# Why we dispute 'Dunbar's number': Can people really maintain only 150 relationships?

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Credit: AI-generated image (disclaimer)

Many of us are aware of the claim that humans can maintain no more than 150 friendships. That figure is called "Dunbar's number" after the evolutionary psychologist Robin Dunbar, who first introduced the idea three decades ago. Dunbar claimed that the number of neurons in the neurocortex would limit an organism's capacity to process social information. This would in turn limit the number of relationships that an individual can maintain.

But while the number has achieved widespread fame, and is often referenced in the plans of business managers and software developers, it hasn't achieved widespread acceptance in scientific circles.

In collaboration with our colleague Andreas Wartel, a researcher in evolutionary biology, we investigated the empirical underpinnings of Dunbar's number, and found that it doesn't stand up to scrutiny when larger datasets and more modern statistical methods are used.

Dunbar has since challenged our findings, questioning our methodology. We therefore want to clarify our approach and comment on his critique.

## Social brains

The idea that there may exist a correlation between social complexity and intelligence was first proposed in 1976 by Cambridge neuropsychologist Nicholas Humphrey. Unfortunately, no accepted "intelligence test" for animals exists, so researchers turned instead to measures of brain size as a hypothetical proxy for intelligence. Robin Dunbar hypothesized that the neocortex—the top layer of the cerebral hemispheres—is the intelligent part of the brain that handles social information.

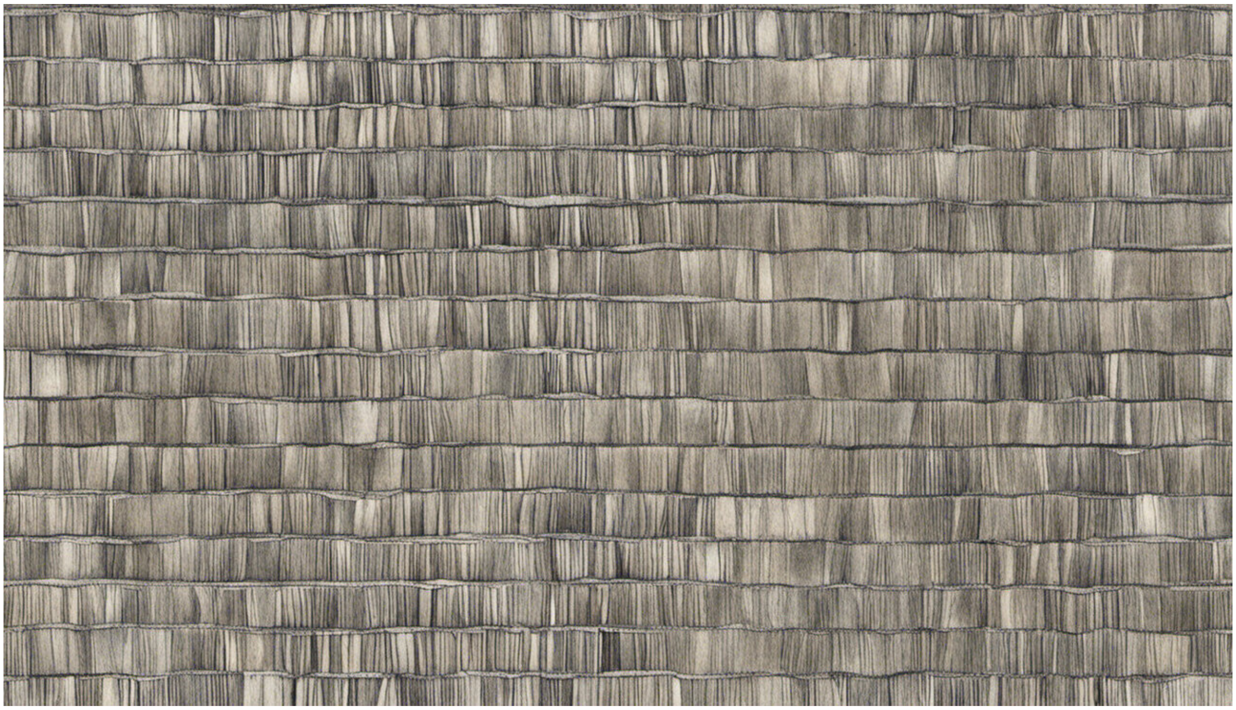
Dunbar proceeded to identify a correlation between relative neocortex size and social group size in primates: the bigger the neocortex, the bigger the social group. Using this relationship and the average size of the human brain, he extrapolated to get an estimate of human group size. It is this estimate that has since been termed "Dunbar's number".

