

THE RELATIONSHIP BETWEEN FACIAL HAIR WHORLS AND TEMPERAMENT IN LUNDY PONIES

By

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ABSTRACT

The relationship between hair whorl features and subjective temperament ratings was assessed in 18 feral Lundy ponies (*Equus caballus*). The herd consisted of 17 mares and 1 gelding, aged between 2 and 34 year of age. Temperament was assessed by two independent observers. Both observers rated all of the ponies subjectively on a linear scale for 18 different aspects of temperament. Quantitative scores were derived for each temperament rating. The number of facial whorls, their vertical position (high, middle, low) and lateral position (left, central, right) was recorded. Significant agreement was found between the two raters, most strongly for shy-pushy, easy-difficult and bold-timid ratings ($P < 0.01$). Age did not have a significant influence on temperament ($P > 0.05$). Initially coat colour appeared to be influential, however, closer inspection revealed that it in fact did not, owing to the presence of an individual with an unusual history. Ponies with two facial whorls were significantly more 'enthusiastic' and less 'wary' than those with 1 or 3 facial whorls ($P < 0.001$). Whilst, the vertical position of facial whorls was not related to temperament, lateral whorl position was ($P < 0.05$ to $P < 0.01$). Ponies with 'left' whorls scored highly on calmness, placidness, enthusiasm and friendliness, unlike those with 'right' whorls who scored highly on wariness, associated flightiness and unfriendliness. This study indicates that facial whorls are associated with temperament and could therefore provide a simple but useful method of assessing equine temperament.

Keywords: *Facial Hair Whorl, Temperament, Lundy Pony, Lundy.*

INTRODUCTION

Most scientists would agree that the way that an animal behaves is determined both by it's genetic make up and the environment in which it has developed and currently lives

(Manning and Dawkins, 2000). This is particularly true of the *Equus* species (Budiansky, 1997; Fraser, 1997). It is apparent that the domestic horse is no longer evolving due to the process of Natural Selection (as referred to by Charles Darwin in his 1859 book 'The Origin of the Species'), because as a species it has become closely associated with humans (Kiley-Worthington, 1987; Mills and Nankervis, 1999). Instead, humans subject the *Equus* species to Artificial Selection, dictating which individuals breed as part of strict breeding programmes, ultimately aimed at obtaining a particular type of equine- whether as a 'breed standard' or for competition.

a TEMPERAMENT, PERSONALITY AND INDIVIDUAL DIFFERENCES: WHAT IS TEMPERAMENT?

Darwin referred to variation within any population of individuals (Mills and Nankervis, 1999). This variation applies equally to behaviour as to morphology, physiology and genetic make up. A substantial number of researchers have uncovered individual differences in the majority of behaviours exhibited by a vast range of species (see chapter in Randle, 1995 for a review), including the Lundy pony (Randle, 1994).

The study of individual differences, personality and temperament is extremely complex and not helped by considerable confusion over the definition of these concepts (see Randle, 1995 and 1998). The Oxford Compact English Dictionary Thompson, (1996) defines 'Temperament' as an individual's "distinct nature and character". Indeed the behaviour exhibited by an individual is commonly attributed to its 'temperament' (e.g. Lanier *et al.*, 1999). It is frequently thought that the performance of an individual horse, whether in a sports or leisure environment, depends upon its temperament as well as its physical abilities (Visser *et al.*, 2001). However, to date, this belief remains relatively unquantified and based on largely anecdotal evidence, although recently Visser *et al.* (2003) suggested that it may be possible to predict a substantial part of the show-jumping performance of an individual horse from the personality traits it demonstrated earlier in life.

