What are animals conscious of?[1]

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1- Introduction

There is little doubt that animals are "conscious". Animals hunt prey, escape predators, explore new environments, eat, mate, learn, feel, and so forth. If one defines consciousness as being aware of external events and experiencing mental states such as sensations and emotions (Natsoulas, 1978), then gorillas, dogs, bears, horses, pigs, pheasants, cats, rabbits, snakes, magpies, wolves, elephants, and lions, to name a few creatures, clearly qualify. The contentious issue rather is: Do these animals know that they are perceiving an external environment and experiencing internal events? Are animals self-conscious?

Recent attempts at understanding animal consciousness (e.g., Edelman & Seth, 2009) agree that non-human animals most probably possess "primary" (or "minimal") consciousness. But these views also argue that unlike humans animals lack many (but not all) elements that make up higher-order consciousness—the capacity to self-reflect on the contents of primary consciousness. In this chapter I will aim at offering a more elaborate picture of this position. I will present detailed information on what is meant by "higher-order consciousness"—i.e., self-awareness. I will suggest that some dimensions of self-awareness (e.g., self-recognition, metacognition, mental time travel) may be observed in several animals, but that numerous additional aspects (e.g., self-rumination, emotion awareness) seem to be absent. Some other self-related processes, such as Theory-of Mind, have been identified in animals, but not as the full-fledged versions found in humans. I will postulate that these differences in levels of self-awareness between humans and animals may be attributable to one distinctive feature of human experience: the ability to engage in inner speech.

2- Definitions, measures, and effects of self-awareness

Mead (1934) established a classic distinction between focusing attention outward toward the environment (consciousness), and inward toward the self (self-awareness). This framework was recaptured and expanded by Duval and Wicklund (1972). It became very popular in experimental social and personality psychology, where it has been guiding empirical research for more than four decades (see Carver, 2003, for a review).

Unconsciousness refers to the absence of processing of information, either from the environment or the self. As previously stated, consciousness constitutes the processing of environmental information or responding to external stimuli. Cabanac, Cabanac, and Parent (2009) suggest that this kind of consciousness (the non-reflective type) could very well be present in reptiles, including tortoises, turtles, lizards, snakes and crocodiles, and in birds and mammals. These animals possess comparable brain volume (as measured by the ratio of brain to body mass), structure and neurochemistry, and like conscious humans, exhibit emotions, feel pleasure, play, and dream.

Self-awareness is usually defined as becoming the object of one's own attention. It represents a state in which one actively identifies, processes, and stores information about the self (Morin, 2004). Self-awareness constitutes a complex multidimensional phenomenon that comprises various self-domains (e.g., thinking about one's past and future, emotions, thoughts, personality traits, preferences, intentions; sense of agency) and corollaries (e.g., making

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inferences about others' mental states, self-description, self-evaluation, self-esteem, self-regulation, death awareness, self-conscious emotions, self-recognition, self-talk). Self-awareness also entails knowing that one stays the same person across time and that one is separate from the environment (Kircher & David, 2003).

Initial empirical work focused on short term effects and long term consequences of being self-aware. Much of this research involved exposing participants to self-focusing stimuli known to remind the person of his or her object status to others—e.g., mirrors, cameras, an audience, recordings of one's voice; such stimuli reliably produce heightened self-awareness (Carver & Scheier, 1978). Other manipulations and measures of self-awareness include (1) questionnaires that assess dispositional self-focus (Fenigstein, Scheier & Buss, 1975) or spontaneously occurring fluctuations in self-awareness (Govern & Marsch, 2001), (2) first-person singular pronouns use (Davis & Brock, 1975), (3) self-novelty manipulation (Silvia & Eichstaedt, 2004), where participants are invited to write about ways in which they differ from others, (4) word-recognition measures (Eichstaedt & Silvia, 2003), where subjects are asked to identify self-relevant or self-irrelevant words as quickly as possible, and (5) match between self- and other-ratings on cognitive or personality measures to evaluate self-knowledge in healthy people (Hoerold, Dockree, O'Keeffe, Bate, Pertl & Robertson, 2008) and self-awareness of deficits in patients with traumatic brain injury (Cocchini, Cameron, Beschin & Fotopoulou, 2009). Note that all these measurement techniques are inappropriate for animals because they require language; to my knowledge the most used non-verbal measure of self-awareness is self-recognition, which will be discussed in another section.

