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Thinking Pigs: Cognition, Emotion, and Personality

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THINKING PIGS:

Cognition, Emotion, and Personality

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AN EXPLORATION OF THE COGNITIVE COMPLEXITY OF *SUS DOMESTICUS*, THE DOMESTIC PIG

By Lori Marino and Christina M. Colvin

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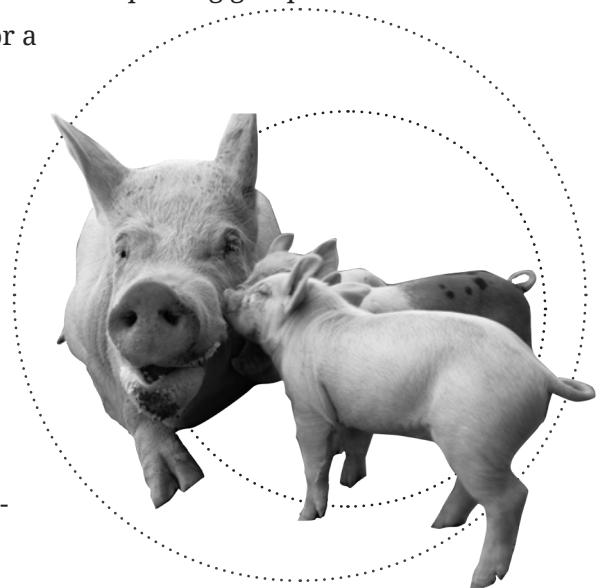
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The pig of our imagination is the Tom Sawyer, the Scarlett O'Hara, the Falstaff of the farm animal world: clever, charismatic, mischievous, and gluttonous. References to road hogs, going whole hog or hog wild, pigging out, and casting pearls before swine pepper our everyday language. In the Chinese zodiac and literature, the pig characterizes strong emotions, lack of restraint, and virility. In other cultures both ancient and modern, the pig has been not only a symbol of luck, abundance, and strength, but also of sloth and uncleanness. In Western popular culture, the diva Miss Piggy, smart and ambitious Babe, and the deeply emotional Wilbur of *Charlotte's Web* delight us in our books and films.

But just who are pigs, *Sus domesticus*, who have lived closely with humans since the species was domesticated 9000 years ago? Today, the animal is found in our medical products and clothing and in our idioms and literature. What's more, humans consume millions of pigs each year as food. But few of us have had more than a passing glimpse of an actual pig—perhaps at a country fair or a hog farm along the highway. In fact, most pigs today are locked away in large factory farm warehouses in remote rural areas, far from view.

Talk with anyone who runs a sanctuary for farm animals, and you're sure to hear tales of escape artists, charmers, rabble-



rousers, and fiercely devoted mothers—tales of pigs as animals with keen intelligence and big personalities. In the developed world, however, the vast majority of these intelligent, feeling individuals spend their entire lives confined in the barren world of industrial agricultural complexes.



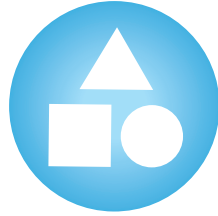
Many people will tell you that pigs are smart, but what does that mean?

What do we really know about the intelligence of pigs? Recent scientific studies of pigs not only lend support to our popular depictions and assumptions about pigs, but also demonstrate that pigs possess cognitive capabilities similar to dogs and young children, show self-awareness, form likes and dislikes, enjoy creative play, and experience emotions not unlike our own.

Here we summarize the current scientific research on cognition, emotions, self-awareness, personality and social complexity in pigs based on Marino & Colvin (2015).

A Pig's World

A number of recent studies have investigated how pigs perceive and think about their physical environment. These studies examined problem solving, object discrimination, spatial cognition, learning and memory in the physical world, and time perception.



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Object Discrimination

The ability to discriminate objects—say, distinguishing a circle from a square or a blue circle from a red circle—is the foundation for more complex mental tasks, such as categorizing objects or understanding abstract concepts. Humans and nonhuman animals use object discrimination with various levels of sophistication for everything from simple tasks, such as selecting an orange over a grapefruit or choosing the right tool for a job, to survival, such as recognizing a predator or distinguishing a venomous snake from a harmless one.

