

CANID AND HUMAN COHABITATION: CANIDS DID NOT MOVE INTO CAVES WITH HUMANS

Lauren Kirk

ABSTRACT: It is not known how long dogs and humans have had a relationship. If dogs and humans coexisted in the past, then their fossils should be located in the place they both resided. As canids developed a relationship with humans, it would make sense that they moved into caves when humans did. Data was obtained from the Paleobiology Database and sorted by time period, Pleistocene and Miocene versus Paleogene, and further sorted depending on if the fossil was found in a cave and tested for a relationship with humans showing coexistence by a χ^2 -test. It was found that canids did not move into caves along with humans. In fact, there was a statistically significant difference that supports that there may be a negative relationship. Since canids were very recently domesticated with respect to the time periods evaluated, a coexisting relationship may not have existed previously.

Key Words: Canid, Caves, Paleogene, Pliocene, Miocene, Homo Sapiens, Coexist

Introduction

In some cultures today, dogs are considered man's best friend. The connection between a dog and human includes a level of social interaction that seems to be unparalleled in regard to other species. Since dogs have a unique relationship with people, scientists have begun studies on the behaviors of dogs, as well as comparisons of wolves and dogs (Heberlein, 2016). Dogs, unlike wolves, are unique in that they are domesticated and can also serve as special needs support or help identify the existence of cancer cells in a lab, making them not only a great companion, but also a great support for other tasks (Bjartell, 2011). Many scientists have been interested in the relationship that dogs have with humans, but do not know how long this relationship has existed (Frantz, 2016).

Determining if dogs and humans always coexisted may help us understand the relationship between the two species and how such a relationship evolves. This may broaden understanding of how domestication, selection pressures, and training animals may benefit the human population. Since *Homo sapiens* and canids have evolved in similar time periods, it

would be logical to assume that they may have crossed paths and began to develop a relationship (Stringer 1988). Because canids are omnivorous and pack animals, they have been able to have peaceful communal feeding and typically are not nocturnal (Kleiman, 1973). Since they are awake during the day and are more approachable during feeding than cats, humans may have been able to interact with dogs easily in order to develop a relationship in the past (Kleiman, 1973).

In this paper, I test the hypothesis that dogs did not need to live in caves previously and as time increased, dogs moved into caves because of their relationship with humans since humans evolved and lived in caves. Previous hominid fossils, such as a Neanderthal in Croatia and another in Siberia, have been found in caves which suggests that hominids utilized the protection of caves (Green 2006, Reich 2010). If dogs had also resided in caves, it would prove that dogs and humans have always had a close relationship and coexisted. Before hominids evolved, canids had no reason to live in caves. As the hominids evolved and developed a relationship with canids, I predict that canids moved into caves along with the hominids.

Materials and Methods

All data that was modified and sorted was obtained from the Paleobiology Database. The data was downloaded from the Paleobiology Database on October 25, 2018 by Dr. Rebecca Price by using the class “Mammalia,” which I then narrowed down to occurrences of Canidae that could be identified to the species level. The data was further narrowed down. The Canid species were then differentiated by age – whether the species occurred in the time period of Paleogene or Miocene and Pleistocene. The Paleogene time period spans from 56 million years ago to 23.03 million years ago, while the Miocene spans from 23.03 million years ago to 5.33 million years ago (Walker, 2018). Additionally, the Pliocene spans from 5.33 to 2.58 million years ago (Walker, 2018). Since this study focuses on Canid occurrences over time, the most recent Neogene epochs were not used. If the data did not fall into these categories, it was eliminated. If the data overlapped and was found in more than

one time period, it was categorized by whichever time period it was more abundant in. I determined whether the remaining species were ever found in caves. If the species did not have a location noted in the Paleobiology Database, it was not analyzed.

After the data was sorted, pivot tables were used to combine the information for one species into a single row. The total number of canids found in caves and not in caves during each of the Paleogene and Miocene and Pleistocene time periods were totaled and placed into a table. Using these values, frequencies were obtained by dividing each value by the total value in each time category. The significance level of 0.05 was decided since this is not a medical study and no harm will be done when testing the significance through analysis. A χ^2 -test was conducted using the number of species found in caves and not found in caves in the Paleogene to predict the numbers found in the Miocene and Pleistocene. A graph depicted in Figure 1 was then created to compare the frequency values run in the χ^2 -test.

