

Bigger is smarter: Overall, not relative, brain size predicts intelligence

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When it comes to estimating the intelligence of various animal species, it may be as simple measuring overall brain size. In fact, making corrections for a species' body size may be a mistake. The findings were reported by researchers at Grand Valley State University and the Anthropological Institute and Museum at the University of Zürich, Switzerland. The study has now been published online in the journal *Brain, Behavior, and Evolution*.

"It's long been known that species with larger body sizes generally have larger brains," said Robert Deaner, assistant professor of psychology at Grand Valley and the first author on the study. "Scientists have generally assumed that this pattern occurs because larger animals require larger nervous systems to coordinate their larger bodies. But our results suggest a simpler reason: larger species are typically smarter."

Deaner said the findings imply that a re-evaluation may be in order for many previous studies that have compared brain size across different animal species, including ancestral hominids.

The new results build on a paper by the same researchers, published in the online journal *Evolutionary Psychology*, in July 2006, which showed that some primate species consistently outperform others across a broad range of cognitive tasks. That finding provided evidence for species differences in intelligence or "domain-general cognition," in the parlance of the field. This intelligence allows an animal to tackle new and unpredictable situations. Domain-general cognitive ability stands in

contrast to domain-specific skills that are suited to particular environment challenges, such as a bird remembering where it cached food.

The new study compared how well eight different brain size measures predicted the domain-general cognition variable generated in the earlier study. To the researchers' surprise, overall brain size and overall neocortex size proved to be good predictors, but the various measures that controlled for body size did not. The results did not change even when various statistical assumptions were altered.

Another unexpected finding was that the overall size of the whole brain proved to be just as good a predictor of intelligence as was the overall size of the neocortex. Scientists making cross-species comparisons have often assumed that the neocortex would be more closely linked to intelligence, since it is considered the "thinking part" of the brain.

The findings raise the question of why larger animals should generally be smarter. "That's now the \$64,000 question," said Carel van Schaik, Ph.D., a co-author on the study and the director of the Anthropological Institute and Museum at the University of Zurich. "We have some ideas. Larger animals may be better able to control aspects of their environment and therefore have more to gain from being more intelligent. But perhaps more important is that larger animals tend to live longer, and can therefore benefit longer from being flexible and adaptable, and perhaps may also need it more because the environment is more likely to change during their lifetime. The challenge is to test these ideas."

The authors warned that the study's primary implication-that body size need not be considered when comparing brain size-shouldn't be taken too literally. Deaner noted, "We believe that most of the relationship between brain size and body size is due to larger animals being smarter,

but it's certainly possible-even likely-that some part of the relationship is due to larger animals needing to maintain greater neural traffic. Our point is that completely controlling for body size is almost certainly a mistake."

"We didn't have data on enough species to address this question conclusively," Deaner said. "But the human brain imaging data indicate that some correction for 'neural traffic maintenance' is probably needed. If it wasn't needed, then we would be stuck with some real puzzles, such as the fact that there are no consistent sex differences in IQ, yet men generally have larger brains. And, of course, elephants and whales possess larger brains than we do, yet it's hard for us to imagine that they are smarter than we are."

Source: Grand Valley State University

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