Tohoku Psychologica Folia
2001, **60**, 93－97

When and where did crows learn to use automobiles as nutcrackers?

NIHEI YOSHIAKI (仁平義明)[1] and HIGUCHI HIROYOSHI (樋口広芳)[2]
(*Tohoku University*) (*The University of Tokyo*)

In Sendai, Miyagi Prefecture, northern Japan, Carrion Crows *Corvus corone* have frequently been observed to use automobiles as nutcrackers. A questionnaire survey and our own observations show when and where the crows learned this behaviour and how the behaviour spread. The car-using behaviour originated at a driving school in Sendai in the 1970s, and has been spreading from there to surrounding areas within about a 5 km in radius for the last 20 years. This－as with the case of some European tit species opening the tops of milk bottles (Fisher & Hinde, 1949; Hinde & Fisher, 1952)－is a rare case demonstrating the spreading process of a novel behaviour occurring at a particular site and during a particular period.

Key words: Carrion Crow *Corvus corone*, walnuts, automobiles, nutcracking, car-using behaviour, learning.

Introduction

Some bird species have been reported to use tools to get food (e.g.. Eibl-Eibesfeldt & Sielmann 1962, van Lawick-Goodall & van Lawick, 1966; Higuchi, 1986). There is a recent report on the manufacture and use of hook-tools by New Caledonian Crows *Corvus moneduloides* (Hunt, 1996). In California, USA, Common Crows *Corvus brachyrhynchos* were reported to use automobiles as nutcrackers (Maple, 1974; Grobecker & Pietsch, 1978), although further close observations rejected the possibility (Cristol et al. 1997).

In Japan, Carrion Crows have been frequently observed to use automobiles as nutcrackers in the city of Sendai, Miyagi Prefecture, northern Honshu (the largest main island) (Nihei, 1995). We thereafter observed that this car-using behaviour is highly flexible in terms of how the walnut to be cracked is placed on roads. For example, crows may return unbroken walnuts hit by cars to their original position. They also move the walnut several centimeters when much time passes without it being run over. These observations indicate the cognitive abilities and intelligence of the crows.

This car-using behaviour is seen on the Kawauchi Campus of Tohoku University and vicinity in Sendai. In order to demonstrate when and where the crows started this behaviour, we carried

1. Department of Psychology, Graduate School of Arts and Letters, Tohoku University, Kawauchi, Sendai, Aoba-ku, Miyagi 980-8576, Japan; E-mail: nihei@sal.tohoku.ac.jp
2. Laboratory of Biodivresity Science, Department of Ecosystem Studies, Graduate School of Agricultural and Life Sciences, The University of Tokyo, Yayoi, Bunkyo-ku, Tokyo 113-8657, Japan
3. We thank T. Kurosawa and E. Morishita for preparing the manuscript, J. Nakase for rending us photographs used in this paper, and J. Fries for improving the English. This research was supported in part by a grant-in-aid from the Ministry of Education, Science, and Culture.

out a questionnaire survey on sightings of the behaviour.

Method

Questionnaires were distributed to staff and students of Tohoku University who commuted through the Kawauchi area, and also to members of the Miyagi Branch of the Wild Bird Society of Japan. In addition, the instructors of the Akamon Driving School and the Kadan Driving School were asked to participate in the survey, as they are familiar with roads in and around Kawauchi. A total of 679 questionnaires were sent out in 1994 and 1995.

The questionnaire included the following questions.

1. Have you ever seen a crow use a car to crack nuts?
2. If so, when and where? (Show the locations on a map).
3. How did the crow place the walnut? (Choose one or more from the following three methods): (a) It placed the walnut in front of a car which had stopped at a red light, (b) It placed the walnut beforehand at a spot where the wheels of cars are likely to run over it, and (c) It tossed the walnut with its bill in front of a slowly moving cars.

Results

Five hundred and five people (74.7%) filled in the questionnaire. One hundred and twelve people (22.2%) had witnessed the car-using behaviour, suggesting that car-using behaviour has a considerably high sighting frequency.

Those who witnessed the behaviour of placing walnuts beforehand at spots where cars were likely to run over it accounted for 91.1% of these 112 people. Crows were seen to place walnuts in front of stopped cars by 48.2% of the people (Fig. 1). The behaviour of tossing walnuts in front of slow-moving cars was observed by 25.5% of the people.

