

Title: How Did New Caledonian Crows Get So Smart?



New Caledonian Crow targeting a larvae with a hooked stick tool. (Ref. 3) .

Can you see the crow's eye looking straight at you?

The bird's visual acuity is nearly as good as a human.

I. Isolation of the New Caledonian Crow

The New Caledonian (NC) Crow (*Corvus moneduloides*) lives only in New Caledonia, which is an archipelago in the South West Pacific Ocean discovered by Captain James Cook in 1774. An Australasian crow population probably first colonized New Caledonia after the last emersion of the island several million years ago. Since there were few predators on the islands, the NC crow evolved a prolonged juvenile development highly supervised by mated parents. NC crows eventually learned to fabricate hooked sticks to extract hard-to-reach beetle larvae that were normally foraged by woodpeckers. This may be a scenario similar to the evolution of the Galapagos woodpecker finches (*Cactospiza pallida*) that also use a stick to extract beetle larvae to compensate for their short tongue. Yet, these finches do not carve hooks on the sticks!

II. Unique behavior of the New Caledonian Crows

According to Dr. Alex Taylor (Univ. Auckland, New Zealand), only **TWO** species on earth are known to carve tools made with hooks: **humans and the NC crows.**¹⁻² Dr. Taylor illustrates his studies with NC Crows in the following video: <http://www.ideacityonline.com/talks/alex-taylor-on-the-clever-crow/> (accessed 9/25/2013). For example, NC crows are shown pulling a string to retrieve a short stick. They then use the short stick to retrieve a longer stick from a cage. Eventually, they are successful at getting food out of a tube with the long stick. Dr. Taylor comments in the video that he

was surprised by the ability of the NC crow to remember the original objective of the task. In his conclusion, though, Dr. Taylor's says that "he has no idea" how the NC Crows got so smart. That question may have been answered by recent exciting studies which you can watch by clicking on the below video.³ Here is a question: Do you think the video is correct? In the video, you will be face to face with NC Crows peering down a tube trying to figure out how to capture a larvae with a tool stick. You can read the article by clicking of "croweyes" at Reference 3.

<http://www.bing.com/videos/search?q=videos+on+binocular+vision+of++New+Caledonian+Crows&FORM=VIRE3#view=detail&mid=2A9433C9FD8694B32A6F2A9433C9FD8694B32A6F> (accessed 9/25/13)

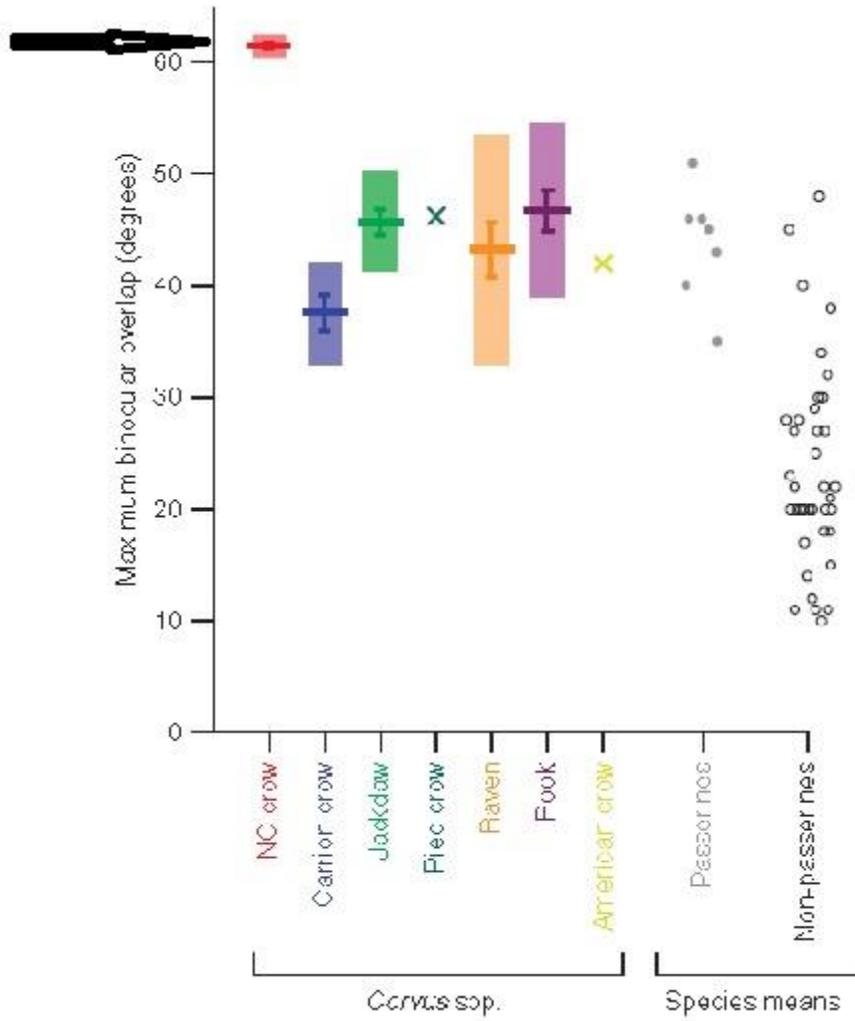
III. Unique morphology of the New Caledonian Crows

