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## **Mobbing Behavior Of Mexican Jays (*Aphelocoma Ultramarina*) And Scrub Jays (*Aphelocoma Coerulescens*).**

Jack F. Cully Jr.

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This thesis, directed and approved by the candidate's committee, has been accepted by the Graduate Committee of The University of New Mexico in partial fulfillment of the requirements for the degree of

Master of Science

MOBBING BEHAVIOR OF MEXICAN JAYS (*APHELOCOMA*  
*ULTRAMARINA*) AND SCRUB JAYS (*APHELOCOMA COERULESCENS*)

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MOBBING BEHAVIOR OF MEXICAN JAYS (APHELOCOMA  
ULTRAMARINA) AND SCRUB JAYS (APHELOCOMA COERULESCENS)

BY

JACK F. CULLY, JR.

B. S., University of New Mexico, 1967

THESIS

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MOBBING BEHAVIOR OF MEXICAN JAYS (APHELOCOMA  
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ABSTRACT OF THESIS

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## ABSTRACT

Mobbing behavior of Mexican Jays (Aphelocoma ultramarina) and Scrub Jays (A. coerulescens) to a Great Horned Owl (Bubo virginianus) was studied in field and laboratory experiments during 1970 and 1971. In both series Mexican Jays had a stronger response to the owl in rate of calling, and a longer lasting response. Population distribution patterns and social compatibility of flock members are considered the most important differences in explaining the stronger response of Mexican Jays to the owl. Hand-reared naive Mexican and Scrub jays were also tested in the laboratory. At age 80 days Scrub Jays mobbed the owl. The naive Mexican Jays did not mob the owl until a later age. Their response was also unlearned. In the wild Mexican Jays probably learn to mob earlier as the young birds associate with adults. Differences in development are attributed to the opportunities of juvenile Mexican Jays to observe adult behavior, whereas Scrub Jays are separated from adults at an early age.

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## Introduction

Mobbing behavior has been used in studying interspecific recognition (Hartley, 1951), changes in the intensity of an innate response due to waning and habituation (Hinde, 1954a; 1954b; 1960), and for analysis of changes in the emotional state of mobbing birds by use of songs (Andrew, 1961). In this study I investigated the relationship between mobbing behavior and social organization in Scrub and Mexican jays.

Scrub Jays (Aphelocoma coerulescens) and Mexican Jays (Aphelocoma ultramarina) exhibit a strong, well developed mobbing response, are closely related species, but have great differences in their social behavior (Brown, 1963). Scrub Jays maintain territories all year (Brown, 1963) except for winter flocks of young birds (Westcott, 1969). The race of the Mexican Jay found in New Mexico and Arizona, A. u. arizonae, on the other hand, occurs in flocks year-round. A. u. arizonae also shows group participation in nest building and in the feeding and care of young birds (Brown, 1970). Couch's Jay (A. u. couchi), found in the Chisos Mountains of Big Bend National Park, Texas, is less well known than the other two populations considered, but reportedly nests in pairs with some flocks occurring all year (Brandt, 1940).



## Methods

Tests used in this study fall into three categories.

1. Mobbing behavior of free-living birds was observed.

For this and all other tests the stimulus object was a live Great Horned Owl (Bubo virginianus). In this series the owl was placed in an open area near the ground on a fallen log or stump. The location chosen was such that perches were available at a variety of heights and distances from the owl. During these sessions I sat in an inconspicuous position under a tree or bush at least 30 m away from the owl, thus observing the action with little effect on the mobbing birds. Observations and calls were recorded on tape using an Uher 4000-Report L tape recorder with an Uher M514 microphone. Calls were analyzed on a Kay Electric Company Sona-Graph 6061B.

2. Wild-caught jays were placed in outdoor aviaries for holding. After adjusting to captivity, each was brought individually into the laboratory where it was placed in a 61 cm cubed wire mesh test cage with two perches running the width of the cage 15 cm from the front and 15 cm from the rear. A Great Horned Owl was placed 6.1 m from the front of the test cage but blocked from view. The jay was left undisturbed for two hours. It was then observed for 5 min through a screened window. If it seemed at ease, e.g., feeding, preening, or sleeping, I entered the



room and removed the screen, thus exposing the owl. Calls were recorded on tape and other activities were counted from outside the room or from a blind in the lab. The blind was used only once. If after two hours the bird was not at ease, it was allowed more time, up to six hours. Then if it was still ill at ease it was returned to the aviary.

3. To learn how the responses of the immature jays were acquired, four Scrub Jays and two Mexican Jays were taken from nests prior to fledging. Two additional juvenile Mexican Jays were captured shortly after fledging and were aviary-reared. These birds were tested as in series two.



### Description of Mobbing

#### A. u. arizonae.

I observed mobbing of Mexican Jays in Clanton Canyon, Peloncillos Mountains, and at the base of Animas Mountain, Hidalgo County, New Mexico on 30 and 31 May 1970, and near Silver City, Grant County, New Mexico on 1 June 1970, and 21 March 1971. I also observed mobbing by Mexican Jays in Cave Creek Canyon, Chiricahua Mountains, Cochise County, Arizona, on 3 and 4 July 1970. In all cases the response was similar and the course of the response was predictable.

Mexican Jay flocks typically number 8-20 birds (Brown, 1963; Hardy, 1961). The mobbing flocks that I observed fell within this range and all participants during June and July 1970 appeared to be black-billed adults. Pink-billed birds were seen mobbing with adults near Silver City in March 1971.

When the owl was exposed, Mexican Jays weren't always the first to discover it. Usually small passerines, or in one case a pair of Coppery-tailed Trogons (Trogon elegans), discovered the owl and began mobbing first. Then it was usually only a short time before the Mexican Jays noted it and began mobbing. Mobbing in all cases but one, at Clanton Canyon, lasted from 35-45 min. At Clanton Canyon the flock I observed had been exposed to the owl about two weeks earlier by J. D. Ligon and their response was weak, lasting only



about 10 min (see Hinde, 1954a; 1954b and 1960 for a discussion of waning and habituation in mobbing birds).