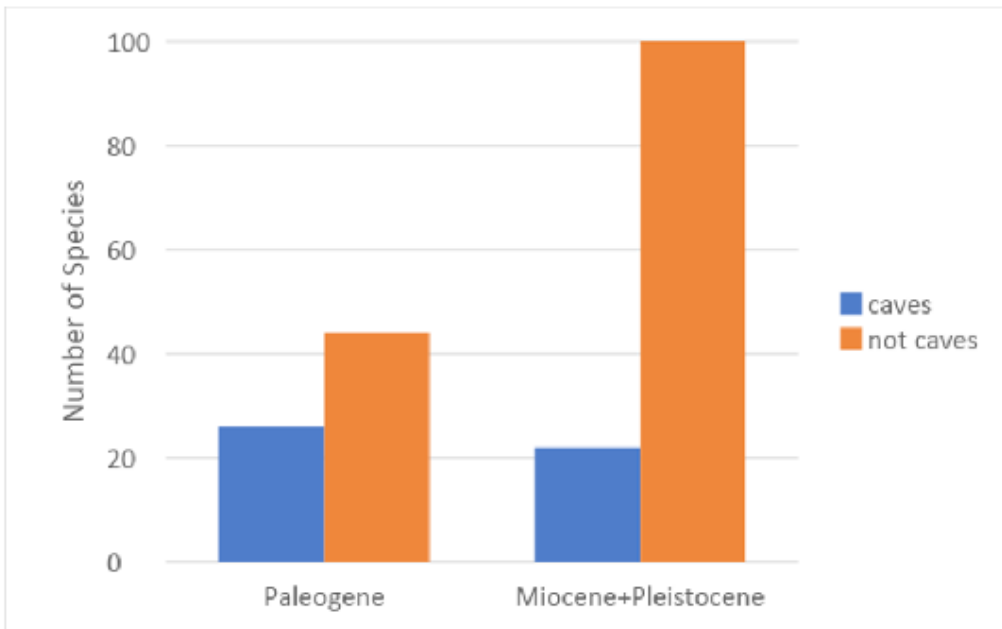


Figure 1: There is a proportionately significant amount of canid fossils found elsewhere than caves in the Miocene and Pleistocene compared to the Paleogene. This comparison was done by a χ^2 -test and resulted in a p-value of 7.9E-06.

Results

As depicted in Figure 1, statistical analysis with the χ^2 -test was used to determine the number of species of canids found in caves versus not in caves among two different time periods, resulting in a p-value of 7.9E-06. The p-value of 7.9E-06 indicates that the probability of getting these results by random chance is correct; therefore, I reject the null hypothesis. This demonstrates that the results are statistically significant, but findings in Figure 1 indicate that the research hypothesis is also incorrect. Therefore, the research hypothesis is also rejected in favor of the conclusion that proportionately more canid fossils were found outside of caves in the Miocene and Pleistocene than in the Paleogene.

Discussion

It was predicted that dogs and humans have always had a close relationship and were living together in the past. This was tested by a χ^2 -test as previously seen in Figure 1. Although the assumption that dogs moved into caves may have not been correct, leading to a rejection of the research prediction, there was a statistical significance in the data. Therefore, the null hypothesis that there is no change is rejected. In fact, the number of species found in caves went down as depicted in Figure 1, indicating that dogs may have been moving out of caves as humans were moving in, demonstrating a contradicting negative relationship.

Dogs were the first animals to be domesticated; dogs and humans have been living in the same environment for several years, nearing about 10,000 years (Heberlein, 2016). Given this evidence, it is possible that dogs and humans existed in caves with each other in the past, but not during the time period that was tested for statistically. The most recent time periods of the Paleogene and Neogene that were evaluated was 2.58 million years ago. Although the statistical test showed that dogs did not move into caves as they evolved during the previously mentioned time periods, this may mean that dogs and humans existed elsewhere besides caves together.

Because dogs were domesticated many years ago, but fairly recently with respect to the data evaluated, humans and dogs have a good relationship. The close relationship is evident by the social communication that is present between a dog and a human. Dogs are able to pick up human communication and social cues by following a human's gaze (Teglas 2012). Not only was it found that dogs communicate efficiently with humans, but wolves did not communicate as well as domesticated dogs, suggesting that there is a greater component to the relationship between a dog and human than just genetic relatedness between species (Kaminski 2012). Another theory may be that canids were going to come into human territories without human intervention by selection pressures alone, which could have intensified the relationship between humans and dogs today (Trut, 1999).

