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THINKING CHICKENS:

A REVIEW OF COGNITION, EMOTION, AND BEHAVIOR IN THE DOMESTIC CHICKEN

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I. RE-INTRODUCING THE DOMESTIC CHICKEN

> *"[B]efore a couple of days had passed, watering and feeding the chickens, I had fallen in love with them. They were so undeniably gorgeous…And of course I did not know who they were."*
> *-Alice Walker,* The Chicken Chronicles

When famous writer Alice Walker adopted a flock of domestic chickens, beautiful feathered ladies she soon names Hortensia, Splendor, Babe, Glorious, Agnes of God, Rufus, and Gertrude Stein, respectively, she quickly realized that she "did not know who they were."[1] For many humans, domestic chickens maintain a simplicity of life and, by extension, intelligence. What is there to know about them? As Walker discovers, however, the group of chickens in her care have much to teach her about who they are: about their social lives, capabilities, likes and dislikes, and distinct, individual personalities. These chickens love naps, she realizes with excitement, as well as corn on the cob and scratching the ground with their powerful legs. Taking inspiration from Walker as well as the nearly 10 billion domestic chickens who annually live and die in the United States, those individuals we do not know due to their confinement within industrial farms,[2] let us ask: just *who* is the domestic chicken? Recently, scientific understanding of bird intelligence has undergone a revolution. Complex intelligence, once thought to be the exclusive domain of

mammals, is now widely found in birds as well as fish. The time has come to reevaluate our conception of the domestic chicken, to invite her to teach us about herself.

II. AIMS AND SCOPE

In what follows, we intend to separate the facts about chickens from the fiction; we want to see how stories that tell of chickens' big personalities and care for their children might correspond to measured assessments of their capacities. To learn more about who chickens are, we turned to scientific research.[3] Specifically, we reviewed all of the available peer-reviewed, scientific studies on chicken cognition, emotion, and sociality. Our review focused on complex capacities like time perception, self-awareness, and emotion to develop the best idea of how chickens demonstrate intelligence in ways humans can recognize. In this white paper, we summarize our findings from the scientific literature.

Industry interests currently dominate the available scientific literature on chickens. These studies, undertaken in "applied" contexts, express interest in chicken intelligence only to the extent that their data might be used to more efficiently turn chickens into objects for human consumption. The many studies that rely on highly artificial settings to evaluate chickens' intelligence experience a related shortcoming: artificial settings limit chickens' ability to express a full range of natural behaviors. In sum, the current research on chicken intelligence is provocative, but woefully incomplete. In response, in addition to providing a review of the available science, the capacities explored in this paper also serve to highlight exciting areas of chicken cognition, behavior, and sociality in need of additional research. More non-invasive studies undertaken in natural settings like sanctuaries would doubtlessly contribute significantly to our understanding of chickens not as commodities, but as birds and individuals.

III. BECOMING THE DOMESTIC CHICKEN

Evolutionary history and domestication

Considered a subspecies of the red jungle fowl — a native of the field edges, groves, and scrublands of India and Southeast Asia — domestic chickens share many similarities with their wild counterparts.[4] At present, domestic chickens are intensively and selectively bred to grow larger bodies and lay eggs at accelerated rates.[5] Even though domestic chickens have been selected for these "production" traits, the scientific literature presents no evidence that chickens' cognitive capacities have been substantially affected since they descended from red jungle fowl at least 8,000 years ago.[6]

For both jungle fowl and wild or free-ranging domestic chickens, social groups are comprised of one dominant male, one dominant female, lower-ranking chickens of both sexes, and chicks. Group members live on a home range during their breeding season; within that range, they have regular roosting sites that include the lofty branches of trees.[7] From berries and seeds, insects and small vertebrates, chickens eat a varied diet.[8]

Rod Stewart with his flock
Photo from Farm Sanctuary

Sensory capacities

A consideration of chickens' sensory repertoire shows that domestication has not impeded these birds' abilities to feel, see, smell, taste, and interact with their environments in varied ways. Sensory capacities determine the kind of basic information chickens can use to perceive and experience: for this reason, understanding their basic sensory capacities is essential to any evaluation of their intelligence.

