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PERSONALITY ASSESSMENT IN CLONED EQUINES

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PERSONALITY ASSESSMENT

IN CLONED EQUINES

by

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ABSTRACT

PERSONALITY ASSESSMENT IN CLONED EQUINES

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The nature versus nurture debate of personality has been widely researched, yet it has seldom used cloned animals. Since cloned animals are genetically identical to their donors, this avenue of research provides a unique opportunity to understand the genetic and environmental factors of personality. To explore these influences of personality, a donor polo pony and her cloned offspring were analyzed. The trainers of the horses rated each horse based on its personality traits and physical characteristics. A positive correlation was found between the personality of the donor horse and her cloned offspring. Moreover, the personality of the donor positively predicted the personality of the clones. The results were not significant, however, due to the study's limitations, but previous literature suggests that such relationships would exist. Future research would address these limitations as well as explore the relationship between the current factors and behavioral performance.

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CHAPTER 1

INTRODUCTION

The personalities of cloned horses are a new topic of interest for researchers. Considering how recent the cloning process was developed, it is no wonder that this field is in its beginning stages. Nonetheless, this area of research pulls from a variety of well-established fields. From behavioral genetics to animal personality, these fields provide cloned horse personality research with a strong foundation.

1.1 Animal Behavior

Animal behavior is a popular subject. People read books, hire pet trainers, and watch animal-related media to immerse themselves in the field of animal behavior. In other words, people want to know why animals behave the way they do. Unsurprisingly, humans have shared this interest for thousands of years, though the reasons for analyzing the behaviors of animals differ. Early civilizations observed animal behaviors to hunt them and avoid danger. These groups needed to know how the animals responded to them and interacted with the environment to feed themselves and survive potential threats. However, the severity of that need dwindled as humans began to domesticate them.

Wolves, among other species, are thought to be domesticated via the commensal pathway (Zeder, 2012). This states that docile animals stayed near human settlements, living off human scraps. Because these animals remained near humans and had a calm demeanor, they became domesticated. Another pathway, called the prey pathway, states

that prey animals were domesticated as an indirect result of hunting strategies (Zeder, 2012). Over time, human hunting strategies evolved from stalking prey to maintaining herds. Like the commensal pathway, the prey pathway suggests that docile animals were ideal candidates for domestication. The last pathway to animal domestication is the directed pathway (Zeder, 2012). This suggests that humans intentionally domesticated animals that were not docile to acquire a necessary resource. Horses are among the species that were domesticated in this way for the purpose of transportation and food. These proposed pathways show how integral studying animal behavior has been in cultivating human practices and interests in animals that are seen today.

Although the practice of studying animal behavior has existed for thousands of years, it has only recently found a place in the scientific community. Research involving animal behavior began in the mid-1900s with the help of three major ethologists: Niko Tinbergen, Konrad Lorenz, and Karl von Frisch (Newberry & Sandilands, 2016). These researchers are considered the Fathers of Ethology for the work they have done to empirically study and interpret behavior patterns in animals.

Tinbergen is a notable ethologist because of the concepts he developed for studying animal behavior. His findings allowed researchers to determine what causes a behavior in an animal at a given moment. These concepts include causation, ontogeny, survival value, and evolution of an animal (Tinbergen, 1963). Later, they were known as the proximate and ultimate causes of behavior; causation and ontogeny are proximate causes of behavior, while survival value and evolution are ultimate causes of behavior (Dugatkin, 2014). As a result of Tinbergen's contributions, researchers can understand how evolutionary and immediate causes influence behavior in animals.

Lorenz is well known in ethology because of his research on sexual imprinting (Dugatkin, 2014). His discoveries showed that some species learn social behaviors from the animal that is present during their critical period after birth (Lorenz, 1935). That is, the newborn imprints on said animal, which is usually their parent, and learns the appropriate conduct for their species. This results in the animal being sexually receptive to members of their species once it is mature. If the animal imprints on an animal from a different species, then it will learn the social conduct of that species and not be sexually receptive to members of its own species. Because of Lorenz's work, ethologists understand how early life experiences can impact an animal's behavioral tendencies.

Von Frisch is a renowned ethologist because of his studies on honeybee communication. In his research, he found that honeybees have an elaborate communication system that allows them to direct others in their hive to food sources. They can tell other honeybees how far away and in what direction flowers are by dancing near the other honeybees at a certain angle and for a certain period (Dugatkin, 2014). These findings from von Frisch demonstrate how non-human animals are capable of complex behaviors and communication methods.