Limitations and Further Research

Although the assumption that dogs moved into caves may have not been correct, there was a statistical significance in the data; therefore, the null hypothesis is rejected. This suggests that dogs did have some relationship with hominids in the past. A more accurate study may be to look at more recent time periods of the Pleistocene versus the Neogene and Paleogene. To better understand the relationship, the geographical distances that canid fossils were found from the hominid fossils should be examined. A more comprehensive analysis should be conducted to determine the extent of the relationship. Since only the fossils located in caves were studied, it could be expanded to evaluate all of the location's canid fossils are found in comparison to the hominid fossils. It is also important to note that the presence of canid fossils in caves may not mean they were in the presence of human fossils. Another avenue to further expand research is to evaluate if humans coexisted with dogs could be to study domestication in further detail. One way to determine when a dog was domesticated is to find evidence pertaining to the time floppy ears and other morphological features appeared and the seasonal rhythm of reproduction changed (Trut,

1999). If those morphological and reproductive changes can be tracked, it may be possible to see if there are any fossils that exhibit these changes in the Paleogene and Miocene and Pliocene. Additionally, limitations may have occurred in deleting some pertinent data from the Paleobiology Database or missing data in the Paleobiology Database. It is also important to note that the fossil record is not a complete record and may have bias as to which fossils are researched (Benton 2000, Koch 1978).

Acknowledgements

First and foremost, I would like to thank Dr. Rebecca Price for her patience and willingness to help throughout the entire research process. Second, I would like to thank my fellow peers for reviewing and editing my work. Finally, I would like to thank my husband for helping me find the time to complete my education.

References

- Benton, M. J., Wills, M. A., & Hitchin, R. (2000). Quality of the fossil record through time. *Nature*, 403(6769), 534.
- Bjartell, A. (2011). Dog sniffing urine: A future diagnostic tool or a way to identify new prostate cancer markers? *European Urology*. 59. 202-203.
- Frantz, L. A., Mullin, V. E., Pionnier-Capitan, M., Lebrasseur, O., Ollivier, M., Perri, A., ... & Tresset, A. (2016). Genomic and archaeological evidence suggest a dual origin of domestic dogs. *Science*, 352(6290), 1228-1231.
- Green, R. E., Krause, J., Ptak, S. E., Briggs, A. W., Ronan, M. T., Simons, J. F., ... & Pääbo, S. (2006). Analysis of one million base pairs of Neanderthal DNA. *Nature*, 444(7117), 330.
- Heberlein, M., Turner, D., Range, F., Viranyi, Z. (2016) A comparison between wolves, *Canis lupus*, and dogs *Canis familiaris*, in showing behavior towards humans. *Animal Behavior*. 122. 59-66.
- Kaminski, J., Nitzschner, M. (2012). Do dogs get the point? A review of dog-human communication ability.

Learning and Motivation. 44. 294-302.

- Kleiman, D.G., Eisenberg, J.F. (1973). Comparisons of Canid and Felid Social Systems from an evolutionary perspective. *Animal Behavior*. 21. 637-659
- Koch, C. F. (1978). Bias in the published fossil record. *Paleobiology*, 4(3), 367-372.
- Reich, D., Green, R. E., Kircher, M., Krause, J., Patterson, N., Durand, E. Y., ... & Maricic, T. (2010). Genetic history of an archaic hominin group from Denisova Cave in Siberia. *Nature*, 468(7327), 1053.
- Stringer, C. B., & Andrews, P. (1988). Genetic and Fossil Evidence for the Origin of Modern Humans. *Science*, 239(4845), 1263-68.
- J. Topál, Á. Miklósi & V. Csányi (1997) Dog-Human Relationship Affects Problem Solving Behavior in the Dog, *Anthrozoös*, 10:4, 214-224
- Trut, L. (1999). Early Canid Domestication: The Farm-Fox Experiment: Foxes bred for tamability in a 40-year experiment exhibit remarkable transformations that suggest an interplay between behavioral genetics and development. *American Scientist*, 87(2), 160-169. Retrieved from <http://www.jstor.org/stable/27857815>
- Walker JD, Geissman JW, Bowring SA, Babcock LE. GSA Geologic Time Scale v.5.0. 2018 [accessed 2018 Nov 10]. <https://doi.org/10.1130/2018.CTS005R3C>

Supplemental Materials

Exel file available upon request.