One of the chicken's most important sensory organs is her beak.

One of the chicken's most important sensory organs is her beak. Equipped with numerous nerve endings and a highly specialized, sensitive tip, the beak enables chickens to make precise distinctions between the objects they touch.[9] Chickens also use their beaks to grasp and manipulate objects when eating, nesting, exploring, drinking, and preening. They even use their beaks as weapons when establishing their place in the social hierarchy and when defending themselves. Because of the beak's incredible sensitivity, damage to it causes her intense pain.[10] In addition to their beaks, chickens are sensitive to touch, and their skin detects temperature, pressure, and pain thanks to numerous sensory receptors.

Mayfly chicken scratching
Photo by Derek Goodwin

Templeton chicken keeping a look-out
Photo by Farm Sanctuary

In addition to their use of tactile information, chickens also rely on their sophisticated vision to navigate their environments. Like many other bird species, chickens can simultaneously focus on objects that are close-up and far away; in other words, chickens can focus on objects near to them on the ground — like friends and food — while watching the sky for predators at the same time.[11] Chickens also possess keen senses of smell and taste.[12]

Chickens can even process sensory data that remains imperceptible to humans. For example, chickens see a broader spectrum of colors than humans can,[13] and their ability to detect low frequency sounds may mean they can hear sounds that humans cannot.[14] Some chickens even possess a sense that humans do not, namely, the magnetic sense, a capacity shared with some other birds. The magnetic sense enables chickens to feel the magnetic pull of the Earth and to use it to orient themselves.[15]

IV. REASON AND ARITHMETIC

Transitive Inference

What do chickens have in common with Sherlock Holmes, Arthur Conan Doyle's famous detective? The ability to apply a form of deductive reasoning, of course! Specifically, chickens demonstrate this hallmark of human and nonhuman intelligence — the application of logical reasoning — through the capacity known as transitive inference. A type of deductive reasoning, transitive inference involves figuring out the relation-

A type of deductive reasoning, transitive inference involves figuring out the relationship among objects that have not been compared before.

ship among objects that have not been compared before. To offer a basic example, applying transitive inference enables the reasoner to discern that if Item A is larger in size than Item B, and Item B is larger in size than Item C, than Item A, by inference, must also be larger than Item C. Despite the famous child psychologist Jean Piaget's claim in the early twentieth-century that transitive inference represents a cognitive milestone unique to humans at least seven years old,[16] ample evidence exists of nonhuman animals — including chimpanzees, various species of monkeys, rats, and several bird species — who can use transitive inference.[17]

The observing hens showed they not only gained information by watching other hens interact, but also applied that information in a self-reflective manner.

In one study, hens used transitive inference to figure out how likely they were to win during a confrontation with another hen.[18] When hens first get to know each other, they establish who's the head hen. Hens in charge assert their dominance by pecking at, jumping on, and clawing hens lower on the pecking order. Subordinate hens concede defeat by crouching down or attempting to escape. With hens' getting-to-know-you routines in mind, researchers placed hens in groups of twos and threes. Then, the grouped hens were presented with one of three situations. In the first, the group of hens watched a familiar, dominant hen lose during a confrontation with a stranger. In the second, hens watched a familiar, dominant hen win against a stranger. Finally, hens in the third situation watched two unfamiliar hens meet each other and establish who was in charge; afterward, the observing hens were reunited with a hen they knew previously to be dominant as well as the stranger they had just seen defeated.

