An investigation into the effect of floor colour on the behaviour of the horse

Carol A. Hall*: School of Animal, Rural and Environmental Sciences, Nottingham Trent University, Brackenhurst College Campus, Southwell, Nottinghamshire, England, NG25 0QF.

Helen J. Cassaday: School of Psychology, University of Nottingham, University Park, Nottingham, England, NG7 2RD.

* Corresponding author: carol.hall@ntu.ac.uk

Telephone number: +44 (0)1636 817012

(Address for correspondence as above)

Abstract

Adverse reactions of the domestic horse to environmental stimuli can be problematic in training and management. Hesitation and alarm reactions to visual features of the ground can occur in both ridden work and when handling horses. To assess the effect of one visual feature (colour) on the behaviour of the domestic horse, the reactions of sixteen riding horses to eight different coloured mats were recorded. The effect of stimulus position on these reactions was assessed by presenting them in two different positions, either on the ground (where the horses had to walk over them) or against a wall (where the horses walked past them). Each colour/position combination was presented twice in order to assess the effect of previous experience. An alleyway was constructed to allow the horses to be tested unconstrained and freely walking throughout. The time taken to traverse the alleyway and the observed reaction to the colour was recorded. Significant differences in both measures were found in relation to the position of the colour and whether the subject had previous experience of that colour/position combination. The initial presentation of the colours on the ground produced the highest percentage of adverse reactions. Certain colours encountered for the first time on the ground (yellow, white, black and blue) were found to cause a greater number of adverse reactions than others (green, red, brown and grey) and an increase in the time taken to traverse the alleyway. Although a significant difference in relation to colour was found in the behaviour observed during the second presentation on the ground, no difference was found in relation to the time taken to traverse the alleyway. No significant effect of colour was found when the coloured stimuli were presented against the wall. These findings have important implications for situations where the colour of flooring could be controlled in order to minimise adverse behavioural reactions, in particular during initial training.

Keywords: Horse; Colour aversion; Flooring; Vision

1. Introduction

The ability to predict the reaction of the horse to different stimuli is an important factor in their management and training. When training horses to perform a simple task of visual discrimination, it was advantageous to present the stimuli at ground level as opposed to at a height of 70 cm (Hall *et al.*, 2003). The relative salience of the stimuli in this position indicates the importance of the assessment of ground conditions to a prey species such as the horse, whose safety is reliant on the ability to flee from predators.

The visual features of flooring have been found to cause hesitation and alarm reactions in horses as well as in other species. Sudden changes in colour or texture, particularly of flooring and loading ramps, in the handling and transportation facilities for livestock (cattle, pigs, sheep and horses) have been suggested as the cause of hesitation or stopping, possibly to assess whether this change signifies a hole or uneven area (Grandin, 1989). Black rubber matting commonly is used in stables and for trailer and horsebox ramps, and the reluctance of some horses to walk up these ramps or enter an enclosed area may be partially the result of the texture or colour of this flooring. One horse that refused to walk up a black trailer ramp, although still hesitant, did walk up once a dark red carpet had been placed over it (Lucas, 1999). This could possibly be the result of a change in the texture of the ground surface, but also could relate to the colour.

Certain features of the equine visual system may help to explain this sensitivity of the horse to ground level stimuli. The tapetum lucidum increases retinal sensitivity by reflecting light back through the photoreceptor layer. In the horse this reflective layer is located in the upper half of the retina, thus increasing sensitivity to light, particularly that reflected from the ground (Ollivier *et al.,* 2004). The amount of light entering the eye from above is further limited by the corpora nigra (projections along the dorsal margin of the pupil), which shade the lower half of the retina and accentuate information from the inferior visual field (Davidson, 1991).

