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Further Observations on the Black-breasted Buzzard *Hamirostra melanosternon* Using Stones to Break Eggs

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Summary

A naive, captive juvenile Black-breasted Buzzard *Hamirostra melanosternon*, hand-reared in isolation, used stones to break large eggs and feed on the contents. In a series of trials conducted over two days, it was provided with c. 15 stones (10-80 g in weight) and whole eggs of domestic goose *Anser anser*, Rhea *Rhea americana* and domestic turkey *Meleagris gallopavo*. It threw the stones from its raised bill, from a standing position on the ground, and favoured rounded stones in the intermediate (40-60 g) size range. The bird became more proficient with practice, requiring fewer blows to open an egg as the trials progressed. It is concluded that stone-throwing is innate behaviour, modified by experience.

Introduction

There has been early circumstantial evidence and recent doubt that the Black-breasted Buzzard *Hamirostra melanosternon* uses stones to break the eggs of large ground-nesting birds, in order to feed on the contents. Aumann (1990) and Pepper-Edwards & Notley (1991) independently confirmed, on two different captive birds, that this species does indeed pick up stones in its bill and hurl them, while standing on the ground, at eggs in the same manner as the Egyptian Vulture *Neophron percnopterus* (e.g. Thouless et al. 1989). One captive Buzzard was immature, and the other was immature when obtained and adult when tested, when this behaviour was investigated. Both birds improved with practice, and the behaviour was related to egg-throwing. One bird threw chicken eggs at its water-trough to break them but stoned larger eggs, and the other stoned chicken eggs if dropping them failed to crack them sufficiently. However, these investigators were unable to determine whether the stoning behaviour was innate or learned, because the history of the birds was not known.

An opportunity to investigate the developmental origin of egg-smashing arose when Featherdale Wildlife Park in Sydney (N.S.W.) obtained a juvenile Black-breasted Buzzard. It had been taken from the wild as a downy chick and hand-reared in captivity, and had therefore had no exposure to egg-breaking behaviour in wild or captive Buzzards (B. Kubbere and R. Webb, pers. comm.). It also had no previous experience of eggs as food, having been fed on day-old cockerels and mice, the usual fare of captive raptors in zoos (R. Webb pers. comm.). In September and November 1990, when this bird was at the end of its first year, I provided it with a range of stones and eggs in order to test whether it recognised eggs as food and instinctively 'knew' how to break large ones. This was the bird's first experience of eggs and stones (R. Webb pers. comm.).

Methods

The captive Buzzard was housed in an outdoor flight aviary. Feeding trials were performed on two days, 24 September and 4 November, in mid afternoon an hour or two before the bird's usual feeding time (1600 h), when it was hungry and anticipating food. On the first day it was provided with domestic goose eggs (Greylag *Anser anser*), intermediate in size between chicken *Gallus gallus* and Emu *Dromaius novaehollandiae* eggs. On the second day it was provided with two Rhea *Rhea americana* eggs (similar

in size to Emu eggs) and a turkey *Meleagris gallopavo* egg. The eggs were presented singly on the ground in the centre of its enclosure. They were surrounded by approximately 15 stones ranging from 10 to 80 g in weight but mostly smooth, rounded ones in the intermediate (30-60 g) size range. The Buzzard was tame, and human presence outside the enclosure did not disturb it. Observations were made from just inside the door of its enclosure, and colour transparencies and super 8 movie film (converted to videotape) were obtained of its behaviour.