When a Mexican Jay discovered the owl the jay would land on an exposed perch, bob its body, simultaneously flitting its tail, and give a series of loud "weet" calls in rapid succession. This attracted the attention of nearby jays who then approached the owl and began to mob also. Brown (1963) noted that birds from nearby flocks sometimes joined a mob in a home range other than their own. The birds that I watched were not marked, thus I was unable to determine whether more than one flock ever mobbed in a single locale.

When the Mexican Jays began to mob they sat on perches high in the trees. After about three minutes they moved closer to the owl and onto more exposed perches. Several of the jays then would begin diving at the owl, some coming to within 3 cm of the owl's head. This usually caused the owl to flinch. The jays always approached the owl from behind or from the side, never directly toward the face. This probably results in greater surprise as well as reducing danger to them during such close approaches to the owl. Usually two or more jays approach the owl at the same time.

After 10-12 min several birds flew away, but returned periodically. For the next 10 min three or four birds mobbed,



but their approaches to the owl became less daring and less frequent. During the last 15 min of mobbing only one or two birds remained around the owl at a time. Their calls became less frequent and they tended to seek more protected perches at greater distances from the owl. With the cessation of calling the birds left the vicinity of the owl.

A. u. couchi.

I observed mobbing by A. u. couchi on 30 December 1970, in Pine Canyon, Chisos Mountains, Big Bend National Park, Brewster County, Texas. The mobbing response closely resembled that of A. u. arizonae. This session was divided by a brief pause when all birds flew down canyon and returned two minutes later.

While mobbing these birds did not approach the owl as closely as had individuals of A. u. arizonae, and their posture was more erect. Rather than dive at the owl as did the Arizona birds they would fly to a point over the owl, turn around, and return to their original perch. During these flights they were never closer than 1 m of the owl. These differences from A. u. arizonae may be due to seasonal variation in hormone levels.

Before they flew down canyon, after 8 min of mobbing, the only call given was the "oint" call (Brandt, 1940). This call sounds a great deal like the "weet" call of the



Arizona birds, and like it, is probably an alarm call. When they returned for the second mob they remained for 20 min. During this second session I heard the "rattle" call twice, and when one of the birds flew away it gave a call that I term the "clangor" (see Fig. 1.). Both of these calls seem to be absent from the vocal repertoire of A. u. arizonae (present study; Brown, 1963).

One other notable difference between A. u. couchi and A. u. arizonae is the presence in the former of an individual distance. Several birds gathered on a perch 4.3 m from the owl. Agonistic encounters occurred when one jay moved within about 30 cm of another. I saw individuals of A. u. arizonae sitting within 15 cm of each other while mobbing on several occasions; however I never saw aggressive encounters.

#### A. coerulescens.

I observed mobbing by Scrub Jays on 17 July 1970 at Juan Tabo Canyon, Sandia Mountains, Bernalillo County, New Mexico, Big Bend National Park, Brewster County, Texas on 30 December 1970, and at two localities near Silver City, Grant County, New Mexico, on 21, 22 March 1971. In Big Bend only one bird mobbed although there were four Scrub Jays in the area. The mobbings at Juan Tabo and at Silver City were of about equal intensity and duration, lasting 15-20 min.



When the owl was found, generally by one Scrub Jay, it gave two basic calls, the "scree" and the "whew" calls (Brown, 1963) (see Fig. 1.). Both are undoubtedly alarm calls and the "scree" appears to be the more intensive. The only bird that I observed giving the "scree" call at any mobbing session was the first jay to discover the owl, probably a bird on whose territory the owl was located. This bird mobbed most aggressively and stayed near the owl longer than other Scrub Jays. Because Scrub Jay mobbing flocks were small it was possible to distinguish an individual.

Scrub Jays formed mobbing flocks more slowly than either race of Mexican Jay because of their territorial dispersal. I never observed more than seven Scrub Jays around the owl. Usually the first Scrub Jay to mob was joined by other individuals after 2-3 min. These birds mobbed actively for only 5-10 min, and then they would leave the vicinity of the owl, move into nearby trees to observe the owl, or forage on the ground. On one occasion a territorial Scrub Jay was perched about 1.3 m from the owl when another landed about 30 cm away and was supplanted by the territorial bird. During this same session, near Silver City, when one of the birds was foraging on the ground and found a Pinon seed (Pinus edulis) the territorial bird supplanted him causing him to drop the seed and move 6.3 m away.

Scrub Jays mobbed more passively than the Mexican Jays.



Generally their movements were less pronounced and without many short flights at the owl, as was seen in Mexican Jays. As the response of the Scrub Jays waned, the birds either sneaked away or else sat quietly in the bushes where they could watch the owl. The mobbing sessions were shorter than in the Mexican Jays, and once mobbing stopped, Scrub Jays were less inclined than the Mexican Jays to return and resume this activity.



Laboratory ResponseA. u. arizonae.

Five wild-caught Mexican Jays were tested individually in the laboratory during October and December 1970. All were exposed to the owl for at least 6 min. In no case had mobbing ceased at the end of that time. When jays were exposed to the owl for as long as 12 min, mobbing slowed perceptibly but did not cease.

As the jays mobbed, three activities were tabulated: calls, tail flits, and jumps from perch to perch. The birds could move freely from side to side in the cage, jump from perch to floor to perch (counted as one jump), or jump from perch to perch (also counted as one jump). The Mexican Jays spent most of their time on the perch closest to the owl, calling and flitting their tails. The flit is a rapid jerking movement of body and tail. The body is rapidly bobbed while the tail is flitted and rapidly fanned. The body movements may be vertical or to the right or left. When the birds jump, their posture is more erect and they may jump several times in succession.

Generally at the beginning of the session the bird spent almost all of its time on the front perch, with jumps to the rear followed immediately by jumps back to the front. After several minutes, the action became more evenly distributed between the two perches. The Mexican Jays tended not to settle



quietly in the presence of the owl, but continued to mob until the experiment was terminated. A regression analysis was performed on calls per minute (dependent variable) against time in minutes (independent variable) and  $\hat{Y} = 43.7 + 29X - 4.6X^2$  ( $N = 5$ ;  $F = 6.090$ ;  $P < .05$ ). This indicates an increasing rate of calling to minute 3 when the response begins to wane. There was a great deal of variation between birds (see Fig. 5; Table I.).