The observing hens showed they not only gained information by watching other hens interact, but also applied that information in a self-reflective manner. Hens in the first situation — those who had watched a familiar, dominant hen experience defeat at the claws of a stranger — decided not to challenge that stranger when given the chance. By passing on the opportunity to challenge the stranger, they showed their use of transitive inference: that is, they showed they could discern that if this stranger could win against an individual who could defeat them, their own defeat, in turn, was assured. Hens who had just watched a familiar, dominant individual defeat a stranger confronted the stranger half of the time, showing that they understood they had some chance of emerging as the more dominant hen. Finally, in the third situation, the proportion of times hens first approached the stranger matched whether they saw the stranger lose during her confrontation with the dominant hen or not. Taken together, these results show the complex logical reasoning required for one of hens' most fundamental and basic forms of social organization.

Hens like Thumbelina gain information by watching other hens interact
Photo by Farm Sanctuary

Perhaps most impressive about chicks' sense of number and quantity, however, is their ability to perform basic arithmetic.

Numerical Abilities

A species' conception of number may likely involve the ability to form mental representations,[19] and the ability to determine quantity, for example, is essential to the performance of important acts such as differentiating between a larger and a smaller amount of food. Even newborn chicks can tell a smaller set of objects from a larger set of objects.[20] Chicks share this ability, as well as a preference for larger amounts, with other species such as chimpanzees,[21] bottlenose dolphins,[22] and elephants.[23] Chickens can also place quantities in a series; that is, they can order quantities in a "mental number line," a capacity they share with chimpanzees,[24] crows,[25] African grey parrots,[26] as well as other "intelligent" species.

Perhaps most impressive about chicks' sense of number and quantity, however, is their ability to perform basic arithmetic.[27] During one study, chicks watched as two sets of balls — one set containing two balls and the other containing three — were hidden behind an opaque screen. Some of the balls were then visibly transferred, one by one, from behind one screen to behind the second screen. In order to determine which of the two screens hid the larger number of balls, chicks had to mentally add to one set of balls while subtracting from the other. Then, when given the choice, chicks chose to visit the screen hiding the most balls, indicating they had successfully made the calculations.[28]

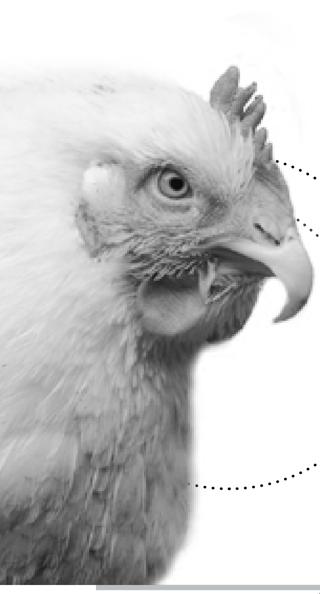
V. TIME PERCEPTION AND MEMORY

An animal's ability to detect the passage of time — what scientists term *time perception* — determines whether or not animals can think about and anticipate future events or whether they live entirely moment-to-moment. Several studies suggest that chickens possess a conception of time. In particular, chickens can perceive time intervals, use personal memories of past events, and exercise self-control in anticipation of the future.

Perception of time intervals

An animal's ability to estimate how long she has to wait before being fed again, to offer a simple example, suggests her ability to perceive time intervals: the time in between events. A range of animals show time interval perception. Domestic pigs can tell the difference between a short length of time and a long length of time; they can also anticipate future negative or positive events.[29] Chimpanzees and other great apes can prepare for the future as much as a day in advance[30] and remember specific features of past events (such as the what, where, and when of events) after two weeks.[31] Bottlenose dolphins are likewise adept at accessing memories, especially memories of their own past behavior.[32] A number of bird species can perceive time as well. One study with pigeons showed they can judge intervals of up to eight minutes,[33] and Western scrub jays can cache food in locations in which they know they will be hungry the next morning, showing their ability to anticipate the likelihood of future events and plan accordingly.[34]

Chickens, too, can estimate time intervals. In one study, researchers showed hens a visual signal indicating that their pecks on a computer



touch screen would be rewarded after six minutes. After seeing the visual signal and waiting for about six minutes, hens pecked at the screen more frequently, showing that they could estimate the time required to get their reward.[35] In another study, hens learned to associate three sounds with either food (a good outcome), a squirt from a water gun (a bad outcome), or nothing (a neutral outcome); these outcomes arrived 15 seconds after the sound. Hens showed different emotional responses to the sounds, demonstrating that they anticipated either a positive, negative, or neutral outcome based on their understanding of what the sounds foretold.[36] In short, chickens can not only estimate time intervals, but also use their past experiences to anticipate the future.