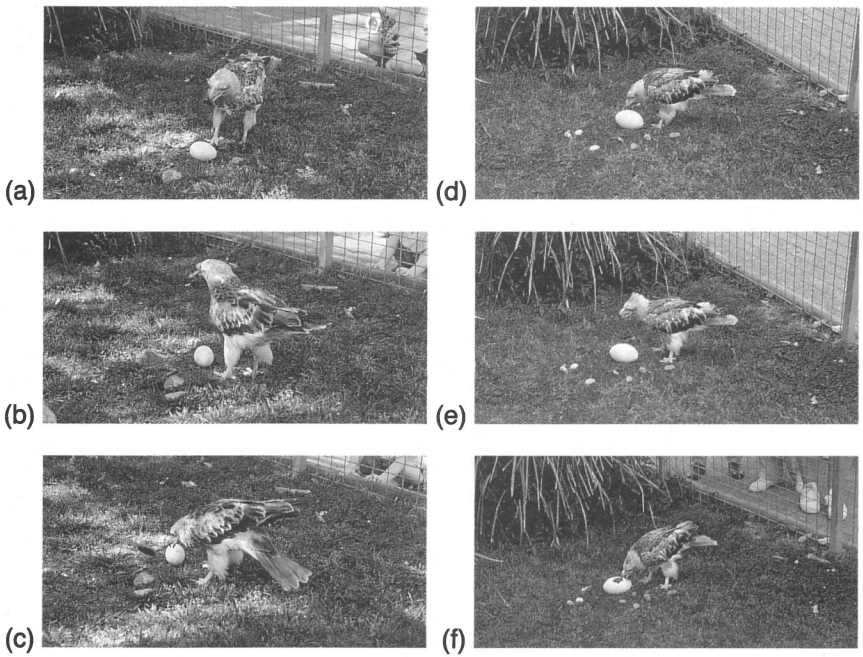
Results

24 September

Feeding trials started at 1355 h, when the Buzzard was presented with the first goose egg and the stones.

Trial 1:

The perched Buzzard peered inquisitively at the egg, then immediately flew down, beaked the egg then tried to pick it up in its bill (ineffectually, as the egg was too large). It then picked up a small (c. 20-30 g) stone in its bill, faced the egg, raised its bill and sharply threw the stone downwards at the egg. It repeated this three times without effect, threw a small stone at a larger stone twice, then threw a 50 g stone at the egg twice, on the last (sixth) blow producing a small crack in the shell. After throwing a 50 g stone twice at another stone, it then threw the 50 g stone at the egg a further three times. Two final blows with a 40 g round stone resulted in effective strikes and further cracking of the shell, sufficient for the bird to start feeding after the last (eleventh) blow. This was accomplished in about ten minutes, and the broken egg was removed before the contents were eaten.



Black-breasted Buzzard using stones to break goose eggs (a-c) and Rhea eggs (d-f), Featherdale Wildlife Park, Sydney, N.S.W.

(a) Picks up stone
(b) Raises stone
(c) Casts stone at egg
(d) Inspects egg
(e) Stone in bill
(f) Stone is cast

Plate 17

Photos: S. Debus

Trial 2:
A fresh goose egg was provided at 1410 h. The Buzzard threw a stone at another stone four times, a small stone (ineffectually) at the egg three times, then a 40 g stone at the egg twice. These last two blows cracked the egg, and after the final (fifth) blow it inserted its mandible in the hole and began to eat. Again this was accomplished within about ten minutes, and the broken egg was removed.

Trial 3:
A fresh goose egg was provided at 1425 h. The Buzzard threw a small stone on another stone twice, a small stone (ineffectually) at the egg twice, then a medium-sized (c. 40-50 g) stone at the egg twice. The last two blows cracked the shell, and the bird started feeding after the final (fourth) blow, in less than ten minutes. The broken egg was removed.

Trial 4:
A fresh goose egg was provided at 1435 h. The Buzzard picked up a medium-sized (c. 50 g) smooth, flat stone but prematurely dropped it twice and missed the egg on a third attempt to manipulate the slippery, awkwardly shaped missile. It ate some yolk spilt from the previous eggs, threw a small stone once (ineffectually) at the egg, ate more spilt yolk, then flew up to its perch to preen.

4 November

The stones were left in the enclosure for the second day's trials. Four unbroken goose eggs remained after the previous occasion, and these had been left with Featherdale staff for them to offer to the Buzzard, which they did in the intervening period. A Peafowl *Pavo cristatus* egg had also been presented to the Buzzard during the intervening weeks, and this it broke by throwing stones (R. Webb pers. comm.). The Buzzard had therefore had some practice and rewards, in addition to the first day's trials.

Later viewing of videotape showed that in the following three trials at least, the Buzzard sometimes (n=4) used an 'aiming' procedure as described by Aumann (1990) and Pepper-Edwards & Notley (1991): it momentarily lowered the stone in its bill to within a few centimetres of the egg before raising and throwing the stone.

Trial 5:
The Buzzard was presented with a Rhea egg at 1435 h. It threw a medium-sized (40-60 g) stone twice, cracking the egg on each blow and opening the egg sufficiently to start feeding after the second blow. It then threw a stone on a stone twice, and a stone at the egg twice. The broken egg was then removed, after about five minutes in total.