The calls are probably a good indicator of excitement level and after a general increase in call rate during minutes 1, 2, and 3 the rate lessens in a waning curve not unlike that which Hinde (1954a, 1954b) reported for the Chaffinch (Frin-gilla coelebs). Tail flits have been described as flight intention movements (Daanje, 1950; Hinde, 1954a) and my observations agree with this in part, as discussed below. The jumps from perch to perch are given most frequently during minutes with few flits. Tail flits per minute and jumps per minute are inversely correlated with one another (correlation coefficient =  $-0.719$ ;  $P < .01$ ;  $N = 28$ .). There was no significant regression of jumps per minute or flits per minute (dependent variable) with time in minutes (independent variable), as there was for calls.

Although the tail flits are undoubtedly flight intention movements, the term is somewhat misleading when applied in the context of mobbing. Wild birds mobbing flit their tails most rapidly when approaching the owl, but the flit doesn't



necessarily result in the birds' flight, nor does it cause other birds to flee. It probably indicates that the bird has a desire to flee which is overridden by a stronger aggressive response to the owl. When the fear or withdrawal component prevails the bird either moves away from the owl, or in the case of a caged bird, it jumps from perch to perch, presumably in an effort to flee from the owl.

A. coerulescens.

Five Scrub Jays also were tested for 6 min each during October 1970 and March 1971 (see Fig. 5; Table II.). The response of Scrub Jays to the owl was similar to that of Mexican Jays. An analysis of variance test showed that Scrub Jays give fewer calls than Mexican Jays ( $F = 194.8$ ;  $P < .001$ ;  $N_1 = N_2 = 5$ ). In structure and probable meaning the calls are quite similar (see Fig. 1 and 2.). On exposure to the owl the Scrub Jays crouched more deeply than the Mexican Jays; their heads were on many occasions held at a level below their feet. The tail, slightly fanned, was held nearly vertical. Tail flitting was less pronounced than in Mexican Jays, but this was probably due to the more vertical posture of the Scrub Jays (see Fig. 3 and 4.).

The Scrub Jays generally started mobbing, as did the Mexican Jays, on the front perch. Jumps to the rear were followed by jumps back to the front perch where activity centered. The progress of mobbing was more varied among Scrub Jays than



among Mexican Jays, and there was no significant regression of calls against time as there was for Mexican Jays. There was again a significant inverse correlation between jumps per minute and flits per minute (Correlation coefficient =  $-.611$ ;  $P < .01$ ;  $N = 30$ .) and the interpretation of these activities is the same as for Mexican Jays. There was again no significant regression of jumps per minute or flits per minute with time in minutes.

The most notable difference between Scrub and Mexican jays exposed to the owl in the laboratory was a tendency of Scrub Jays to become distracted during mobbing. After 3-4 min they would begin to manipulate or eat food from the floor of the cage. Then they seemed again to notice the owl, called and briefly resumed mobbing. As time progressed they paid less attention to the owl and spent more time at miscellaneous activities in the cage. Two of the birds had stopped mobbing by the end of 6 min.



### Development of the Young Birds in Captivity

To learn how mobbing behavior develops in these jays, hand-reared Scrub and Mexican Jays, and two aviary-reared Mexican Jays were tested in the laboratory in the same manner as the adult jays. The four Scrub Jays were taken from a nest in Bear Canyon in the Sandia Mountains on 4 June 1970. These were about ten days old and only partially feathered at the time of capture. Three Mexican Jays (one later escaped), about two weeks of age, were taken from a nest at the base of Animas Peak on 31 May 1970. The four Scrub and three Mexican jays were hand reared in adjoining cages. The birds were always together and the ontogenetic experiences of the two groups were the same. (Captive adult Mexican Jays could be heard but not seen by all the birds.) Two Mexican Jay fledglings, age about 27 days, also were captured on 31 May 1970. These birds had to be force fed, unlike the younger jays who readily gaped for food.

One of these two birds, given a yellow color band at the time of capture, was tied to the ground ca. 1m from the Great Horned Owl during a mobbing session on 1 June at Animas and 2 June at Silver City. His distress calls associated with being handled brought immediate response from nearby adult jays who mobbed vigorously. This was the only juvenile exposed to the mobbing behavior of adults. During the mobbing at Silver City two adult Mexican Jays were captured and placed in aviaries at



the University of New Mexico on 2 June. Two days later the two fledglings were placed with these birds who fed them until the juveniles were fully developed.

The nestling Scrub and Mexican jays remained in a box following their capture. The only call given prior to fledging was the squeaking begging call (see Fig. 2.). On 7 June, one week after capture, all three Mexican Jays fledged. One Scrub Jay fledged at that time also. In the evenings the fledglings became very active, hopping and fluttering about. They also became quite vocal and used the "chuck" call. This call seemed to function in maintaining contact between the birds. More uses for the call may develop as the birds grow older. I never heard this call given prior to fledging. When together the Mexican and Scrub jay fledglings showed no perceptible preference for company of their own species. The begging calls were similar and the "chuck" calls of each species were nearly identical (see Fig. 2). At night the Mexican and Scrub jays all roosted together.

The Scrub Jays fledged at staggered intervals. One fledged on 7 June, the second on 9 June, and the last two on 11 June. As each bird fledged it joined the group with little difficulty. The birds remaining in the nest box were ignored by the others. The Mexican Jays were about three weeks old when they fledged on 7 June. Free-living nestlings fledged on post hatch days 24-25 (Brown, 1970). My birds probably left the nest box early due to the unusual



circumstances of captivity.

By 13 June I began to notice that the Scrub Jays were quicker of movement and seemed to explore their surroundings more actively than did the Mexican Jays. My impression from this time (age four weeks) until age 12 weeks was that the Scrub Jays were developing faster than the Mexican Jays. By the twelfth week their coordination was well developed whereas the Mexican Jays were still quite clumsy. On 30 July (age 11 weeks) all six young jays were feeding themselves, but the Mexican Jays would still beg.