The ability to categorize objects, for example, might be demonstrated by having an animal put all items of the same color together regardless of the items' shapes. Understanding that there are more blue circles than red



Violet playing with a pumpkin.
Photo Jo-Anne McArthur

circles in a group of objects, or that there are no circles present at all, is an example of abstract thinking. Dogs can tell the difference between color photos of dogs and photos of landscapes. Rodents and primates are also skilled at discriminating objects. Pigs, too, are experts at distinguishing between objects.

Pigs have sophisticated abilities to distinguish objects in a range of situations that require robust memory. In one study, pigs were presented with objects

familiar to them (such as a cereal box and plastic grocery bag) and novel objects (dish cloths and colored wooden spoons). After they were shown an object repeatedly over the course of two days, the pigs remembered that

Like dolphins, chimpanzees and other great apes, pigs comprehend a symbolic language.



object for five days or more and showed a preference for novel, unfamiliar objects, clearly demonstrating that they have long-term memories.²

Pigs not only remember but they also prioritize “important” memories. In food-searching tasks in which they could choose just one of two known food sources, the pigs remembered and preferred the site with more food. They used memories of food odors and color cues to navigate, using spatial features for reference, to a site that previously contained food.³

Symbolic language. Like dolphins, chimpanzees, and other great apes, pigs possess symbolic language comprehension. In one particularly intriguing study, two pigs showed they understood gestures and verbal symbols that represent objects such as a frisbee, ball, and dumbbell, as well as actions such as sit, fetch, and jump. Not only were they able to distinguish among three items presented to them, but they also learned complex combinations of symbols for actions and objects, as in “fetch the frisbee,” and they performed the actions asked of them. Also, like dolphins, pigs can make complex three-object choices: for example, they learned to fetch the ball on request when the ball and dumbbell were present. They can even complete three-object, one-action combination tasks as well, such as jumping over one of three available objects on request.⁴

Time Perception

Some animals demonstrate that they have a sense of time. For example, chimpanzees and other great apes can select tools (rope, rod, or a metal strip) as much as a day in advance to prepare for future events. Moreover, they remember specific details (what, where, and when) of events after hours, weeks, and even years have passed, demonstrating episodic memory, or, memory for autobiographical events. This capacity is called episodic memory. These abilities to detect the passage of time, remember specific events in one’s life, and anticipate the future allow for very sophisticated cognitive capacities, such as possessing a sense of self through time and planning for the future.

When their hooves repeatedly slipped off the lever, many of the pigs persisted by trying to use their snouts instead!

Pigs appear to have a sense of time also. In one study, pigs could choose between two crates, each of which they had learned to associate with different lengths of confinement: 30 minutes versus 4 hours. The pigs showed a clear preference for being in the crates with the shorter confinement time, showing they could use their prior experiences to anticipate future situations.⁵

In another study—a good example of the difficulties researchers can face when designing species-appropriate experiments—six pigs were required to press a lever with their hooves for a specific number of seconds to obtain a food reward. When their hooves repeatedly slipped off the lever, many of the pigs persisted by trying to use their snouts instead, showing that they understood the task and its time requirements and demonstrating impressive functional flexibility.⁶

Pigs also seem to have a sense of the future; that is, they appear to anticipate whether positive or negative experiences might be imminent. In one study, different tones indicated whether the pigs would be able to enter a room that contained a bowl of popcorn (a positive outcome) or be required to cross a ramp over a visual simulation of a cliff (a negative outcome). The pigs indicated fear by vocalizing at high frequency when they heard the tone for the ramp, suggesting that they were responding emotionally to an impending negative event.⁷



Spatial Learning and Memory

A number of species use their sophisticated spatial abilities to forage, cache food, and navigate their environments. These behaviors involve learning, remembering, and applying information about the layout of their environments and location of objects. Dogs, for example, use mental maps to search for objects, formulating shortcuts based on their knowledge of previously used paths.⁸

Pigs, too, as foraging animals, are whizzes with mazes and tests that

Pigs, as foraging animals, are whizzes with mazes and tests requiring location of desired objects.

require locating desired objects. The holeboard procedure is one particularly effective method for studying spatial learning and memory in pigs and other animals. The holeboard is an open area in a large room with many holes, or wells, that can be baited with food. Pigs, then, can be observed as they forage with their snouts in the wells as they would by rooting in the ground in a natural setting.