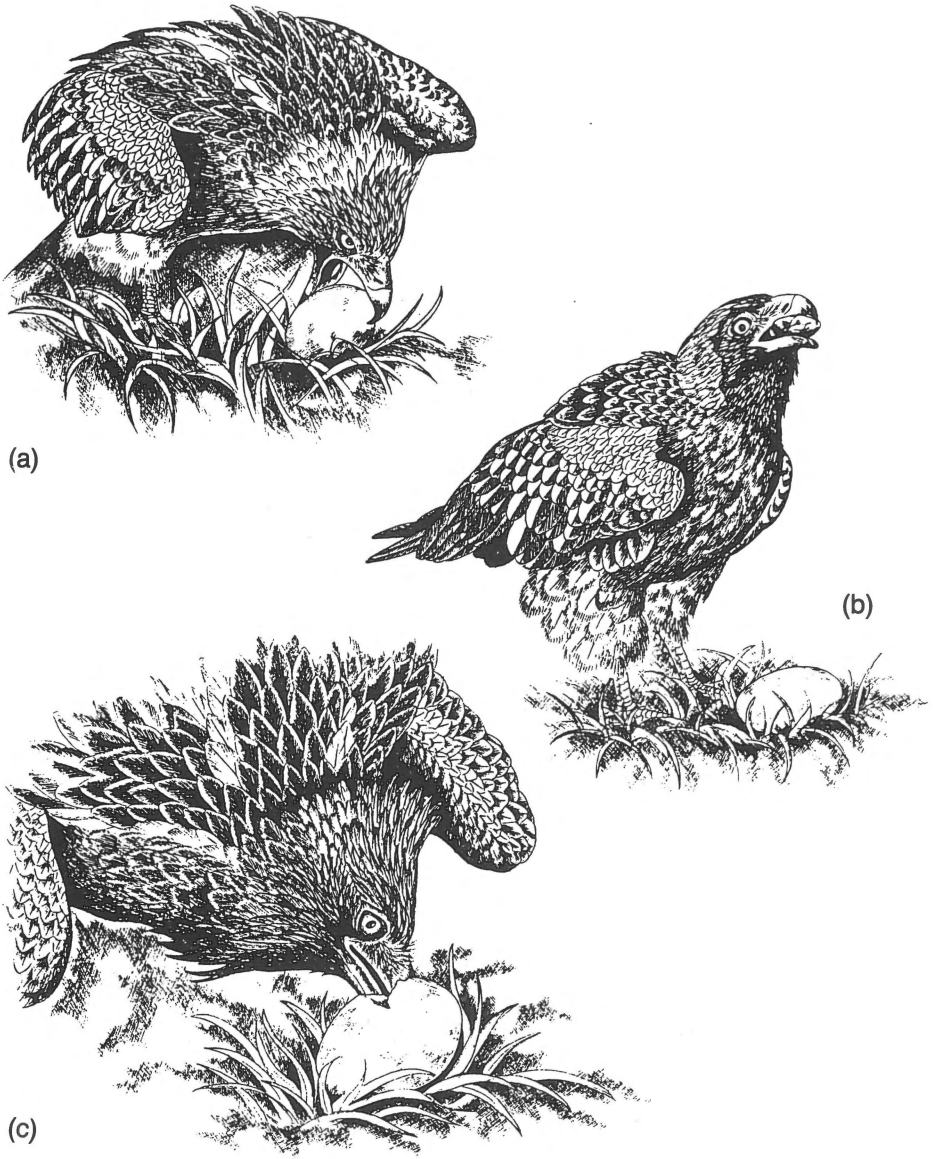
Trial 6:
A fresh Rhea egg was presented at 1442 h. The Buzzard threw small and medium-sized stones at the egg five times, and a stone on a stone once, cracking the egg on the first two blows (with a 50 g stone) and feeding after the fifth blow. It then threw small stones at the egg several more times before feeding again. The egg was then removed, after <10 minutes in total.

Trial 7:
A turkey egg was provided at 1450 h. The Buzzard threw a medium-sized (c. 40-50 g) stone twice: the first blow glancing and ineffectual, the second breaking the egg sufficiently for it to feed. After feeding, it threw a larger (70 g) stone three times, almost demolishing the egg. After further feeding, it flew to its perch to preen.

Additional trials

After the above trials, R. Webb (pers. comm.) provided the Buzzard with turkey and Golden Pheasant *Chrysolophus pictus* eggs, the latter being slightly smaller than chicken eggs. It stoned the turkey egg(s), but broke the pheasant eggs by picking them up in its bill and throwing them against the stones in its cage. In July 1991 a keeper provided the Buzzard with a large domestic duck egg, which it broke by stoning. This

trial formed the basis for the notes and sketches by S. Tredinnick (Plate 18). Since the original trials, the Buzzard has performed the stoning behaviour 'on demand' in front of onlookers.



