JOURNAL OF ANIMAL SCIENCE
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J ANIM SCI 1988, 66:2159-2164.

SOCIAL AND ILLUMINATION PREFERENCES OF MARES

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ABSTRACT

The social and physical environmental preferences of horses were studied using preference testing, changes in behavior with changes in the social environment and operant conditioning. The preference of 10 mares for visual contact with other mares was determined by measuring the time spent in a position where they could watch other horses vs a position where they could not. Although horses spent slightly over half their time in a position where they could watch other horses, the time spent where they could watch other horses was not significantly greater than the time spent in the position where they could not. When the behaviors of the same 10 mares in three different social environments were compared, horses with no other horses present were three times more active and spent 10% less time eating than those that could make visual, auditory and physical contact with other horses. Using an operant conditioning technique, each of five horses in a dark environment learned to turn on lights, indicating a preference for a lighted environment.

(Key Words: Horses, Behavior, Social Interaction, Light Regime.)

INTRODUCTION

Certain environmental preferences such as the social, pen size and flooring preferences of pigs and chickens have been studied (Hughes, 1976; Dawkins, 1980). Illumination preferences also have been studied in calves, pigs and sheep (Baldwin and Meese, 1977; Baldwin and Start, 1981). Although horses were one of the first species of farm animals to be intensively managed, their environmental preferences have not received the same attention as have the preferences of some food-producing species. Horses are removed from their natural herd-living social group (Keiper, 1985; Berger, 1986); most are placed in individual stalls, indoors, sometimes with only dim light and no opportunity for visual contact with other horses. The aims of this study were to determine 1) whether horses would choose an environment in which they could have visual and limited physical contact with other horses; 2) whether their behavior changed depending on the social environment; and 3) whether, while living in a dark environment, they would learn to perform a task for a reward of light.

MATERIALS AND METHODS

Social Preferences. Ten adult mares, two Thoroughbreds, one Quarterhorse and seven Standardbreds, were used in this study. The horses were maintained in one of two adjacent pens, the two-horse pen (17.2 × 13.2 m) and the one-horse pen (8.0 × 13.2 m). Each pen contained a three-sided shed or stall (4.8 × 2.4 m in the two-horse pen and 3.1 × 2.9 m in the one-horse pen) to which the horses had free access and a water trough that was heated in the winter. The horses were fed 4 kg of hay from the ground and 2 to 4 kg of grain from tubs twice a day. The nutrient level was enough to maintain or increase their body weight. The horses were studied under three conditions: 1) together, in the two-horse pen with another horse; 2) separated, in the one-horse pen alone,

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[1] Dept. of Physiol., New York State College of Vet. Med.

[2] The authors gratefully acknowledge the assistance of Soroya Juarbe-Diaze, Warren Rivera and Heidi Johnson. We also are grateful to Ellis Loew for measuring the illumination.

[3] Supported by a grant from Humane Information Serv., Inc., St. Petersburg, FL.

Received October 26, 1987.

Accepted April 1, 1988.

but with two other horses on the other side of a metal rail gate in the adjacent pen; or 3) alone, in the one-horse pen alone while no other horses were present in the adjacent pen. In order to measure the separated horses's preference for visual and limited physical contact with other horses, the one-horse pen was divided in half by an L-shaped wooden partition. Each panel of the partition was 2.6 × 6.6 m. The partition blocked the view of the horses when the separated horse stood in the inside angle (blocked). The separated horse could pass from the blocked to the unblocked side by walking around the partition, which was separated from the wall of the pen by 1.4 m on the far end from the two-horse pen (Figure 1). The partition could be rotated so that either the right or left side of the pen was blocked. Each horse spent 1 wk in the separated condition with the right side blocked and 1 wk with the left side blocked.

Behavior of the horses and the side (blocked or unblocked) on which the separated horse stood were recorded from 0700 to 1900 using a videocamera[4] positioned above the pens on an adjacent building and a videorecorder[5] set at one-sixth normal speed. The behavior of each horse under each condition was recorded each minute. The mutually exclusive behaviors were standing, eating, lying, locomoting (walk and trot; canter was not observed), in the stall, miscellaneous behaviors and out of sight. Miscellaneous behaviors included rolling, grooming and elimination. In the together condition the stall was within camera range and, therefore, the position "in stall" could be recorded by the observers. The stall for the second paddock, that for the alone and separated conditions, was out of camera range; therefore, "out of sight" included time in the stall for the alone and separated conditions. Mean environmental temperature during the 2 wk each horse was observed varied from −4 to 15° C.