One hundred and eight people (96.4%) had witnessed the car-using behaviour in Sendai, but the other four had observed it outside Sendai. One sighting was in Kesennuma, Miyagi Prefecture in 1993; one in Shiogama, Miyagi Prefecture in 1992; one in Kitakami, Iwate

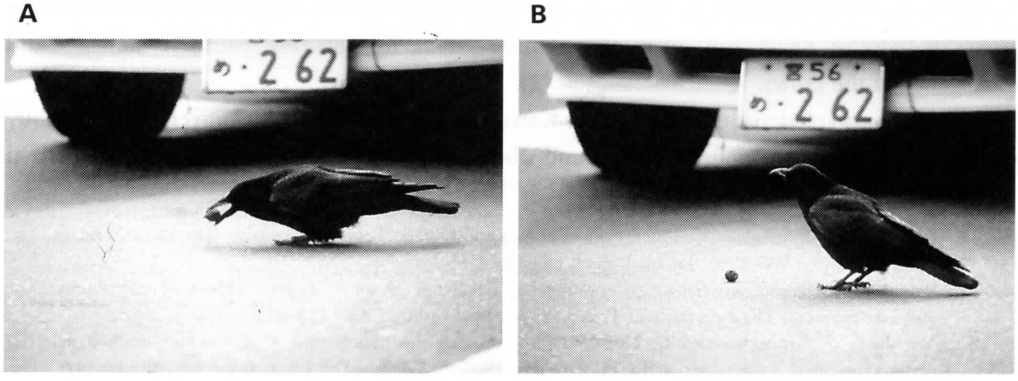

Fig.1(a, b). A Carrion Crow placing a walnut in front of a stopped automobile. (Photo by Jun Nakase).

Prefecture adjacent to Miyagi in 1994; and one in Hiratori-cho, Hokkaido (the northernmost main island of Japan) in 1990.

In Sendai, the car-using behaviour was observed at 17 sites in the vicinity of the Hirose River, a major river flowing through the city, and its tributaries. At 12 of the 17 sites, we confirmed by our own observations that crows did indeed use cars to crack nuts.

We examined all 17 sites in the autumn of 1996, and showed that they have three habitat characteristics in common: (1) There are intersections or sharp bends in the roads where cars must stop or move slowly, (2) there are Japanese walnut trees *Juglans ailanthifolia* in the area, (3) there is a moderate amount of traffic (10 − 83 cars/5 min., mean ± SD = 48.6 ± 19.2, n = 91). These findings indicate that car-using behaviour occurs in zones located between a rural area where walnut trees grow and an urban area with heavy traffic.

The earliest sighting of this behaviour occurred at the Kadan Driving School along the Hirose River, which flows through Sendai (Fig. 2). Crows have been observed to use cars on the driving courses of this school since 1975. The next sighting locality was Sumiyagura Intersection about one kilometer away from the driving school. This occurred in 1988, 13 years after the first sighting at the driving school. At the sites where the numbers of people who observed the behaviour were the greatest, these numbers show an increasing tendency within each site.

Connecting the sites where the behaviour was first seen in the same year gave rise to contour lines, or "isochrones", expanding outward from the Kadan Driving School as years elapsed (Fig. 3). The figure indicates that the car-using behaviour spread into the hilly areas to the north-west from the original site over about 20 years. In the hilly areas there are many walnut trees along the roads, which might increase the number of opportunities for crows to crack the walnuts using cars.

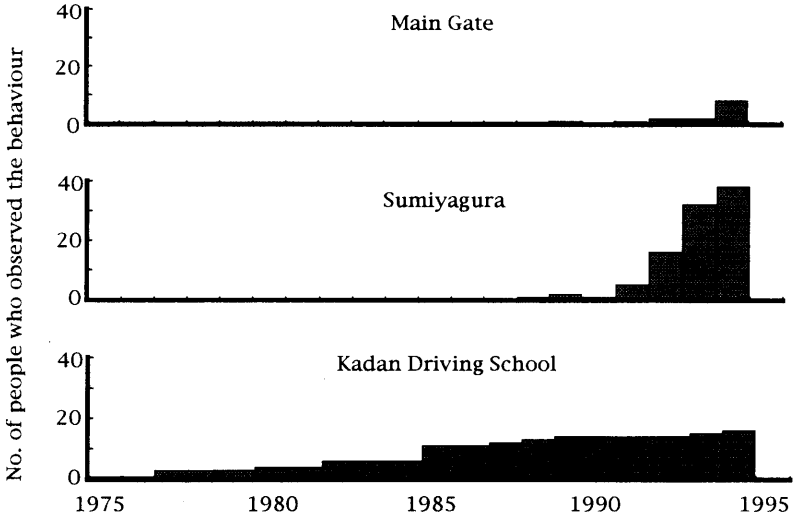

Fig. 2. Annual changes in number of reporters who witnessed the car-using behaviour at the three main sites in Sendai: Sumiyagura, Tohoku university Kawauchi main gate, and Kadan Driving School. At these three sites, the behaviour was observed by enough people to show an increasing trend. Based on a questionnaire survey.

