Tool Manufacture, Social Learning and Cognition in New Caledonian Crows

Jennifer Christine Holzhaider

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Bird, I said, that fliest forever on New Caledonia’s shore
That hast manufactured tools no other bird has dreamt before
Scientists have for centuries searched and thought and tried in vain
To reveal the dreary secrets that lie hidden in thy brain
Will there, will there come the hour when thy genius we’ll explore?
Quoth the Raven: NEVERMORE!

H. Holzhaider, based on E.A. Poe, *The Raven*

Abstract

Wild New Caledonian crows are among the most sophisticated non-human tool manufacturers. In this thesis I investigate three important aspects related to the evolution and ontogeny of their tool skills that have not been studied in the wild before: the crows' social structure, the development of pandanus tool manufacture and use, and the crows' grasp of the functional properties of pandanus tools. My main methodological approach was to observe crows at feeding sites in their natural habitat on the island of Maré, New Caledonia.

The findings on NC crows' sociality revealed that they are one of the less social corvid species, with a social network size of probably less than 20 individuals. However, they have close, long-term relationships within their immediate family, which includes a partner and juveniles of up to two consecutive breeding seasons. Parental care is very extended, and juveniles may be tolerated and fed until 20 months old. The social structure of NC crows is likely to promote vertical transmission of tool skills while limiting the opportunity for horizontal transmission.

My developmental study showed that the ontogeny of wide pandanus tool manufacture is a lengthy process comparable to the development of tool use in primates, and that both individual and social learning are likely to play important roles. Juveniles do not reach adult proficiency until their second year of life and have ample opportunity to observe their parents' tool behaviour, while parents strongly scaffold the juveniles' learning environment. Exposure to parental tools might help juveniles form a mental template of functional tool design and thus facilitate the faithful transmission of local design traditions.

My experiments on NC crows' understanding of tool functionality showed that they do not strongly attend to the functional properties of pandanus tools. Instead, they appeared to solve tool problems through associative rules. In the wild, successful pandanus tool use is likely to rely on procedural knowledge of tool manufacture acquired during an individual's ontogeny.

Overall, my results suggest that New Caledonian crows' social structure and the mechanisms involved in the ontogeny of tool manufacture are suitable to support cumulative technological evolution that has been proposed to underlie the diversification of tool designs on New Caledonia's mainland Grande Terre.

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The research reported in this thesis was approved by the University of Auckland Animal Ethics committee (approvals R231 and R375) and complies with the laws of New Caledonia.

Table of Contents

List of Figures

List of Tables