Inducing self-awareness with self-focusing stimuli produces self-evaluation (Duval & Wicklund, 1972), whereby the person compares any given salient self-aspect to an ideal representation of it. Self-criticism is then likely to occur, leading to an avoidance of the state of self-awareness or a reduction of the intraself discrepancy, by either modifying the target self-aspect or by changing the ideal itself. Another effect of self-awareness is emotional intensity—the proposal that focusing on one's emotions or physiological responses amplifies one's subjective experience (Gibbons, 1983). To illustrate, empirical evidence suggests that angry self-aware individuals behave more aggressively than non self-aware participants. Self-awareness also increases accurate access to one's self-concept; for instance, self-reports of self-aware individuals are more accurate. Other effects or consequences of self-awareness are heightened consistency between one's behavior and attitudes, increased self-disclosure in intimate relationships, stronger reaction to social rejection, and a decrease in social conformity and in antinormative behavior (see Franzoi, 1986, for references). While it is ultimately pointless to ponder if animals exposed to self-focusing stimuli would, like humans, engage in self-evaluation, "self-disclose" more, or act more ethically, it sure is intriguing to wonder if they would become more aggressive if angered or if they would react more strongly to social rejection—these are potentially observable events. Remarkably this has never been done—i.e., trying to replicate some effects and consequences of self-awareness in animals using self-focusing stimuli. Positive results would suggest the presence of the above-mentioned forms of self-awareness in tested creatures. Of course this assumes that the presence of a camera or a mirror would successfully induce self-focus in animals.

Past research also shows that self-awareness increases the likelihood of more effective self-regulation (e.g., Carver & Scheier, 1981). Self-regulation includes altering one's behavior, resisting temptation, changing one's mood, selecting a response from various options, and filtering irrelevant information (Baumeister & Vohs, 2003). Do animals self-regulate? They must be able to monitor their ongoing behavior and compare it to set goals, or else they could not be able to hunt or to copulate to survive. But given the demonstrated importance of speech-for-self in self-regulation, I would suggest that animal self-regulation is much more primal than that of humans. Vygotsky (1943/1962) pioneered the view that language can be used as a verbal self-guidance devise, and decades of work on private speech use in problem-solving, planning, and decision-making support this view (Winsler, 2009). In short, people who rely on self-talk while engaged in self-regulatory activities perform significantly better than those who do not. Thus non-verbal animal and verbal human self-regulation should probably not be equated.

Although self-awareness clearly represents an evolutionary advantage, it has its setbacks

as well (Leary, 2004). In humans, excessive self-focus creates worry, guilt, shame, jealousy, insomnia, etc., and may contribute to social anxiety (Buss, 1980), depression (Pyszczynsky & Greenberg, 1987), and even suicide (Baumeister, 1991); unhealthy people are also known to self-ruminate (J.M. Smith & Alloy, 2009). Do animals experience these psychological ailments? To my knowledge animals have never been observed worrying and do not seem to experience sleeping difficulties as a result. Maybe they can feel guilty or jealous—it's hard to say. There is no evidence of suicide in animals (Preti, 2005), suggesting that non-human creatures may not be able to mentally represent their own death. Do animals possess a more general awareness of death? Here the evidence is mixed. On one hand we have African elephants known to pick up and scatter the bones of deceased elephants (McComb, Baker & Moss, 2006). Perhaps these elephants are aware of death, but the bone scattering could be seen as simple survival behavior that hides their migration routes or feeding patterns. On the other hand, the way rabbits react to the death of their companion is puzzling. While some cautiously smell the body of the deceased, others take turns lying nested against the dead rabbit, and in some cases, directly on top of it. J.A. Smith (2005) suggests that these behaviors indicate an understanding that a partner has undergone a permanent and catastrophic change.

Animals apparently do not blush (Darwin, 1872) so there is also no evidence indicating that they experience social anxiety. Rats have been shown to experience negative emotional states, or "depression", as suggested by increased sensitivity to the unanticipated loss of food reward (Burman, Parker, Paul & Mendl, 2008). Humans are more sensitive to reward loss than gain, but depressed individuals tend to be even more responsive to reward loss. Although pet owners may describe their cat or dog as being "depressed", clear scientific data to this effect is still lacking. In addition, such depressive episodes, if they do exist, may have little to do with heightened self-awareness or with the animal being aware of experiencing them.

