Relationships and Communication in Socially Natural Horse Herds
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**Social Organisation of Horses and Other Equids**

Horses are quite unique. In most mammals, sexes segregate and maintain bonds only during the breeding season (Clutton-Brock, 1989). Some canids, a few rodents and primate species such as gorillas, hamadryas baboons and red howler monkeys are the exception, where the same males stay with the same females all year round and over many breeding seasons. Typically, both sexes disperse at puberty in these species. In horses, it was clearly shown that the causes for female dispersal were incest avoidance and not intra-specific competition (Monard, 1996). As a rule, this is confirmed for mammal species where tenure length by males exceeds the age at first reproduction in females (Clutton-Brock, 1989). When horses are allowed to choose their mating partner freely, the inbreeding coefficient of the offspring is lower than expected should they mate randomly (Duncan et al, 1984).

Two broad types of social systems have been defined in the seven equid species presently alive.  Feral horses, plains *Equus burchelli* and mountain zebras *Equus zebra* typically live in small and permanent family groups consisting of one adult stallion, one to three mares and their common offspring (Klingel, 1972), following the classical definition of families where young animals stay in their parents’ group beyond physical dependence. Przewalski horses *Equus ferus przewalski* adopt the same group type (Feh, unpublished data). Reproductive groups with more than one adult stallion were observed by most authors having studied feral horses or plains zebras (Berger, 1986; Klingel, 1972) and occur in Przewalski horses too. In three populations where detailed data on individual relationships were available, it was clearly shown that some, mostly low-ranking, stallions form alliances based on cooperative coalitions against their rivals (Berger, 1986; Feh, 1999, Schilder, 1990). In all family forming equids, young or sometimes old stallions that have lost their mares to a competitor join up in bachelor groups.

Moehlman (1998) summarized the detailed studies carried out on feral and wild donkeys *Equus asinus* and Ginsberg (1987) on Grévy’s zebra *Equus grévyi*. In both species, males usually defend breeding territories and lasting bonds are found between females and their recent offspring only. Less is known about the social groups in the two remaining species. Kiang *Equus kiang* seem to live in all-male groups, mixed-sexed groups of various numbers, all-female groups and solitary, probably territorial males (Schaller, 1998). Group types seem to vary widely across different populations of Asian asses *Equus hemionus*, the most flexible equid species with regard to its social organisation. In Indian khur *Equus hemionus khur*, males defend breeding territories and only females and offspring associate over longer time periods (Shah, 1993). Persian onagers *Equus hemionus onager* show mixed-sexed and all-male groups (Tatin, 2001), whereas Turkmenian kulan *Equus hemionus kulan* (Raschek, 1973; Solomatin, 1973) and Mongolian khulans *Equus hemionus hemionus/luteus* in the Gobi B National Park live in family- and all-male groups (Feh, 2001; Zhirnov and Ilinski, 1986).

Herds, where several reproductive units associate, engage in the same activities and move around together, sometimes temporarily, sometimes on a permanent basis, are a common feature of equid societies. Temporary herds consisting of several hundred individuals were observed in plains zebras (Klingel, 1972) and kiangs (Schaller, 1998), and we saw up to 1200 Mongolian khulans, composed mainly of family groups with young foals, roaming the Gobi together on numerous occasions (Feh, unpublished data). Permanent herds with up to 12 family groups exist in both Camargue (Duncan, 1992) and Przewalski horses (Feh, unpublished data). The families spread out during winter and gather closely together when the frequency of insects increases in summer. By contrast, in both kiang (Schaller, 1998) and khulan populations (Feh, 2001), herd size increases in winter, when predator attacks by wolves become more frequent and intense.

In family forming equids, stallions are known to actively defend all members of their band against predators, and the permanent bond between stallions and mares in these societies may well have evolved as a response to large and cooperatively hunting predators which traditionally don’t occur in the habitats of the other equid species (Feh, 1994). Phylogenetic inertia appears to play an important role in equid species (Berger, 1988). Regardless of habitat type and resource distribution, horses and plains zebras stick to their family groups, whereas for example, in Grévy’s zebras, stallions and mares consistently segregate.

**Individual Social Relationships and Their Ontogeny**

Throughout their lives, horses have one or two, rarely three, preferred social partners, regardless of the size of the group they live in (Feh, 1987). These ”friends” spend much time together, always rest in each other’s company, approach and follow each other frequently, exchange confident body-contacts and allo-groom. Besides these characteristic basic interactions, they add others according to their sex and age. Young horses play with each other and address submissive gestures towards the adults, adult horses establish a dominance hierarchy, adult stallions drive their families together.