#### Mobbing Response.

The yellow-banded Mexican Jay had seen mobbing so it was tested first. Its first exposure to the owl in the lab was on 26 June (age 56 days), 24 days after exposure to the owl in the field. It did not mob or show agitation at that time. It gave one "weet" call from the front perch and then remained quiet in the "resting" posture (see Fig. 4.) until the owl was screened. Yellow was next tested on 17 August (age 108 days). Prior to testing it jumped a little in the cage but gave no calls or flits. When exposed to the owl it mobbed well for 6 min at which time the owl was again screened. (Results for this and subsequent tests are shown in Table III.) This bird's sibling was then shown the owl; it showed a fear reaction consisting of a few calls or flits and much jumping in the cage. After 3 min the owl was screened.



The sib of Yellow was again shown the owl in a series of tests on 20 October 1970 (age 172 days). It was first exposed alone in the morning and assumed the same posture as did Yellow on 26 June. An adult was then placed in a cage next to the juvenile and they were exposed to the owl together later the same day. The juvenile gave no reaction although the adult bird mobbed. The adult was then removed from the lab. The juvenile was then tested singly two hours later for 2 min. When I removed the screen it jumped to the front perch, crouched slightly and flitted its tail once. It then shifted into the upright "resting" posture and remained quiet for the duration of the test. On 27 October (age 179 days) it was again exposed to the owl. It had been jumping between perches prior to exposure. When it saw the owl it stopped and again assumed the "resting" posture. This was sib of Yellow's last test. It never mobbed.

Kuo (1967, Chapter 3) describes situations in which animals react to situations in new ways as a result of altered ontogenetic experiences. He calls these new behavioral responses "neophenotypes." Possibly seeing an owl on several occasions prior to the maturation of the mobbing response, resulted in a neophenotype, not mobbing. Another possibility is that the response just had not developed at the age of six months. The development of a response as a result of learning may require maturation or a resting period of some type in the same sense that other "innate" behavior undergoes maturation.



One of the hand-reared Mexican Jays was shown the owl on 28 August (age 103 days) and it reacted by sitting quietly as had Yellow on its first exposure to the owl. This bird was again shown the owl on 16 November (age 183 days), at which time it mobbed with moderate intensity for 10 min. This bird's sibling, Blue, was then exposed to the owl for the first time and it too mobbed moderately for 6 min.

The four Scrub Jays were tested on 13-14 August (age 80 days). Three gave moderately strong mobbing responses. The fourth bird did not mob, but sat quietly as had the Mexican Jays on their first exposure to the owl. This bird was found to have a minor head injury; possibly this affected its behavior.



## Discussion

### Field and Laboratory Observations.

Before a meaningful discussion of the evolutionary significance of differences in the mobbing response can ensue it is necessary to consider of what value mobbing is to birds. In various species of birds manifestations of mobbing are much the same with loud calls, rapid movements of the body or parts of the body, and usually the participation of more than one bird. In territorial birds, territorial defenses are dropped during mobbing (Crook, 1961). The widespread nature of mobbing indicates that it does perform some valuable function. Tinbergen (1951) suggests that mobbing calls of small passerines attract the attention of other birds to the presence of a predator thus enabling them to better avoid predation. This implies altruism, however, and Williams (1966, pp. 4-8) warns that if other more conventional interpretations can explain biological phenomena they should be considered first.

The value of mobbing becomes clearer if one considers an owl's behavior during the day, i.e., hiding and general avoidance of notice. An owl is well adapted for hunting at night and, of equal importance, for hiding by day. By avoiding notice, he avoids some of the dangers of the owl's world. The actions of mobbing are perfectly atuned to remove the effects of an owl's camouflage. The calls are loud and easily located (Marler, 1955). The frequent tail or wing flicking, combined with jumping,



is immediately visible for some distance, and the more birds attracted, the more obvious becomes the location of the owl. This pattern continues either until the owl takes flight or until the mobbing response wanes. If the response wanes before the owl leaves, the birds may return shortly to mob with renewed intensity. Mobbing then seems to serve to cause a predator to move to another area, thus enhancing the fitness of the participating birds. This interpretation avoids the problem of invoking altruism.

The differences in intensity of the response of these two species of congeneric jays probably is related to two primary factors: i) the spacial distribution pattern, and ii) the social compatability of the members of the mobbing flock. Crook (1965) discusses factors resulting in different dispersal patterns and in different social organizations in birds. Birds may be over-dispersed within their habitats as in territorial species such as Scrub Jays. This results in a lowering of predation pressure as a result of the rarity of individuals over a large area. Prey dispersal should work against a predator becoming specialized on the over-dispersed species. Mexican Jays probably roost together as a flock, and would thus be of more potential value to a nocturnal predator that located their roost. For this reason a nocturnal predator might tend to specialize on Mexican Jays as a source of food. Hardy's (1961) captive Mexican Jays roosted together and their preroosting behavior suggests that they probably do so in the



wild also. The potential danger to Mexican Jays of discovery by a predator might be considerably greater than it is for Scrub Jays, and it might therefore be of greater importance to Mexican Jays to cause an owl to roost far away from their territory. A Scrub Jay mobbing an owl on an adjacent territory would derive less benefit than the bird that it aids, and it is possible that it could damage its situation by causing the owl to roost closer to its own territory.

The other factor important in the intensity of mobbing is the social compatability of flock members. When Scrub Jays mob they generally maintain an individual distance of about 60 cm. A. u. couchi also demonstrated individual distance during mobbing, but it seemed smaller than for Scrub Jays. A. u. arizonae never exhibited characteristics of individual distance during mobbing, and at no time did they seem distracted by other members of the flock.

If one assumes that mobbing may be dangerous, then it becomes apparent that any distraction from the owl will increase the likelihood of injury. Scrub Jays may feel uneasy in the presence of other Scrub Jays because they are territorial at other times. They are therefore unable to give the owl their full attention and a less emphatic mobbing response is in order.

