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Subjectivity in the Quantification of Intelligence

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Subjectivity in the Quantification of Intelligence

It's easy to label someone as smart. But as recent studies have shown, intelligence is not as easy to quantify as one might think. Intelligence is a complex, multifaceted subject, and often impossible to measure or compare to human intelligence. Not only is it impossible to measure consistently in humans, but other species have shown varied levels of intelligence that don't align with humans at all. In fact, there is a wide range of intelligence incomparable to human intelligence.

Human intelligence itself is difficult to measure. Until the late 19th century, craniologists measured the size of individual skulls to estimate the intelligence of the owner (Luchetti). Despite initial popularity, as new methods of intelligence testing were developed these craniological methods were found to be increasingly flawed. With the advent of the 21st century, the general consensus among scientists has become that cranial size is not directly related to intelligence. Thus, intelligence quantification cannot be achieved purely through physical measurement. However, even today's most popular technique of quantifying intelligence, mental testing, may be flawed as well. Many tests today quantify intelligence as a single number, but various studies have shown that there are many different types of intelligence (Saricaoglu et al.). Not only is there IQ versus EQ (Dawda et al.), but there are several types of the intellectual quotient, including "verbal" and "performance" intelligence (Ramsden et al.). Together, these discrepancies make it extremely difficult to quantify intelligence, even in humans.

Intelligence in other species is even more difficult to measure. One of the most popularly studied animals for intelligence are chimpanzees, as they are our closest known living genetic relatives, and have exhibited features often associated with intelligence. One of the most well known instances of intelligence in chimpanzees is Ayuma, a chimpanzee so adept at memorization of sequences of numbers that he beat memory champion Ben Pridmore in 2008 ("What Animals Teach Us"). Tetsuro Matsuzawa, Ayuma's primary caretaker at Japan's Primate Research Institute, has confirmed that chimpanzees tend to be exceptionally skilled at certain tasks requiring intelligence, especially memorization ("Thinking Like a Chimpanzee"). Chimpanzees even possess a partial understanding of language, as was proven by several tests at the Primate Research Institute, in which chimpanzees including Ayuma and his mother, Ai, were challenged with matching Japanese characters with their correct meanings. Again, the chimpanzees excelled, nearly matching human test rates.

However, even with these common indicators of intelligence, chimpanzees appear to fall short when it comes to teaching. While chimpanzees have shown an incredible range of adaptability and ability to learn, including the usage of tools, they do not appear to exhibit teaching behavior. At a field lab in Bossou, Guinea, several scientists tested the teaching ability of chimpanzees in terms of their ability to teach young to crack nuts using stones ("Thinking Like a Chimpanzee"). Observing the chimpanzees with videotaping, the researchers found that although young chimps did learn from elders through observation, no "active teaching" took place. In other words, each teacher had to teach with intention, a cost to themself, and either positive or negative reinforcement. In this study, adult chimpanzees exhibited little of this behavior. Thus, since chimpanzees only appear to exhibit particular indicators of intelligence, it is difficult to identify whether they are truly "more intelligent" than humans.

Perhaps it is unreasonable to compare human intelligence to that of other species. Studies with other species have shown indications of intelligence divergent from human intelligence, including an unlikely subject: ants. Ants exhibit a type of intelligence different from that of most animals, called "collective intelligence" (Mustafa et al.). Individual ants are unlikely to accomplish much alone, requiring support from others. However, when many ants are integrated as a colony they can be extremely adaptable, almost in an “intelligent” way. Certain species of ants have shown incredible feats of tool usage, such as the “ant rafts” in the *Solenopsis* genus (Adams et al.), and *Megalomyrmex*’s fungal “agriculture” (Schultz et al.).

Ants also tend to show complex adaptability in navigation when encountering obstacles and new food sources. Ants are able to collectively find and refine paths to food sources with the use of pheromones, and, as a recent study from 2018 revealed, teaching (Mustafa et al.). In this study, ant behavior simulations showed how ants use a system of teachers and learners to share information about paths to food sources. In these teachings, “Tandem Leaders” lead “Tandem Followers” along the path to a food source, taking stops along the way to memorize landmarks so that followers may teach others, quickly spreading new information throughout the colony. Since teachings are purposeful and cost the leader time, they may, according to the rules used by Tetsuro Matsuzawa, be considered active teaching (“Thinking Like a Chimpanzee”). All these examples show instances of insectoid intelligence quite different from common indicators. This shows how variable intelligence can be, making it extremely difficult to measure.

Another study portraying divergent intelligence involves elephants. In the past, elephants had shown high intelligence in terms of memory, social behavior, cognition and more (Foerder et al.). However, this study in particular showed the extent of an elephant's ability to use tools (“What Animals Teach Us”). In this study, researchers from The City University of New York examined elephants in Smithsonian National Zoological Park, Washington, D.C., testing their ability to interact with tools by challenging them to reach food with various items (Foerder et al.). The elephants were first provided with sticks that went unused, showing few signs of problem solving. However, as soon as the elephants were provided with boxes to push around and reach the food with, the boxes were used in that way. One elephant in particular, Kandula, suddenly realized how it could use the box to reach food, and from then on used boxes to reach food in every experiment. This difference in results reveals something profound about Kandula's world view. As humans, the researchers expected the elephants to use their trunks like hands to grab sticks, unaware that elephants may view their trunks as *sensory organs*. Kandula valued protecting its trunk, and as such never considered using it. Thus, because Kandula viewed its trunk differently than humans might, it did not even consider what any human may have considered to be logical.

Later in the study, another experiment exhibited similarly fascinating results. In this experiment, the researchers swapped the block with several slabs and a ball, intending for the slabs to be stacked (Foerder et al.). However, instead of using the slabs, one of the elephants climbed and balanced atop the ball to reach the food. This result was entirely unexpected, and not only worked but also brought the elephant closer to the food than the slabs would have. Again, this result reveals a difference in understanding between elephants and humans. Humans, familiar with the concept of construction, immediately concluded that the best way to reach the food was by stacking items. Yet, due to their unfamiliarity with such concepts, elephants found a very different solution that was just as effective. Therefore, because elephants see the world differently from humans, they are likely to act in ways that are entirely unexpected, because they possess a very different type of intelligence.

Herein lies the problem with intelligence; There is no objective way to define it. Any living thing, even those that might be considered "intelligent," will have a different view of the world. These views can lead to differences in what the organism considers an intelligent or reasonable decision. This is the basis of the Orthogonality Thesis. In the study of general intelligence, the Orthogonality Thesis states that the possibilities for all minds and intelligences show an orthogonal, or unrelated, relation between terminal intelligence, goals an intelligent agent has all the time regardless of how "reasonable" they might be, and instrumental intelligence, the ability of an intelligence to form reasonable temporary goals to reach its terminal goals (Haggstrom et al.). This creates a universe in which intelligence may come in a variety of forms, including any combination of instrumental and terminal intelligence. This is why intelligence is so diverse. Additionally, we can only measure terminal intelligence in relation to our own, because there are technically no "reasonable" goals, only goals (Bostrom et al.). Thus, terminal intelligence is subjective. Therefore, because terminal intelligence is subjective, and any decision must be based on terminal goals, intelligence is impossible to objectively quantify.

As one can see, intelligence is essentially impossible to quantify, as it is more complex and subjective than meets the eye. Still, the understanding of intelligence is an ever growing field, and as old of a field as it is, this issue is extremely important today. With the steady advances being made in artificial intelligence and astrobiology, the topic becomes more and more relevant as we come closer to encountering another "intelligent" being. The more we understand this field now, the more we can handle the future with understanding and certainty.

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