



The Psychology of Cows? A Case of Over-interpretation and Personification

Commentary on Marino and Allen (2017) The Psychology of Cows

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Reviews of existing literature on topics that have been neglected, such as the subject of the cognitive and affective abilities of cows, are productive and necessary exercises in science (Elwen, Findlay, Kiszka, & Weir, 2011; Mulrow, 1994). These syntheses organize and integrate bodies of literature that have been relatively isolated from one another. If performed systematically and objectively, reviews can highlight areas of research that are in need of more information or identify areas that could be integrated in novel ways. The effort made by Marino and Allen (2017) to gather the extant, fragmented literature regarding the “psychology of cows” was timely and commendable. Most of the research on sensory abilities, learning and cognition, emotion, personality, and social complexity in cows has been conducted within applied contexts, which the authors considered to be a skewed representation based on the statement below:

And because these kinds of applied contexts continue to shape our understanding of cows from both a scientific and public perspective, it is all the more important to objectively assess cows on their own terms by trying to understand their psychology so that we might better align that knowledge with their welfare and interests. (p. 475)

Although Marino and Allen (2017) purport to provide an objective assessment of the available research, an independent review of their selected literature instead suggests that much of their article is based on over-interpretations and biased representations of the findings that were pertinent to their argument that cows should be considered as sentient individuals that are on par with elephants, primates, dolphins, and pigs. The purpose of this commentary is to highlight areas of concern particularly with respect to the dangers of using science to advance anthropomorphic and biased objectives.

Marino and Allen (2017) began their discussion of cows with a relatively inflammatory summary of the “horrible” conditions that cows experience as farmed animals, ending their evaluation with the following statement: “Given that cows are subjected to so many highly invasive and objectifying practices, the need to understand who they are – on their own terms – is long overdue.” (p. 475). This statement in conjunction with the above statement illustrate one of the major and consistent weaknesses

of this paper – the use of anthropomorphic language to elicit specific perceptions. For example, what is meant by the cows’ “interests” (e.g., maybe to give or not give milk that day or to choose which cow to graze next to?). Likewise, how can cows be “objectified”? Instead of objectively thinking whether the treatment of cows as objects for human exploitation is warranted, the term “objectified” elicits a very strong, negative emotional response. Words such as “intelligent,” “like humans and primates,” “complex cognition,” “feats of memory,” “attachments,” “emotional contagion,” “sophisticated abilities,” “self-awareness,” “self-efficacy,” “mother-child bonds,” “severe psychological and social impairments,” and “distinct personalities” elicit specific perceptions that are not necessarily supported by the studies selected or interpreted by the authors. These issues will be examined across each section.

Cow Conditions

In the summary presented on the historical and current cow conditions, it is unclear if these practices were world-wide or specific to the United States (U.S.). The authors did not mention in their review that many of these practices are governed by welfare laws these days. Although welfare requirements for farmed animals are much more stringent in European and Canadian countries (Fraser, 2008; Veissier, Butterworth, Bock, & Roe, 2008), some of their criteria have filtered into U.S. practices today (Mench, 2008), an important fact that was missing from the introduction. Instead, the authors set their review of the scientific findings into a biased framework being sure to highlight the “distressful and unnatural conditions” (p. 474) experienced by cows.

Learning Through Conditioned Associations – Is this Intelligence?

The first aspect of cow psychology discussed was their learning and cognitive abilities, which the authors equated almost instantly to intelligence, arguing that “Intelligence, arguably, refers to the quality of these mechanisms [learning and memory] in terms of rapidity, depth, and complexity. And there is always an interplay between “higher-level” cognitive processes and those considered to be more basic (Shettleworth, 2010)” (p. 477). The authors then indicated that “Much of our current understanding of intelligence in cows has to be inferred from other areas of study, including social complexity and communication in other mammals” (p. 477). These statements were confusing as the experiments initially presented were constrained to applied settings involving the testing of associative learning abilities in cows locating feeders, learning auditory cues for alarms or shocks indicating fence boundaries or visual cues to turn lights on and off, or performing actions to gain access to salt. All of these experiments assessed behaviors that were directly linked to basic survival needs of the cows. It is, therefore, not surprising that the cows conditioned quickly and memories for these associations lasted for some period of time (i.e., up to six weeks in one study). Associative forms of learning involve basic mental representations but do not necessarily involve “robust” higher-order cognitive skills (as intimated in the quotation above). Rather these conditioned associations tend to be mediated or stored in more primitive or sub-cortical areas of the brain, such as the cerebellum and amygdala (Lange et al., 2015; Jozefowicz, 2014; VanElzakker, Dahlgren, Davis, Dubois, & Shin, 2014). Moreover, it is expected that these conditioned associations are maintained over time as they are related to enhanced fitness outcomes (Domjan, Mahometa, & Matthews, 2012; Jozefowicz, 2014). With this knowledge in mind, these findings are not particularly exciting and certainly did not deserve the statement made by the authors that cows “are capable of not only complex learning but feats of long-term memory” (p. 479).