It appears probable that Mexican Jay flocks are composed of closely related individuals (Brown, 1970). If this is true it is conceivable that the apparent recklessness of individuals might result in increased fitness of the flock. Hamilton



(1964, p. 16) shows how such altruistic behavior can evolve if the individual's genotype is enhanced through the increased fitness of closely related individuals: "... for a hereditary tendency to perform an action of this kind to evolve the benefit to a sib must average at least twice the loss to the individual ...." If genetic relationship within flocks of Mexican Jays does prove to be great, then perhaps mobbing behavior of that species has resulted from kin selection.

#### Development of Mobbing.

The results of laboratory tests with Scrub Jays indicate that they have an innate response to the presence of an owl by the time they are 12 weeks old. Mexican Jays also develop an innate response to an owl, but at a later age. The fact that the yellow-banded Mexican Jay mobbed at the age of 15 weeks, after seeing adults mobbing suggests that experience accelerates the development of an innate response.

Lorenz and Thorpe (cited in Hinde, 1970, p. 428) feel that an animal has access to two sources of information, genetic and environmental factors. They state that whether information is learned or unlearned has its basis in the source of the information. Based on the data obtained from the Mexican Jays this appears to be an over-simplification. Immatures of this species probably learn to mob owls as they associate with adults. Under circumstances where they see mobbing at an early age the response is exhibited at an age comparable to that of Scrub



Jays and Pinon Jays (Gymnorhinus cyanocephalus) (Ligon and Cully, in progress). The response doesn't show up until later in the inexperienced laboratory-reared birds. Hinde (1970, Chapter 26) and Kuo (1970) argue that there may be a significant interaction among genes and environmental information. This seems to be clearly the case with Mexican Jays and supports Lehrman's (1953) view that "either-or" discussions can obscure the presence of facts.

At the age of 12 weeks naive hand-reared Mexican and Scrub jays do exhibit differences in their response to an owl. These differences probably are genetic since individuals of both species were raised under identical circumstances. The significant question is: "What are the environmental factors causing the evolution of different responses to an owl among birds raised under similar laboratory conditions?" The two species occur in similar habitat where they are allopatric. In areas of sympatry they are allotopic, with Mexican Jays occupying the canyon bottoms and Scrub Jays the drier slopes. Differences in the physical environment of the two species probably are not directly responsible for the differences in the development of mobbing behavior.

The important differences probably occur in the social environment. Adult Scrub Jays occur in territorial pairs year-round (Brown, 1963), whereas immature birds form winter flocks (Westcott, 1969). My observations of Scrub Jays in the Sandia Mountains agree with this. I first began seeing flocks in early



August. My first observations of fledged birds occurred in early June and would place the members of this flock at about two and one-half to three months old. In animals that become independent of adult care at such an early age and are separated from adults, it is probable that automatic (i.e., innate) recognition of a dangerous situation (e.g., presence of an owl) will be of positive survival value.

Tinbergen (1965) points out that in a situation where animals have an opportunity to learn to cope with various situations, the additional flexibility is of value and that innate behavior patterns will tend to disappear. Mexican Jays are in the presence of older more experienced birds for at least their first year, and probably throughout their lifetime. Thus they can constantly observe adult behavior and this situation is conducive to a learning type of behavioral development. The differential development rate between the behavior of the two groups is probably related to the Scrub Jays' early separation from adults, whereas Mexican Jays remain with adults and develop more slowly.



### Summary

Mobbing behavior of Mexican Jays (Aphelocoma ultramarina arizonae, and A. u. couchi), and Scrub Jays (A. coerulescens) to a live Great Horned Owl (Bubo virginianus) was observed in the field. A. u. arizonae had the most intensive and long lasting response followed by A. u. couchi and then A. coerulescens. A. u. arizonae and A. coerulescens were exposed to a live Great Horned Owl in laboratory tests. Here too, the Mexican Jays had a more intensive response. Ecological factors were considered in an attempt to understand differences in the response levels of the three groups. Population distribution patterns and social compatibility are considered as the most important differences in explaining the stronger response of Mexican Jays to the owl.

Hand-reared naive Scrub and Mexican jays were also tested in the laboratory. Scrub Jays were found to mob an owl at the age of 12 weeks; at this age Mexican Jays did not mob. At six months of age they did so and their response also was unlearned. In the wild mobbing probably is learned by Mexican Jays at an earlier age as juveniles associate with adult jays and observe mobbing. Differences in developmental rates are discussed and conditions of the social environment are again considered fundamental in the evolution of this behavior system.