The correlation has been confirmed in other studies, though almost all of them have used the same dataset. However, the correlation can disappear when adding more data to statistical models, such as information about other aspects of primate life. Researchers have found that primate neocortex and brain sizes may be better predicted by diet than by sociality.

In another study, we found that one can summon almost any correlation between brain data and different aspects in primate lives by selecting what data is included in an analysis. There's a perfectly good reason for this inconsistency of results. Many variables that have been hypothesized to influence primate brain evolution are exceptionally noisy and correlated with each other. This illustrates a core problem with Dunbar's number: the correlation it is based on is shaky and disputed.

Also, other researchers question the value of extrapolating cognitive trends from other primates to humans. While the human brain is anatomically remarkably similar to that of other primates, it functions differently in terms of memory and information processing.

One crucial difference between humans and other animals is that non-human species only have a limited capacity to recognize ordered sequences of information, for example a string of words. This key cognitive element, which sets humans apart from other animals, may explain why only humans learn languages and flexibly plan for the future.



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**Deconstructing Dunbar's number**

With all this in mind, we replicated Dunbar's original analysis with a larger dataset and more advanced statistical methods. To ensure robust results, we used three different but overlapping datasets, two different statistical approaches, and carried out analyses both including all primates, and a more limited sample including only monkeys and apes.

Our results were clear. Estimates of Dunbar's number were highly inconsistent, and the 95% confidence intervals—a measure of the certainty of the estimates—were consistently far too large to specify any one estimate as a cognitive limit on human group size. Our analyses and results were awaited by many in the scientific community.

Many aspects of Dunbar's number are misleading. Dunbar's method arrives at an estimate of average human group size. But then it is used to indicate maximum human group size—two different things. Sometimes Dunbar's number comes from data on relative neocortex size; other times from data on relative brain size. Sometimes all primates are used in the analyses, but at other times only monkeys and apes.

Responding to our study, Dunbar even proposed that a proper analysis should *only include apes*. And recently, he used a clustering method to identify *four evolutionary "grades"*, classifying primate species together with total disregard for their evolutionary relationships.

This creates a situation where every new suggestion also produces a new, different "Dunbar's number". Effectively, this means that the original estimate is revised over and over again, without these revisions being stated and acknowledged.

## Dunbar's criticism—a technical comment

In his comment on our paper, Dunbar suggests that we committed a statistical error by using a statistical method known as ordinary least squares regression instead of a different method, called reduced major axis regression, not acknowledging that we also reached the same conclusion with other methods.

His suggestion of using the reduced major axis method is a poor one, as it severely over-corrects the slope bias in the results, delivering misleading results. Nevertheless, if employing Dunbar's newly suggested approach the estimate for the average (or maximum) human group size was not 150. The new estimate was 289.8, but again with very large 95% confidence intervals between 226.0 and 371.6 (in other words, the estimate is highly uncertain). If the analysis is carried out only on monkeys and apes, rather than all primates, the estimate is instead 404.1, with 95% confidence intervals between 300.6 and 543.3.

These are, however, not new suggestions for the cognitive limit on human group size, but simply more illustrations of how poorly this approach works. Overall, "Dunbar's number" is a concept with limited theoretical foundation lacking empirical support.



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