Chickens can use their past experiences to anticipate the future
Photo by Farm Sanctuary

Episodic memory

Perception of time intervals is, arguably, strongly related to a form of memory known as episodic memory. Episodic memory describes the ability to mentally “travel back in time” to recollect specific events in the past. Studies of episodic memory investigate whether animals remember personal, lived experiences; because this capacity relies on distinct, individual memories, many scientists view episodic memory as evidence for conscious experiences in other animals. Episodic memory may also help determine whether an individual experiences life “autobiographically,” that is, whether she has a sense of herself (self-awareness) in the past, present, and future.

A range of animals demonstrate evidence of episodic memory, including great apes[37] and some birds such as pigeons[38] and Western scrub jays.[39] Jays in particular can remember the specific locations of food caches as well as the rate at which their cached food decays drawing on the what, when and where of those memories to retrieve the stored food in an order that will assure its freshness. Food-caching behaviors — like those demonstrated by the Western scrub jay — provide a basis for considering episodic memory in chickens. As explored above, chickens also perceive time intervals and anticipate the future, capacities that correlate with episodic memory. In other studies, researchers fed five-day-old chicks with two plates, each plate containing a different kind of food. The researchers "devalued" one of the two kinds of food, that is, they made one kind of food less desirable to the chicks by feeding them that type of food in advance. When offered a choice between the two plates (and thus two kinds of food) later (on the order of a few minutes), the chicks preferred the non-devalued food. Similar results have been found in studies involving hens, showing that both chicks and adult chickens can remember the "where" and "what" components of information about food.[40] While compelling evidence certainly exists for episodic memory in chickens, additional research with chickens in natural settings would contribute greatly to our understanding of these animals' perception of time and of themselves.

Chickens also have a great memory for objects,[41] and they perform as well as most primates when similarly evaluated for what scientists term "object permanence."[42] Many animals, including great apes, monkeys, cats, dogs, and birds, demonstrate, to various degrees, an understanding that objects absent from view are not necessarily absent from existence.[43] Studies with both chicks[44] and adult hens[45] reveal that chickens can recognize familiar objects even when those objects are not completely visible. Chicks can also perceive the contours of partly hidden objects when those contours are implied but not totally within view.[46] When it comes to objects that are completely hidden, too, chicks can infer the position of a familiar ball by searching behind the obstructions large enough to successfully hide the ball, suggesting that they maintain some mental, visual representation of objects even after those objects “disappear.”[47] In further testament to their good memories, chicks and adult hens remember not only the location in which they have previously found preferred food, but also what that food site contained.[48]

Self-control

Can an animal resist the temptation to consume a single treat if her restraint will be rewarded with two treats later on? If yes, that animal demonstrates self-control, or the ability to hold herself back from immediate gratification in order to reap a greater reward later on. Self-control may be associated with both planning for the future and self-awareness given that it requires an animal to choose among possible behaviors in order to promote a future outcome.[49] Tests for self-control further require that an animal predict the future based on a past experience. A range of both mammal and bird species demonstrate self-control.

Chickens also demonstrate self-control in testing situations. When given a choice between access to food for three seconds after waiting for two seconds and access to food for 22 seconds after waiting for six seconds, hens restrained themselves for the requisite six seconds in order to chow down for the longer period. This study demonstrates that hens can not only distinguish between different future outcomes, but also that they can use self-control to achieve the outcomes they want most.[50] Chickens may even outperform human children between three and five years of age in similar studies of self-control: for example, many children can’t help but immediately eat a marshmallow given to them even when they are told they’ll get two marshmallows if they can wait! Self-control has clear consequences for our understanding of chickens’ perception of time; as shown below, this capacity may also reveal chickens’ awareness of self.