The research regarding the discrimination and spatial cognition abilities of the cows also fails to support this conclusion as, once again, these abilities are likely innate skills that were hard-wired and not flexible behaviors (i.e., familiar individuals are likely related/kin and less aggressive so safer than the unfamiliar individual that smells funny, or this area of the pasture was tasty last time we visited).

Marino and Allen (2017) referred to the complex cognitive abilities of cows multiple times throughout this section using evidence primarily from research involving conditioned associations (i.e., classical conditioning and operant conditioning paradigms). This strategy of describing basic cognitive

abilities as “complex” is misleading and an overgeneralization of the available data. Take the following quote as an example: “These kinds of capacities [i.e., discrimination abilities] not only underlie the ability to recognize kin from nonkin and stranger from familiar individual, but also allow for finer discriminations of individual identity within one’s social network” (p. 478). While discrimination tasks may require more “complex” abilities as they could require the cows to hold at least two mental representations for comparison if a successive or match-to-sample discrimination training procedure was used, discriminations can also be solved by using basic associative rules, when not controlled. Unfortunately, the experimental methodology used in these studies was not discussed in the current review, making it difficult for a reader to ascertain the validity of these conclusions. And how one gets to a conclusion that this basic discrimination ability enables a cow to recognize/identify/distinguish itself as a distinct individual from other conspecifics in the herd is unclear, unless of course cows can self-recognize and identify relevant characteristics?

What Does “Moo” Mean? – Emotional Expression

The initial presentation of emotion as a construct and the available science, including animals other than cows, was comprehensive and objective until the following statement: “The literature on emotions in cows and other farmed animals is substantial and confirms that they experience a wide range of emotions and that some of those responses are quite complex” (p. 480). This statement was not explicitly supported by the authors. Instead a reader needed to be familiar with the paper by Forkman, Boissy, Meunier-Salaun, Canali, and Jones (2007) to evaluate it. Similarly, based on the research reviewed by Marino and Allen (2017), the “wide range of emotions” cows experience seemed to be limited to two similar negative emotions (i.e., fear and anxiety) and an axis that represented the frustration-contentedness dimension, which happened to be investigated with an interesting and novel method, eye white percentage. Other emotions, such as surprise, anger, guilt, and joy were not addressed, perhaps because they have not been measured. Regardless, objective scientists should not make generalizations without empirical data. Aside from the handful of emotions, most of this section described different methods by which internal states were assessed. Unfortunately, in Marino and Allen’s discussion of the tests that have typically been used to measure fear and anxiety in various animals (including rats, goats, cattle, sheep), the Open-Field (or Novel Arena) Test, they failed to mention that this test has been argued to be unreliable based on the host of confounds present during a trial (e.g., novel environment, isolated testing, an open environment rather than closed/protected, duration in the arena) and is most likely not ecologically valid (Forkman et al., 2007). So instead of concluding that the expression of fear by cows has been difficult to measure, they argued that conclusions about cow emotion had been oversimplified:

... fear responses in this paradigm are not strongly correlated with fear in other situations. This overall finding demonstrates that fear responses in cows are shaped by diverse and complex factors and the idea of “general fear” in cows is an over-simplification (Forkman et al., 2007). (p. 480)

Fear is a basic emotion that is found across taxa and is elicited by innate stimuli and conditioned stimuli, pending individual experiences, and results in a multitude of physiological and behavioral responses that tend to correlate with one another. These responses do not require a complex, cognitive explanation, but may simply represent physiological responses to stimuli (e.g., VanElzakker, Dahlgren, Davis, Dubois, & Shin, 2014).

The discussion of the complex emotions was interesting, but once again over-generalized from the actual findings with anthropomorphic twists. Beginning with discussion of the emotional reactions during learning, Marino and Allen (2017) indicated that cows might be self-aware and might react with a sense of self-efficacy based on a study in which cows became more aroused/excited (heart rate increased and more vigorous movement; Hagen & Broom, 2004) when the cows improved significantly on an

operant conditioning task. Whereas Hagen and Broom cautiously interpreted their findings as having “found some, albeit inconclusive, indication that cattle may react emotionally to their own learning improvement” (p. 203), Marino and Allen used language that again encouraged readers to relate cow behavior to their own sense of self and emotional excitement when solving a difficult task. This presentation represented an overly complex interpretation and use of human-centric concepts for a response that may be explained by conditioned associations with rewards. The section on cognitive bias also produced some consternation; why is it a complex emotional experience given that cognitive biases may simply be the product of conditioned associations? Forming preferences for or avoidance of stimuli that are associated with survival would seem to be a basic, innate ability selected for its increased fitness benefits. A similar question exists regarding the reasoning behind emotional contagion being a complex emotion; contagion is an outcome based on the sharing of an emotion. Marino and Allen suggest that this experience, which they emphasize may possibly be the simplest form of empathy, is a basic building block for more complex expressions of emotions. Their entire argument for emotional contagion is built upon a single set of studies performed with a set of cows that began to produce increased levels of cortisol after being housed with stressed individuals. The question becomes whether empathy is the simplest explanation or could a conditioned association or an innate, physiological response be a more appropriate explanation? The section on social buffering also suffered from the authors’ tendencies to overgeneralize from the available evidence. Marino and Allen stated “As highly social mammals, cows demonstrate a strong response to their social circumstances, finding social isolation to be highly distressing and showing robust social buffering responses when they are together” (p. 483). This statement is made with no supporting references, suggesting that this information is general knowledge; an unfounded assumption. Of all the sections presented in this paper, the social buffering section has the most reasonable evidence to support the claims made by Marino and Allen. Yet, if this species truly is sociable, then one might expect social buffering to occur at the physiological level suggesting that categorizing it as a complex social experience may be over-generous.