Tinbergen, Lorenz, and von Frisch won a Nobel prize for their research in 1973 (Newberry & Sandilands, 2016). These ethologists provided insight on animal behavior and vitalized the field as their findings garnered attention from other researchers. As such, countless others have contributed to the study of animal behavior, which in turn has influenced the field of animal personality.

1.1.1 Animal Personality

Like ethology, the study of animal personality is relatively new to the scientific community. Interest in it has existed for a long time, especially for the purposes of comparative psychology, but its appearance as a scientific field only occurred in the late-1900s (Whitman & Washburn, 2017). Decades before then, researchers moved towards making animal personality its own scientific field. They did this by describing the behaviors of animals in a way that resembled the language used to describe personality traits in humans (Whitman & Washburn, 2017). Such a decision emphasized the individual differences in the behavioral tendencies of animals. Over time, researchers began to incorporate animal personality into their research, expanding the field into what is known today.

Chamove et al. (1972) were the first to apply human personality research techniques to animal personality research. They developed a list of personality traits to describe the monkeys, rated the monkeys' behaviors, and compiled the data into the following three factors: hostility, fearfulness, and sociability. Through their analyses, they were able to find stable patterns in the monkeys' behaviors, a feat that was mainly accomplished in humans at that time. Importantly, their research laid the foundations for future personality factor analysis in animal personality studies.

King and Figueredo (1997) used the Big Five Personality Traits Model to study personalities in chimpanzees. This was unique because they used a human-centered personality model to study the behavioral patterns in chimpanzees. Their findings revealed that chimpanzee personalities were accurately described by this model, marking a significant milestone in animal personality research.

Gosling and John (1999) conducted a cross-species review with several sound studies on animal personality. Every study used the same Big Five Personality Traits Model to examine the personalities of a variety of animals, ranging from guppies to chimpanzees. They found that the personalities of these species were strongly represented by the personality factors, especially those of Extraversion, Neuroticism, and Agreeableness. This cross-species review highlights the ability to study animal personality in a plethora of species and produce significant results.

1.1.1.1 Horse Personality

Multiple studies on animal personality have supported the idea that horses have personalities. Lloyd et al. (2008) analyzed how personality traits vary between eight horse breeds. They found that anxiousness and excitability were the most variable traits between the breeds, and dominance and protection were the least variable traits between the breeds. Furthermore, they found typical personality trait combinations for each breed that was tested; for instance, they found that Appaloosas were easy-going and less reactive to stressors, while the Arabians were energetic and more reactive to stressors.

In a systematic review, Rankins and Wickens (2020) investigated how personality traits in horses vary based on sex, discipline, and environmental conditions. In terms of sex, they found that females were more reactive and anxious than males. Males were also more inquisitive and easier to train than females. Within disciplines, they found that therapeutic riding horses were reactive, jumping horses tended to be investigative, and dressage horses were excitatory. Regarding environmental conditions, they found that the dam's interactions with humans taught the foal to be less fearful of handlers. Moreover,

they found that human interaction with foals shortly after birth influenced the foal's receptivity to humans throughout its life.

In another study, Vidament et al. (2021) determined how age, sex, and breed relate to personality traits in horses. They found that younger horses were more fearful and reactive than older horses. They also found that males were louder, tenser, more fearful, and moved around more than females. Additionally, their research showed that breeds primarily used for riding were more sensitive to pain than breeds typically used for laborious tasks.

The aforementioned studies are among the many that examine how horses differ in personality characteristics. Whether those differences are a result of breed, age, sex, or life experiences, the idea that horses have personalities is supported by the research. These findings are significant because they can have real-world applications for horse owners of any kind. By understanding the individual differences in horse behavior, people can ensure safety while working with them, teach them in an effective manner and pass on desirable traits through breeding.

1.2 Nature Versus Nurture

Nature versus nurture has been a long-discussed topic, both in and out of academic settings. This debate is centered around the underlying causes of personality and what influences it the most. Put simply, it seeks to answer the following questions: Which has a greater impact on personality—genes or the environment? To what extent do genes and environmental conditions determine personality?

