquisitiveness may indicate that these two personality traits have a common genetic linkage. Links between two personality constructs have been demonstrated in other species including boldness and aggression in dogs [51]. Variability of these behavioral traits may also be partly affected by genes. Dopamine receptor D4 gene has been reported to affect horse personality [35]. The D4 receptor A allele is associated with lower curiosity and higher vigilance in Thoroughbred horses [52].

#### 4.3. Personality and Age

Association between personality and age was significant when age group 11–15 years was compared with both age groups

**Table 9**  
Factor association with personality component—turnout with other horses.

Turnout With Other Horses	n	Nervousness		Curiosity		Threatening	
		Mean	SD	Mean	SD	Mean	SD
1 (0%)	139	-0.093	1.012	0.054	0.918	-0.021	1.071
2 (25%)	75	0.042	1.018	0.292	0.932	-0.117	0.948
3 (50%)	69	-0.002	1.049	-0.132	0.937	0.122	1.053
4 (75%)	90	0.059	0.972	-0.086	1.053	-0.153	0.976
5 (100%)	474	0.006	0.993	-0.031	1.028	0.033	0.984
Significant at $P < .05$	ND <sup>a</sup>			2 versus 5		ND	

Abbreviation: SD, standard deviation.

<sup>a</sup> No significant differences.

6–10 years and >20 years. Horses in the 11- to 15-year-old group may have been more nervous because of sale and change in ownership, shift in environment, new rider, or trailering and competition all of which may be a significantly larger part of their life than their younger counterparts. Their increased nervousness compared with the old age group may be because of the fact that the older horses are well acclimated to traveling and competition and have an established housing situation. It is easy to account for the older group being the least nervous personality because of acclimation and desensitization to novelty. Although it was not significant statistically, the youngest group was the second least nervous in terms of actual score, this may be because of the fact that training for the youngest horses has generally just started, and they have not had the opportunity to be exposed to a wide variety of novelty.

Playfulness was associated with the component curiosity. Curiosity and age exhibited significant differences with youngest horses being significantly more curious than all other age groups with the older horses being the least curious. Social play, as well as behaviors such as mutual grooming, appears to be necessary for bonding and cohesion in equid social groups [53]. Play behavior and curiosity are documented to be more common in foals (and other young animals) than in adults [54]. Play behavior in young horses may serve as a mechanism to optimize blood flow to muscles and provide the opportunity to practice flight, findings mates, and escaping predators [55].

#### 4.4. Personality and Sex

There was no significant association between nervousness and threatening personality components and sex in our study. The only significant finding between personality and sex was difference in curiosity between geldings and mares with mares being less curious (e.g., playful) than geldings. Differences observed in curiosity is consistent with previous investigations that observed a decrease in median inquisitiveness scores for mares compared with geldings [50]. Previous studies have observed mares to be more anxious [50,56] than geldings; however, LeScolan et al. found no

**Table 10**  
Factor association with personality component—feeding.

Feeding	n	Nervousness		Curiosity		Threatening	
		Mean	SD	Mean	SD	Mean	SD
1 (Hay/Pasture)	149	-0.122	0.982	-0.045	1.106	-0.008	0.972
2 (Grain/Hay)	166	0.028	0.980	0.020	0.948	0.028	1.018
3 (Grain/Pasture)	45	-0.064	1.049	-0.138	1.006	0.503	1.220
4 (Grain/Pasture/Hay)	487	0.037	1.013	0.004	0.991	-0.038	0.988
Significant at $P < .05$	ND <sup>a</sup>			ND		ND	

Abbreviation: SD, standard deviation.

<sup>a</sup> No significant differences.

**Table 11**  
Factor association with personality component—trained discipline.

Trained Discipline	n	Nervousness		Curiosity		Threatening	
		Mean	SD	Mean	SD	Mean	SD
1 (Pleasure/Trail)	187	0.070	0.966	-0.083	1.021	0.034	0.990
2 (Western Pleasure)	53	-0.247	0.983	-0.017	1.071	-0.090	0.989
3 (Roping/Reining)	17	-0.412	1.191	0.263	0.934	-0.141	0.907
4 (Hunter/Jumper)	41	0.210	1.041	-0.248	1.010	-0.067	1.084
5 (Eventing)	24	-0.312	0.806	0.259	1.027	0.409	1.205
6 (Dressage)	79	0.217	0.972	0.192	0.925	-0.170	0.975
7 (Driving)	9	0.537	1.564	0.050	0.571	-0.014	1.105
8 (Other)	105	0.208	1.088	-0.095	0.965	-0.007	0.946
9 (None)	64	0.236	0.954	-0.162	1.073	0.350	1.012
10 (>1 of Above)	268	-0.180	0.932	0.068	1.001	-0.063	0.987
Significant at $P < .05$	ND <sup>a</sup>			ND		ND	

Abbreviation: SD, standard deviation.