The results of previous studies of colour vision in the horse (Grzimek, 1952; Pick *et al*., 1994; Macuda and Timney, 1999; Smith and Goldman, 1999; Ver Hoeve *et al.*, 1999; Yokoyama and Radlwimmer, 1999; Macuda, 2000; Carroll *et al*., 2001), suggest that the horse is dichromatic and has the ability to see a limited range of colours. However, a more extensive study into the ability of the horse to perceive colours demonstrated their ability to use chromatic information from across the visible spectrum, yellow and blue being the easiest for them to discriminate from grey (Wyldes, 2004). These behavioural findings are consistent with the peak sensitivities of the cone photopigments of the horse (429 and 545 nanometres; Macuda, 2000). These wavelengths appear in the blue (429 nm) and yellow (545 nm) parts of the visible spectrum.

However, only anecdotal evidence as to their reactions to colours is available, the majority of which refers to avoidance reactions where the horse moves away from or refuses to approach. The reaction to a visual stimulus can be assessed by recording the difference in the time taken for a horse to walk over a given distance when that stimulus is either present or absent (Mackenzie and Thiboutot, 1997) and by the observation and scoring of associated behaviour (Wolff *et al.,* 1997). For example,

Saslow (1999) trained horses to walk freely down a constructed alleyway and used changes in their speed of approach as well as behavioural reactions as measures of their first perception of that stimulus. The time taken to negotiate the alleyway was found to relate to the visibility of the stimulus, with the widest and most highly contrasting stimuli causing the greatest slowing of the horses' walk. To assess whether colour affects the behaviour of the horse, particularly when located on the ground, a similar methodology was used in the present study.

The present study was conducted to test whether individual colours cause different behavioural reactions in the horse and whether the position and previous experience of that colour affect the response.

2. Method

2.1 Subjects

The subjects used were 16 riding horses, 6 mares and 10 geldings, of various types from the Brackenhurst Equestrian Centre, Nottingham Trent University. Their ages ranged from 4-20 years with a mean age of 11.3 years, with heights of 152-172 cm and a mean height of 159.8 cm. When taking part in the study the horses all wore head-collars from which the lead ropes had been removed. Two of the subjects were shod all round, the rest being shod in front only. All horses had been turned out for the summer but were still handled on a daily basis.

2.2 Coloured stimuli

Eight different coloured mats, 1.5 m x 2 m, were produced. They consisted of identical pieces of cord carpet originally oatmeal in colour and rubber backed. Each piece was sprayed a different colour using Plasti-kote Super Spray paint

(manufactured in the U.S.A. by Plasti-kote Co inc.). Spraying was repeated until a consistent appearance was obtained. The paint colours used are listed in Table 1.

The texture of the carpet produced a consistent matt appearance even though some of the paints were supposed to result in a gloss finish. An alleyway was constructed (Figure 1) within which the coloured mats were displayed in one of two positions.

2.3 Test design

The coloured stimuli were presented in one of two positions (on the wall or on the ground) that necessitated the horse either walking past or over the stimulus. The data analysed in the study by Saslow (1999) were taken from the first trip of a two-way trial due to less reaction being shown on the return trip. In the present study two consecutive presentations of each colour/position combination were made. The reactions shown by the horse on the first and second trips were compared to determine whether behaviour in response to colour was similarly affected by habituation to the stimuli.

All three studies were conducted in daylight between 10 am and 3 pm. The light conditions varied throughout the test period but any effect that this may have had on the reactions of the horses to the mats was randomly distributed across all conditions and mat colours. This would be similar to the light variation naturally experienced by the horse and would not have impacted on the results of this study, but would have increased their relevance when applied to everyday situations.

2.4 Test area and apparatus

A 10.5m long and 1.5m wide alleyway was constructed on a level concrete surface along the back wall of a stable block. The stable wall was 14.5m long and consisted of a 2.1m high vertical wooden wall, above which was a pitched roof. This formed one

wall of the alleyway, the other being constructed of three galvanised wire mesh barriers, each 3.5m long and 1.2m high, linked together at the base. The barriers were positioned to leave a 2m length open at either end of the alleyway to allow access for the subjects. The 1.5 x 2m coloured stimuli were presented in one of two positions, either hung from the stable wall requiring the subjects to walk past them or on the ground requiring the subjects to walk over them. Metal hooks were screwed into the wooden stable wall from which to hang the coloured mats. Square section ($10cm^2$) wooden poles 2.75m long were laid either side of the alley to secure the coloured mats to the ground. Both fixings were left in place regardless of the position from which the stimulus was being presented. The fixings were positioned to display the stimuli halfway down the alleyway, the central point being 7.25m from either end of the stable wall. The ground surface was roughened concrete and level. The colour of the background on which the colour was displayed at the two levels (wooden stable wall or concrete ground) was unavoidably different. All horses were used to walking along this part of the yard, although without the presence of the metal barriers. See Figure 1 for a plan of the construction of the alleyway (the horse is shown at one end; for starting at the other end, the position of the horse and the handler with the bucket were reversed).