Modification of bird beaks depending on food source is well documented and was an important factor in the development of the concepts of natural selection. (Ref. 4). After Darwin collected the 13 different birds at the Galapagos Islands, he misidentified them as blackbirds, grosbeaks and finches since their beaks were so different, It was his friend John Gould, a British ornithologist, who correctly identified the birds as 13 new species of ground finches. This discovery led Darwin to form the idea that different species evolved from common ancestors that had flown from the mainland thereby adapting to the various foods sources on the Galapagos Islands. In the 1845 Edition of the Voyage of the Beagle, Darwin wrote: "Seeing this gradation and diversity of structure in one small, intimately related group of birds, one might really fancy that from an original paucity of birds in this archipelago, one species had been taken and modified for different ends."

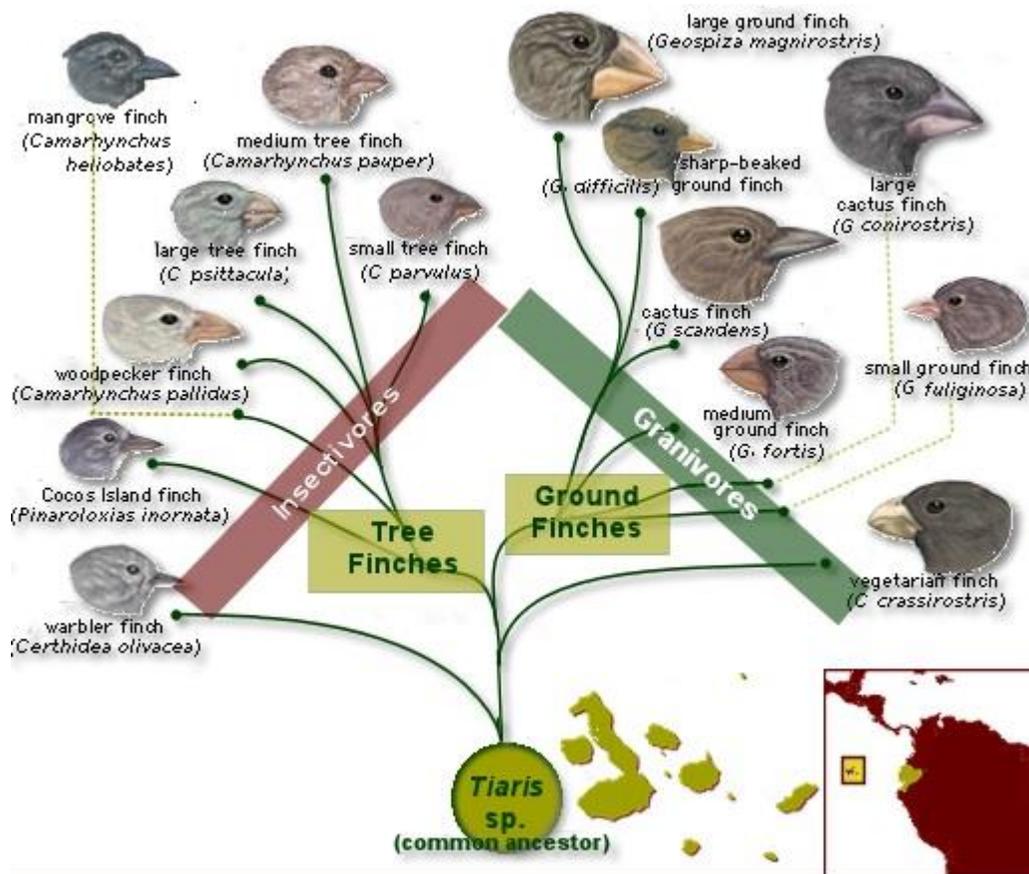
Dr. Taylor does not address the effect of the unique beak morphology of the NC Crow in completion of the various tasks. In contrast, the Troscika group (Ref. 3) quantitatively showed that the NC crow exhibited a greatly improved binocular field of vision as shown in the below figure from the paper. The black arrow on the left points to a red bar illustrating the unique visual acuity of the NC Crow compared to other crow (Corvid) species. . . .