VI. SELF-AWARENESS

Self-awareness describes an animal's understanding of who she is to herself: that is, her sense of herself as an "I" independent from others. Often associated with a range of complex psychological capacities that include phenomenal consciousness (what it feels like to have an experience), self-consciousness (awareness of oneself as an individual), metacognition (the ability to think about one's own thoughts), and autonoetic consciousness (the ability to mentally orient oneself in the past, present, and future), self-awareness is not a cognitive feature that should be understood as simply available or unavailable. Instead, self-awareness is a concept best defined as a continuum.[51]

Brooks chicken looking very smug with her own intelligence
Photo by Farm Sanctuary

Studies of both self-control and self-awareness in chickens help provide a sense of who chickens are to themselves. As discussed in the previous section, chickens show self-control; for some authors, self-control indicates self-awareness.[52] Still other authors suggest that self-control requires episodic memory and therefore a calculation of future outcomes based on individual, past experiences.[53] Chickens' exercise of self-control may indicate, then, their possession of a cognitive capacity located on the same continuum of complexity as foreplanning and mentally travelling in time.

In addition to self-control, self-assessment — the ability to compare oneself, as a distinct individual, to others — represents another important way in which animals demonstrate a sense of self. Chickens, as well as other birds such as pinyon jays[54] and greylag geese,[55] use transitive inference as what is likely a form of self-assessment. Indeed, the ability to apply transitive inference supports the development of complex social relationships in many nonhumans (and humans!), and may also indicate an animal's self-awareness. In the study discussed above, chickens can infer their own position on the pecking order by watching familiar and unfamiliar individuals interact.[56] Compellingly, it stands to reason that chickens draw on some sense of selfhood when evaluating their social "place." In other words, for a hen to assess her position on the pecking order, she likely needs a sense of herself as an entity discrete from the hens she compares herself to. With these promising studies in mind, the area of self-awareness in chickens presents ample opportunity for future investigation.

VII. COMMUNICATION

Bawk, bawk, bawk; cluck, cluck, cluck: chickens may be well-known for how their communication sounds when it falls on human ears, yet the ways chickens transfer information from one individual to another is far more complex than what we might hear on first listen. A critical component of social complexity, ample evidence exists that animal commu-

Bawking chickens
Photo by Farm Sanctuary

nication involves flexible, intentional, rule-governed systems of information conveyance.[57] Researchers have observed chickens communicating with at least 24 distinct vocalizations as well as a range of different visual displays[58]. A review of the ways chickens use these vocalizations, however, provides the best indication of the sophistication of their communication, and, hence, their minds.

Referential Communication

Referential communication implies that animals who exercise it attach meaning to each signal in a way comparable to the way humans use words to refer to objects and other features in the world.

When a chicken hears another say "bawk," might they understand that sound to convey information, perhaps even the warning for "Hawk!"? Indeed, chickens rely on referential communication, signals such as calls, displays, and whistles, that refer to specific elements of their environment (for instance, a predator circling overhead). Referential communication implies that animals who exercise it attach meaning to each signal in a way comparable to the way humans use words to refer to objects and other features in the world. When researchers find a tight correlation between a signal-eliciting event and the signal-receiving animals' response, such signals are understood as referential, that is, as conveying information about the event (a hawk is overhead!) and perhaps even how to respond to the event (take cover!). Importantly, referential communication requires both intentionality — the signaler's deliberate choice of what information to convey — as well as mental representation. That is, referential communication evokes mental representations of the referred-to event in the minds of the animals who hear the signals.[59]

Chickens join a large group of mammals and birds known to exercise referential communication, including chimpanzees,[60] bottlenose dolphins,[61] domestic dogs,[62] and ravens.[63] In one study, chickens gave distinct alarm calls when shown computer-generated animations of natural predators to denote whether the predators seen were in the air or on the ground.[64] That chickens do not have one catch-all term for "danger" shows the specificity of their alarm calls; since receivers of these calls react to them in specific and appropriate ways, chickens' calls clearly carry the same meaning for all the individuals in a group.