2.5 The scoring of behaviour

Behaviour was recorded using a Sony Video8 Handycam (Sony, U.K.) video camera and observations recorded on prepared sheets. The behaviour was scored by two observers and confirmed by observation of the videotape. A scale of 1-6 (Table 2) was used to record the behaviour of the subjects as they walked down the alleyway, with a score of 1 indicating no change in speed or behaviour and a score of 6 indicating the subject stopped and did not continue despite “encouragement” (encouragement being

158 defined as shaking the feed bucket, calling the name or saying “walk on”; no physical
159 contact was made). Behavioural scores of 2 and above indicated that the coloured mat
160 had been noticed, those of 3 and above that an adverse reaction had been recorded.

161 The location in the alleyway where the reaction occurred was also recorded as
162 follows:

163 At the start of the alleyway
164 Before the mat (the last stride before reaching the mat was recorded as
165 being directly in front of the mat)
166 Directly in front of the mat (the last stride before treading on or past
167 the mat)
168 On / adjacent to the mat
169 After the mat

170

171 The passage through the alleyway was timed using a stopwatch. Timing commenced
172 when the subject’s first front foot passed the first upright of the metal barrier and
173 stopped as its first front foot passed the last upright. Timing was thus over a distance
174 of 10.5 m and was carried out by an observer with a stopwatch. A cut off time of 60
175 seconds was allocated to trials where the subject refused to proceed, despite the use of
176 the standardized prompts, to enable this data to be included in the analysis.

177 *2.6 Pre-test training*

178 Pre-test training entailed the subjects learning to walk freely and without hesitation
179 down the alleyway before the addition of the coloured mats. Each subject was led to
180 the fenced alleyway; eight horses starting at the right end, eight at the left end. A
181 handler was positioned at each end of the alleyway, the one at the opposite end to the

subject holding a bucket containing a handful of commercial feed. The subject was released and encouraged to walk down the alleyway by the receiving handler shaking the bucket containing the nuts gently and calling the horse's name. During the first trial a handler walked alongside the horse but on the outside of the alleyway. Once the horse had reached the end, it was allowed some feed from the bucket, held stationary for 5 seconds then led out of the alleyway, turned round and the process repeated from the opposite end. This process was repeated until the subject would walk without hesitation directly to the bucket at the end of the alleyway, (ignoring an observer positioned approximately 10m away outside the alleyway and the video camera mounted on a tripod). All subjects reached this criterion within four trials. The times were recorded for each subject during the pre-test training and compared with those recorded during the test phase.

2.7 Test procedure

The colour and position of the mat (on the wall or on the ground) was constant for each pair of trials, the first and second presentations being approached from opposite ends of the alleyway. Each colour / position combination was presented to all 16 subjects. The sequence of presentation and direction from which they were first approached being randomly allocated to each subject and counterbalanced to control for any effect of order of presentation or variation in ambient light conditions. At the start of each trial, the subject was walked to the starting line, released by one handler and received by a second handler at the other end of the alleyway. After being allowed some feed from the bucket, the subject was led out of the alleyway, turned round and the process started again from the opposite end. After completing the pair of trials, the subject was returned to the stable for a period of least 1 hour before

participating in the next trial. Each subject took part in a maximum of four separate pairs of trials per day. The study was carried out over a four-week period.