In humans, self-awareness does not represent a uniform construct and is made up of two different tendencies (Trapnell & Campbell, 1999): self-reflection, which constitutes an authentic curiosity about the self, and self-rumination, which represents anxious attention paid to the self. While it is clearly impossible to know if self-aware animals are genuinely curious about their selves, one can state with some confidence that self-rumination in animals is unlikely. Self-rumination consists in recurrent, intrusive, and disruptive thoughts. These thoughts are most probably articulated with inner speech, and indeed, measures of self-rumination strongly correlate with the Automatic Thoughts Questionnaire (Conway, Csank, Holm & Blake, 2000)—in essence an inner speech scale. Animals lack inner speech, but perhaps they could "ruminate" with mental images? Self-ruminators are more likely to suffer from depression, anxiety, stress, and social phobia or withdrawal; they also experience problem-solving and concentration difficulties (J.M. Smith & Allow, 2009). Animals do not seem to present any of these problems, at least not as self-induced conditions.

3- Agency and mental time travel

As indicated previously, self-awareness consists of various dimensions, among which are sense of agency and mental time travel (MTT). Most animals probably have a sense of agency based on representations of the relation between their action and the subsequent effects which develops through operant conditioning. This capacity allows organisms to interact with and control their own environment (Engbert, Wohlschläger & Haggard, 2008).

MTT, also known as autonoetic consciousness, represents the ability to remember personally experienced events that occurred in the past and to imagine personal happenings in the subjectively felt future (Tulving & Kim, 2009). It includes a "what, where, and when" (www) of events, as well as the conscious re-experiencing of oneself in the remembered event. The "remembering one's past" portion of MTT has been assessed in various animals; in primates, a typical experiment goes as follows. The animal first witnesses a unique event—e.g., seeing a familiar person doing something odd, such as stealing a cell phone. This is followed by a 15-minute retention interval, and then the subject is shown three photographs (two distractors and the witnessed event) and is asked to select the correct photograph depicting what he/she had seen before. A good answer is rewarded with food. Chimpanzees and gorillas perform significantly higher than chance on that type of trial (Manzel, 2005). Variations of this task have

been created to test MTT in other creatures such as scrub-jays, magpies, and rats. They also remember the "www" of personal events, suggesting rudiments of an MTT system (Roberts & Feeney, 2009). It remains impossible to determine if these animals actually mentally re-live the events.

Can animals anticipate and plan for the future? The evidence is very limited and is open to alternate interpretations. Scrub-jays can anticipate the need for specific food at breakfast the following day by storing seeds in novel locations where they have not encountered food before, and captive chimpanzees will cache stones which they will later hurl at human visitors (Roberts & Feeney, 2009). However, the possibility remains that, in both cases, these animals rely on semantic knowledge (generalized knowledge that does not involve anticipation of a specific event—e.g., human visitors periodically appear) rather than on genuine planning (human visitors will appear tomorrow morning). In short, it is still unclear if animals are "stuck in time" or not.

4- Private and public self-awareness

One fundamental distinction that has been proposed early on is the difference between private and public self-focus (Fenigstein, Scheier & Buss, 1975). Self-awareness includes a knowledge of one's own mental states (private self-aspects) such as thoughts, emotions, preferences, personality traits, opinions, goals, sensations, attitudes, etc., and visible characteristics (public self-aspects) such as one's body, physical appearance, mannerisms, and behaviors.

Humans routinely focus on private and public self-dimensions. Do animals also focus on both private and public self-aspects? All animals must possess some rudimentary form of body self-awareness (Bekoff & Sherman, 2004). They position their body parts in space so that they do not collide with nearby conspecifics, and they travel as a coordinated hunting unit of flock. Also, some animals are capable of self-recognition, which requires a mental representation of one's body (Mitchell, 2002). Note that one's body can be apprehended both as a private self-aspect (kinesthetic experience) and public self-aspect (the image of one's body seen in a mirror). Do animals reflect on their physical appearance? Unlike humans, they do not wear body adornments such as bracelets and beads (Leary, 2004). This suggests that animals do not experience a need for self-enhancement nor physical appearance concerns.

Do animals reflect on their unobservable mental states? It is virtually impossible to determine animals' awareness of their own sensations, motives, opinions, or attitudes (if they do form the latter two, which is unlikely). Animals, including primates, dogs, cats, and birds, certainly experience emotions. Physiological, behavioral, and cognitive changes that spontaneously accompany affective states are remarkably similar in humans and animals (Paul, Harding' & Mendl, 2005). Chimpanzees and orangutans display emotional reactions of pride, shame, and embarrassment (Tracy and Robins, 2004). However, an organism may experience emotions, including self-conscious emotions, without being aware of them (Salzen, 1998), and to my knowledge evidence for emotional awareness in animals is nonexistent. This remark also applies to animals' awareness of preferences (e.g., food). Animals do have preferences, but there is no known way of determining if they know about their preferences. Animals also exhibit individual differences, but awareness of one's personality characteristics in terms of traits entails linguistic representation that non-human creatures lack.