The variability of chickens' alarm calls becomes even more complex when taking into account roosters' attention to "audience effects," or the changes they make to how they communicate based on who is listening. For example, when a hen is present, a rooster is more likely to sound the alarm indicating an aerial predator, a calculation that increases the likelihood that his mate and children will survive the threat.[65] Roosters also communicate in ways that simultaneously warn fellow chickens of danger and confuse predators who might be listening. Roosters are more likely to sound an alarm if a lower-ranking chicken is nearby, effectively giving the predator an additional target and increasing the signaling male's chance of survival.[66] When hiding under a tree or a bush, roosters take into account what aerial predators can see: roosters give alarm calls that are longer in duration (and easier for predators to follow) when they are hidden under cover than when they are exposed.[67]

Boyd chicken is getting his point across
Photo by Farm Sanctuary

In addition to alarm calls, roosters broadcast their discoveries of delicious food to call attention to themselves and their meal-finding abilities. By combining such "food calls" with rhythmic movements like picking up and dropping the food over and over, roosters communicate to hens their value as providers for a family.[68] Indeed, roosters perform more vigorously when they find particularly high-quality food and when a hen is more likely to approach.[69] All of these examples point to the relationship between chickens' social awareness and their ability to make deliberate, intentional choices about their manner of communicating as well as for whom they are communicating.

VIII. SOCIAL COGNITION

A chicken's flexible, dynamic intelligence is perhaps most visible when she gets together with her fellow chickens. Social cognition — the use of cognitive skills such as learning, memory, reasoning, decision making, and more — forms the basis for cognitive complexity in a wide range of animals, and ample evidence exists for chickens' social intelligence, too. Species that live in complex social groups, including domestic pigs,[70] dogs,[71] primates,[72] dolphins and whales,[73] and birds,[74] often possess complex cognitive capacities that likely evolved in part to help them navigate the nuanced intricacies of their relationships with one another.

Species that live in complex social groups, including domestic pigs, dogs, primates, dolphins and whales, and birds, often possess complex cognitive capacities that likely evolved in part to help them navigate the nuanced intricacies of their relationships with one another.

Discrimination among Individuals

A chicken's ability to tell Henrietta apart from her friend Feathers, an example of what scientists call the capacity of "individual discrimination," forms the basis for social relationships, hierarchies, and how animals react to each other when meeting again or for the first time. Many social mammals can discriminate among individuals in their social group, and several bird species are known for telling each other apart based on vocal recognition (songbirds differentiate each other's voices) and visual recognition (rooks, pigeons, and white-throated sparrows can tell each other apart by looking).[75] Some birds can even tell each other apart based on smell.[76]

Chickens differentiate among members of their social group, suggesting that they maintain an understanding of each other as particular individuals. Beyond telling group members apart, chickens can keep track of their group's pecking order and recognize who is and who isn't a part of the group.[77] Testament to their attention to visual detail, chickens can also differentiate between familiar individuals when shown a color slide that contains their image.[78]

Perspective-taking

Another fascinating feature of chickens' social cognition is their ability to take the perspective of others, or to consider what an individual other than oneself sees, wants, or might do in a given situation. Chickens exercise this complex cognitive capacity to anticipate others' actions and even tactically manipulate their behavior. In addition to chickens, other species who have shown their ability to consider the perspective of others include chimpanzees,[79] dogs,[80] pigs,[81] and Western scrub jays.[82]

The calls and movements roosters make after finding an excellent meal (discussed above) present one example of chickens' perspective-taking abilities. Both the roosters' calls and movements after finding food give the same message: "Look at me and the food I found!" But, when a dominant male hears a subordinate bragging about his tasty discovery, the top rooster will often attack and displace him. In order to still show off yet minimize their chances of getting attacked, subordinate males will restrict their performance to its visual components and omit the more conspicuous, vocal aspect. Subordinate males will add back the vocal component when the top roosters are distracted, thereby enticing hens who might be listening. Subordinate roosters' choice to cease vocalizing their enthusiasm when dominant males are around suggests that they take into account the perspective of others — here, the perspective of top roosters who could displace them — and use that information to their advantage.[83]

