Shetland ponies (*Equus caballus*) show quantity discrimination

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The complex housing environment and the close contact between humans and horses in equine sports place high demands on the learning capacity of horses. To date only limited information is available on the learning ability of the horse including higher order cognition. A type of higher order cognition is to perceive and discriminate quantities. Several mammals and birds have shown to be capable of discriminating objects due to their quantity (Brannon and Roitman, 2003). With regard to horses, there are only few studies available concerning their numerosity judgment (Uller and Lewis, 2009) and this ability is discussed controversially (Henselek et al, 2012). Possibly, the legacy of "Clever Hans" overshadowed further research on numerical capacity in horses, a horse to whom several psychologists incorrectly attributed the capacity of symbolic calculation (Pfungst, 1907; Rosenthal, 1965). In the present study we wanted to show whether Shetland ponies are able to transfer a previously learned concept of sameness to a numerosity judgment. The base of the test design was a "matching to sample" task, where the ponies had learned to relate abstract symbols to another which were presented on a LCD screen. Three Shetland ponies, which previously solved the matching to sample task, were tested in two test phases. In the first test phase different quantities of dots were presented (1 vs. 2; 2 vs. 3; 3 vs. 4; 4 vs. 5). To exclude discrimination due to the shape of the stimuli, the dots were varied in size and arrangement. The stimuli were presented in a triangular arrangement on the LCD screen; the sample stimulus was presented in the middle above and the discrimination stimuli in the two lower corners (S+ and S-). The pony received a food reward, by choosing the positive stimulus (S+). When the negative stimulus (S-) was chosen, the pony entered the next trial. Each learning session consisted of 20 decision trials. To investigate whether the numerosity judgment was transferable to mixed geometrical symbols (tri-, rectangle, rhomb, dot and cross) a second test phase was designed. All of the three Shetland ponies met the learning criterion of the first test phase (80% correct responses in two consecutive sessions) within the first eight sessions. One pony could transfer all judgments to the mixed symbols (up to 4 vs. 5), another pony up to 3 vs. 5 and the third on the level 2 vs. 3. These are the first reported findings that ponies are able to discriminate up to five objects. The numerosity judgment seemed to be easier for the ponies when homogenous objects were presented, than in the case of heterogeneous symbols. The reaction of the ponies occurred within few seconds, suggesting that the animals used subitizing for their numerosity judgment.

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