The paired *t*-test was used to measure the significance of difference between percentage of time spent in an activity under each environmental condition; the behavior of each horse in the together condition served as the control for that animal in the separated condition. The separated condition served as the control for the alone condition. Chi square was used to test the significance of differences in the side chosen in the separated condition. A correlation coefficient between environmental temperature and time spent standing was calculated.

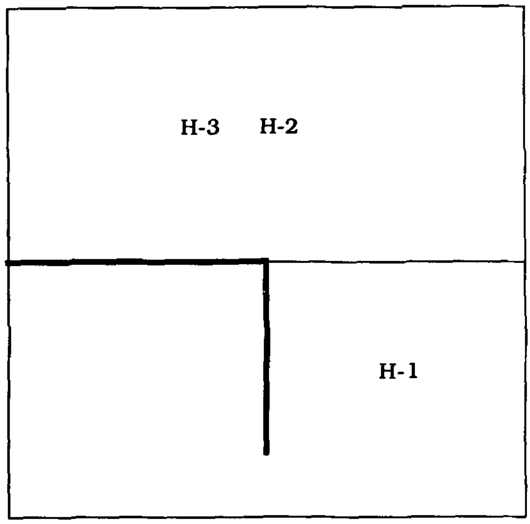

Figure 1. Plan of the social environments. H-1 is the separated horse. The heavy L-shaped line represents the solid partition that blocks visual contact with horses in the adjacent paddock (H-2 and H-3) when H-1 stands on that side. The partition was revolved so that the right and left sides were blocked on alternate weeks. In this case H-1 is standing on the unblocked side. H-2 and H-3 represented horses living in the same paddock. Each horse was tested separated (H-1), together (H-2 or H-3) and alone (as H-1, but with no horses in the adjacent paddock).

Light Preferences. Five Standardbred mares were studied. Each horse was tested in a box stall (3.4 × 5.4 m) in a windowless barn with which it had had no previous experience. Wood chips were used as bedding. The feeding regimen was the same as that in the social preference study. Hay was fed on the floor of the stall, half on each side of the stall; the grain ration was fed in two buckets on either side of the stall. Water was available in two buckets on either side of the stall. Two empty mangers 1 m apart were equipped with photoelectric cells[6]. The horses had not previously seen these mangers. If the horse interrupted the beam in the test manger, the lights, two 300-watt flood lights, positioned 2.6 m above the floor of the stall, were turned on for 1 min. If the beam on

[4] RCA TC1500 Series camera, Univisions, Syracuse, NY 13206.

[5] Panasonic NV-8050, Univisions, Syracuse, NY 13206.

[6] Eico photoelectric relay system, Herbach and Rademan, Philadelphia, PA 19134.