Wiggins (1979) was one of the first researchers to suggest that the manifestation of temperamental differences between (human) individuals occurs in three ways: emotional reactivity, sociability and mental ability. The idea that temperament reflects the emotional component of personality is subscribed to by many, including Kiley-Worthington (1987), Randle (1994; 1995; 1998), Williams (1995) and Visser *et al.* (2003).

b INFLUENCES OF TEMPERAMENT ON BEHAVIOUR

Grandin (1994) reported that cattle (*Bos taurus*) with an 'excitable' temperament were more likely to vocalise and/or injure themselves during handling. A common problem occurs whereby the handlers of such 'excitable' individuals expect the animals to behave in a certain way and in so doing establish a self fulfilling prophecy. As Grandin (1994)

argued, it is crucial that such individuals are handled appropriately, as 'excitable' individuals may quickly become labelled 'difficult' and 'dangerous'. This is very common with horses (Mills and Nankervis, 1999) where all the equine is trying to do is to avoid frightening situation, as a 'flight' animal would be expected to do. As Grandin (1989) pointed out, animal handling can be improved dramatically by a careful and thorough consideration of the animal's temperament, in addition to ensuring that handling facilities are appropriate and that the personnel involved are adequately trained.

c MEASURING TEMPERAMENT

It is difficult to measure temperament objectively and quantitatively - indeed attempts to do so have lead to over simplistic labels such as 'dominant', 'submissive' and 'the boss'. One of the main problems encountered is the recording and categorisation of behaviour using methods which are not objective, not repeatable and fail to take into account whether the behaviour being observed is consistent over time (Visser *et al.*, 2001; Seaman *et al.*, 2002). Moreover, quantitative studies of equine temperament have often been based on an inadequate number of subjects of different breeds, ages, genders, management practices and histories (Visser *et al.*, 2001).

However, the qualitative, subjective assessment of behaviour can be informative if it is based upon the integration of many pieces of information which in conventional quantitative approaches are recorded separately, or even not recorded at all (Wemelsfelder *et al.*, 2000). It cannot be denied that this approach has recently facilitated the scientific assessment of personality and temperament in animals.

Horses are commonly subject to a Vetting prior to purchase in order to establish that the individual is physiologically sound and conformationally correct for its intended purpose. Vetting does not assess characteristics of psychological soundness such as temperament. (There are only old wives tales to bide by, Chestnut mares with four white socks and horses with wall eyes reputedly being difficult!) It would be very useful to be able to assess the temperament of an equine before purchase in order to ascertain its suitability for the intended purpose (Seaman *et al.*, 2002).

By the end of June 2004 all equines must have a passport (The Horse Passports, England, Order, 2003) in line with EU Food Safety Legislation (Defra, 2002). The passport will contain a detailed identification of the individuals markings, scars, freeze brands and whorls (where a whorl is defined as a pattern of hairs, typically about 2.5cm across, also referred to as a Trichoglyph: Boden, 1998).

d THE LINK BETWEEN TEMPERAMENT AND WHORLS

The link between hair patterning and temperament and psychological function was first suggested by pediatric research conducted in the 1960s and 1970s. Key publications by Smith and Gong (1973 and 1974) demonstrated that, in humans, scalp whorls and

hair inclination are determined by the 10th to 12th weeks (18th week at the latest) of foetal development. There are three theories of scalp hair pattern development, the most widely accepted being that of 'Mechanical Tension' proposing that hair pattern and direction are determined by the tension placed on the epidermis during rapid expansion of the cranium during foetal development (Smith and Gong, 1973, 1974; Smith and Greely, 1978). The second theory of scalp hair pattern development is that of inheritance (hair distribution, texture and colour are known to be heritable), whilst the third, is due to differential and/or asymmetrical hair growth (Samalska, James and Sperling, 1989).

Smith and Gong (1973 and 1974) noted that abnormal hair whorl patterns were common in children with developmental disorders such as Down's syndrome and Prader-Willi syndrome. Similarly, Samalska *et al.* (1989) reported that 'normal' scalp patterns were associated with individuals with normal physiological development and normal mental function, and that 'abnormal' brain development typically results in gross malformations in hair follicles. More recently, Alexander *et al.* (1992) discovered a higher prevalence of anti-clockwise whorls in Schizophrenics.

