



The Interpretation of Cows' Psychology

Commentary on Marino and Allen (2017)

The Psychology of Cows

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We admire Marino and Allen's (2017) attempt to "take on" cow psychology. The literature surveyed is messy and confusing, and deriving an understanding of cow psychology from it is hard work. The authors' plea for more research on cow psychology is well-placed, and their marshaling the relevant available evidence is commendable. It is quite evident that, like most mammals, cows are intelligent, emotional, sentient beings who exhibit evidence of knowledge, memory, and skill in tasks that many mammals also test well on. It is less evident that cows are as complicated psychologically as the authors believe. We discuss below some areas in which their interpretations of cow psychology seem problematic.

According to Marino and Allen (2017, p. 8), "Play is related to curiosity and innovation and, therefore, forms the basis for complex object-related and social abilities," but how the kinds of play that cattle enact are related to these skills, attitudes, and global abilities is unclear. The authors posit (p. 9) that "an increase in play expresses the rewarding nature of good welfare," arguing that "Pair housing and enhanced feeding work synergistically to enhance play, and thus welfare," citing research comparing play of isolation- and pair-reared calves (Jensen, Duve, & Weary, 2015). Marino and Allen state that pair-reared calves engaged in locomotor play longer, using this as evidence of the welfare benefits derived from pair housing. However, Jensen et al. (2015) observed that it was isolation-reared calves who exhibited longer locomotor play than pair-reared calves, and there was no difference in the duration of play overall for the two groups. It would not be reasonable to conclude, given the inherent sociability of cows, that isolation-reared calves have better welfare than pair-reared calves. Consequently, play duration does not seem a useful measure of positive welfare.

Marino and Allen (2017) stated (p. 8) that "Cows engage in all forms of play found in mammals," but cows apparently do not engage in pretend play, as some mammals do (Mitchell, 2002). Evidence of pretense in cows would be suggestive of the same mental representational abilities present in understanding object permanence, both of which have theoretical ties to self-awareness (Piaget, 1947/1972). The responses of cattle in the Krushinskii task described by Marino and Allen appear to satisfy a form of visible displacement, rather than the more cognitively complex invisible displacement suggested, in the object permanence task.

Marino and Allen (2017) direct us to the "complexity of factors that moderate emotional states in cows," but a complexity of factors influencing emotions need not indicate emotional complexity. The authors present four forms of "complex emotions": cattle enjoy being the cause of success on a task

(*emotional reactions to learning*); cattle recognize and avoid the cause of unpleasant emotional experiences and continue to feel unpleasant emotional experiences in new situations beyond the original one (*cognitive bias*); cattle appear to experience stress when detecting (most likely through their urine) that other cattle are stressed (*emotional contagion*); and cattle enjoy affiliating with other cattle, seek them out when stressed, and are less stressed together than alone (*social buffering*). For the authors, these four forms “...suggest the possibility of sophisticated levels of psychological capacities in cows, such as self-awareness and empathy” (Marino & Allen, 2017, p. 482) and offer “...a level of complexity of emotions found in other mammals, who are generally recognized as being intelligent.” (p. 484). In our view, none of these forms appear to express emotional complexity beyond the standard consequences of having the specified emotions. Positive emotions occur when your actions and their consequences are experienced as good. Negative emotions let you know that something is unpleasant or not as good as you expect it to be. When depressed people generalize their negative emotional states to diverse contexts (i.e., show cognitive bias), this seems to be part of what it means to be depressed, rather than something additional to the depression. Strong emotions extend over time; “cognitive bias” names the continuing effect of these strong emotions.

When originally conceived, emotional contagion had an unconsciously imitative aspect: “the tendency to automatically mimic and synchronize facial expressions, vocalizations, and movements with those of another person and, consequently, to converge emotionally” (Hatfield, Cacioppo, & Rapson, 1992, pp. 153-154). The idea was that, in sharing the same bodily expressions, people would have similar internal experiences. The research mentioned (Boissy, Terlouw, & Le Neindre, 1998) offers no such evidence of behavioral matching between cows. In this research, companion cows had either been shocked (stressed) or not in a pen; when placed in this pen again, stressed companions had to be pushed in, and urinated and defecated more and were more often immobile than unstressed companions, who walked in. Test cows who followed the companion cows took longer to feed and fed less when the companion cow was stressed than unstressed, but showed no behavior matching. In a further study to test cows when no other cow was present, Boissy et al. (1998) placed urine from stressed or non-stressed cows close to food (or, in another experiment, to a novel stimulus), from which the urine’s smell emanated. The cattle showed the same differential responses in feeding time and latency (and comparable differential responses in avoidance of and latency to explore the novel object) in relation to the two types of urine that they had in the original study with the two types of companion cows. Boissy et al. (1998) noted that “behavioral responses appeared to be specifically related to avoidance of the source of the odor” (p. 494). Additionally, the decreased feeding mentioned by Marino and Allen as evidence of a pronounced stress effect may have occurred because cows spent more time smelling the air prior to approaching the food; as they were given the same amount of time with the food however long it took them to approach it, diminished feeding time was inevitable with increased smelling of the air. Cows became stressed when they detected that other cows were stressed, but the evidence does not suggest emotional contagion as the cause.