1.2.1 Genetic and Environmental Influence

The genetic influence on personality has been widely debated. Amid the debate, researchers have tried to understand how genes influence personality. According to Turkheimer (2000), there are three behavioral laws of genetics that attempt to explain that influence, and they are as follows: 1) all human behavioral traits are heritable, 2) the effect of being raised in the same family is smaller than the effect of genes, and 3) a substantial portion of the variation in complex human behavioral traits is not accounted for by the effects of genes or families. In other words, behavioral traits are heritable, shared environmental conditions are less influential than genetics, and non-shared environmental conditions influence personality traits (Turkheimer, 2000). Krueger et al. (2008) added that shared environmental conditions minimally contribute to personality, and that genes and nonshared environmental conditions influence personality the most.

In addition to these behavioral laws of genetics, there have been multiple studies that explored the genetic basis of personality. Monozygotic and dizygotic twins are often used because the genetic similarities between each twin is known. These studies typically show that genes influence nearly 50% of personality, but it can be argued that the genetic influence approaches 66% (Bouchard, 1994). However, these percentages may be mere generalizations because the data collection methods are unable to account for unique circumstances and behaviors of the individual (Krueger et al., 2008). Nonetheless, the extensive literature surrounding this topic show that genetics, as well as environmental conditions, influence personality. These findings can be applied to nonhuman animals as well, including horses.

1.2.1.1 Influence in Horses

Research in horses has shown that genetics and the environment interact to determine their personalities. According to Hausberger et al. (2004), the bloodline of a horse, as well as its breed, has a significant influence on its behavioral patterns. They found that behaviors in horses, such as emotionality and learning abilities, had ties to the sire. They also determined that the breed of a horse influenced the previous behaviors, along with the tendency to exhibit stereotypical behaviors of that breed. Regarding environmental influences, they discovered that the type of discipline horses were trained in had an impact on their emotionality and stereotypical behavior. Interestingly, a lack of training also had an impact; horses that were not trained had lower emotionality and learning ability scores than those trained regularly. Although this study did not provide a genetic analysis of the horses' personalities, their results support the idea that genes, and environmental conditions, have a significant effect on the horses' personalities.

1.3 Cloning

Cloning animals has always been a controversial practice. People tend to be skeptical of cloned animals and harbor negative feelings about the process. In fact, about 45% of Americans in 2005 thought poorly of cloning, and 32% in 2006 believed that cloning animals was morally unacceptable (Brooks & Lusk, 2011). However, the cloning of animals is an impressive innovation that has extended the boundaries of science. Because of the cloning process, the desirable traits of a single animal can now be passed on to the next generation of animals, which can benefit people in a variety of settings.

1.3.1 Process

The beginnings of animal cloning had its fair share of failures. Multiple researchers attempted to clone animals like sea urchins and salamanders, but they often failed (Vajta & Gjerris, 2006). During one of these attempts, a researcher accidentally discovered the nuclear transfer mechanism that is used in today's cloning process. This researcher noted that an isolated part of an embryo began to form when a nucleus entered its space (Vajta & Gjerris, 2006). This accidental discovery eventually established the science needed to clone animals via nuclear transfer.

During the nuclear transfer process, a somatic cell of a donor animal has its nucleus removed. An oocyte also has its nucleus removed, which is replaced by the nucleus of the somatic cell. Once that is complete, the oocyte and the nucleus fuse to create an embryo. The embryo develops into a blastocyst and is then placed into a host animal to complete gestation. The resulting animal is a clone that is genetically identical to the somatic cell donor (Tian et al., 2003).

Even though this process is effective, it has had its failures. These failures range from unsuccessful blastocyst transfer to the death of the clone. The cloning process can be so difficult that roughly 0-5% of successfully transferred blastocysts survive gestation, but the numbers may be higher in some instances (Campbell et al., 2005). Other failures of the cloning process include size abnormalities, placental abnormalities, weakened immune systems, general weakness, and weight loss. However, these health issues do not appear in all cases, and most cloned animals that survive gestation are healthy (Campbell et al., 2005). As science progresses, these cloning failures are bound to falter, allowing the process to yield more successful clones.