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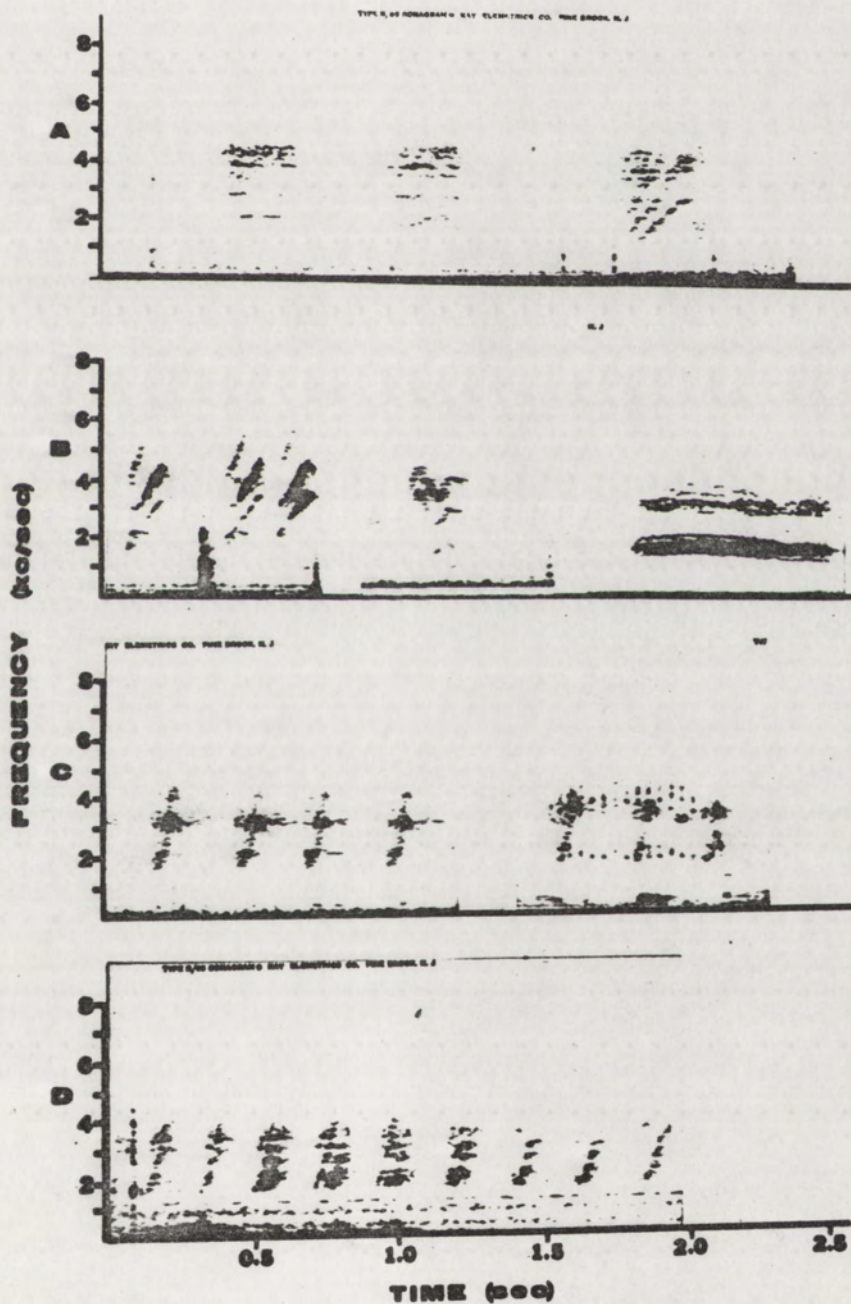
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Figure 1.

- (A) A. coeruleascens "scree, scree, whew."
- (B) A. u. arizonae "weet, weet, weet, weet variation" adult distress call.
- (C) A. u. couchi "oint" calls, "rattle" call.
- (D) A. u. couchi "clangor" call.







## Figure 2.

- (A) A. coerulescens "clangor" call.
- (B) Juvenile Scrub Jay "chuck" calls.
- (C) Juvenile Mexican Jay begging calls and "chuck" calls.
- (D) Juvenile Mexican Jay "weet" calls; juvenile Scrub Jay "whew" call given in response to Great Horned Owl on first mobbing response.



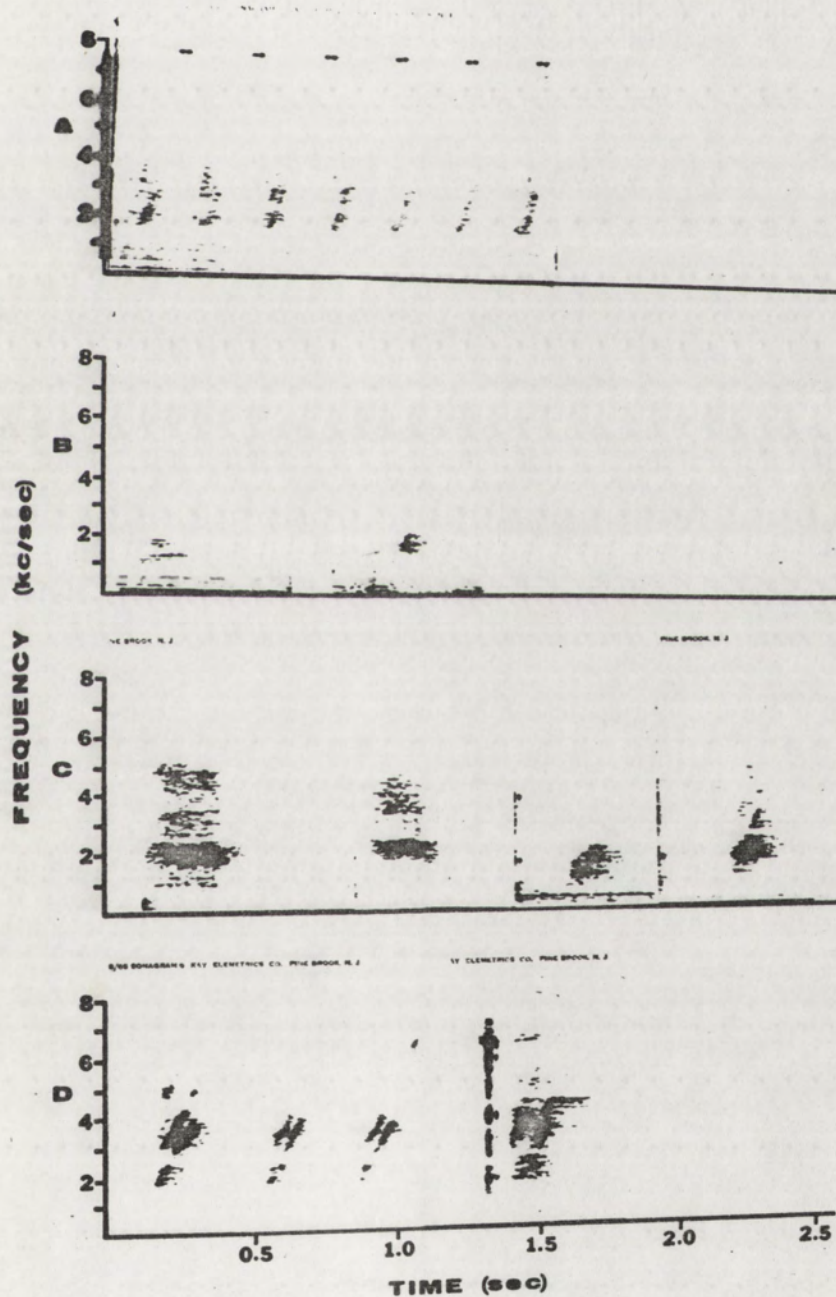




Figure 3.