Chickens even use deception and strategies to counter deception; complex forms of perspective-taking comparable to similar behaviors demonstrated by highly intelligent mammals such as primates and often called "Machiavellian Intelligence." For example, roosters will sometimes vocalize as if they have discovered food. By pretending in this way, roosters can attract hens who they can then keep away from other males.[84] Hens, however, are not so consistently fooled by roosters' deceptive tactics: hens eventually stop responding to males who have too often only pretended to have found food.[85]

Chickens watch each other for social cues
Photo by Farm Sanctuary

Social learning

For social species like chickens, living in groups provides a number of benefits, including the opportunity to learn by watching others. This form of learning through observation (called "social learning") enables social groups to transmit learned behaviors through the generations and develop what we term "culture." Many intelligent animals learn socially, including chickens. When chickens discerned their place on the pecking order by watching others interact (described in the "Transitive Inference" section), they demonstrated their ability to learn through observation.[86] In another study, hens who did not know how to perform a certain task (naive hens) were more likely to correctly perform the task after watching a trained hen complete it than when they watched another naive hen.[87] These examples show that chickens can learn by watching others rather than risk precious time and energy to figure everything out by themselves!

IX. EMOTION

Chickens experience a range of emotions. As complex combinations of behavioral, cognitive, and physiological processes, emotions play a central role in determining how chickens and other animals learn, remember, and think.[88] For humans to make sure chickens are well cared for, they must take into account the positive and negative emotions these feeling animals experience.[89] Further, by exploring animals' emotions, we illuminate another major facet of psychology that nonhumans share with humans.[90] Indeed, studies that demonstrate the emotional lives of animals abound: with regards to birds in particular, for example, sparrows react emotionally to the songs of their fellows,[91] European starlings experience mood shifts,[92] and quail show fear.[93] All of these studies provide evidence of not only negative emotions in birds, but positive emotions as well.

Chickens use their emotions to make decisions on what kinds of environments they prefer
Photo by Farm Sanctuary

Chickens respond emotionally to both the events they experience and events they know they are about to experience. For example, chickens anticipating a negative, neutral, or positive event respond with emotions that demonstrate their worry, disinterest, or comfort with what's about to take place. When awaiting a squirt from a water gun (a negative event), chickens move their heads and bodies more, a pacing behavior correlated with anxiety. When looking forward to a treat, however, chickens preen themselves, ruffle their feathers, and scratch their bodies, behaviors that indicate they are relaxed and comfortable.[94] When frightened, chickens show situation-specific "fear responses": they become limp and unresponsive when restrained, and they may try to avoid potentially scary, unfamiliar objects in their environment.[95] Chickens' emotions also often trigger bodily reactions: their heart rates accelerate, for instance, and their bodies heat up in much the same way as humans may feel a rush of warmth in response to a frightening or unexpected event. Chickens use their emotions to make decisions about the kinds of environments they prefer, e.g., those promoting less stress and more stimulation.[96]

X. EMOTIONAL CONTAGION AND EMPATHY

In addition to the range of emotions chickens experience, they also "catch" each other's feelings. Considered a simple form of empathy, emotional contagion occurs when one individual experiences an emotion by witnessing another individual experience the same emotion.[97]

Many socially complex species including humans, demonstrate emotional contagion; this sophisticated capacity allows animals to use social cues to help them respond to important, often challenging situations. For example, hens experience emotional contagion when watching their chicks in distress.[98] In this study, researchers acquainted hens with three conditions: the mildly aversive sensation of having air puffed into their cage, the experience of watching their chicks inside a separate cage receive an air puff, and a control situation in which an air puff was aimed outside both cages. Importantly, hens did not demonstrate any significant physical or behavioral response when they themselves received an air puff.