Personal Comments

To my knowledge, my little essay seems to be the only commentary that I have found connecting NC Crows with Darwin's finches as an explanation of how NC crows got so smart. The NC crow, as shown in the below picture, is definitely an outlier from other crow species as well as other birds in general. Studying a map, New Caledonian archipelago is very isolated made up of three islands: Grand Terre and the smaller islands Lifou and Mare. Genetic studies in progress indicate that the NC crow originally settled the larger island, Grand Terre, and that the crows on Mare descended from Grand Terre crows probably about a hundred years ago. There are no crows on Lifou. So, the NC crows are not disposed to traveling very far. It appears that the crows even established strict territories on Grand Terre, developing different "designs" on their tools in the different territories. Like Darwin's finches, the NC crows could have similarly adapted to the unique food opportunities offered on the island. Since the NC crow does not have the long, thin tongue of a woodpecker, it instead adapted by using "tools."



The above figure illustrates the unique binocular field of vision for NC Crows (on far left) compared to other Corvids (Ref 4)



The above figure illustrates changes that probably occurred to a mainland finch depending on food availability.

REFERENCES

1. Alex H. Taylor, Brenna Knaebe, and Russell D. Gray. An end to insight? New Caledonian crows can spontaneously solve problems without planning their actions. (See <http://www.youtube.com/watch?v=ZnqUAsyOTv4>)
2. Alex H. Taylor, Felipe S. Medina, Jennifer C. Holzhaider, Lindsay J. Hearn, Gavin R. Hunt, Russell D. Gray. An Investigation into the cognition behind spontaneous string pulling in New Caledonian Crows. Plos One Feb. 2010, Vol. 5, Issue 2 (<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0009345>)
3. J. Troscianko, A. M.O. von Bayern, J. Chappell, C. Rutz, and G.R. Martin. Extreme binocular vision and a straight bill facilitate tool use in New Caledonian crows. Nature Communications 2012;3L1110. [CLICK HERE TO SEE ARTICLE](#) [croweyes](#)
4. Reiner, A. Avian Evolution: from Darwin's finches to a new way of thinking about avian forebrain organization and behavioral capabilities. Bio. Lett. (2009) 5, 122-

124. See: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2657742/pdf/rsbl20080473.pdf> (accessed 9/29/13)