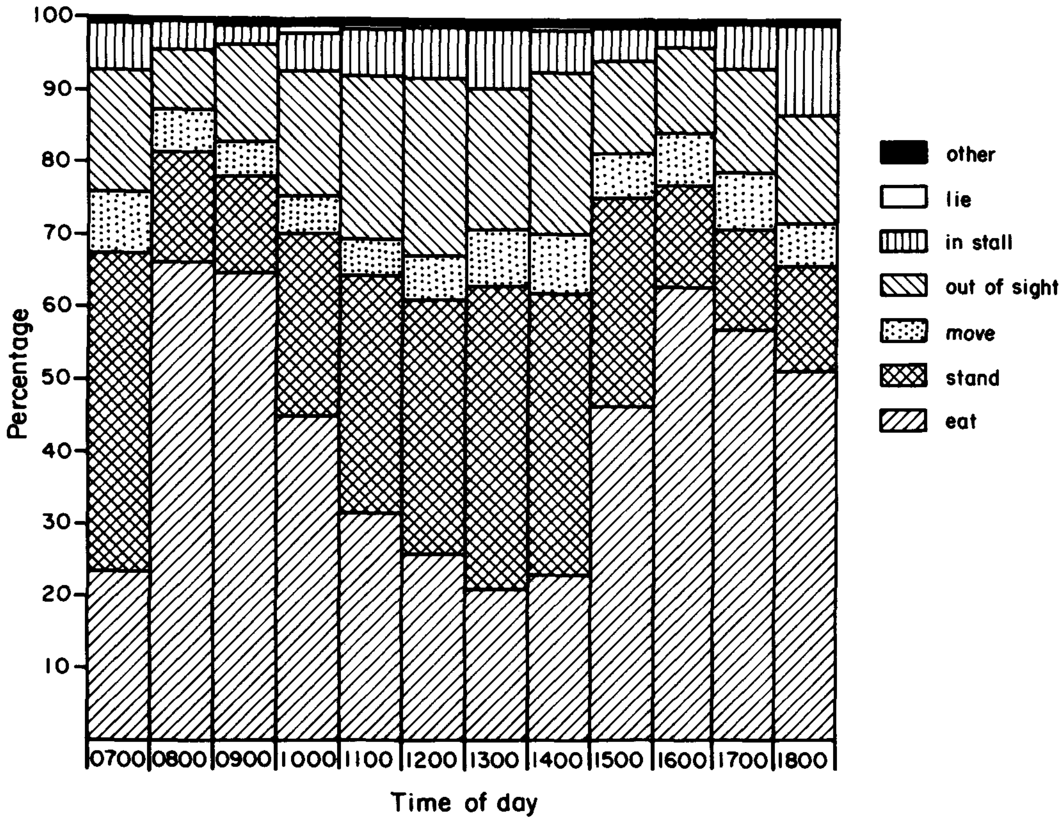

Figure 2. Time budgets of horses in a social group. The behavior of the horses (n = 10) when housed with another horse in an outdoor pen with access to a stall. Behavior was recorded each minute. Fresh hay and grain were provided twice a day (0800 to 0900 and 1500 to 1700).

the control manger was broken, the lights were not turned on. The beam breaks were recorded on an event recorder[7]. Each horse remained in the stall for 2 wk. During the 2nd wk the former test manger became the control manger, and vice versa. This reversal procedure was used in order to control for side preferences.

Light intensity was measured at the level of the horse's head using a photometer[8] in the pen. When the overhead bulbs were not lit, the light was 2.2×10^{-3} to 6.2×10^{-1} lx during the day and less than 10^{-4} lx at night. When the bulbs were lit, the light levels were 40 to 4,000 lx, depending on the direction in which the light was measured and the distance (0 to 2 m) from the spot directly below the lights.

The paired *t*-test was used to measure significance of the differences between interruption of the beam in the control and light activating manger.

RESULTS AND DISCUSSION

Social Preferences. Time budgets of the horses under three social conditions are shown in Figures 2 through 4. When behavioral patterns of horses in the various conditions are considered, several differences in behavior emerge that depend on the social environment. Solitary horses (alone condition) walked or trotted more often ($P < .05$), 24.7 ± 6.3% of the observations, than they did in the separated condition in the same paddock, when they were moving during 7.2 ± .6% of the observations (Table 1). The increase in moving appears to

[7] Esterline-Angus Minigraph, Cole Parmer Instruments Inc., Chicao, IL 60648.

[8] Calibrated photodiode, EG and G, Salem, MA 01970.

