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Preliminary studies on visuo-spatial cue use in horses

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A number of discrimination learning studies suggest that horses attend to spatial cues in preference to visual ones. However, global and relative spatial cues have generally been confounded so it is not clear what information horses actually used. There has also been no study of whether one cue is learnt at the expense of another, or whether multiple cues are encoded but prioritised differently. We therefore carried out a series of studies examining how horses use different cues in learning a food-finding discrimination task. All studies used a criterion for success of 7/10 on two consecutive days (binomial test, $p=0.0004$).

A pilot study showed that horses could discriminate between three buckets using visual cues (striped, chequered or plain patterns). All four subjects performed significantly above chance levels, although one horse's performance did not meet the criterion. Three others completed the task in between two and 12 sessions. There were some indications that horses tried to solve the task using irrelevant spatial information.

Nine foals were then taught to find a food reward using the same three patterned buckets placed in a row in any corner of a test arena. In Stage 1 the rewarded bucket was signified both by visual cues (pattern) and by relative spatial cues (left, middle or right position). Foals took between 2 and 10 days to complete the task, whereupon the cues were separated. Foals then had to ignore the inappropriate cue in Stage 2. For the Spatial group ($n=5$), only relative position remained relevant; for the Visual Group ($n=4$) bucket pattern indicated the rewarded bucket. Spatial group foals completed Stage 2 faster than Visual group foals (Mann Whitney U, $z=-2.71$, $p=0.008$). Position cues seemed to overshadow learning about visual cues: Visual group foals persisted in responding to the previously correct position and none reached criterion within the maximum available time (15 days to complete both stages).

Finally, five adult horses and one 10 month old filly learnt to find a reward in one of three identical yellow buckets whose position in an array (left, middle or right) and location within the test arena were consistent. On reaching criterion, responses were recorded in two unrewarded probe trials where the buckets were either shifted along the same axis or rotated by 90° . When the array was shifted, five out of six horses chose the previously correct position (binomial test, $p=0.018$) that was now in a new location within the school. Choices were not significantly different from random when the array was rotated, suggesting that the horses had learnt something about global cues even if they did not use them in selecting a bucket.

At the small scale tested, relative spatial cues (position with regard to other goals) seemed to be more important to horses than either visual cues or global spatial cues, though the latter appeared to be encoded to some extent. Reliance on spatial cues may reflect their usefulness in the horse's natural lifestyle in navigating over long distances and feeding on visually similar plants.

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