2.8 Data analysis

The percentage of trials resulting in each of the behaviour scores (1-6), the mean behaviour scores and mean times were calculated for each condition to allow comparison of the effect of each variable (colour, position and past experience) on behaviour. The number of reactions that occurred at each of the designated locations within the alleyway was recorded, and each was then calculated as a percentage of the total number of reactions recorded. All statistical analyses were carried out using SPSS 9.0 for Windows. The Kolmogorov-Smirnov test of normality confirmed that the data were not normally distributed and that non-parametric tests were appropriate throughout.

The effect of the position of the stimulus (on the wall or on the ground) on the behaviour scores and times was assessed using the Wilcoxon test. The effect of previous experience (first compared with second presentation) on these measures was also assessed using the Wilcoxon test. Mean behaviour scores and times were calculated for each of the colours and the Friedman test used to assess whether there was a significant difference in the responses of the subjects to the eight individual colours (regardless of position or presentation number). The effect of the different colours was then assessed for each of the different position / presentation number combinations (first and second presentations on the ground and first and second presentations on the wall) using the Friedman test. Two-tailed analyses were used throughout.

3. Results

3.1 Overall performance

In just over half of the trials (51.37%) the subject was recorded as having at least noticed the mat (behaviour scored at 2 or above). Adverse reactions (scoring 3 or above) were recorded for 16.02% of the trials. The more extreme avoidance reactions were uncommon. In only two trials did the horse stop and refuse to continue, reversing backwards out of the alleyway and scoring six (the same subject during the first and second presentation of yellow on the ground).

The time taken to traverse the alleyway during the training trials (with no mats displayed) ranged from 4.75 – 25.00 seconds. The speed increased for the first three training trials, then decreased slightly on the fourth and final training trial when the performance of the subject appeared to have stabilised. The time taken during the test trials ranged from 4 – 46 seconds, apart from two of the trials where the cut-off time of 60 seconds was reached and the subject had failed to traverse the alleyway.

The overall percentage of trials that were allocated each behaviour score and the mean times recorded during these trials are shown in Table 3.

3.2 Location of reactions

The locations within the alleyway at which the reactions occurred are shown in Table 4. Almost all of the reactions occurred at the mat, i.e. just before the subject had to tread on it or as the subject reached the point on the wall where the mat was displayed. The next most frequent location for a reaction to occur was on the approach to the mat. Sixteen out of the eighteen reactions recorded before the mat were in response to ground level presentations, five to yellow, three each to black and blue, two to green and one each to brown, white and red. The reactions recorded at the start

of the alleyway were associated with two mats on the ground (black and green) and one on the wall (yellow). All of the reactions on / by the mat were to stimuli on the ground, two to white and one to red. Only one reaction occurred after the mat, associated with black on the ground.

3.3 Effect of position and previous experience

Higher behaviour scores were recorded when the coloured mats were displayed on the ground as opposed to on the wall (Wilcoxon signed-ranks test: $z = 3.07$, $p = 0.002$). The mean behaviour score when the mats were presented on the ground was 2.00 (± 0.63), compared with 1.55 (± 0.39) when on the wall. It also took significantly longer to traverse the alleyway with the mats on the ground ($z = 3.26$, $p = 0.001$). The mean time when the mats were on the ground was 10.01 (± 2.27) seconds compared with 8.26 (± 2.27) seconds when they were on the wall.

Regardless of the position or colour of the mat, previous experience of each combination resulted in a significant reduction in the behavioural reaction recorded (Wilcoxon signed-ranks test: $z = 3.53$, $p < 0.001$) and in the time it took to traverse the alleyway ($z = 2.99$, $p = 0.003$). When the effect of previous experience was assessed separately for the two different stimulus positions only those to the ground level stimuli were significantly reduced on second presentation. The reaction to the coloured mats on the ground was significantly greater when they were encountered for the first time, both in terms of the behaviour scored ($z = 3.52$, $p < 0.001$) and the times ($z = 3.21$, $p = 0.001$).

The combined effect of the position in which the coloured mat was displayed and whether the subject had previous experience of that position / colour combination was found to significantly affect the reaction to it, both in the behaviour scored (Friedman

test: $\chi^2_{(3)} = 28.01$, $p < 0.001$) and the times ($\chi^2_{(3)} = 25.28$, $p < 0.001$). The differences between each of these conditions, as shown by the percentage of trials resulting in behaviour scores of 1 – 6, the mean behaviour scores and the mean times for each condition are shown in Table 5.