1.3.2 Significance

Cloning animals via nuclear transfer allows certain animals with desirable traits to pass on their genes without interference from another animal's genes. This process also allows for trait control within a population because the traits of the animal being cloned are known, desirable and are being passed on. As a result, cloning animals can keep desirable traits in a population and remove the threat of undesirable traits from a population. This is significant in various species contexts because it can improve the safety of handlers as well as performance and quality of the population.

1.3.2.1 Significance in Horses

There are numerous benefits to cloning horses. Cloning a horse that has a desirable personality, like being competitive or obedient, will likely produce more horses with similar personality traits. This can make finding horses well-suited to a certain discipline easy, especially if the donor horse was successful in that discipline. Cloning a horse with a desirable conformation also has its benefits. Because certain disciplines may only work with a certain conformation, like a long neck or wide back, producing clones that match such a conformation may bring success in that discipline to the owner. In general, cloning horses is beneficial if the owner wants to keep the qualities of a successful sire or dam, therefore continuing the owner's trusted bloodline.

1.4 Hypotheses

Genes are known to influence a significant portion of an individual's personality. Since cloned animals are genetically identical to their donors, it is expected that any genetically influenced personality traits from the donor will be present in the clone. Naturally, it can be expected that a clone's personality would strongly resemble its donor's

personality. Using these assumptions, the researchers hypothesize that there will be a relationship between the personalities of the cloned horses and the donor horses. The results of the study will also provide insight on the relationship between personality traits and physical attributes in cloned horses.

CHAPTER 2

METHODOLOGY

2.1 Participants

The personalities of four polo ponies were analyzed. Out of the four horses, one was the donor and three were the cloned offspring. The donor horse was 15 years old, two cloned horses were five years old, and one cloned horse was nine years old ($M = 8.43$, $SD = 4.72$). All horses were female.

In affiliation with Crestview Farm, L.L.C., three raters volunteered to rate the personalities of the cloned horses. These raters had extensive experience handling and training the horses included in the study.

2.2 Materials

A 32-item questionnaire was created in and administered through QuestionPro (see Appendix A). The first four items asked for general information about the raters and the horses. The next 20 items dealt with the horses' psychological characteristics. Taking inspiration from the Big Five Personality Traits Model, these questionnaire items were combined to form factors of four related questionnaire items; items 1-4, 5-8, 9-12, 13-16, and 17-20 were averaged to create the factors of Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism, respectively. The next seven items dealt with physical attributes of the horses. Items 1, 4, and 7 were combined to create the body factor, while items 2, 3, 5, and 6 were combined to create the ability factor. The last item

allowed raters to report additional information they felt was not covered by the previous questions.

The psychological and physical attributes sections were in the form of a five-point Likert scale. The ends of the scale used bipolar adjectives that corresponded to the trait at hand. The low end of the scale was the adjective that did not represent the given factor, while the high end of the scale was the adjective that represented the factor well. SPSS Statistics was used to analyze the data.

2.3 Procedure

The raters received a link to the survey. They were able to take it at any time, and they were not required to meet with the researchers to complete it. If they had any questions, they were asked to contact the primary researcher, whose contact information was provided with the survey.

Instructions were given for the psychological and physical attributes sections as well as the last questionnaire item. For the psychological and physical attributes sections, raters were instructed to check the box that indicated the degree to which the given horse matched each trait. For the last item, raters were able to leave a comment about the horse if they felt that topic was not covered by the previous questions.

CHAPTER 3

RESULTS

A total of seven observations on personality and physical characteristics were gathered from the raters. Each horse, except for Clone 3, was rated independently by two raters, providing greater objectivity on personality and physical characteristic items included on the questionnaire. Inter-rater reliability was statistically evaluated using the Cronbach's alpha procedure (Cronbach, 1951). Table 3.1 shows the calculated Cronbach's alpha coefficients of the raters on all variables combined for each horse included in the study. In general, there is a high degree of reliability among the raters on their evaluation of personality and physical traits. Alpha coefficient values obtained are between 0.76 and 0.89.

Table 3.1: Cronbach's Alpha for Inter-rater Reliability

Donor	$\alpha = 0.76$
Clone 1	$\alpha = 0.89$
Clone 2	$\alpha = 0.88$

Note: No inter-rater reliability was available for Clone 3

Descriptive statistics of personality and physical factors for donor and cloned horses can be found in Table 3.2. Based on the factor averages, the donor shows a pattern of moderate Openness, high Conscientiousness, moderate Extraversion, high Agreeableness, and low Neuroticism. The cloned horses, compared to their donor, show

higher personality scores on Openness, Conscientiousness, and Agreeableness; however, they are rated as less neurotic and as equally extroverted.

