

### Mirror on the wall, who is the horsest of our all? Self-recognition in *Equus caballus*

Paolo Baragli<sup>1</sup>, Elisa Demuru<sup>2</sup> & Elisabetta Palagi<sup>2,3</sup>

<sup>1</sup> Dipartimento di Scienze Veterinarie, Università di Pisa, Pisa, Italia

<sup>2</sup> Museo di Storia Naturale, Università di Pisa, Calci (Pisa), Italia

<sup>3</sup> Istituto di Scienze e Tecnologie della Cognizione, Unità di Primatologia Cognitiva, Consiglio Nazionale delle Ricerche, Roma, Italia

Mirror Self-Recognition (MSR) is an extremely rare capacity in the animal kingdom that reveals the emergence of complex cognitive capacities (de Waal 2008). So far, MSR has been reported only in humans, chimpanzees (Gallup, 1970), bottlenose dolphins (Reiss and Marino, 2001) and Asian elephants (Plotnik et al, 2006), all species characterized by a highly developed cognition. There is growing evidence that domestic horses possess high cognitive abilities, such as cross-modal individual recognition (Proops et al, 2009), triadic post-conflict reunion to maintain social homeostasis (Cozzi et al, 2010), complex communicative systems (Whatan and McComb, 2014), flexibility in problem-solving (Lovrovich et al, 2015), and long-term memory (Hanggi and Ingersoll, 2009). All these capacities make horses a good candidate to test the ability of MSR in a domestic species. Through a classical MSR experimental paradigm (de Waal 2008) we tested eight horses living in social groups under semi-natural conditions (from the Italian Horse Protection rescue centre). Animals showing MSR typically go through four stages (Plotnik et al, 2006): (i) social response, (ii) physical mirror inspection (e.g., looking behind the mirror), (iii) repetitive mirror-testing behaviour (i.e., the beginning of mirror understanding), and (iv) self-directed behaviour (i.e., recognition of the mirror image as self). The final stage, known as the “mark-test”, is verified when a subject spontaneously uses the mirror to check for a coloured artificial mark on its own body which it cannot perceive otherwise. The horses underwent through a three-phase “mark-test”: 1) with sham mark (transparent ultrasound water gel) positioned on both side at jaw level, 2) mark (yellow eye shadow mixed with ultrasound water gel) positioned on left side of jaw (with sham mark on the right), 3) mark (yellow eye shadow mixed with ultrasound water gel) positioned on right side of jaw (with sham mark on the left)



Figure 1: Shape, dimension and position of the coloured mark. Shape, dimension and position are identical in the sham mark on the opposite site.

The mirror was one 0.5-cm-thick pieces of 140x220-cm plexiglass glue on wood. Each test lasted one hour, horses were tested once a day, in consecutive days and at the same time. Our preliminary result on 1 horse shows some changes in self-directed behaviours which can be attributed to presence of the coloured mark. Firstly, the presence of the coloured marked significantly increased the frequency of scratching on both sides of the muzzle ( $p < 0.0001$ ). The most intriguing result ( $p < 0.0001$ ) comes from the comparison of the scratching rates directed towards the coloured mark side ( $N = 41$ ) and the sham mark side ( $N = 23$ ). Under the control condition (i.e. sham mark on both sides) no statistical difference was found for the scratching rates directed to the muzzle sides ( $dx N = 8$ ;  $sx N = 5$ ). Although further analyses are needed to confirm these preliminary results, our finding opens new scenarios about the evolution of Mirror Self-Recognition. The capacity of horses to recognize themselves in a mirror may be the outcome of an evolutionary convergence process driven by the cognitive pressures imposed by a complex social system and maintained despite thousands years of domestication.

## Keywords:

Domestic horse · Mark test · Socio-cognitive skills ·  
Self-awareness

## References

De Waal FBM (2008) The thief in the mirror. *PloS Biol* 6(8):e201

Gallup GG Jr (1970) Chimpanzees: Self-recognition. *Science* 167: 86-87.

Reiss D, Marino L (2001). Mirror self-recognition in the bottlenose dolphin: A case of cognitive convergence. *Proc Natl Acad Sci U S A* 98:5937-5942.

Plotnik J, de Waal FBM, Reiss D (2006) Self-recognition in an Asian elephant. *Proc Natl Acad Sci U S A* 103: 17053-17057.

Proops L, McComb K, Reby D. (2009) Cross-modal individual recognition in domestic horses (*Equus caballus*). *Proc Nat Acad Sci USA*;106:947-951.

Cozzi A, Sighieri C, Gazzano A, Nicol CJ, Baragli P. Post-conflict friendly reunion in a permanent group of horses (*Equus caballus*). *Behav Process* 2010;85:185-190.

Wathan J, McComb K. The eyes and ears are visual indicators of attention in domestic horses. *Curr Biol* 2014;24(15): R677-R679.

Lovrovich P, Sighieri C, Baragli P (2015) Following human-given cues or not? Horses (*Equus caballus*) get smarter and change strategy in a delayed three choice task. *Appl Anim Behav Sci*, in press.

Hanggi EB, Ingersoll JF. (2009) Long-term memory for categories and concepts in horses (*Equus caballus*). *Anim Cogn*; 12:451-462.