De: **What we cannot know**, de Marcus du Sautoy

Of course, asking an animal like my cat about its internal world is a problem. In the late 1960s animal behaviourist Gordon Gallup was shaving in the mirror, pondering the question of how to test self-awareness in animals, when he was suddenly struck by an idea. He was aware that the face he was looking at in the mirror was his. He wondered which animals know that what they see in the mirror is not another animal but actually an image of themselves.

"Perusing the near infinite number of cat videos on the Internet reveals that cats tend to think the image in the mirror is a rival cat in the room. But how can we tell whether an animal realizes that actually the image is of them? Gallup came up with a very robust test to reveal which species recognize themselves in the mirror, which in turn indicates that they have a sense of self.

His test is simple. Introduce the animal to the mirror so that it familiarizes itself with its reflection. (There is fascinating footage of chimpanzees excitedly dancing along with their images in front of the mirror. But do they think they are dancing with another chimp, or are they admiring their own moves?) At some point, the experimenter takes the animal aside and, while wiping its face, surreptitiously places a red mark just below the eye of the animal in such a way that the animal is unaware of the mark and can’t see it without looking in the mirror. Gallup wanted to know how the animal would now react to seeing its image in the mirror.

If you looked in the mirror and noticed something strange on your cheek, your immediate reaction would be to touch the mark to investigate it. Gallup’s mirror self-recognition test, as it is known, reveals the startling fact that humans are part of a very small group of animals that systematically pass this test of consciousness or self-awareness. The only other species that Gallup found reacted in a similar fashion are orang-utans and chimpanzees. A third species was added to the list when research by Diana Reiss and Lori Marino on bottlenose dolphins was published in 2001.

Although dolphins have no hands with which to touch a mark, they spent much more time in front of the mirrors in their tanks when they had been marked. They were uninterested in marks on other dolphins in their tank, indicting some awareness that the dolphin in the mirror was not just another dolphin. In addition to orang-utans, chimpanzees and dolphins, there is evidence of other individual animals passing the test. A clever magpie. An elephant. But certainly not a whole species that passes the test on a consistent basis.

It is striking that chimpanzees start to fail the test once they reach 30 years old, despite having some 10 or 15 years left to live. The reason could be that self-awareness comes at a cost. Consciousness allows the brain to take part in mental time travel. You can think of yourself in the past and even project yourself into the future. And that is why Gallup believes that in later life chimpanzees prefer to lose their ability to be conscious of themselves. The price you pay for being aware of your own existence is having to confront the inevitability of your demise. Death-awareness is the price we pay for self-awareness. It raises the interesting question of whether dementia in humans plays a similar role, protecting an ageing human from the painful recognition of their impending death.

Of course, the mirror self-recognition test is a very crude measure of consciousness. It has a bias towards species with highly developed sight. Dogs, for example, do not have good vision but rely on scent to identify other dogs, so you wouldn’t expect a dog to pass such a test of self-awareness even if it had an equally well-developed sense of self. Even for those species for whom sight is the primary sense with which they negotiate the world, it is a very rough test of awareness of self. Nonetheless, it has striking consequences when applied to humans, because we can use it to discover when the brain goes through some transition that means we start to recognize the image in the mirror.

I don’t think my children, when they were babies, had the same sense of self as they do now. But at what point would they have started to react like the chimpanzees to a mark surreptitiously placed on their faces? It turns out that a child of 16 months will continue playing in front of the mirror quite oblivious to the new mark, though they might put their hand up to the mirror to investigate the slightly unusual image.

But place a child of 24 months in front of the mirror and you see their hands reach for their faces at once to explore the strange spot. The strong reaction is an indication that the 24-month-old recognizes the image and thinks ‘That’s me.’ Something happens during the brain’s development that means we become self-aware, but quite what it is still remains a mystery.

"If consciousness emerges in humans at 18–24 months, we can ask the same question on a more cosmic scale. When did consciousness first emerge in the universe? Surely nothing was evolved enough to qualify as conscious just after the Big Bang. So there must be a moment when the first conscious experience occurred. So consciousness probably does have a different quality to gravity or time, although the extent to which the latter emerged or are fundamental is also coming under scrutiny.

American psychologist Julian Jaynes, who died in 1997, hypothesized that the emergence of consciousness in humans may help to explain the creation of the concept of God. With the evolution of consciousness came the creeping awareness of a voice in our heads. Perhaps, Jaynes suggested, God was formulated as a way to try to make sense of this emerging internal world.

As you read this now, you can probably sense the words being sounded out in your head. This is part of our conscious world. But those words aren’t being sounded out aloud or heard by anyone else. They are part of your conscious world, and yours alone. Jaynes believed that as we evolved and consciousness emerged, the shock of the voice in our heads might well have given rise to the idea of a transcendent intelligence, something that isn’t of this world, and this led the brain to interpret it as the voice of God.

This idea of our internal world being close to the transcendent concept of God is central to many Eastern religious practices, including the Vedic tradition. Brahman, the transcendent supreme being of the Hindu religion, is often identified with Atman or the concept of the self.

"Rather amusingly, Jaynes believed that you can actually date the emergence of consciousness in human evolution. He places it somewhere in the eighth century BC between the creation of Homer’s Iliad and the Odyssey. In the Iliad there is no evidence in the characters of internal worlds, of introspection or consciousness. The characters in the Trojan siege are simply pushed around by the gods. In the Odyssey, in contrast, we see that Odysseus is clearly introspective, aware of his own self, conscious in a way the characters in the Iliad appear not to be."