<sup>a</sup> No significant differences.

significant difference between mares and geldings in their study on equine temperament. Variability in personality and sex reported may be attributed to differences in breeds, age, and training level which all had a more significant association with personality in our study [22].

#### 4.5. Personality Housing, Turnout, and Feed

None of our questions related to housing, turn-out time, or feeding was found to have a significant relationship to personality. Previous studies have shown that factors such as housing conditions may have an influence on behaviors associated with emotionality and cognition [2]. Lesimple et al. determined that the horses in their study were less reactive when they spent more time outside as groups in paddocks [2]. Other investigators have found that although genetic factors such as breed seem to influence fearful/nervous behaviors, environmental factors (such as housing and human contact) can be additive and modulate core behavioral traits [6]. Studies have indicated that confinement and lack of social contact in horses, along with other management factors, are associated with stereotypic and other abnormal behaviors [57]. It is surprising in our study that horses housed predominantly indoors or outdoors were not significantly associated with any of the personality components. It is possible that housing conditions such as social contact time, stable group size, and opportunity for movement allowed for adequate opportunities for healthy social interaction for the horses in this study. It is also likely that environmental factors such as housing and turnout act as modulators to core personality traits (e.g., nervousness is heightened if stabled in isolation) and were not alone strong enough factors to drive a significant association with personality. In our study, the majority of horses were kept in welfare-friendly conditions (i.e., turnout on pasture with social companions), so it is possible that many of the negative behavioral effects of housing were not

**Table 12**  
Factor association with personality component—competition.

Competition	n	Nervousness		Curiosity		Threatening	
		Mean	SD	Mean	SD	Mean	SD
1 (Never)	389	0.184	0.986	-0.008	1.039	0.038	0.999
2 (1–3 Per Year)	233	-0.049	0.971	0.061	0.958	0.106	1.072
3 (4–10 Per Year)	148	-0.172	0.996	-0.010	1.021	-0.141	0.943
4 (Full Time)	77	-0.338	1.012	-0.124	0.930	-0.235	0.813
Significant at $P < .05$	1 versus 2, 3, 4	ND <sup>a</sup>		ND		ND	

Abbreviation: SD, standard deviation.

<sup>a</sup> No significant differences.

**Table 13**  
Factor association with personality component—competition level.

Competition Level	n	Nervousness		Curiosity		Threatening	
		Mean	SD	Mean	SD	Mean	SD
1 (Beginner)	186	0.122	0.969	0.104	1.004	0.278	1.117
2 (Intermediate)	241	-0.174	0.922	-0.007	0.942	-0.078	0.947
3 (Advanced)	145	-0.149	1.034	-0.060	1.058	-0.183	0.966
4 (International)	22	0.002	1.320	-0.043	1.117	-0.111	0.941
5 (None)	253	0.181	0.990	-0.018	1.012	0.007	0.963
Significant at $P < .05$		1 versus 2 2 versus 5 3 versus 5		ND <sup>a</sup>		1 versus 2, 3	

Abbreviation: SD, standard deviation.

<sup>a</sup> No significant differences.

observed. In the case of sport/competition horses that are often kept in social isolation (both in stalls and paddocks) and with limited turnout, their reactivity to stimuli (nervousness) may be much higher. A higher incidence of shying, reactivity, and/or disobedience may be observed in this population of sport/competition horses and may contribute to misleading assessments of personality in previous studies.

#### 4.6. Personality and Discipline, Level, and Frequency of Competition

Nervous personality was significantly associated only with the category “other.” None of the listed trained disciplines was significantly associated with any of the three personality components (nervousness, curiosity, or threatening). Findings from our study are in contrast to a commonly held belief that dressage horses are more nervous and show stronger and more frequent fear reactions than other performance horses [58,59]. This view is supported by work which compared anxiousness of horses used for a variety of disciplines and found dressage horses to be among those with the greatest “emotionality” and show jumpers with the least [6]. Results from another study pointed to a genetic basis for low reactivity in show jumping horses, and this low reactivity linked to genetic selection for jumping potential versus training “causing” reactivity in dressage horses [60]. The results of our study point to personality traits such as nervousness as inherited with breed (and line) and not intrinsic to training a specific discipline, which are external handling and training factors. It is possible that housing factors (social isolation and limited turnout) and handling play a significant role in the personality traits observed in previous horse personality studies.

**Table 14**  
Factor association with personality component—behavior problems.

Misbehaviors/ Stereotypies	n	Nervousness		Curiosity		Threatening	
		Mean	SD	Mean	SD	Mean	SD
1 (None)	514	-0.130	0.919	-0.031	1.053	-0.184	0.861
2 (Cribbing)	29	0.203	0.967	0.199	0.731	-0.061	0.852
3 (Windsucking)	18	0.462	0.925	0.051	0.980	-0.317	1.083
4 (Weaving)	12	0.330	1.172	0.028	0.856	-0.378	1.096
5 (Pawing)	66	0.147	0.987	0.110	0.862	-0.059	0.824
6 (Door Kicking)	19	0.334	1.243	0.279	1.100	0.558	1.137
7 (Biting)	13	-0.143	1.415	0.047	0.874	1.481	1.608
8 (Other)	60	0.202	0.977	-0.094	0.916	0.188	1.063
9 (>1 of Above)	116	0.195	1.179	0.010	0.951	0.501	1.180
Significant at $P < .05$		ND <sup>a</sup>		ND		1 versus 6, 7, 9 7 versus 2, 3, 4, 5, 8, 9 5 versus 9	

Abbreviation: SD, standard deviation.