A link between hair whorl pattern and handedness was first identified by Friedman, Golomb and Mora (1952) who stated that children with the hair whorl on the left side of the head are nearly always right-handed for hand abilities such as writing, and vice versa. More recently, Ortiz de Zarate and Ortiz de Zarate (1991) reported that 79% of left handed people had a right-sided hair whorl. Current research on humans has shown that right handed humans are more likely to have clockwise scalp whorls. Furthermore, both left handed -and ambidextrous- humans tend to have less predictable scalp hair patterns than right handed humans (Klar, 2003). Tanner *et al.* (1994) discovered a similar kind of link in Holstein cows, whereby cows with two round spiral facial whorls exhibited less side preference in the milking parlour in comparison with other cows.

Trichoglyphics, the study of hair directional patterning, has proved informative in terms of temperament. Grandin (1994) proposed that the link between hair whorls and behaviour arises from the fact that the nature of hair whorls being determined at the same time as the foetal brain development (Smith and Gong, 1974, 1975; Samalska *et al.*, 1989). On examining 1500 equines Tellington-Jones and Taylor (1995) identified a relationship between temperament and facial whorls. Unfortunately, although based on a respectable sample size, this study did not include a statistical analysis of the results.

A number of studies have revealed a significant relationship between facial whorl position and temperament in cattle (*e.g.* Tanner *et al.*, 1992; Grandin *et al.*, 1995; Randle, 1998; Lanier *et al.*, 1999). The common conclusion was reached that individuals with higher facial whorls are significantly more 'reactive' than those with lower facial whorls. In connection with this, Randle (1998) found that cattle with low hair whorls were also significantly less wary of a novel human than others.

The aim of this study is to establish whether there is a relationship between temperament and facial hair whorls in Lundy ponies using a combined approach of subjective but quantifiable descriptions of temperament.

METHOD

The herd comprised 18 Lundy ponies, a relatively recently established native breed (Pickeral, 1999). (At the time of this study there was no stallion present on the island in order to avoid reduction of the gene pool.) There were 17 mares and 1 gelding, aged between 2 and 34 years of age. (Full details of the subjects are in Table 1).

PONY NAME	AGE (years)	COLOUR	DISTINGUISHING CHARACTERISTICS
Belinda	34	Dun	Star, 3 white socks
Calloo	28	Dark Dun	Star, no white feet
Stonechat	21	Bay	Little white on left hind foot
Phonenix	11	Cream Dun	3 white socks, left fore dark
Cirl Bunting	9	Cream Dun	Stripe, 4 white socks
Red Kite	8	Bay	Star and stripe, dark legs
Reed Warbler	7	Cream Dun	Greyling, obese at time of study
Lerina	7	Dark Brown	Mealy nose
Jilly	5	Bay	Star, small white hind socks
Jenny	5	Dun	Blaze, wall eye
Iona	4	Bay	Large blaze, white hind socks
Annie	4	Cream Dun	3 white socks, dark right fore
Eliza	2	Dun	Star, no white on legs
Charlotte-Louise	3	Bay	4 white socks
Hannah	3	Dun	Star, 3 white socks
Eclipse	3	Cremello	Distinct body colour, pink skin
Francis Anne	2	Bay	Blaze, white hind socks
Albion (gelding)	3	Cream Dun	Very pink nose

Source: Randle and Gill (2003)

Table 1: Individual subject details

b LUNDY PONY MANAGEMENT

The ponies are usually given full access to most of the island from Quarter wall through to the North End of the island throughout the summer and winter seasons. They receive no supplementation during the summer season. During the winter their grazing is supplemented with hay. Because of her age (34) the oldest mare, Belinda is brought into a sheltered area with another individual for company. After being halter trained and handled to small extent as foals (for management purposes), the ponies are subject to minimal handling on a daily basis. Their feet are trimmed twice a year and they are also wormed twice a year. They are observed for injury and checked daily for health and welfare purposes (Proty, 2000) They are however accustomed to humans being in close vicinity owing to the large number of visitors to the island.

c DATA RECORDING

1 Whorls

The whorl data were recorded by the third author immediately after undertaking the study described in the previous paper (Randle and Gill, 2003). The standard veterinary Equine Identification Form produced by Royal College of Veterinary Surgeons was used (Figure 1). A separate form was used for each pony.