5- Metacognition

What about awareness of thoughts? Metacognition consists in thinking about thinking, or cognition about cognition (Nelson & Narens, 1994). Examples of metacognition in humans are: becoming aware of a thought one just had or how one just solved a problem. One other case of metacognition is when we feel uncertain about some information we might possess or not—for instance: Can I recall this phone number or do I need to look it up in the directory? Uncertainty responses during perceptual tasks (e.g., tone discrimination) or memory tasks (e.g., item recall) are often used in animals as an indicator of metacognition (J.D. Smith, 2009). In addition to discrimination responses per se, subjects are given the possibility to decline completion of any trials they want. Doing so suggests uncertainty and probably knowledge that information is

missing to adequately perform the task. Available evidence indicates that dolphins and monkeys, but not rats, make uncertainty responses in a variety of tasks (J.D. Smith, 2005). Hampton (e.g., 2001) reports studies on "memory awareness" showing that rhesus monkeys, but not pigeons, turn down trials when they are uncertain they will pass a memory test.

Another metacognition test consists in asking subjects to make metaconfidence judgments in which they evaluate up to what point they are confident that a previously made response is correct (Son & Kornell, 2005). This requires metacognition because one has to think about one's own knowledge (or lack thereof) when assessing one's confidence in an answer. In a representative experiment, monkeys are asked to identify the longest of nine lines. The "metaconfidence judgment" part of the task consists in subjects making a high bet (for high reinforcement) or a low bet (for lower reinforcement) on the correctness of their previous answer. Making a high bet means that the animal is very confident in the previously given answer, and vice versa. Monkeys are indeed able to make accurate confidence judgments.

Not only do some animals decline a task because of lack of knowledge—some will also seek information when it is incomplete (Call, 2005), suggesting that they are aware of not knowing. In a typical study, subjects have to choose one of two containers to obtain a reward. The experimenter places food in one of the two containers. In one condition, subjects can see in which container the food is put before choosing. In another condition they don't have direct visual access to that information, but if they bend down and look under the containers they can see where the food is. Chimpanzees, gorillas, and orangutans actively seek additional information in that type of experiment by looking under the containers before choosing; dogs however, do not.

Various experimental paradigms consequently suggest that some animals could be aware of their thoughts, although alternative non-mentalistic (first-order, as opposed to second-order) explanations are available (Carruthers, 2008). Also, animals show functional parallels to human conscious metacognition, but they may not experience everything that accompanies conscious metacognitive experience in humans.

6- Self-recognition and Theory-of-Mind

Most organisms that get confronted to a reflecting surface react as if they were seeing another conspecific creature by engaging in a variety of social responses such as bobbing, vocalizing, and threatening. Only humans, chimpanzees, orangutans, and some bonobos, elephants, dolphins, and most recently magpies have been shown to exhibit spontaneous mirror-guided self-exploration, e.g., self-directed behaviors such as examining body parts only visible in the mirror (see Morin, in press, for a review). The aforementioned animals also pass the more formal "mark test" and will touch a red dot that has been inconspicuously applied to their brow or forehead (or throat feathers in magpies' case). Emitting self-directed responses in front of a mirror and passing the mark test indicate self-recognition. In humans, this developmental landmark is achieved between 18 and 24 months of age (Amsterdam, 1972).

How does self-recognition relate to self-awareness? According to Gallup (e.g., 1982), emitting self-directed behaviors in front of a mirror indicates that the organism can take itself as the object of its own attention. In addition, re-cognizing oneself in front of a mirror presupposes pre-existing "self-cognition" (i.e., self-knowledge, a self-concept) and therefore self-awareness. There is little doubt that self-recognition implies some form of self-awareness; rather, the question should be: what type, or what level, of self-awareness is involved? Mitchell (2002) and others suggest that self-recognition only requires knowledge of one's body. The organism matches the kinesthetic representation of the body with the image seen in the mirror and infers that "it's me". This interpretation implies that an awareness of one's own thoughts (or any other more private dimensions of the self) is not needed for self-recognition to take place. An awareness of private self-aspects does not seem relevant for self-recognition, whereas an awareness of the body is critical for self-identification in front of a mirror. Note that perhaps self-recognizing creatures do have access to their thoughts (e.g., metacognition); but passing the self-recognition test does not demonstrate this.