Social Complexity Simplified

The final section on social complexity represented consistent misrepresentations and incomplete ideas. The introductory material was accurate and comprehensive, reflecting a brief but thorough discussion of social complexity and its relevant constructs. Unfortunately, the subsequent review of the pertinent cow literature was incomplete, disjointed, and misleading. For example, Marino and Allen (2017) highlighted the current definition of social complexity as consisting of a number of differentiated relationships with other conspecifics, which transcend group size and physical proximity or synchronized activities. Yet, the bulk of the evidence used in this section relied on group size and network models based on physical proximity and synchronized activities of cows in a pen measured by radio collars (Gygax, Neisen, & Wechsler, 2010). Although this is a common technique for assessing associations in gregarious animals, the primary issue is that Gygax et al. used two very human-oriented terms: attachment and avoidance relationships. For readers familiar with attachment theory, these terms have very specific definitions and criteria: (1) attachments are bonds in which two individuals receive emotional support from one another when together and experience distress when separated, and (2) avoidance refers to bonds in which limited social support is expected and thus, little distress or comfort is experienced by the individuals involved. Unfortunately, these definitions were not the definitions used by Gygax et al. Attachment was defined by animals that were near one another and engaged in the same activity and avoidance was defined as animals that were in different areas of the pen and asynchronous in activities. Intentional or not, Marino and Allen perpetuated this misrepresentation by continuing to use that language instead of acknowledging the limitation.

Marino and Allen (2017) then discussed what hierarchies would entail in species that formed them. Unfortunately, in this discussion, they never actually indicate if cows have hierarchies, only mentioning that cows form matrilineal groupings. After reviewing this literature, it appears that hierarchies are somewhat present in cows with the oldest female “leading” the group and bulls and steers

competing with one another based on level of testosterone when housed together (Bouissou, Boissy, Le Neindre, & Vessier, 2001), information that may have been helpful in supporting their point. A similar concern exists for Marino and Allen's conclusions on a handful of studies about bonding and alliances. Although the mother-offspring section was relatively accurate (with the exception of the use of the term "mother-child" bond when discussing non-human animals), alliances were actually never discussed but rather were inferred by the "...lasting social bonds, both with their offspring and their herd members." (p. 489) a statement that was not substantiated clearly. Herd members tended to be related or familiar conspecifics that were raised together and spent time in close proximity. However, proximity is not enough to evaluate if a bond exists. Responses to separations or distress and seeking comfort from others are measures needed to evaluate these claims. It is also unclear if this research has been conducted with adult members of a herd. Thus, the use of "alliances" in this section is unfounded. Despite the incompleteness of this section, the authors concluded that based on the evidence they examined, cows displayed broad parameters of social complexity such that "They have demonstrated knowledge about conspecifics and the exchange of relevant social knowledge with conspecifics. Through dominance hierarchies and affiliative bonds, they have demonstrated knowledge about conspecifics and of their own social interactions with them" (p. 490). By my assessment, none of these statements were supported by the evidence presented. The simplest conclusion currently is that cows form herds, thus meeting the criteria for gregariousness and sociality, but it is not clear if they are as sociable with each other as implied by Marino and Allen in their conclusions.

So, What About a Cow's Psychology?

Ultimately, the areas of research proposed for the learning and cognitive abilities of cows (i.e., object permanence, numerosity, time perception), their emotional capabilities, social complexity, and even personality are reasonable. The goal of comparative psychology is to understand the similarities and differences in behaviors across similar and disparate species. Marino has attempted to do this by presenting the same type of reviews for pigs (Marino & Colvin, 2015), chickens (Marino, 2017), and now cows. By pursuing topics in a comparative fashion, we begin to understand the functions, evolution, development, and mechanisms involved. This knowledge should be used to understand the origins or pressures that produced these abilities such that future outcomes may be predicted. Similarly, this knowledge should be used to enhance the current and future welfare of animals in human care. As scientists, it is our responsibility to vet this knowledge using systematic, parsimonious, objective, reliable, and valid approaches. The misrepresentation of information leads to biased, and potentially wrong, bodies of knowledge that are very difficult to modify once established (e.g., vaccines, animal/plant sentience, climate change). As scientists, we must be the critical thinkers and ask the hard questions, but we must also be willing to represent the facts accurately not as we wish them to be as is the case with many of the points in "The Psychology of Cows."

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