*From birth to weaning*

The first month is the most critical period in a free-living horse’s life. Mortality is at its highest in the days following birth (Berger, 1986; Duncan, 1992), and many deaths are due to accidents, partly because foals become separated from their mothers. Foals of primiparous mothers stand a greater risk of dying than foals of multiparous mares, presumably due to the formers inexperience in defending the foal against other herd members during the first hours and days decisive to bonding. The arrival of a new herd member arouses great curiosity in all other horses, and fathers play an important protective role for they consistently circle the mare with her newborn foal and keep all other individuals at bay. Interestingly, Camargue foals born into families where two stallions formed alliances had a 20% higher chance of survival than foals born into one-male families (Feh, 1999). The first “stranger” to be allowed contact with the new born foal is its older sibling, sister or brother alike, but only after two to three days, once the foal has learned to follow its mother like a shadow (Murbach, 1976). Mutual grooming is initiated by the mother on the day of birth, and first running plays by the foal are performed in circles with its mother in the centre. By the age of two weeks, foals make the acquaintance of their peer, as well as of their father. Fathers groom the foal and tolerate its playfulness, sometimes responding in a very gentle way much different from the more intense bites exchanged during play with their grown up sons. But the preferred play partners of the foal are other foals. By the age of 1 month, both in Camargue (Monard, 1983) and Przewalski horses (Carenton, 1997), male foals played more often and longer than female foals, and in different ways. Whereas colts have a tendency to rear, bite and chase each other frequently, females predominantly kick out with their hind legs. This behaviour mirrors adult fighting techniques. Stallion fights are characterised by bites, rearing and chases, while mares kick at each other when asserting their rank position (Wells, 1978).

Weaning is a conflict between mother and foal. The mother starts to reject the sucking attempts of her offspring in relation to the date of  birth of her next foal. In Camargue horses, most mares gave birth once a year, and the foal was weaned 15 weeks before the arrival of its sibling, at the age of 7 to 8 months. The foals nevertheless continued to stay in their family group and maintain close relationships based on grooming and proximity with their mother, father and older brother or sister. Besides the family members, the peer group became more important. When no foals of the same age were present in its natal group, young males went to play with colts of other families, and young females initiated contact in a similar way. Once its mother had a new foal, the now yearlings took great interest, groomed and played with the newborn and often rested close to it when their mother grazed in a distance (Wells, 1978).

*Adolescence and dispersal*

Young mares gradually emigrate from their natal group between two and three years of age during an oestrous period (Berger, 1986). When other reproductive groups are in the vicinity, most of them leave on their own accord, and are neither expelled nor does aggressiveness by resident females, including their mother, or their father, increase prior to departure (Monard, 1998). When no such groups are around, fathers may chase them out. Mating attempts by all stallions from their natal groups were always actively refused by the young mares, moreover, their mothers frequently intervened. During oestrus, the young females often left their natal groups for a few hours or days, and matings by unfamiliar males from these other groups were always encouraged through presenting. Most of the mares integrated an already existing reproductive unit where they ranked last in the hierarchy. Others, particularly mares with their first foals, were abducted in the days following parturition by young stallions that started their own family.

Young males follow a different path from females. They too leave their natal group between two to three years, but, usually after a short and unsuccessful attempt at monopolizing one or more mares, they end up in an all-stallion group for one or three years, a pattern observed in all feral (Berger, 1986; Feh, 1999) and Przewalski horses as well (Feh, unpublished data). Similar to females, they are chased out by the adult stallion of their group, generally their father, when not leaving on their own. Inside the stallion group, their main activity consisting of play fighting, presumably to measure their respective strength and establish their rank position. Some of the stallions form close bonds at this time. At the age of four to five, they are often seen in the proximity of reproductive units, sometimes in pairs. They investigate all faeces to detect mares in oestrus, and take up contact with young mares at the periphery of their family groups whom they groom frequently with. The high ranking stallions manage, after a while, to monopolize one or two females on their own, while some low ranking stallions team up in pairs to defend mares against their rivals, therefore forming cooperative alliances (Feh, 1999).

*Dominance hierarchy*

Adult horses living in natural social societies where individuals know each other from birth all form stable linear dominance hierarchies based on access to limited resources such as water, food or wind shelter, with occasional reversals and triangles. Remarkably for ungulates, size or weight are not important, whether in males (Feh, 1990) or in females (Duncan, 1992). Both age and order of arrival in the reproductive group are the key factors determining rank position in Camargue (Monard, Duncan, 1996) as well as Przewalski mares (Lescureux, 2001), while mother’s rank influences the rank of their sons in the herd and correlates with their reproductive success (Feh, 1990). Adult stallions are usually dominant over the mares of their family with regard to access to limited resources.

Priority of access to resources is not to be confounded with leadership. Most of the time, one mare initiates the movement and leads the group to drinking or new feeding grounds. Neither in Camargue (Wells, 1978) nor in Przewalski horses (unpublished data) did we found a correlation between this leading position and rank.

**Social Communication**

Horses are open grassland animals, and they rarely lose visual contact with other group members during 24 hours. This may be a reason why their acoustic communication repertoire is remarkably poor for an animal with such an elaborate social system. Typically, horses start to vocalize (whinny) intensely when losing visual contact with their group members. Another reason may be that acoustic signals are averted in order to avoid attracting predators. Only four vocal categories were identified, the nicker, the whinny, the squeal and the roar, in addition to two non-vocal acoustic signals, the snort and the sneeze (Kiley, 1972).