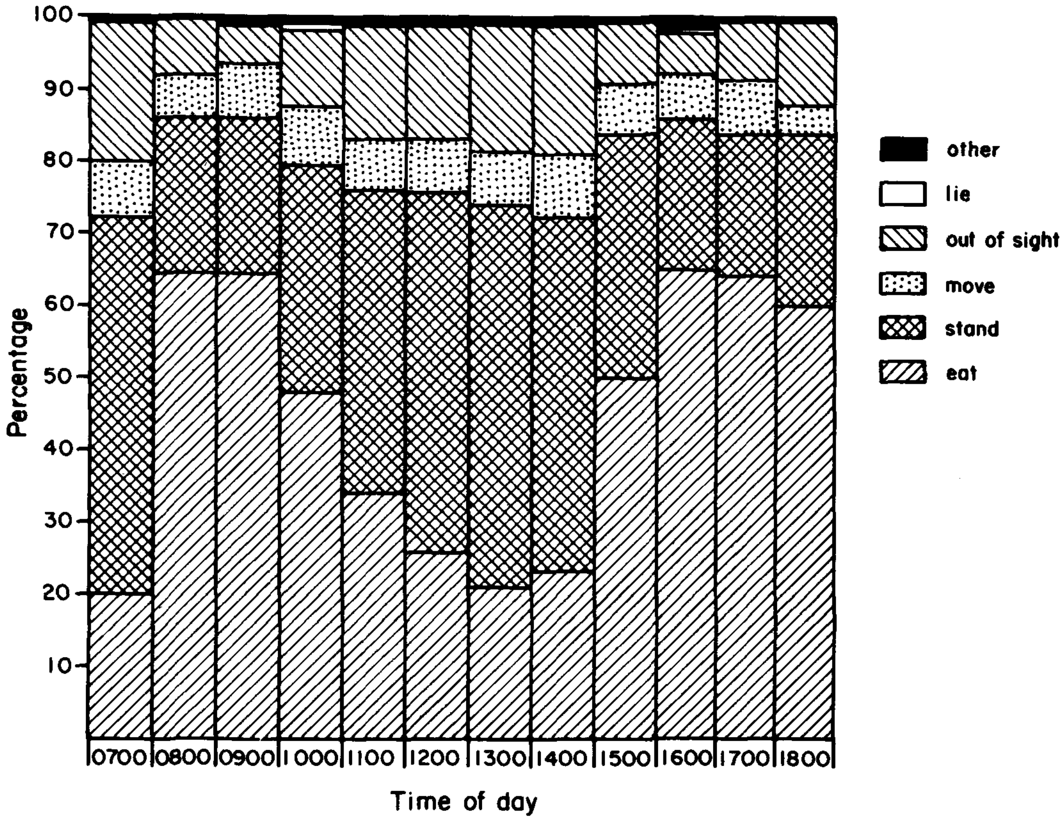

Figure 3. Time budgets of horses living next to other horses. The horses (n = 5) were housed alone in a pen, but had the opportunity to make sensory and physical contact with two horses in an adjacent pen. Behavior was recorded each minute. Fresh hay and grain was provided twice a day (0800 to 0900 and 1500 to 1700).

have taken place at the expense of feeding time, rather than of standing time. Feeding occurred during 28.9 ± 1.8% of the observations of the horses in the alone condition, which is less ($P <$ .05) than 44.7 ± 2.7% of the observations spent feeding in the separated condition. Standing time was not significantly different between the alone condition (22.0% ± 7.8%) and the separated condition 33.4 ± 4.7%. The horses in the together condition spent 42.9 ± 2.5% of the observations eating and 27.2 ± 2.3% standing, not significantly different from their behavior in the separated condition.

When alone, the horses ate less and walked more. An increase in activity in stressful situations, such as weaning, has been noted in other

TABLE 1. MAJOR ACTIVITIES[a] OF MARES IN THREE SOCIAL ENVIRONMENTS

Behavior	Alone	Separated	Together
Stand	22.0 ± 7.8	33.4 ± 4.7	27.2 ± 2.3
Eat	28.9[b] ± 1.8	44.7[c] ± 2.7	42.9[c] ± 2.5
Locomote	24.7[b] ± 6.3	7.2[c] ± 0.6	6.7[c] ± 0.4
In stall	23.6 ± 12.2	11.7 ± 2.4	5.0 ± 1.3

[a]Means ± standard error of the mean.

[b,c]Mean in a row with different superscripts differ ($p < .05$).