When they saw their chicks feel an air puff, however, hens became emotionally distressed: their heart rates and blood pressures increased; they stood alert and called out to their chicks. A follow-up study even showed that hens' responses did not simply result from their chicks vocalizing more; rather, the mothers used their own familiarity with the adverse sensation of the air puff to understand the experience of their chicks.[99] As the researchers themselves asserted, these studies show that hens "possess at least one of the essential underpinning attributes of 'empathy'; the ability to be affected by, and share, the emotional state of another."[100]

Ahmed rooster is Mr. Personality
Photo by Farm Sanctuary

Additional studies that examine the reactions of chicks to puffs of air show that mother hens can reduce their distress by acting as a social buffer. Interestingly, less emotional hens buffered their chicks' stress more effectively than very emotional individuals,[101] a finding that suggests that mother hens possess different maternal styles that likely correspond to differences in the hens' personalities.

XI. PERSONALITY

Personality represents a significant way we recognize individuals *as* individuals, that is, by identifying those patterns of behavior, thinking, and emotion unique to a particular being. We often recognize the distinct personality of animals with whom we are familiar: our pets, for example. Even so, many animals with whom we have less frequent interactions also have personalities and should likewise be recognized as complex individuals with multi-dimensional characteristics. Species across the animal kingdom, including a wide range of fish, birds, and mammals, demonstrate persistent personality features that vary across individuals.[102]

Small farmers, people who keep backyard chickens, and those who maintain animal sanctuaries frequently testify to their chickens' individual personalities. As shown in the previous section, too, hens mother in ways reflective of their individual personalities. Additional evidence for the unique personalities of chickens emerges when considering how roosters behave during social encounters. Studies that examine the relationship between roosters' individual personality traits and how dominant they rank in their social groups have found that, when two equally-matched roosters meet, the roosters' personality influences who will emerge victorious in a confrontation. Further, the rooster personality traits of boldness, activity/exploration, and vigilance correlate positively with a higher place in the pecking order.[103] These studies, not to mention the testimonies of those who keep chickens in natural settings, should inspire additional studies on chicken personalities so we can learn more about these feathered individuals *as* individuals.

XII. *WHO* IS THE DOMESTIC CHICKEN?

The available scientific research teaches us about chickens' diverse personalities, fierce mothering abilities, rich social lives, and more. To review, scientific studies show that chickens

- tell each other apart
- possess a number of visual and spatial capacities that may depend on their ability to form mental representations of, for example, objects that are removed from view
- demonstrate self-control and self-assessment, capacities that may indicate self-awareness
- communicate in complex ways, including through means that may require self-awareness and the ability to take the perspective of other animals
- exercise reason and make logical inferences
- possess some understanding of number and can perform basic arithmetic
- have a sense of time and may be able to anticipate future events
- learn from each other

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- tactically deceive one another
- experience emotions, exhibit emotional contagion, and show some evidence for empathy
- have distinct, individual personalities

A visitor to Farm Sanctuary interacts with Penelope chicken
Photo by Farm Sanctuary

These conclusions only scratch the surface of who domestic chickens are: family members, group leaders, mothers, fathers, children, and, most of all, particular individuals who each maintain habits, preferences, and complex social relationships. The available research on chickens is quite suggestive. Even so, a fuller understanding of these fascinating creatures requires much more respectful, non-invasive study in naturalistic settings that allow chickens to express themselves and, in so doing, help us learn more about who they are. Therefore, inspired by what we *do* know about chickens, we hope for a future full of human-chicken relationships curious about and celebratory of what both species may share in common.

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The Someone Project is a joint undertaking by the Kimmela Center for Animal Advocacy and Farm Sanctuary to compile, review, and publish scientific evidence for cognitive and emotional complexity in farm animals and to support promising research in these areas.

Farm Sanctuary advocates observational and cooperatively designed studies with pigs in a sanctuary setting to build upon existing research and to elevate awareness and respect for the magnificent beings they are.

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