Unfortunately, there are no detailed studies on olfactory communication. Horses spend a great amount of time sniffing objects or smelling conspecifics, but nothing is known about the information they gather or transmit. As with other ungulates and carnivores, horses exhibit  “flehmen,” retracting their nostrils while in- and ex-haling and analysing the scent in their vomeronasal organ which is packed with olfactory nerve cells. This behaviour is present in foals a few hours old when they suddenly are confronted with a strange scent (eg smoke), and specially developed in stallions when they smell the urine or faeces of mares at the onset of oestrus.

***Visual and tactile communication***

Tactile and visual signals are by far the most elaborate gestures in horses. The retraction of a nostril, the twitch of an ear all have meanings to their social partner, and from the point of their nose to the tip of their tails, horses communicate continuously.

The basic expressions are categorized and their social context and function described in Table 1.

**Table 1. Interactions in natural horse societies and their function**Breeds observed: Mustangs (Feist, McCullough, 1976; Berger, 1986), Camargue (Wells, von Goldschmidt, 1979; Feh, 1987, 1993), Przewalski (Tatin, 1995; Feh, unpublished data)

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| **Categories & Actions** | **Description** | **Social context and function** |
|   |   |   |
| Close distanceNearestneighbourApproachFollow |   | All horses with their preferred partners, regardless of age. Relationships are not always symmetrical. Mothers maintain close distance with their foals; yearlings maintain close distance with their mothers. Preferred partners rest together. Function is individual bonding and group cohesion |
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| **Investigation**Nose-nose contactNose-body contact | Often no direct skin contact | Nose-nose sniffing during greeting. Nose-elbow and nose-flank contact typical for stallion encounters and courtship. Nose-genital contacts during courtship and stallion encounters. Function is olfactory information and transmission |
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| **Comfort**RubbingMutual grooming | Flat side of the head against any other body-part. Rhythmical scratching with incisors. Preferred site at base of neck | Rubbing and allo-grooming is shown from the first week of age, by both sexes and throughout life, rubbing in connection with insects. Grooming exchanged between preferred partners. Mother-foal-yearling, father-foal, and peer group for all ages, including adult mares and stallions (alliance-partners only). Low-ranking individuals groom more and initiate more groomings. Function is bonding, group cohesion and appeasement. Allo-grooming at the base of the neck reduces heart rate. |
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| **Play**BiteRearChaseCircleKick | Ear position not flat against neck. Most frequent bites at throat, base of neck and legs. Foreleg kicks during rearing (boxing). Circling around each other in attempt to bite legs. Kicks during chase. | Starting at two weeks. Colts play more (bites, rear, chase) and longer than fillies, who kick more often. Frequency of play peaks in young stallions from 2 to 4 and becomes gradually more intense (superficial wounds). Young mares stop playing once they have their first foal. Adult stallions play with their sons and other young stallions outside the breeding season. Function is training for dominance fights |
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| **Dominance**Bite threats and bitesKick threats and kicksAttack and chase | Ear position flat against neck. Head or rump movement directed against the recipient . Attack often follows unsuccessful bite or kick threat. In certain circumstances, adult stallions can chase young or subordinate stallions as well as young mares for many minutes to make them leave the family group. | Starting at one week. Rank position often not clear in young horses. Dominance hierarchy linear in adults, with few reversals, based on age and arrival in the group for mares. Adult stallions are dominant over adult mares. Function is priority of access to water, food and social partner. In stallions, their mother's rank is correlated with their own rank which is correlated to reproductive success. In herds, there is a linear dominance hierarchy between families. High-ranking groups have better access to high-quality home ranges |
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| **Submissive behaviour**Avoid"Snapping" | As a reaction to bites or kicks, or deliberate.Lips pulled back, rhythmical teeth-clapping. Tail frequently tucked in, back arched. | "Snapping" starts on the day of birth. Only seen in young horses towards adults, up to the first foal in mares, up to founding an own family in stallions. Can be a reaction to aggressive behaviour, or a deliberate action towards the family stallion only, by both sexes.Function is appeasement of adults (?). |
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| **Group cohesion**"Driving" or "Herding" | Ears back, head low and in extension of neck, walking or trotting | Usually adult stallions towards stray mares but also isolated foals. Usually directed away from rivals. Sometimes young stallions towards their younger siblings.Function is group cohesion and maintaining distance from rivals. |
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| **Stallion ritual**DefecationStrikePrance | One stallion defecating over a dung pile is joined by a second stallion. They smell the dung together, toss their heads (squealing), strike alternatively with their forelegs. One stallion leaves while the other defecates, or both stallions leave, prancing, or both stallions defecate at a distance | Starts at around two years. Rank demonstration in relation to mare-ownership. Dominant stallions defecate last. Can escalate into a fight when rank position not acknowledged. Parallel defecation signals mutual acceptance of respective mare ownership. Usually followed by the stallion driving away his family. In alliances, subordinate stallions perform rank demonstrations while dominants drive away the mares. |
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| **Fight**See "play" for actions | Ears flat back, the intensity of the actions is much higher than in play. | Starts at four to five years. Some stallions develop individual fighting techniques, systematically aiming at the throat, ears or tails of rivals, or specialising in boxing. Function is mare ownership. |

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