Scrub Jay mobbing posture.





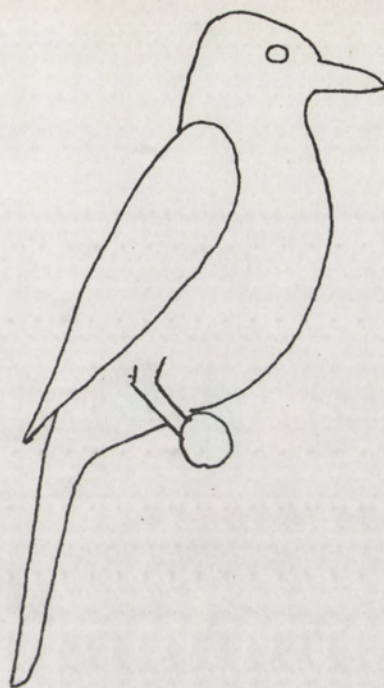


Figure 4.

- (A) "Resting" posture of young Mexican Jays.
- (B) Mexican Jay mobbing posture.



a



b

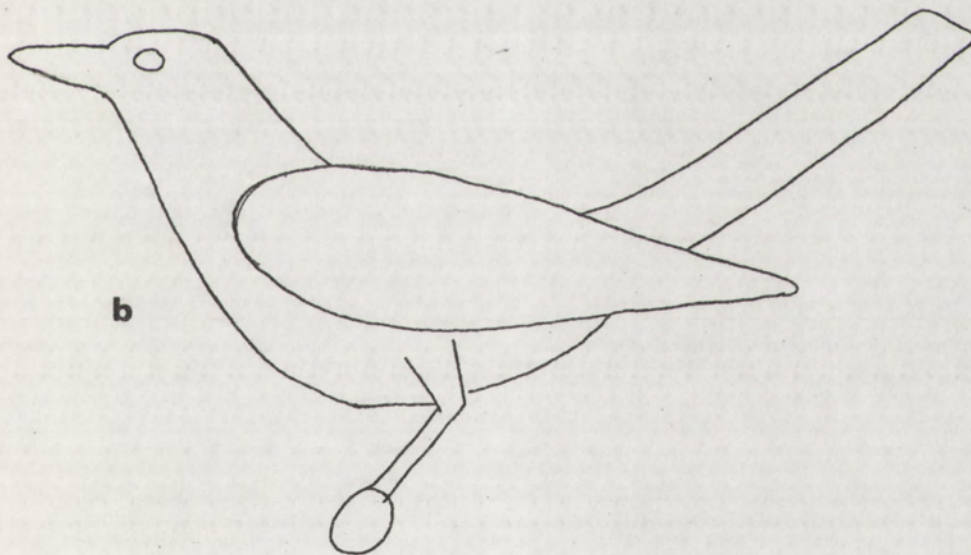
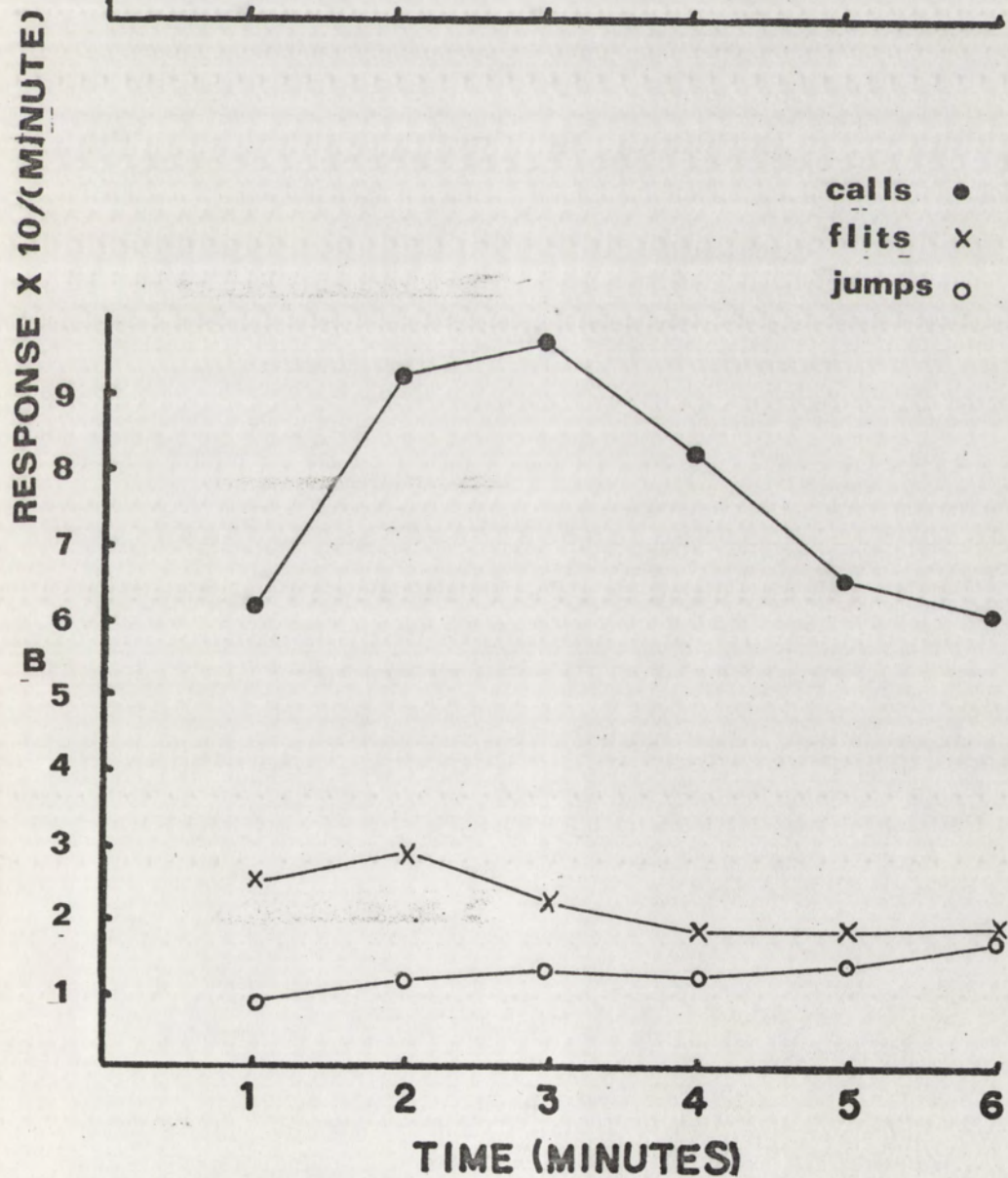
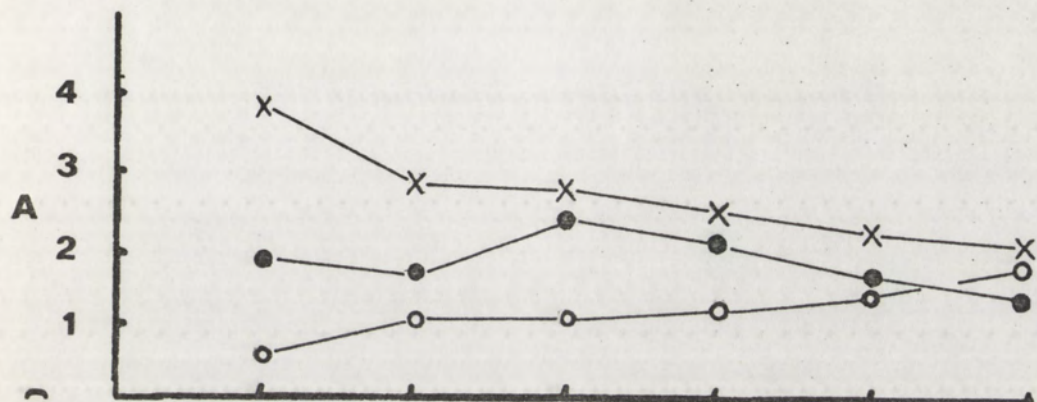