Theory-of-Mind (ToM) consists in attributing mental states such as goals, intentions,

beliefs, desires, thoughts, and feelings to other social agents (Gallagher & Frith, 2003). The social cognitive and evolutionary benefits of ToM are the ability to predict others' behavior, and to help, avoid, or deceive others as the situation dictates. Do animals engage in ToM? This represents a highly controversial question, with some claiming that primates, and possibly birds (e.g., ravens) do (Gallup, 1982; Premack & Woodruff, 1978), and others denying ToM in animals altogether (e.g., Heyes, 1998). A more likely scenario is that primates are capable of some forms of ToM, but do not possess the fully-developed human version. While early experiments on chimpanzees seemed to imply an ability to understand human goals, much subsequent work increasingly suggested that they do not appreciate human goals or visual perception, as exemplified by Povinelli and Eddy's study (1996) in which chimpanzees begged from humans facing them but also solicited the attention of others humans who had buckets over their heads. According to Call and Tomasello (2008), more recent evidence instead shows an understanding of goals, intentions, perceptions, and knowledge in others—but not of others' beliefs. In a typical experiment on intention understanding, the animal observes the human experimenter trying to turn on a light with his head because his hands are occupied holding a blanket. The subject reacts to this not by imitating the experimenter's behavior (miming turning on a light with its head) but rather by imitating the intention behind the physical constrain—by miming turning on the light with its hands.

Povinelli and Vonk (2003) remain skeptic and propose that chimpanzees form mental concepts of visible, concrete objects in their environments (e.g., apples, facial expressions, leopards), but not about inherently unobservable things (e.g., God, gravity, love). In ToM experiments, chimpanzees would reason solely about the abstracted statistical regularities that exist among certain events and the behavior, postures, and head movements of others (behavioral abstractions), but not about others' unobservable mental states.

7- Conclusion

In this chapter I raised the question: What are animals conscious of? Table 1 summarizes my analysis. I suggest that some animals are conscious of their body (as measured by self-recognition) and of being the agent behind their actions (sense of agency). Animals seem to be unaware of various private and public self aspects (e.g., traits, physical appearance, attitudes), and some might know about their thoughts (metacognition) as well as their past and future (MTT). Unlike humans, who can experience negative states resulting from excessive self-focus, animals do not appear to worry, ruminate, or self-destruct. However, like humans, animals seem to engage in self-regulation and ToM, but these represent less refined versions. Take note that the last "unknown" column contains quite a few self-related processes, indicating that our knowledge of animal self-awareness is still precarious. This analysis supports the widespread view that self-awareness differences in humans and animals are not radical and come in degrees.

Yes	No	Less sophisticated version	Perhaps	Unlikely	Unknown
• Body awareness • Sense of agency • Self-recognition •Guilt • Shame	• Suicide • Insomnia • Awareness of: - personality traits - physical appearance	• Self-regulation • ToM	• Depression • Death awareness • MTT • Metacognition • Awareness of goals	• Rumination • Ethical judgments • Worry • Awareness of: - attitudes - opinions	• Social anxiety • Self-evaluation • Emotional amplification • Self-disclosure • Sensitivity to social rejection • Jealousy • Awareness of: - Sensations - Emotions - Preferences

Table 1. Effects, consequences, and dimensions of self-awareness in animals.

Why is self-awareness less sophisticated in animals? The lack of language in animals is

often cited, but I propose more specifically that it is the absence of inner speech in animals that should be credited. Inner speech is known to contribute to the development of self-awareness in humans (e.g., DeSouza, DaSilveira & Gomes, 2008). Self-directed speech allows us to verbally label our internal experiences and characteristics; as a result these become more salient—more conscious. A significant positive correlation exists between diverse validated scales measuring the frequency of private self-focus and use of inner speech (see Morin, 2005, for a review); accidental loss of inner speech following brain injury impedes self-awareness (Morin, 2009). In light of this evidence, I would predict that linguistically tutored apes such as those trained by Savage-Rumbaugh and colleagues (Savage-Rumbaugh, Fields & Taglialatela, 2000) should exhibit heightened self-awareness, assuming that speech-for-self automatically follows social speech.

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