3.4 Effect of colour

The overall reactions recorded in response to the eight different colours, regardless of position or previous experience, were found to vary significantly with respect to both the behaviour scored (Friedman test: $\chi^2_{(7)} = 38.12$, $p < 0.0005$) and the times ($\chi^2_{(7)} = 20.96$, $p = 0.004$). However, when the response to the different colours presented in the four different conditions (first/ground, second/ground, first/wall, second/wall) was compared, it was found that there was no significant difference in the reactions shown to the individual colours when they were displayed on the wall (first or second). The mats were noticed in this position, but the reactions to them were not affected by their colour. The colour of the mat only affected behaviour when it was encountered on the ground.

During the first presentations on the ground, colour was found to significantly affect behaviour, both in the scores ($\chi^2_{(7)} = 38.23$, $p < 0.01$) and in the time taken to negotiate the alleyway ($\chi^2_{(7)} = 28.14$, $p < 0.001$). This effect was reduced on the second presentation on the ground, colour having a less significant effect on the behaviour scored ($\chi^2_{(7)} = 15.89$, $p = 0.026$) and no significant effect on the time ($\chi^2_{(7)} = 12.14$, $p = 0.096$).

The initial reactions to the individual colours when presented on the ground are shown in Table 6. The yellow mat was always noticed, produced the highest mean behaviour score and mean time, as well as provoking an adverse reaction in 87.5% of the trials

that it was presented in. The effect of the yellow mat on the time taken to traverse the alleyway varied considerably, as shown in the standard deviation of this measure. The second highest mean behaviour score and mean time was recorded for the black mat although a higher percentage of adverse reactions were recorded for the white mat (50% for white, 43.75% for black). Both the white and blue mats were also recorded as having been noticed more than the black mat. The green and grey mats were noticed least, with the latter also resulting in both the lowest mean behaviour score and mean time (which also showed the least individual variation). The grey, brown and red mats resulted in the lowest percentage of adverse reactions (18.75%).

4. Discussion

The behavioural reaction shown to the coloured mats varied according to both the position in which they were presented and whether the subject had had previous experience of that colour / position combination. Although the behavioural response to the mats was found to relate to their colour when they were on the ground, this was not the case when they were displayed on the stable wall. The results confirmed that the visual appearance of flooring, in this case the colour, is important in determining the behaviour of the horse.

4.1 Effect of position

The attention paid to the ground level stimuli confirmed both the findings of the visual discrimination study (Hall *et al*., 2003) and previous studies into the transportation of livestock, where changes in the colour or texture of ground surfaces caused animals to hesitate or stop (Grandin, 1989). The increased response to the low level colours could have been the result of a change in both the texture of the ground and the sound made by the subjects' hooves. However, as all of the mats were of the

same texture differences found between the individual colours was likely to be caused by the variation in their visual appearance. This is further confirmed by the fact that the majority of reactions occurred before the mat was trodden on. The sensitivity of the equine visual system to stimuli in the lower visual field may also have made these ground level stimuli more noticeable to the horse than those displayed on the wall.

The significantly higher behaviour scores recorded when the mats were presented on the ground could have been partially the result of the necessary lowering of the head associated with looking at the mat on the ground. When the mat was presented on the wall no large head or neck movements were required to see it. However, the overall mean times were found to increase, indicating greater hesitancy in response to the stimuli on the ground.

4.2 Effect of previous experience

As found by Saslow (1999), the response to the coloured mats on the ground was greater when the individual colours were encountered for the first time. Once the subjects had walked over the mat, the second presentation resulted in decreased hesitation and demonstrated the speed at which horses will habituate to novel stimuli if no adverse consequences have occurred. The subject that refused to approach the yellow mat on the ground on either the first or second presentation failed to gain experience of this particular colour / position combination and the extreme adverse reaction remained. No effect of colour on the reactions to the mats displayed on the wall was found either initially or when encountered for the second time.