Pigs foraging in a field of chamomile.

Photo Farm Sanctuary

Pigs, it turns out, are highly capable of locating food quickly and accurately in holeboard tests, and they remember the location, content, and relative value of food they've discovered. Following 10-minute and 2-hour waiting periods, pigs, like dogs, successfully returned to areas where food had been found earlier and avoided areas that did not contain food.⁹

In another foraging-type experiment, pigs chose to visit food sites that they knew contained larger amounts of food, indicating that they remember and discriminate among sites based on their value. Interestingly, this experiment also suggests that pigs may possess some level of "numerosity," a basic sense of quantity.¹⁰



Novelty Seeking, Inquisitiveness, and Play

Play, as we know, is critical to the healthy development of social mammals, and it's a marker of cognitive complexity. Primates, dolphins, dogs, and other cognitively complex mammals play.

If you've interacted with unconfined pigs, you know that pigs take their play seriously, so to speak! Pigs are inventive in their play, both with objects and with other pigs,¹¹ carrying or shaking objects such as balls or sticks, or tossing straw.^{12,13,14} They push, chase, and engage in mock fighting with each other, similar to play in dogs and other mammals.¹⁵ They scamper, jump, paw, pivot, run for fun, flop on the ground, and wave their heads in play.¹⁶

Pigs take their play seriously.



Kim Gordon leaping in characteristic piglet play.
Photo Farm Sanctuary

Play is so important in the development of animals that the lack of opportunity to play can lead to behavioral abnormalities.^{17,18,19} Young pigs reared in enriched environments where they can interact with objects and

Pigs are notorious for rushing to greet and “talk” with their porcine and human friends.



Eric and Jane expressing affection.

Photo Farm Sanctuary

other pigs are more socially and cognitively developed than pigs raised in the crates used in production facilities.²⁰

Pigs are active and intelligent participants in their worlds in much the same way as other cognitively complex animals. These studies reveal that pigs possess a sophisticated understanding of their physical surroundings, navigate efficiently, remember and anticipate experiences, and enjoy their world through play.

The Social Pig

If you’ve spent time with pigs, you know that you want to stay on their good side. Pigs are notorious for rushing to greet and “talk” to their porcine and human friends, but ignoring, nipping, or pushing those they are not so fond of.

Primates, dolphins, whales, and other animals who live in socially complex groups have high-level cognitive capacities. According to current research,



pigs are as socially complex as many other highly intelligent animals as evidenced by their social structure, keen ability to discriminate among individuals (both pigs and humans), and apparent awareness of the mindset of others—all markers of high cognitive social functioning.

Discriminating Other Animals and Humans

The ability to tell individuals apart is the basis of all social relationships and is, of course, important in differentiating strangers from familiar individuals and family from non-kin. Dogs can distinguish between the barks of other dogs. Elephants are well known for their remarkable ability to recognize and remember individuals of their kind even over long distances and periods of time.



Greeting a familiar and beloved human animal friend, Farm Sanctuary's National Shelter Director Susie Coston.

Photo Derek Goodwin

Like other socially complex animals, pigs prefer familiar individuals over strangers.^{21,22,23} Pigs as young as six weeks can distinguish between two female pigs using sensory and social cues, and they can even differentiate between closely related individuals.²⁴

... pigs are able to tell humans apart based on body size and some facial characteristics.