Table 3.2: Descriptive Statistics

	Donor		Clone 1		Clone 2		Clone 3	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Openness	2.63	1.77	4.25	0.89	4.13	0.99	3.75	0.96
Conscientiousness	4.75	0.46	4.38	0.92	4.25	0.89	3.50	1.00
Extraversion	3.63	1.69	3.75	1.17	4.25	0.89	3.75	0.50
Agreeableness	4.00	1.07	4.88	0.35	4.88	0.35	5.00	0.00
Neuroticism	2.88	1.46	1.25	0.46	1.25	0.46	1.00	0.00
Body	4.33	0.52	4.17	0.75	4.17	0.75	4.00	1.00
Ability	4.38	0.52	4.25	0.71	4.38	0.52	5.00	0.00

3.1 Personality and Physical Factor Correlation Analysis

A correlation analysis was conducted to examine the relationships among the personalities and physical attributes of the clones and donor. Table 3.3 shows the inter-correlation coefficients for each personality and physical factor. Among the personality factors, several strong positive correlations were obtained between Extraversion and Openness, Extraversion and Conscientiousness, and Openness and Agreeableness. Whereas, strong negative correlations were obtained between Neuroticism and Openness, and Neuroticism and Agreeableness. This suggests that personality factors of Conscientiousness, Extraversion, Agreeableness, and Openness are associated with positive attributes of horses. Neuroticism, which indicates emotional instability, is associated with negative attributes of horses.

Table 3.3: Intercorrelations of Personality and Physical Factors

	Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism	Body	Ability
Openness	1						
Conscientiousness	-0.01	1					
Extraversion	0.55	0.65	1				
Agreeableness	0.64	-0.30	0.27	1			
Neuroticism	-0.76	0.50	-0.16	-0.94	1		
Body	-0.18	0.96	0.53	-0.53	0.69	1	
Ability	0.06	-0.07	0.26	-0.10	0.02	0.04	1

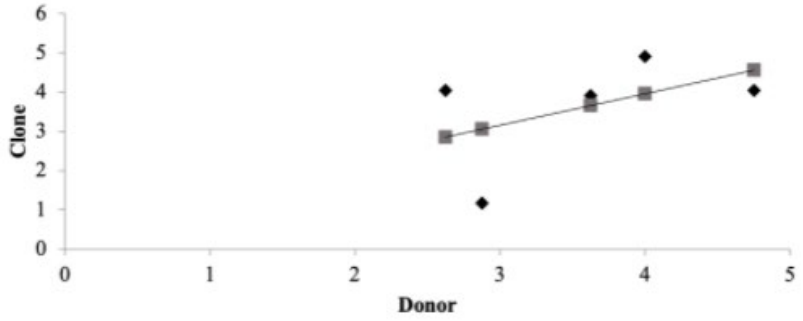
3.2 Donor-Clone Regression Analyses

Simple linear regression analyses were conducted to examine the association between donor and clone personality and physical factors. Specifically, these analyses were conducted to determine whether the attributes of a clone may be predicted from the attributes of the donor.

3.2.1 Personality Factors Only

A donor-clone regression was conducted to predict clone personality. To do this, the averages of each personality factor were calculated for the clone and donor groups. The analysis failed to yield a statistically significant effect of a donor-clone linear relationship. Likewise, the statistical test of the slope coefficient was not significant, (B = 0.82, $t(3)$ = 0.99, p = 0.39). A positive regression slope coefficient with a moderate magnitude was found, but it was not significant, (r^2 = 0.24, F(1,3) = 0.99, p = 0.40). The results of the regression analysis can be found in Figure 3.1.