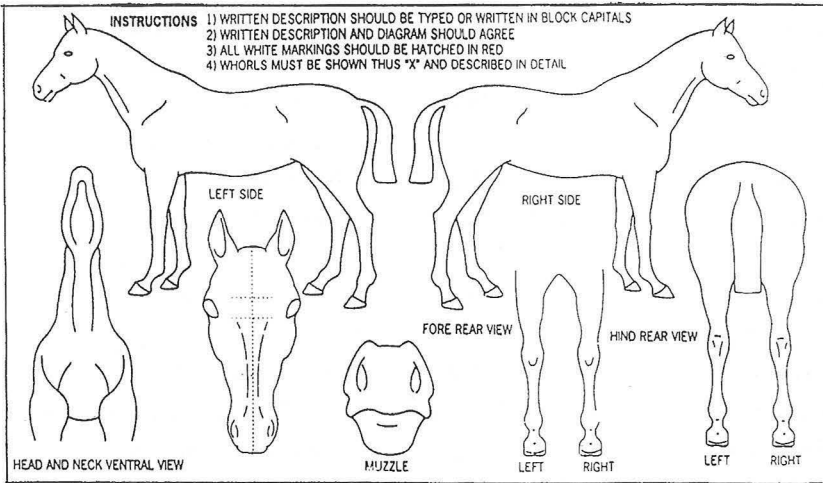


Figure 1. The standard Veterinary Equine Identification Form (Royal College of Veterinary Surgeons).

The ponies were familiar with the observer (having been observed by her for the preceding 2 weeks) and allowed her in close proximity. Recording commenced at the

head of each pony, then moved onto its near side (left side), around its hind end and back along its off side (right side).

All whorls were marked onto the diagrams with a cross (see Figures 2 and 3). The precise position of the facial whorls were logged using the method described in (Grandin *et al.*, 1995; Randle, 1998; Ryan, 2001 and Brimicombe, 2002). The vertical position of the whorls was recorded (Figure 2). Whorls above the eye level were defined as 'High', those between the eyes were 'Middle' and those below the eyes were 'Low'. The lateral position of whorls was also recorded. Whorls on the centre line were defined as 'Central', whilst those to the right or left of the central line were labelled 'Right' and 'Left' respectively (Figure 3). (Whorls on the neck, body and limbs were also recorded but not analysed in this study.)

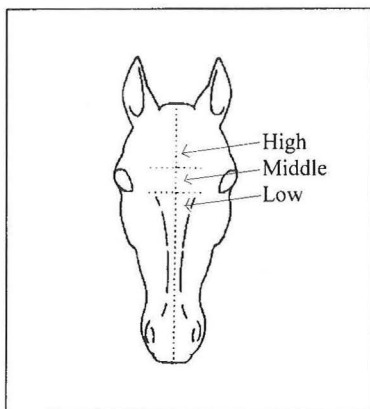


Figure 2. Vertical whorl position.

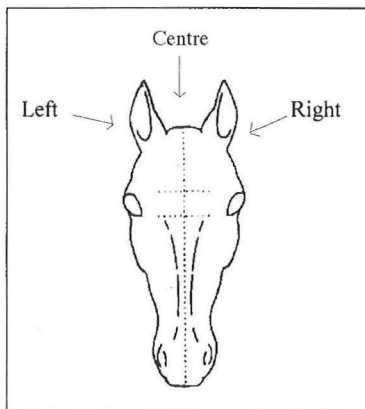


Figure 3. Lateral whorl position.