Young pigs can identify familiar and unfamiliar individuals based on urinary samples alone with their keen olfactory sense.²⁵ Pigs also use auditory cues. When sows listened to recordings of piglet vocalizations, they responded more strongly to calls of their own piglets than to those of unfamiliar piglets.²⁶

Differentiating among individual members of another species may require even more sophisticated cognitive capabilities. Dogs can tell the difference between a smiling human face and a neutral expression, perhaps not surprising given their long history of domestication. Pigs can also distinguish familiar and unfamiliar human faces.^{27,28} Young pigs who were handled gently and fed treats for five weeks were then allowed to choose between the gentle handler and a stranger. They chose the familiar handler using olfactory, visual, and auditory clues.²⁹ Poignantly, in commercial settings in which they are often handled roughly, pigs do not bother to discriminate between handlers, which may be their way of adapting to being treated the same by everyone.³⁰

In another study, when pigs were shown different people wearing the same clothes, they were able to tell humans apart based on their body size and some facial characteristics, showing that they were not responding to superficial features such as clothing but were sensitive to features more consistent with personal identity.³¹

Perspective Taking

Perspective-taking is a very complex mental capacity involving putting oneself in the mental “place” of another individual and recognizing that their thoughts, intentions, emotions, and motivations may differ from one’s own. Pigs can take the perspective of other pigs, and they even use this information to manipulate each other.

In their foraging activities, pigs can be wily and competitive, clearly showing that they understand the intentions of other pigs. In one study,

Pigs pass the “pointing test” — they can locate a food reward using the cue of a human pointing to it.



Fig, Joan, and Fiona interacting in a social group.
Photo Farm Sanctuary

pigs foraged for food in pairs. Only one pig was shown the location of the food. The uninformed pig followed the pig-in-the-know to the food source and then took the food first. In response to this behavior, the informed pigs altered their behavior in later trials to reduce the chances that they would be followed and increased their forging speed to stay ahead of their exploiters.³²

These types of strategies and counterstrategies are a complex form of perspective-taking called tactical deception, a capacity also observed in great apes and ravens. As Dr. Michael Mendl of Bristol University stated, “Our results suggest that pigs can develop quite sophisticated social competitive behavior, similar to that seen in some primate species.”³³

Pigs also sense the “attention state of humans,” another indication of their perspective-taking abilities. In one study, young pigs were required to choose between two humans using only head cues to determine who was paying attention to them. The pigs easily selected the attentive humans. And, pigs pass the “pointing test,” meaning that they can locate

a food reward using the cue of a human pointing to it.^{34,35} The pointing test, made famous by dogs outperforming chimpanzees and other great apes, evaluates an animal's ability to respond correctly to the visual cue of a human pointing to an object. While this test is not strictly perspective-taking, it does indicate that the animal has some sense of the intentions of another.

The body of findings on pigs' perspective-taking, sensitivity to attention state, and social preferences shows that they belong in a group of very sophisticated animals, such as great apes, ravens, and dolphins, all of whom possess a keen and nuanced understanding of their role in their social group.



Lola, expressing her unique personality.
Photo Farm Sanctuary



“I” Am Pig!

Self-awareness is the ability of animals to have a sense of themselves physically as well as awareness of their own thoughts and feelings, in other words, a sense of “I.” Because humans and animals do not share a language, self-awareness is especially difficult, but not impossible, to study. Researchers traditionally use the mirror self-recognition (MSR)

test—determining if an animal recognizes himself in a mirror—as a tool in understanding self-awareness. The test itself doesn’t work for all species, and results can be less than conclusive, but animals do react in markedly different ways to mirrors.

In the mirror test, an animal is introduced to a mirror, often for the first time. Some animals react to the mirror as though it is another individual of their own species. Others, however, start to use the mirror to investigate parts of their own body. When that happens, a mark is surreptitiously applied to a part of the animal’s body that he or she cannot see without a mirror. The animal is reintroduced to a mirror and observed to see whether he uses the mirror to investigate the new mark on his body or whether he treats the image in the mirror as representative of another individual. All great apes demonstrate mirror self-recognition. European magpies show MSR by pecking at the mark on their body with their beaks, elephants by investigating the mark with their trunks, and dolphins by maneuvering in front of the mirror to expose the newly marked part of their bodies.