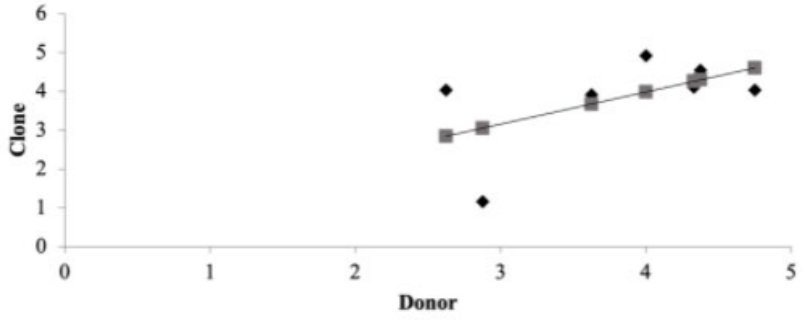
Figure 3.1: The Donor-Clone Regression Analysis for Personality Factors



3.2.2 Personality and Physical Factors Combined

A donor-clone regression was conducted to predict clone personality and physical attributes. To do this, the averages of every factor were calculated for the clone and donor groups. The analysis failed to yield a statistically significant effect of a donor-clone linear relationship. Likewise, the statistical test of the slope coefficient was not significant, (B = 0.83, $t(5) = 1.45$, $p = 0.21$). A positive regression slope coefficient with a moderate magnitude was found, but it was not significant, ($r^2 = 0.30$, $F(1,5) = 2.09$, $p = 0.21$). The results of the regression analysis can be found in Figure 3.2.

Figure 3.2: The Donor-Clone Regression Analysis for Personality and Physical Factors



CHAPTER 4

DISCUSSION

The purpose of this study was to determine if a relationship existed between the personalities of the clone and donor horses. Based on relevant research, the researchers hypothesized that such a relationship would exist. Unfortunately, the hypothesis was not supported, likely due to the small sample size that did not represent the population of clone and donor horses. A larger sample size would offer a better representation of the population. Given an increase in sample size, and therefore a complete representation of the population, significant results would likely occur.

To determine the sample size needed for significant results, a sample size analysis for a simple linear regression with a power of 0.80, an alpha of 0.05, and a moderate effect size was completed. This indicates that approximately 50 observations would be needed for significance. Obtaining this sample size, coupled with support from relevant research, would suggest potential support for the hypothesis.

The results of this study highlighted a relationship between physical attributes and personality factors, especially those of body and Conscientiousness factors. Initially, this seems obscure because it can be difficult to relate an individual's appearance to their personality. However, some studies explored this relationship and offered explanations for these findings.

Agnew (1984) examined the appearances of people and found how they influence people's personalities and behaviors. For instance, attractive individuals perform better in

school, have higher expectations for their futures, and exhibit higher self-esteem in comparison to unattractive individuals (Agnew, 1984). In essence, individuals with more attractive qualities are treated better than individuals who lack those qualities, which in turn shapes their personality. Zebrowitz et al. (1998) expanded on this notion by studying how an individual's appearance may lead them to live up to or denounce their perceived expectations. For instance, men who were perceived as having an honest face would in turn develop an honest personality. On the flip side, women who were perceived as unattractive did not fulfill the prophecy that they would be unsociable; instead, they defied those stereotypes.

Although these studies were conducted on humans, they can still be applied to the results of the current study. It is possible that the horses in this study, who were perceived as having ideal body types for the polo pony discipline, were treated well because of their appearances. This treatment may have influenced how the horses behave, especially in terms of Conscientiousness. In short, these treatments from the humans may have acted as environmental influences on the horses' personalities, making the horses more careful and motivating them to generally live up to the people's expectations.

Because this area of behavioral genetics is new, there is a lack of research to compare with these findings. Cloning animals itself is a new science, so it is difficult to find literature related to the study of their personalities. With that said, this study initiated the exploration of behavioral genetics with cloned animals. Even though the results of the current research were not significant, past studies on personality and behavioral genetics still indicate that a relationship between the personalities of clones and donors may exist.

4.1 Limitations

This study had a few limitations. Most importantly, the sample size of clone and donor horses was small. Analyzing data from only four horses makes it difficult to find significant results and understand the true relationship between the donor and clone personalities. Similarly, this study's small number of raters was another limitation. Not having enough raters, as well as not having an equal number of raters per horse, may have inaccurately represented the personalities of the horses.

This research was also limited because it did not consider the in-utero environment of the clones. Because cloned horses complete gestation in a horse that is not their donor, they may receive epigenetic influence from that surrogate animal. As a result, it is difficult to determine how much genetic influence the donor horse had on the personalities of the clones.

The last limitation of this study was the lack of male clones. For this research, all the clones were female because the donor horse was female. Clones are genetically identical to their donors, so it makes sense that they were all female. However, male clones also need to be analyzed to determine if there were any differences in personality that were a result of sex.