2 Temperament

A questionnaire was used to assess the temperaments of the individual ponies. Two different raters (Lisa Gill who had known the ponies for only 2 weeks, 0.06year, and Jan Symons who had known the majority of the ponies for most of their lives, if not all) were asked to complete a questionnaire for each pony. (Both raters have extensive experience of the equine species.)

The questionnaire comprised two sections. Section 1 sought demographic information about the observer, their knowledge of the ponies, the ponies attributes (name, age, gender, size, colour) and any other information such as any past experience which may influence its behaviour and temperament (Kiley-Worthington, 1987). Any other comments about the ponies were also invited.

Section 2 consisted of a list of 18 pairs of adjectives (Figure 4), each pair consisting of opposite behavioural traits, *eg.* calm-flighty. These adjectives had been validated in a

previous study (Lanier *et al.*, 1999) and successfully used for equines by Ryan (2001), Brimicombe (2002) and Randle (*in prep.* - study on Household Cavalry and Royal Horse Artillery horses).

Please rate the horse on the following commonly used temperament dimensions. Please mark the line with a cross as shown in examples below: All lines measured exactly 10cm.

Example 1. The horse is more flighty than calm

Calm |-----X-----| Flighty

Example 2. The horse is slightly more flighty than calm

Calm |-----X-----| Flighty

1. Calm |-----| Flighty

2. Enthusiastic |-----| Wary

3. Confident |-----| Nervous

4. Relaxed |-----| Tense

5. Dominant |-----| Submissive

6. Willing |-----| Lazy

7. Laidback |-----| Sharp

8. Affectionate |-----| Aggressive

9. Cooperative |-----| Stubborn

10. Friendly |-----| Unfriendly
(sociable) *(unsociable)*

11. Shy |-----| Pushy

12. Trusty |-----| Untrusty

13. Easy |-----| Difficult

14. Bold |-----| Timid

15. Playful |-----| Placid

16. Excitable |-----| Docile

17. Patient |-----| Impatient

18. Good |-----| Moody

tempered

19. Predictable |-----| Unredict.

20. Independ't |-----| Dependent.

Figure 4: Temperament rating adjectives.

Each pair of adjectives (temperament rating) was separated by a line measuring exactly 10cm (100mm). The raters were asked to mark the point they felt best reflected the individual pony's temperament with a cross (see example in Figure 4). A quantitative measure (the distance, in mm, from the left hand side to the rater's mark) was then derived and used as the pony's numerical score for that temperament rating. This method ensured the accurate recording of the temperament ratings (French, 1993).

d STATISTICAL ANALYSIS

The data were analysed using the Minitab (v13.31) statistical package. Since all of the ratings were Normally distributed, Parametric tests were used. A series of Pearson's Product Moment Correlation Coefficients were used to assess the consistency of the temperament ratings generated by the two raters and the statistical validity of the data. A Pearson's Product Moment Correlation Coefficient was used to assess the possible influence of age. A series of Oneway Analysis of Variance (ANOVA) tests were conducted to evaluate the effect of coat colour on the temperament ratings. A further series of Oneway ANOVAs were carried out to ascertain whether there were significant relationships between first the number of facial whorls and second the vertical and lateral position of facial whorls and temperament.

RESULTS

(The facial whorls present on Lundy Eliza can be seen in the coloured plates at the back of this Annual Report.)

a INTER OBSERVER AGREEMENT AND STATISTICAL VALIDITY

Significant relationships were found between the temperament ratings attributed to the ponies by the two different raters (r statistics significant between $P < 0.05$ and $P < 0.001$). Since the ratings given by Rater 2 (who had known the ponies the longest) covered a greater part of the scale, these were used in subsequent analysis.

b DEMOGRAPHIC ATTRIBUTES AND TEMPERAMENT

1 Age

The average age of the ponies in the herd was 8.89+9.28years, ranging from 2 to 34 years old. None of the 18 temperament ratings were related to age (all r statistics were non significant, $P > 0.05$).

2 Gender

Since there was only 1 male in the group and 17 mares it was not possible to assess the effect of gender on temperament statistically.