The mirror test requires that an animal show curiosity or interest in a mark on her body in order for her experience in front of a mirror to be easily interpreted. But some animals, pigs among them, show that they understand the relationship between their own body and the reflected image without passing the “mirror mark test.” Such behaviors are open to interpretation. For instance, in one study, seven out of eight pigs who already had experience with mirrors were able to quickly locate food visible only by viewing the mirror.³⁷ This study demonstrates that the pigs do understand something about their own body as it is reflected in the mirror in relation to the hidden food. Pigs have also been observed making repetitive movements while appearing to watch themselves in a mirror for the first time.³⁶ This behavior, called contingency checking, is seen in some animals who eventually pass the mark test. Contingency checking, therefore, may indicate mirror self-recognition, but the evidence is not conclusive.



Pigs
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“... pigs are
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~ Dr. Sarah Boysen

Another component of self-awareness is self-agency, the ability to know that one’s actions cause change. One way to study self-agency is to see if an animal can use a joystick that controls a cursor on a computer screen. Pigs, like chimpanzees, understand that a joystick they control moves an on-screen cursor. In one study, pigs outperformed dogs in manipulating a joystick to move a cursor to hit an on-screen target. Despite the physical challenges the pigs faced when manipulating a joystick, all the pigs in the study successfully hit their targets.³⁸



Roxy, innovating a new use for her water trough.

Photo Farm Sanctuary

“Pigs could be as smart as chimpanzees and other nonhuman primates,” explained Stanley Curtis, former professor of animal sciences at Pennsylvania State University. Curtis noted that the pigs learned to play games every bit as quickly as chimpanzees. In fact, “Hamlet and Omelette [the pigs in the study] exhibited more interest in the task at hand than their primate cousin” Animal cognition researcher Dr. Sarah Boysen noted that “pigs are capable of focusing their attention with even more intensity than a chimp.”



The intriguing abilities pigs show with mirrors and video games call for further investigation in creative noninvasive ways. The payoff may be a deepened understanding of what it is like to be a pig, from the pig's perspective.



The Feeling Pig

Emotions are complex processes that involve behavior, cognition, and physiology. They are influenced by one's situation and even by the mood of others, and they affect a variety of abilities such as attention, decision-making, and memory. Studies of emotion in pigs reveal that they are sensitive and complex animals.

Pigs exhibit emotional contagion, a capacity thought to be the basis for empathy, or the ability to feel the emotional state of another. Emotional contagion is the arousal of emotion in one individual when witnessing the same emotion in another individual.



Portia, Nikki, Chuck, Honey, and Ellen sharing a peaceful moment resting in their barn.

Photo Farm Sanctuary

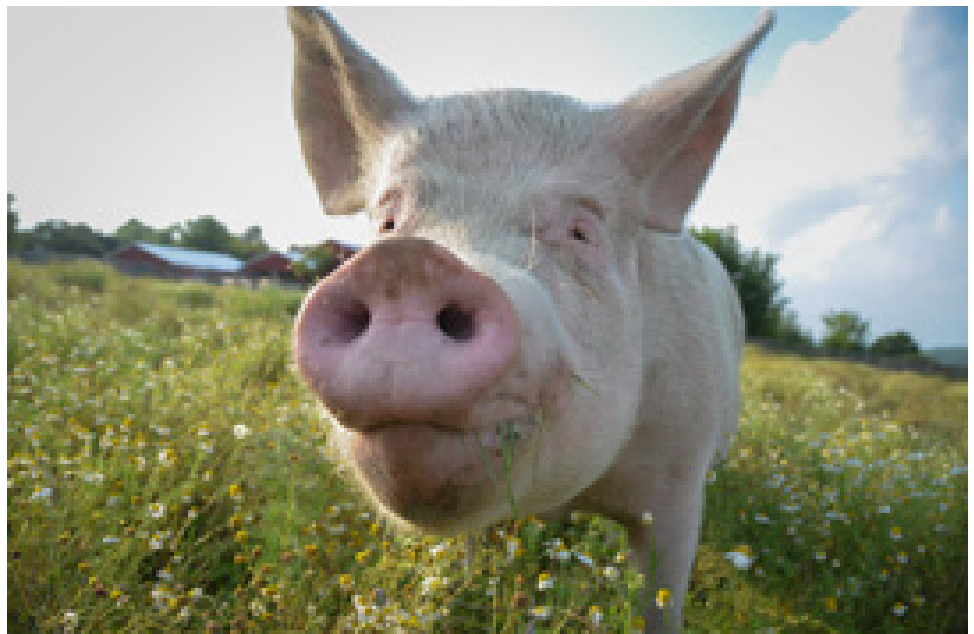
In one study, naïve pigs joined pen mates who had been trained to