Figure 5.

- (A) Scrub Jay response to Great Horned Owl in laboratory  
(N = 5) average rate per minute.
- (B) Mexican Jay response to Great Horned Owl in laboratory  
(N = 5) average rate per minute.







Jay	Date		Minute					
			1	2	3	4	5	6
1	17 Sept. '70	Calls	129	163	144	141	137	127
		Flits	51	41	38	29	38	41
		Jumps	2	0	0	2	0	0
2	16 Sept. '70	Calls	51	40	82	85	91	81
		Flits	--	--	36	30	26	30
		Jumps	--	--	2	0	0	0
3	23 Dec. '70	Calls	50	78	87	49	37	23
		Flits	6	24	19	10	7	3
		Jumps	13	4	8	9	13	22
4	24 Dec. '70	Calls	97	104	92	102	88	75
		Flits	20	10	5	6	7	13
		Jumps	23	36	33	28	22	30
5	22 Dec. '70	Calls	26	96	108	97	52	62
		Flits	17	34	18	12	8	7
		Jumps	0	14	20	20	23	27

Table I.

Mexican Jay response to Great Horned Owl in the laboratory.



Jay	Date		Minute					
			1	2	3	4	5	6
1	1 Oct. '70	Calls	15	11	19	9	7	3
		Flits	51	46	35	35	39	34
		Jumps	4	3	2	4	3	10
2	6 Oct. '70	Calls	22	28	26	22	19	19
		Flits	24	22	17	15	10	21
		Jumps	1	0	0	0	0	0
3	26 Oct. '70	Calls	21	33	27	29	6	4
		Flits	22	33	31	20	9	5
		Jumps	2	4	3	4	3	3
4	15 Mar. '71	Calls	21	32	33	34	36	32
		Flits	41	34	40	42	40	32
		Jumps	1	2	0	0	0	0
5	"	Calls	10	4	8	6	5	6
		Flits	40	5	11	8	7	2
		Jumps	23	27	27	30	33	42

Table II.

Scrub Jay response to Great Horned Owl in the laboratory.



Jay	Date	Exposure		Minute					
				1	2	3	4	5	6
Mex Y	26 June '70	2	No Mob						
"	17 Aug. '70	3	Calls	77	94	91	89	64	53
			Flits	37	31	21	23	18	10
			Jumps	5	6	9	7	13	12
Mex	17 Aug. '70	1	Calls	12	16				
No band			Flits	7	6				
			Jumps	14	27				
						Terminated After 2 Min.			
"	20 Oct. '70	2	No Mob Alone			See Text p. 16-17			
		3	Adult Mobbing				"		
		4	No Mob Alone				"		
"	27 Oct. '70	5	1 Flit No Mob				"		
Mex	28 Aug. '70	1	No Mob	1 Minute					
Orange									
"	16 Nov. '70	2	Calls	50	62	53	47	62	58
			Flits	32	29	22	19	24	23
			Jumps	1	0	0	0	0	0
Mex	16 Nov. '70	1	Calls	52	79	65	52	20	4
			Flits	36	23	18	19	7	9
			Jumps	1	2	0	0	2	0
Scrub	13 Aug. '70	1	Calls	6	13	26	26	24	24
Red			Flits	46	17	25	36	25	27
			Jumps	11	8	17	21	31	26
Scrub	"	1	Calls	0	0	0	1	0	1
Yellow			Flits	22	25	16	11	7	9
			Jumps	5	2	12	12	22	3
Scrub	14 Aug. '70	1	Calls	7	10	20	21	24	25
Orange			Flits	17	22	22	19	20	21
			Jumps	2	8	13	20	10	13
Scrub	"	1	No Mob						
White									

Table III.

Mobbing response of juvenile Mexican and Scrub jays in the laboratory.