These results show that colour only mattered, or was only noticed when on the ground. In addition, novel experiences of such ground level colours produced the most adverse reactions. This suggests that in training situations in particular (where

350 novel stimuli are often encountered) the colour of flooring could be controlled to
351 minimise adverse behavioural reactions.

352 The initial reaction shown to the different colours varied with individual subjects,
353 certain colours producing adverse reactions in some, but not all. Differences in
354 temperament may account in part for this variation, but the past experience of
355 individuals varies. Some of the subjects will have had a greater experience of different
356 colours, particularly in relation to changes in the visual appearance of the ground.
357 Given the effect of previous experience found in the present study and the effect of
358 previous experience on various aspects of behavioural reactivity shown in other
359 studies (Jezierski *et al.,* 1999), this is a probable cause of the individual differences
360 found.

361 *4.3 Effect of colour on the ground*

362 Adverse behavioural reactions to the mats on the ground occurred more frequently
363 with certain colours. Those that were highly contrasting (such as the black and white
364 mats), or were perceived as the most colourful (blue and yellow), were found to
365 consistently affect behaviour. The green, red, brown and grey mats were noticed less.
366 By far the strongest and most adverse reactions were shown to the yellow mat. This
367 colour was noticed by all of the subjects the first time it was presented on the ground
368 and resulted in adverse reactions in 87.5% of the trials. Although blue was noticed in
369 81.25% of the trials when on the ground, adverse reactions were only recorded in
370 31.25% of them, less than with the black or white mats.

371 It is likely that the reactions shown to the white and black mats resulted from their
372 strong contrast with the background. Adverse reactions to the white mat were more
373 prevalent than to the black mat. Black flooring is more common in horse management

than white and therefore would have been experienced more frequently. Grey, brown and green are all common ground colours which may have accounted for the lack of reaction shown to them. Although red is not a common ground colour for the horse it failed to elicit adverse reactions. This confirms the findings of a previous study into the ability of the horse to discriminate colours from greys; red does not appear as colourful to the horse as to the human trichromat (Wyldes, 2004). This may explain the preference for red matting over black by the horse described by Lucas (1999).

The contrast between the individual colours of the mats and the different background colours against which they were displayed may have resulted in certain colours being more noticeable. To the trichromatic human observer, for example, some contrasted less with the stable wall than with the concrete of the floor (e.g. red and brown), or vice versa (e.g. grey and white). However, as there was no significant effect of colour on behaviour when the colours, regardless of their contrast, were displayed on the wall in the high position, whether or not they were encountered on the floor was evidently the most important factor in determining the reaction to them.

5. Conclusion

These findings demonstrate that visual stimuli at ground level are more salient to the horse than those at other levels. This is in agreement with the findings of a previous study into the ability of horses to perform a task of visual discrimination. The task was made easier for the horse by presenting the stimuli on the ground as opposed to at a higher level (Hall *et al.*, 2003). In the present study, the colour of stimuli on the ground, but not of the same stimuli in the higher position on the wall, was found to affect the behaviour of the horse. Although the level of the reaction diminished in

most cases once no negative consequences had occurred, the response to the colour of the ground level stimuli continued throughout each pair of trials. Although colour seems to matter most to the horse when associated with a novel situation, its effect continues despite previous experience.

These findings provide evidence that, over and above the effects of stimulus familiarity (that generally reduces adverse reactions), controlling the visual appearance of stimuli can further reduce the incidence of adverse behavioural reactions. Specifically, colour should be considered when selecting floor surfaces for equine areas. This is of particular importance during initial training and when small, contrasting areas are involved, such as the loading ramps for transportation vehicles.

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448 **Table 1:** The paints used to produce the coloured mats (Plasti-kote Super Spray paint,

449 manufactured in the U.S.A. by Plasti-kote Co Inc.)