Pigs exhibit “emotional contagion” — a simple form of empathy, or the ability to feel the emotional state of another.

anticipate chocolate raisins and straw (a positive outcome) or social isolation (a negative outcome). The naïve pigs adopted the same emotional behaviors (ear and tail postures, increased stress hormone release) as the trained pigs, showing that pigs not only connect with the emotions of other pigs but also respond to pigs who are anticipating future events.³⁹

In a similar study of emotional contagion in pigs, researchers housed pigs in groups of six and trained two pigs from each group to anticipate food (a positive outcome) or social isolation (a negative outcome). Two pigs from each group learned to associate the music of Bach with food, and two others learned to associate social isolation with a military march. The music was played to two other pigs (“naïve” pigs), but without any positive or negative association. When the music was played in a group setting, a few of the trained pigs showed either “happy” behaviors (play behavior, wagging their tails) or stress (standing alert, laying their ears back, urinating, and defecating), depending on the music they heard. The researchers observed that when a naïve pig was near a trained pig who acted stressed, the naïve pig also became more alert and also laid her ears



Honey playfully greeting her photographer.
Photo Farm Sanctuary

back. Interestingly, the “contagion” stress response happened to a much greater degree when naïve pigs were paired with “happy” pigs as opposed to stressed pigs. Importantly, when music was played to the naïve pigs when they were apart from their group, it had no effect on their behavior at all.⁴⁰

Pigs are playful creatures, and it is likely that playing with objects and some forms of social play are indicators of happy emotions. Studies show that pigs play more when they are anticipating positive events.

Emotions may be challenging to study and interpret, but the emotional experiences of pigs are clearly evident in their play, fear and stress responses, and their sensitivity to the emotions of their companions.



Personality is something individuals possess, and when animals manifest personality characteristics, they demonstrate that each of them is an individual, not just a generic member of a species.

Personality and the Pig

Personality is a set of enduring and consistent emotional, cognitive, and behavioral traits of an individual, and personality is displayed in a range of nonhuman species. Personality is something individuals possess, and when animals manifest personality characteristics, they demonstrate that each of them is an individual, not just a generic member of a species. To assess personality in pigs, researchers observed their behaviors, responses, temperament, and coping styles in response to various situations. In one study, researchers found that when pigs were put in a competitive group-feeding setting, individual levels of aggression emerged as a stable personality feature of female pigs.⁴¹ In another illustrative example, researchers examined how piglets respond to different situations (being held down for several seconds, social isolation, contact with an unfamiliar piglet, and the introduction of novel objects), and they measured various behaviors, including vocalization, aggression, and their willingness to approach others. The study found that piglets display individuality along at least three personality dimensions: aggression, sociability, and exploration.⁴² Such aspects of personality correlate closely to the human characteristics of agreeableness, extraversion, and openness.⁴³ These studies reveal that individual pigs each have behavioral traits that reflect

complex personalities, just like those seen in other animals, including humans. The study of personality in pigs is critical to our understanding of “who” they are.



Chuck and Honey cooling in the mud on a summer day at sanctuary.

Photo Farm Sanctuary

Who is the domestic pig?