3 Colour

The ponies exhibited the full range of coat colours permitted for the breed. 10 (56%) were dun, 7 (38%) were bay and 1 (6%) was cremello. A series of Oneway ANOVAs indicated that colour was only significantly related to three of the 18 temperament ratings: dominant-submissive ($F_{2,17}=4.50$; $P<0.05$), bold-timid ($F_{2,17}=4.26$; $P<0.05$) and independent-dependent ($P<0.05$). Figure 5 illustrates that the cremello coat colour is associated with being more submissive, more timid and more dependent than both the bay and dun coloured ponies. Furthermore bay and dun ponies do not differ significantly from each other on these ratings.

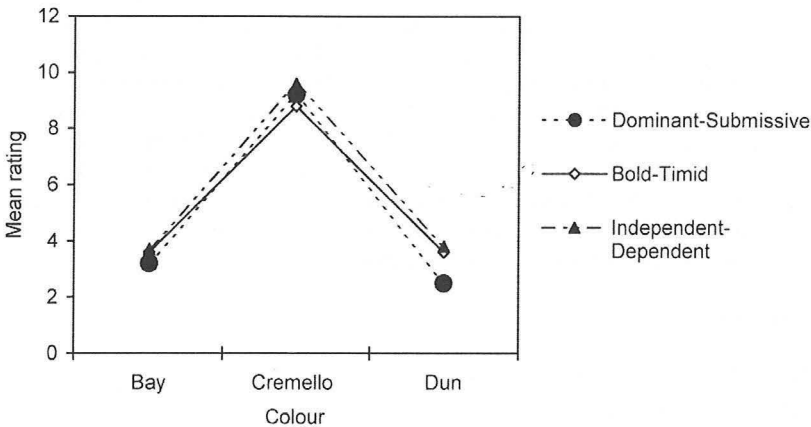


Figure 5. The effect of coat colour on the three significant temperament ratings: dominant-submissive, bold-timid and independent-dependent.

c THE RELATIONSHIP BETWEEN FACIAL WHORL CHARACTERISTICS AND TEMPERAMENT

1 Number of facial whorls

Twelve of the ponies (67%) had a single facial whorl, 5 (30%) had two whorls whilst one (3%) had three facial whorls. The number of whorls was only related to the enthusiastic-wary temperament characteristic ($F_{2,17}=4.40$; $P<0.05$). Inspection of the data indicated that ponies with two facial whorls were significantly more enthusiastic and less wary than those with either one or three facial whorls ($P<0.01$; Figure 6). Furthermore, ponies with three facial hair whorls the most wary of all.

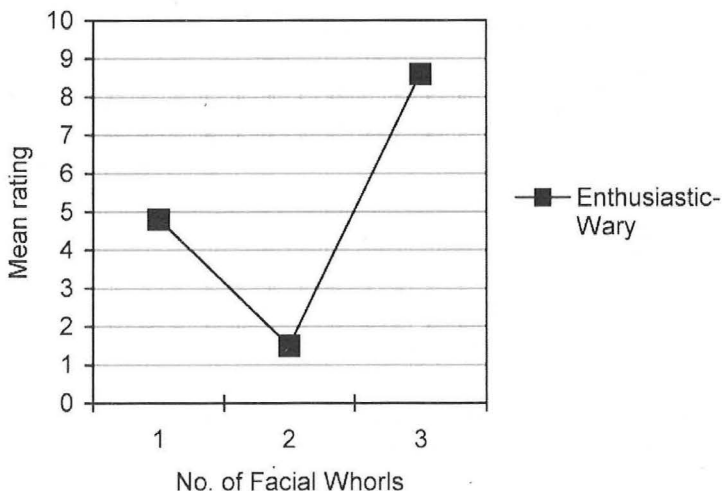


Figure 6. The relationship between number of facial whorls and enthusiastic-wary temperament rating.