450

Mat colour	Name of paint colour	Colour number
Black	Gloss black	1100
White	Gloss white	1109
Grey	Medium grey	1105
Brown	Chestnut brown	1123
Blue	Royal blue	1134
Green	Lawn green	1126
Yellow	Yellow	1115
Red	Bright red	1120

451

452 **Table 2:** Behaviour of subjects walking down the alleyway and the related scores

453

Behaviour	Score
Walks over/past mat without hesitation (or trots)	1
Looks but does not hesitate	2
Slows, looking at floor/wall/mat (or shies) but does not stop	3
Stops at some point (<10 seconds) but continues without encouragement	4
Stops (>10 seconds or steps back) but continues with encouragement	5
Stops and does not continue despite encouragement (or U-turn/reversing)	6

454

455 **Table 3:** The overall percentage of trials that resulted in each behaviour score and the

456 mean times recorded for each score

457

Behaviour scored			Percentage of trials	Mean times (± SD)
1			**48.63**	**7.87** (± 1.59)
2	**Noticed the mat**		**35.35**	**8.15** (± 0.95)
3		**Adverse reaction to the mat**	**8.79**	**9.72** (± 3.27)
4			**4.69**	**17.91** (± 8.32)
5			**2.15**	**24.70** (± 9.00)
6			**0.39**	**60.00** (± 0.00) **(cut-off time reached)**

458

459 **Table 4:** The number of trials that resulted in a reaction being recorded for each

460 location within the alleyway

461

Location of the reaction	Number of trials	Percentage of reactions
At the start	3	1.14 %
Before the mat	18	6.85 %
At the mat	238	90.49 %
On / adjacent to the mat	3	1.14 %
After the mat	1	0.38 %

462

463 **Table 5:** Percentage of trials resulting in behaviour scores of 1 – 6, mean behaviour

464 scores and the mean times for each condition

465

MEASURES		HIGH POSITION (Wall)		LOW POSITION (Ground)	
BEHAVIOUR SCORES		First presentation (% of trials)	Second presentation (% of trials)	First presentation (% of trials)	Second presentation (% of trials)
1		50.78	60.94	31.25	53.13
2	NOT	41.41	35.16	32.03	32.03
3	ADVERSE	3.91	3.12	16.41	11.72
4	ICED	2.34	0.78	14.06	0.78
5		1.56	0.00	5.47	1.56
6		0.00	0.00	0.78	0.78
MEAN BEHAVIOUR SCORES (± SD)		1.63 (± 0.54)	1.47 (± 0.31)	2.33 (± 0.70)	1.68 (± 0.60)
MEAN TIMES (± SD) (seconds)		8.37 (± 2.58)	8.16 (± 1.90)	10.80 (± 7.45)	9.23 (± 6.22)

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Table 6: Percentage of trials resulting in behaviour scores of 1 – 6, mean behaviour scores and the mean times for each colour when presented for the first time on the ground

MEASURES			COLOURED MATS							
BEHAVIOUR SCORES			Black (% of trials)	White (% of trials)	Grey (% of trials)	Brown (% of trials)	Blue (% of trials)	Green (% of trials)	Yellow (% of trials)	Red (% of trials)
1			25	12.5	56.25	31.25	18.75	56.25	0	50
2	NOTICED		31.25	37.5	25	50	50	18.75	12.5	31.25
3		ADVERSE	12.5	31.25	12.5	12.5	6.25	12.5	37.5	6.25
4			18.75	18.75	6.25	6.25	12.5	6.25	37.5	6.25
5			12.5	0	0	0	12.5	6.25	6.25	6.25
6			0	0	0	0	0	0	6.25	0
MEAN BEHAVIOUR SCORES (±SD)			2.63 (± 1.41)	2.56 (± 0.96)	1.69 (± 0.95)	1.94 (± 0.85)	2.50 (± 1.32)	1.88 (± 1.26)	3.56 (± 1.03)	1.88 (± 1.20)
MEAN TIMES (SECONDS) (±SD)			11.54 (± 6.42)	9.75 (± 4.97)	8.87 (± 3.54)	9.26 (± 4.35)	10.4 (± 5.57)	9.56 (± 4.79)	18.27 (± 14.64)	9.71 (± 6.18)

475 **Figure 1:** Plan of the alleyway used to present the stimuli (referred to as coloured
476 mats) either on the ground (position A) or on the stable wall (position B). The horse is
477 shown at one end; for starting at the other end, the position of the horse, start and
478 finish lines were reversed. All dimensions are shown in metres.