Black-breasted Buzzard using stone to break large duck egg, Featherdale Wildlife Park, July 1991: (a) Buzzard tries unsuccessfully to pick up egg; (b) Buzzard raises small stone in bill above egg then quickly jerks head down, releasing stone onto egg; (c) Buzzard prizes away cracked shell and inserts bill inside egg to eat contents.

Plate 18 Drawings and notes: S. Tredinnick

Table 1
Results of feeding trials on captive Black-breasted Buzzard throwing stones to break eggs.

Trial	*Egg type*	*n blows needed to*	
		crack egg	*commence feeding*
1	Goose	6[a]	11
2	Goose	4[a]	5
3	Goose	3[b]	4
4	Goose[c]	—	—
5	Rhea	1	2
6	Rhea[d]	2	5
7	Turkey	2	2

[a] not counting stone on stone x 4
[b] not counting stone on stone x 2
[c] satiated Buzzard abandoned attempt after three misses with an awkwardly shaped missile, and one ineffectual blow with a small stone
[d] not counting stone on stone x 1

Discussion

The naive Black-breasted Buzzard in this study immediately recognised large, intact eggs as food, and instinctively threw stones at them. It seems a reasonable conclusion that such use of stones is innate rather than learned behaviour in this species, because the bird in this study had no opportunity to learn it by imitating another individual. Furthermore, the behaviour in three different solitary, captive immatures, and early reports in the wild from opposite ends of the bird's geographic range, would argue against cultural transmission. The speed with which the naive bird started stoning eggs would also argue against independent learning by trial and error — it instantly seemed to 'know' what to do. As in previous studies on this species (Aumann 1990, Pepper-Edwards & Notley 1991), such behaviour seems connected with (derived from?) egg-throwing, and improves with practice, partly through the birds' learning to select the most appropriate missiles. The Buzzard in this study quickly became very proficient at breaking eggs equivalent in size to those of the Emu, and it seems likely that wild Black-breasted Buzzards put such proficiency to good use.

In most aspects of this behaviour, the Black-breasted Buzzard resembles the Egyptian Vulture which uses stones to break Ostrich *Struthio camelus* eggs (see Thouless et al. 1989). For instance the behaviour is innate in the Vulture and probably derived from egg-throwing; it proficiently throws appropriate egg-shaped missiles. However, the Vulture appears not to recognise intact large eggs as food until it has been shown that they contain a reward (Thouless et al. 1989). The Buzzard in this study appeared to need no such experience, as it immediately tried to feed on the first egg. The trigger for the stoning behaviour in this instance appeared to be its inability to pierce or pick up the egg with its bill.

Aumann (1990) provided his subject with dead chickens. After stoning one chicken, it reverted to seizing them and feeding on them in the usual manner. I suggest that after many egg trials he had simply conditioned the Buzzard to stone whatever he put in front of it.

There is some individual variation in the stone-throwing technique used by the Black-breasted Buzzard. The bird studied by Aumann (1990) raised the stone with a twisting motion to one side, whereas the bird studied by Pepper-Edwards & Notley (1991) and the one in this study raised the stone vertically. However, all three birds hurled stones from the bill, from a standing position on the ground. This seems to be a predominant (if not the only) method, and early reports that it drops stones while in flight await confirmation. Observations on egg-breaking behaviour in the wild are required and could be obtained by setting up a hide at an Emu clutch (or 'staging' an unattended Emu clutch) in northern Australia where Buzzards are reasonably common.

There has been some argument about whether stone-throwing behaviour by the Black-breasted Buzzard constitutes tool use (see Aumann 1990). This behaviour does indeed involve the manipulation of an object as a functional body extension for a specific goal, the only difference from other tool-using birds (e.g. those that use sticks or thorns as probes) being that the Buzzard releases the object at the last moment. Thus tool use is one more facet of the behavioural repertoire of this peculiar raptor, a species deserving further study. As there are (apparently unrelated) raptor species that use tools to break the eggs of large ratites on two southern continents, one might predict that a raptor does the same in order to break the eggs of Rheas in South America. No such raptor has been identified yet although there are several that eat eggs (cf. Brown & Amadon 1968), but it might turn out to be one of the caracaras or a cathartid vulture — another area for study of the subject.

Acknowledgements

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