2 Vertical position of facial whorls

Half of the ponies (9, 50%) had High facial whorls (*ie.* positioned above eye level), 7 (40%) had Middle facial whorls, whilst the remaining 2 (10%) had Low facial whorls (see Figure 2). There were no significant relationships between vertical whorl position and any of the temperament ratings.

3 Lateral position of facial whorls

Half of the ponies (9, 50%) had facial whorls positioned Centrally between the eyes. Six (33%) had facial whorls positioned to the Left, whilst the remainder (3, 16%) had facial whorls positioned to the Right of the face (see Figure 3). Lateral position was significantly related to 4 of the 18 temperament ratings (in descending order of significance): playful-placid ($F_{2,17}=8.83$; $P<0.01$), enthusiastic-wary ($F_{2,17}=4.22$; $P<0.01$), calm-flighty ($F_{2,17}=6.17$; $P<0.05$) and friendly(sociable)-unfriendly(unsociable) ($F_{2,17}=3.59$; $P<0.05$).

Figure 7 indicates that calm-flighty, enthusiastic-wary and friendly-unfriendly ratings follow similar patterns whereby ponies with whorls to the Left are more calm, enthusiastic and friendly than those with whorls on the Right (who tend to be more flighty, wary and unfriendly). Ponies with facial whorls to the Left also tended to be more placid, whereas those with whorls on the Right were more playful. For all four of these ratings ponies with whorls in a Central lateral position tend to be intermediate on these ratings.

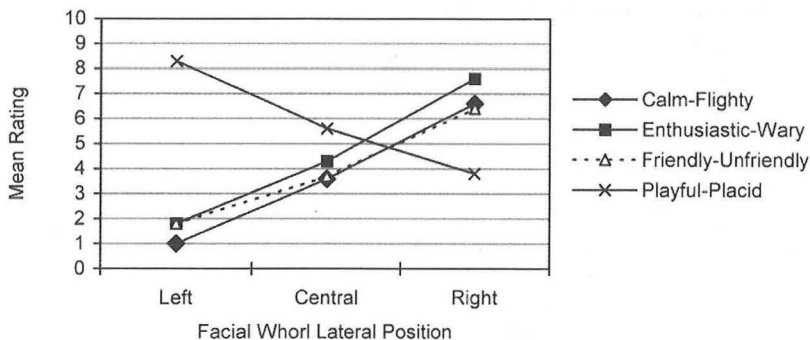


Figure 7. Relationship of lateral whorl position and the four significant temperament ratings: calm-flighty, enthusiastic-wary, friendly-unfriendly and playful-placid.

DISCUSSION

a INTER OBSERVER AGREEMENT AND STATISTICAL VALIDITY

The two independent observers, who did not know each other and had very different experiences of and commitments to, the subjects, rated all of the ponies similarly on all of the 18 adjective pairs representing 18 temperament ratings. Since the rating method employed led to statistically valid results it was scientifically credible, despite having a subjective element (ratings based on perceptions). The ratings given by the two observers for the shy-pushy, easy-difficult and bold-timid aspects of temperament were particularly associated. It could well be that these ratings provide a particularly good description of equine temperament and behaviour in general.

b DEMOGRAPHIC ATTRIBUTES AND TEMPERAMENT

There are a number of attributes of individuals that may be expected to influence temperament, for example, age, gender and colour. It is imperative to rule these potentially confounding factors out before reaching conclusions about the relationship between facial whorls and temperament (Visser *et al.*, 2001). It was not possible for gender to be investigated in this study due to a distribution of one gelding and seventeen mares. Age did not have an effect on temperament. Initially coat colour appeared to be related to equine temperament. However, closer inspection of the data indicated that this finding was an artefact, caused by the single, cremello pony. She was found to be significantly more submissive, timid and dependent than her counterparts. It later emerged that she was hand-reared and although is physically present in the herd, she does not engage in the group activities of the herd (observed during the study described in Randle and Gill, 2003). Not surprisingly, the omission of this pony from the raw data results in a non significant relationship between coat colour and

temperament. Few studies have examined the relationship between coat colour and behaviour, although Mills *et al.* (2002) reported that stereotypic behaviour in equines was not connected to coat colour.