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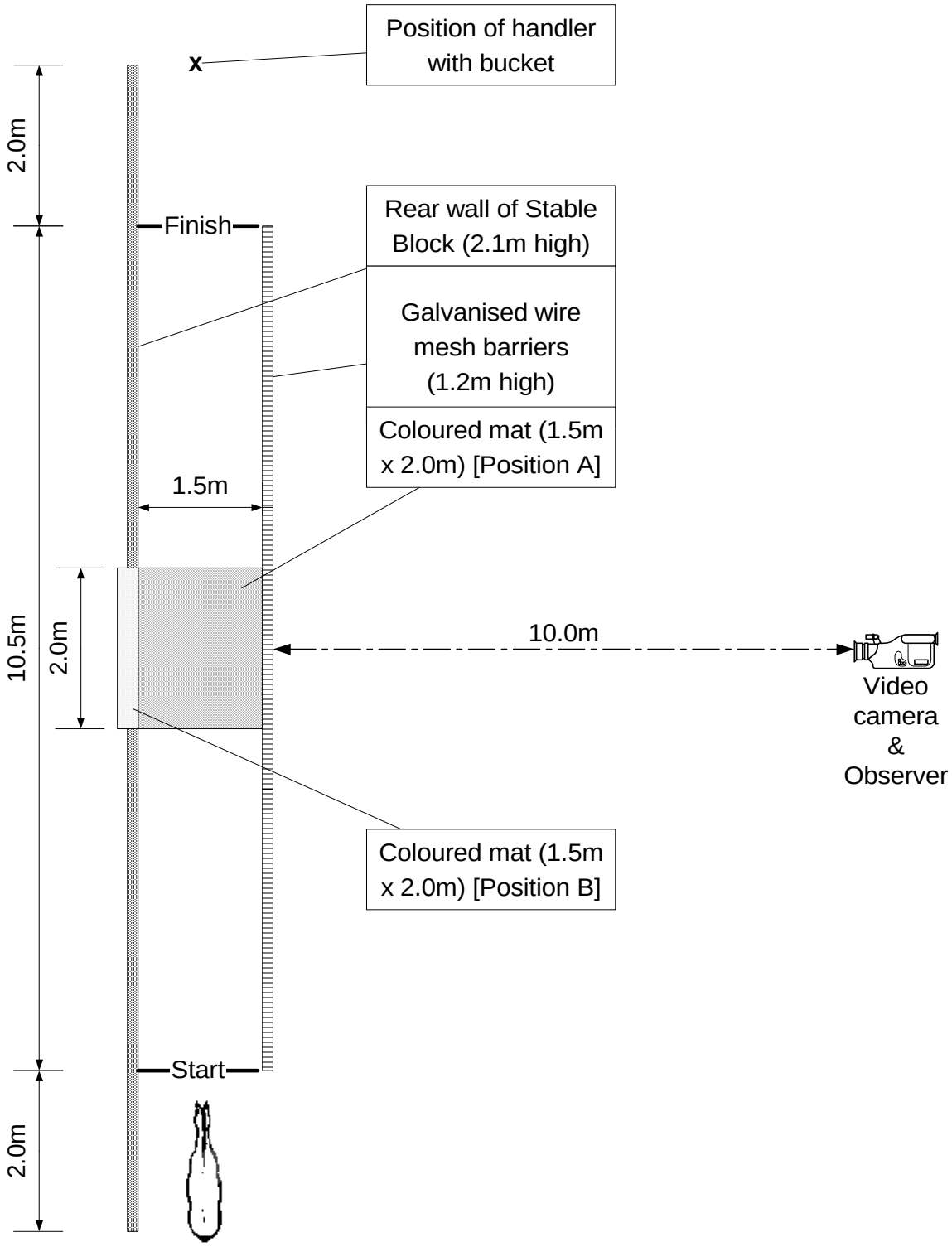

482

483 Figure 1.