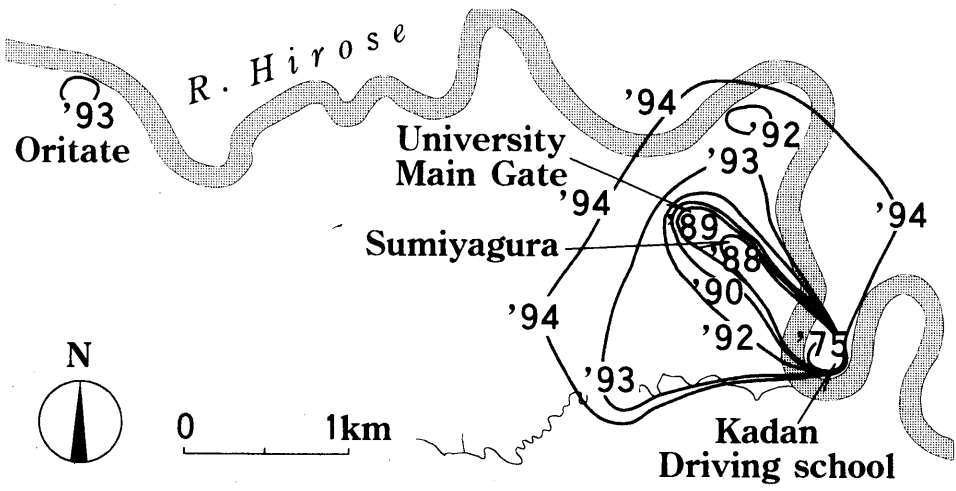

Fig. 3. Contour lines or "isochrones" connecting the sites where the behaviour was first seen in the same year among the 17 sites in Sendai.

Discussion

This is a rare case demonstrating the spreading process of a novel behaviour occurring at a particular site during a particular period. The behaviour among some European tit species of opening the tops of milk bottles (Fisher & Hinde, 1949; Hind & Fisher,1952) is another example of this kind.

Regarding the car-using beheviour observed outside Sendai, we do not think that all such behaviour in Japan originated in Sendai. Car-using behaviour may have developed independently in other areas.

Why did this particular case of car-using behaviour originate at the Kadan Driving School? There are a large number of Japanese walnut trees along the Hirose River, which flows by the driving school. During our interview, some instructors of the school told us that Carrion Crows had been seen carrying walnuts from the riverside and dropping them from the air on the roads in the driving course since the 1960s. These roads are well suited for cracking walnuts in this manner, because they have flat, wide, and paved surfaces. Thus it is likely that crows would have learned to place walnuts on likely spots, after they happened to see cars run over and crack walnuts they had dropped onto these roads from the air. Probably, the relatively light traffic on the driving course (10-28 cars/5 min., mean $\pm$ *SD* = 18.0 $\pm$ 5.0, n = 11) helped facilitate the development of this behaviour as it gave the crows enough time to place walnuts and then eat them on the road once they were cracked.

It is not known how this fascinating car-using behaviour was transmitted from individual to individual. We have started studying the spreading process by monitoring ringed crows.

References

Cristol, D. A., Switzler, P. V., Johnson, K. L., & Walkem L. S. (1997). Crows do not use automobiles as nutcrackers: Putting an anecdote to the test. *Auk*, **114**, 296-298.

Eibl-Eibesfeldt, I. & Sielmann, H. (1962). Beobachtungen am Spechtfinken *Cactospiza pallida* (Sclater und Salvin). *Journal für Ornithologie*, **103**, 92-101.

Fisher, J., & Hinde, R. A. (1949). The opening of milk bottles by birds. *British Birds*, **42**, 347-357.

Grobecker, D. B.& Pietsch, T. W. (1978). Crows use automobiles as nutcrackers. *Auk*, **95**, 760-761.

Higuchi, H. (1986). Bait-fishing by the Green-backed Heron *Ardeola striata* in Japan. *Ibis*, **130**, 285-290.

Hinde, R. A., & Fisher, J. (1952). Further observations on the opening of milk bottles by birds. *British Birds*, **44**, 393-396.

Hunt, G. R. (1996). Manufacture and use of hook-tools by New Caledonian crows. *Nature*, **379**, 249-251.

van Lawick-Goodall, J., & van Lawick, H. (1966). Use of tools by the Egyptian Vulture *Neophron percnopterus*. *Nature*, **212**, 1468-1469.

Maple, T. (1974). Do Crows use automobiles as nutcrackers? *Western Birds*, **5**, 97-98.

Nihei, Y. (1995). Variations of behaviour of Carrion Crows *Corvus corone* using automobiles as nutcrackers. *Japanese Journal of Ornithology*, **44**, 21-35.

(Received October 15, 2002)
(Accepted November 22, 2002)