c THE RELATIONSHIP BETWEEN FACIAL WHORL CHARACTERISTICS AND TEMPERAMENT

This study provided evidence of a relationship between both the presence and positioning of facial whorls and temperament in the Lundy Pony. The facial whorl characteristics were typical of those found in other studies of equines (*e.g.* riding school horses, Ryan, 2001 and Brimicombe, 2002 and the Household Cavalry and Royal Horse Artillery horses, Randle, *in prep.*).

All ponies had at least one facial whorl. Ponies with three facial whorls were found to be more wary than those with one single facial whorl. Furthermore, the ponies rated as the most enthusiastic typically had two facial whorls. The proportions of the lateral and vertical positions occupied by facial whorls in the Lundy ponies were similar to those found in other equine breeds. The vertical position of the facial hair whorl did not appear to be related to temperament in the Lundy pony. This does not agree with other studies, but could be due to the small sample size (Visser *et al.*, 2001).

The lateral position of the facial hair whorl did appear to be related to some aspects of temperament (Figure 7). It is interesting to note that for the aspects of temperament found to be significantly related to lateral whorl position, those with central whorls exhibited an intermediate score on the rating. In other words, individuals with whorls to the left or the right were more extreme on temperament rating. These findings agree with those of Lanier *et al.* (2001) who compared the temperament of cattle with whorls 'on' or 'off' (to the left and to the right, combined) the centre line. It was found that cattle with whorls on the centre line exhibited more intermediate and stable temperamental characteristics, than those with whorls off the centre line who exhibited more extreme temperamental characteristics.

It is interesting to note the combination of temperament characteristics that were related to lateral whorl position. Ponies with whorls to the left of their faces appeared to be more amenable (scoring highly on calmness, placidness, enthusiasm and friendliness) than those with whorls on the right (scoring highly on wariness, associated flightiness and likely perceived unfriendliness). From this it could be expected that ponies with whorls positioned to the 'left' tend to be more affable and those with 'right' whorls tend to be more 'difficult'.

Grandin *et al.* (1995) observed that the relationship between temperament and hair whorl position was more easily assessed in cattle that have had little or no contact with humans. The same argument can be applied to this equines. The majority of the few studies that have been carried out on hair whorl position and temperament in horses

have used subjects from a mixture of breeds, origins, backgrounds and management systems (e.g. Swinker *et al.*, 1994; Ryan, 2001; Brimicombe, 2002) all of which are factors which could affect the validity of the results (Visser *et al.*, 2001). The ponies in this study are of the same breed, kept in their natural environment and subject to identical management procedures. Furthermore, and perhaps most importantly, none of them are ridden or manipulated by humans on a daily basis.

This study only focussed on the hair whorls present on the faces of the ponies. It should be noted that whorls may be present on the neck, body and legs of equines (in fact the first author noted that the Lundy ponies had substantially more whorls on their necks than other equine breeds. It is interesting to consider the anecdotal report by Tellington-Jones and Taylor (1995) that according to folklore the more whorls there are on the neck of Icelandic ponies the better they can swim.

Finally, this study only examined one aspect of facial whorls – position. There are many other aspects to be taken into consideration which have been investigated in studies by Grandin and her co workers in the United States and Randle in the UK. These include size, direction, shape and features such as the nature of the epicentre, and of course, combinations thereof.

CONCLUSION

Hair whorl position can be linked to equine temperament. Facial hair whorls may provide a physical feature which could be used to make a rapid assessment of temperament. Although the group studied was small, their management was such that they were not exposed to environmental influences such as constant interaction with humans and the validity of the experiment was not compromised by external variables such as traffic noise or the consistent introduction of novel stimuli. This study indicates that facial whorls are associated with temperament and could therefore provide a simple but useful method of assessing equine temperament.

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