In the case of emotional reactions to learning, the interesting aspect, as the authors note, is that it makes clear to us that the animals have a sense of their own control over how successful their actions are and they enjoy that control. When we take the time to observe animals without controlling them, we are assailed by their agency (e.g., Mitchell & Thompson, 1991; Porcher & Schmitt, 2012). Agency seems necessary for having emotions. Finding that cattle and other mammals enjoy being agents and that their pleasure is diminished when their agency is taken away (as in Hagen & Broom, 2004) points to agency as a central dimension in the experience of emotions. Marino and Allen (2017) tie the sense of agency to self-efficacy, i.e., animals’ awareness that they can enact behavior to produce an outcome. As such, the authors posit that self-efficacy has “provocative implications for the question of self-awareness in cattle” (p. 9). But agency offers only a rudimentary self-awareness; being an agent offers no obvious insight into one’s self beyond one’s awareness and control of behavior-outcome relations. Presumably animals without agency—some sense of what needs to be done and the expectation of satisfaction—would not survive long.

Cattle categorize two-dimensional images of cows as familiar and unfamiliar (Coulon, Baudoin, Heyman, & Deputte, 2011), but the evidence described in this research does not support Marino and Allen's (2017) claim that these "...images were treated as mental representations of real individuals" (p. 479) and does not necessarily suggest that "...the heifers used previously stored mental images from actual social interactions as representations of real individuals" (p. 479). First, it is not clear what it would mean for an external image to be treated as a mental representation. Second, recognizing a conspecific (or that a visual experience is of something familiar) does not mean that you have a mental image you compare to it; recognition could (and we suspect often does) occur in the process of seeing, without any mental images. Indeed, Coulon et al. (2011, p. 287) more broadly referred to "previously stored visual information" being used to detect the familiarity of the imaged animal. The original research offers contradictory interpretations of cows' understanding of the images. Coulon et al. (2011) wrote that the cattle initially confused the two-dimensional image with a real animal, indicating that the image was not at that time viewed by the heifers as a representation. They noted that the animals continued to treat the images socially, responding with ears forward more often with images of familiar animals, and ears backward, with unfamiliar animals. Thus, their interpretation that the heifers may have "treated images of conspecifics as representations of real individuals" (Coulon et al., 2011, p. 287) seems incorrect. Indeed, they contradicted this claim when noting that "subjects seemed to base their discrimination on the familiarity versus unfamiliarity and not on the identity of the individuals" which suggested that "discrimination is favored over recognition when comparing familiar and unfamiliar conspecifics" (Coulon et al., 2011, p. 288). They created further confusion when they subsequently wrote that the differential ear responses of the heifers are "congruent . . . with our interpretation that heifers associate 2D images with real conspecifics" and that "images of conspecifics seem to be treated as representations of real individuals" (Coulon et al., 2011, p. 288). How can an image be a representation of a real individual by an image-perceiving cow if that real individual is not recognized or identified by the cow? It seems likely that by "representations of real individuals" Coulon et al. (2011) meant that the images looked like cows to the heifers (and thus the cattle "associated" the images with 3D animals), such that the cows treated the images as conspecifics.

Amidst acknowledging these problems, we maintain our esteem for Marino and Allen's (2017) work in coordinating and assessing the literature on the psychology of cows, providing a map for the coming renaissance in their psychological study. We suggest an additional route to follow: the literature might benefit from researchers studying cows in cultures, like India, in which cows are valued as individuals but are also often left to fend for themselves more than they are in the western cultures from which the bulk of the research derives. Perhaps cattle from such cultures will offer a different psychology than what we in cow-devaluing cultures have discovered so far.

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