<sup>a</sup> No significant differences.

When competition frequency and level were evaluated for association with personality, several significant associations were revealed. Horses that never competed were identified as significantly more nervous than any of the other competition levels (occasional, frequent, or full time). This association is most likely related to the fact that horses that have never competed have not been desensitized and counter-conditioned to novel environments (sounds, sights, etc.) and thus exhibit a higher level of nervous or anxious behaviors. It is also possible that because of their nervous personality, some of these horses were not good at competition. When competition level was evaluated, beginner level horses were identified as having significantly more nervous personality than intermediate (but not advanced or international level), and both intermediate and advanced level were significantly more nervous than those horses that had not achieved any competition level (scored as “none”). This association may be attributed to less experienced horses competing at increasingly challenging levels and in novel environments [7]. The fact that advanced and international level horses were similar to beginner in association with nervous personality may indicate that upper levels horses are selected for their more nervous behaviors as it may lead to greater rider sensitivity and/or performance [6] or reflective of housing and handling factors associated with these horses.

Threatening was also significantly associated with beginner level horses which may be associated with handling and training at early levels in unconditioned horses as well as associations with unpleasant cognitive or emotional situations (anticipation of unpleasantness, unpleasant interaction) [61].

#### 4.7. Personality and Misbehaviors or Stereotypies

Associations between personality and misbehaviors or stereotypies indicated that, for nervousness, there was only one significant difference, that between horses with no misbehaviors or stereotypies and those with more than one (horses with more than one misbehavior were more nervous). There was no association between curiosity and stable misbehaviors or stereotypies. When threatening was evaluated, however, horses with behaviors such as biting, kicking, and aggression toward humans and other horses showed a significant association with threatening personality.

In understanding the association (if any) between stereotypies and personality, it is important to understand risk factors for the behaviors. Risk factors may include physical contact (lack of or unstable groups) with other horses [62], amount of forced exercise [62], forage availability and type [63], total number of horses in a paddock [63], opportunities for contact with other horses [62,63], breed type (Thoroughbred, Warmblood, and other breeds) [13], presence of grain in the diet, and personality [13]. Despite the fact that the execution of stereotypic behaviors appears as stress coping behaviors, evidence linking stress to stereotypies is controversial [64]. There is also no evidence that execution of stereotypies reduces an individual's stress level [65].

## 5. Conclusion

The goal of this study was to, for the first time, obtain measures of personality traits of a varied population of predominantly American horses and develop a smaller number of variables (principal components) that would account for most of the variance in the number of personality components. The secondary objective was to develop a score for each principal component of each horse; these scores would then be compared between factors such as feeding, housing, and use. The survey demonstrated consistent key personality components across a large and diverse sample of predominantly American horses. A significant aspect of the survey was

its utility in being able to use owner (or other person familiar with the horse) behavior trait observation data in the assessment of key personality components. The survey was able to identify three personality components that serve as the basis for an individual horse's personality. A more detailed assessment would be required to understand a specific individual's personality. Using the key personality components, we were able to establish and refute links between personality type such as nervousness, curiosity, and threatening and trained discipline. We found that horses who kicked doors, bit, and had more than one stereotypy had a more threatening personality than those horses with no stereotypy. Genetics, as demonstrated by an association between personality components and breed, play the largest role in equine personality with environmental factors, such as association and experience with humans, social contact, and housing applying a significant influence on the expression of specific behaviors/traits. Future additional studies are warranted to evaluate in greater depth the association of personality with selection for optimal performance and companionship, as well as the potential relationship between less welfare-friendly housing, social isolation, and human interaction (handling) and personality.

### Acknowledgments

The authors wish to acknowledge, Joe Hauptman, DVM, MS, DACVS, Professor Emeritus, College of Veterinary Medicine, Michigan State University, East Lansing, MI, for his assistance with statistical analysis and Camie Heleski, PhD, Senior Lecturer, College of Agriculture, Food and Environment, University of Kentucky, Lexington, KY, for her assistance with posting the Web-based survey on relevant equine social media Websites and Blue Pearl Veterinary Partners for funding the cloud-based survey application and statistical analysis.

### Financial Disclosure

The authors acknowledge Blue Pearl Veterinary Partners for its financial support of the conduct of this research that included funding for the cloud-based survey application and statistical analysis. The funding source had no involvement in study design, collection, analysis or interpretation of the data, in the writing of the report, or in the decision to submit the article for publication.

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