4.2 Future Research

In a future study, the limitations of the current study would need to be addressed. Increasing the sample size of clone and donor horses, having a sufficient and equal number of raters, studying the in-utero environment of the clones, and analyzing male clones could all give the researchers a better understanding of the genetic influence on personality in

cloned animals. In other words, addressing these limitations would help eliminate any confusion on what influenced the personalities of the cloned horses.

Future research should include the examination of heritability and non-shared factors in cloned horses. Knowing the heritability of a cloned horse's personality could determine the extent to which genes influenced the horse's personality, with the consideration of the in-utero environment possibly causing epigenetic effects. Moreover, non-shared factors need to be analyzed because it is common for polo ponies to be raises separately from their siblings. As a result, the different environments in which each horse was raised could have potential effects on their personalities.

A different avenue the researchers might take involves behavioral tests. After collecting data on the cloned horses' personalities and physical attributes, activities could be done with the horse to further examine their behavioral patterns. These activities might test their latency to approach novel objects, cognitive abilities, and reactions to unfamiliar humans, to name a few. The researchers could then try to determine if the personalities and physical attributes of the horses would predict their behaviors across the behavioral tests.

Interestingly, the researchers might also explore the relationship between personality, physical attributes, and competition wins in cloned horses. Since certain personality traits and physical attributes are favored in the polo pony discipline, a relationship between them and performance in competitions may be found. Such a finding would be of great use to polo pony owners and breeders alike.

APPENDIX A

QUESTIONNAIRE

Rater's code: Horse's name:

Horse's sex: Horse's age:

Personality Traits

Instructions: Please indicate the degree of polo pony psychological characterizes by checking the appropriate box for each of the following traits.

	1 Very Much	2 Some-what	3 Neither	4 Some-what	5 Very Much	
Unintelligent	☐	☐	☐	☐	☐	Intelligent
Serious	☐	☐	☐	☐	☐	Playful
Uninterested	☐	☐	☐	☐	☐	Curious
Simple	☐	☐	☐	☐	☐	Complex
Careless	☐	☐	☐	☐	☐	Careful
Lazy	☐	☐	☐	☐	☐	Hard-working
Noncompetitive	☐	☐	☐	☐	☐	Competitive
Submissive	☐	☐	☐	☐	☐	Dominant
Introverted	☐	☐	☐	☐	☐	Extroverted
Shy	☐	☐	☐	☐	☐	Bold
Lethargic	☐	☐	☐	☐	☐	Energetic
Unsociable	☐	☐	☐	☐	☐	Sociable
Uncooperative	☐	☐	☐	☐	☐	Cooperative
Suspicious	☐	☐	☐	☐	☐	Trustful
Stubborn	☐	☐	☐	☐	☐	Obedient

Wild	☐	☐	☐	☐	☐	Tame
Calm	☐	☐	☐	☐	☐	Nervous
Predictable	☐	☐	☐	☐	☐	Unpredictable
Stable	☐	☐	☐	☐	☐	Temperamental
Easy-going	☐	☐	☐	☐	☐	Irritable

Physical Traits

Instructions: Please indicate the degree of polo pony physical characteristics by checking the appropriate box for each of the following traits.

	1	2	3	4	5	
	Very Much	Some-what	Neither	Some-what	Very Much	
Delicate	☐	☐	☐	☐	☐	Robust
Clumsy	☐	☐	☐	☐	☐	Agile
Slow	☐	☐	☐	☐	☐	Fast
Short	☐	☐	☐	☐	☐	Tall
Poor stamina	☐	☐	☐	☐	☐	Good stamina
Weak	☐	☐	☐	☐	☐	Strong
Poor conformation	☐	☐	☐	☐	☐	Good conformation

Please leave any other comments about the horse's personality or physical characteristics, as you see fit:

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BIOGRAPHICAL INFORMATION

Alexis Erickson is graduating from the University of Texas at Arlington this semester after three and a half years of her studies. She intends on continuing her education and studying ethology with a specification in horses. Her research interests include evolutionary causes that drive behavior; she wants to understand how the conditions that a species' ancestor lived in influences the current species' behaviors. Alexis plans on working with horses in a training capacity, hopefully using horse behavior to help those in need.