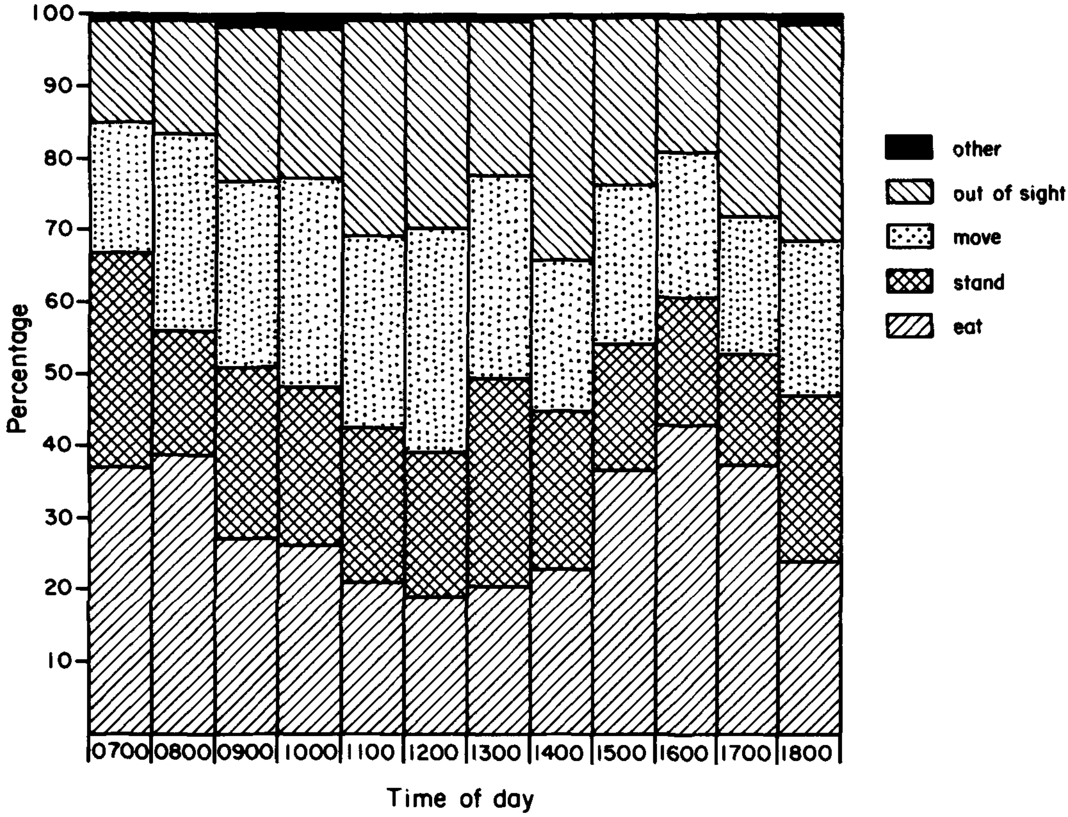

Figure 4. Time budgets of horses living alone. The horses (n = 5) were housed in a pen alone and with no access to other horses. Behavior was recorded each minute. Fresh hay and grain was provided twice a day (0800 to 0900 and 1500 to 1700).

studies (Houpt et al., 1983) and has been correlated with an increase in corticosteroids (McCall et al., 1987). The horse in the alone condition could not see, hear or smell other horses, and their behavior was different from their behavior when they were in the separated or together conditions. Because equine behavior was changed when they were alone, the data lend support to the hypothesis that when separated by a partition (the separate condition) they were aware of the horses' presence on the other side of the partition. It would be of interest to observe horses confined on the blocked side of the paddock or in similar circumstances in which they had auditory and olfactory, but not visual or direct, contact with other horses to determine whether they act more like horses in the alone condition or more like horses in the separated condition.

The horses spent approximately equal amounts of time on each side of the paddock, the visually blocked and the unblocked side. When no horses were present in the adjacent paddock (alone condition) the horse spent 54.9 ± 1.9% of its time, or 6.6 h/12h, on the unblocked side ($P > .05$). When other horses were present (separated condition), the horse spent 52.4 ± 8.3% of its time on the unblocked side ($P > .05$). This indicates that although horses spent no more time in a position where they can make visual and some physical contact with other horses, they spent over 6 h of the 12 h they were observed per day in visual contact with horses. The horses may be aware of the presence of the horses on the other side of the partition through other senses, in particular, audition.

Changes in the physical environment were associated with changes in the horses' behavior. In the separated condition the time spent standing was negatively correlated with environmental temperature (r = −.803). In the

TABLE 2. MINUTES LIGHTS TURNED ON BY MARES

Mare	Per 4-h period ending at: 1000	1400	1800	2200	0200	0600	Per day
49	8	5.5	12.5	5.3	3.6	1.2	36.1
50	17.5	13.5	2.9	14.0	18.5	23.5	89.9
51	31.1	18.3	9.2	2.6	2.3	3.8	67.3
43	13.7	3.9	9	2.4	3.4	2.6	35.0
36	20.7	11.5	18.9	10.2	10.2	5.3	76.8
$\bar{X}$	18.2	10.5	10.5	6.9	7.6	7.3	61.0
SEM	3.9	2.6	2.6	2.3	3.1	3.7	11.0

alone and separated condition, the out-of-sight condition indicated the time spent in the stall. The horses spent only 5 to 12% of the time in the stall, and this percentage was not correlated with weather conditions.

Light Preferences. The mares turned on the lights by breaking the test beam 61.0 ± 11.0 times/d. Because the lights remained on for 60 s after each interruption of the beam, they received light for approximately 1 h/d. They interrupted the control beam less often (18.1 ± 3.3 times/d, $P < .02$). The times at which the horses turned on the lights are given in Table 2. The horses turned the lights on most often in early morning from 0600 to 1000. Further experiments in a stall isolated from all environmental cues will be necessary before circadian rhythms of this behavior can be identified.

When the manger that controlled the lights was changed (from right to left or vice versa), the rate of responding for light fell from 94.4 ± 24.5 times/d on the day before the change to 41.5 ± 7.8 on the day of the change. The horses quickly learned the reversal; by the 2nd d after the change responding had increased to 100.2 ± 28.8. These changes were not statistically significant due to the small number of horses.

Horses are similar to the other farm animals that have been tested in that they will work to receive a reward of light. The number of minutes of light earned per day also is similar to that earned by sheep, pigs and calves (Baldwin and Meese, 1977; Baldwin and Start, 1981). Further experiments are necessary to determine if horses will leave the lights on if a simple on/off switch were available or if they would work harder if another horse were present.

When allowed to control their own environment, horses spent the majority of their time (88 to 95%) outside a stall and half of their time in contact with other horses. They were more active when no other horses were present. Horses worked to increase illumination levels. An environment with some light and an environment with horses in the vicinity appeared to be preferred.

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