And so, who is the domestic pig? The scientific research on pigs to date tells us that they

- have excellent long-term memories
- understand symbolic language
- have a sense of time, remember specific episodes in their past, and anticipate future events
- are excellent at navigating mazes and other spatial tasks
- play creatively
- live in complex social communities and easily distinguish other individuals, both pigs and humans

THE SOMEONE PROJECT



- have an understanding of the perspective of others as shown in their ability to use tactical deception
- are emotional and exhibit empathy
- show a form of self-recognition and self-agency in their abilities to manipulate joysticks and use mirrors to find food
- have distinct personalities

Research on cognition, emotion, and personality in pigs and other farm animals is still in its infancy in comparison with studies of other cognitively complex animals. Each new study seems to reveal just how much we still need to learn. These charismatic and intelligent animals have shared our lives since ancient times. Through respectful noninvasive study, we may come to realize that pigs are not very different from the dogs and cats we share our homes with. They may even be not very different from ourselves.

“We have shown that pigs share a number of cognitive capacities with other highly intelligent species such as dogs, chimpanzees, elephants, dolphins, and even humans. There is good scientific evidence to suggest we need to rethink our overall relationship to them.” ~ Dr. Lori Marino

Learn more about farm animal
cognition and
emotion through
The Someone Project
at [farmsanctuary.org/learn/
the-someone-project/](https://farmsanctuary.org/learn/the-someone-project/)

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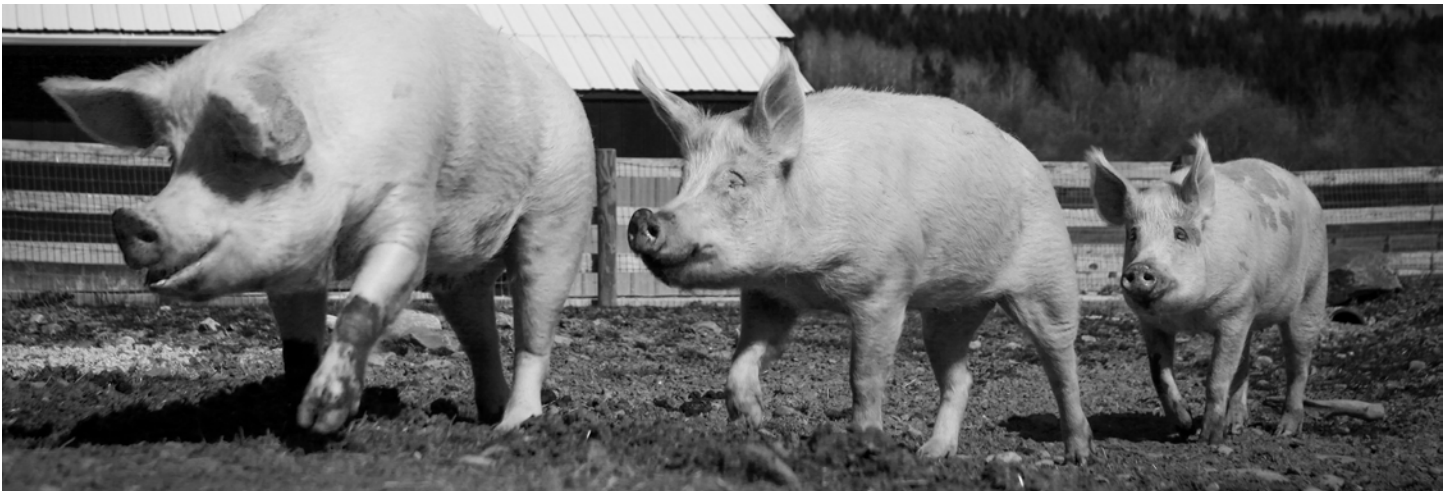
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The Someone Project is a joint undertaking by the Kimmela Center for Animal Advocacy and Farm Sanctuary to compile, review, and publish scientific evidence for cognitive and emotional complexity in farm animals and to support promising research in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

Visit <http://www.farmsanctuary.org/learn/the-someone-project/>

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