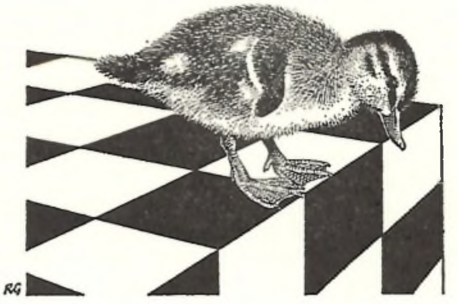

Experiments with young nidifugous birds on a visual cliff

JANET KEAR

Summary

Newly-hatched young of ground-nesting species were found to prefer the shallow side of a visual cliff, while birds normally hatching in holes in trees chose the shallow and deep sides about equally. Species which nest both on the ground and in trees gave intermediate scores. The reaction of the hole-hatching ducklings was definite enough to suggest that their performance was not due to inferior powers of depth discrimination; it possibly represented a compromise between a wide-spread tendency to avoid sharp drops and the necessity for jumping to the ground soon after hatching.

We know that most animals are born with the ability to perceive and react to detailed aspects of the environment, and often their responses seem remarkably adjusted to surroundings of which they have as yet had no experience. Frequently the features they react to are relationships rather than absolutes. Many young wildfowl for instance, respond by pecking at any spots which are small in relation to their visual field and contrast with it. A newly-hatched gosling prefers to peck at a larger object, in absolute terms, than a young duck, and while a Mallard duckling seems particularly attracted to any small spot that moves in relation to the background, a Greylag gosling seems more interested if the object looks green. Thus we may suppose the duckling is drawn to live insects and the gosling to grass, their normal foods.

This preliminary study was designed to test the extent to which young wildfowl and a few other nidifugous birds recognise and prefer another relative feature, depth. Did species that feed on land and those that feed on water react differently to depth, and did both differ from youngsters that dive and obtain their food beneath the surface? The possibilities were investigated by means of a simple experimental apparatus designed and used mainly in America by Gibson and Walk (1960). It is called a Visual Cliff, but the drop is a simulated one so that the reactions of the animals can be observed while they are protected from actually falling.

The apparatus used here consisted of a central board covered with soft cloth laid across a rectangular piece of heavy glass supported about 50 cms. from the ground (see Figure 1). On one side of the board a sheet of chequered material was placed directly against the under side of the glass, thus giving it the appearance of, as well as actual, solidity. On the other side the sheet of material was laid 20 cms. below the glass thereby producing the visual cliff. The piece of glass with the board bisecting it was surrounded by an upright edging some 10 cms. high.

Ten individuals of ten species were used in the tests. Each individual came straight from the incubator or the nest where it had hatched; thus all were less than 24 hours old, and had had a minimum of visual experience. The young bird was placed singly on the board in the centre of the glass, and the direction it took when leaving the board was noted. It was then returned to the centre so that ten responses were recorded in all. After the fifth movement from the board the whole apparatus was turned round to cancel out any irrelevant direction preferences the birds might have.

Results are given in Table I. The first important finding was that there were indeed differences between the species' be-

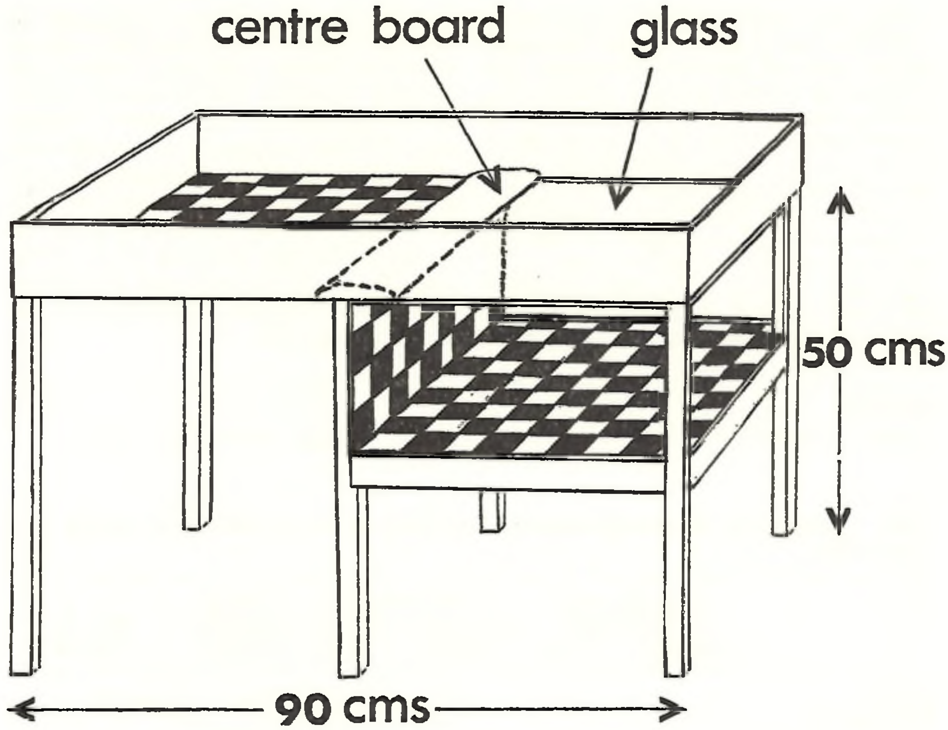

Figure 1. The visual cliff apparatus.

haviour on a brink. However, the obvious correlation did not seem to be with the normal feeding environment of the young. The little Australian White-eye duckling, which in nature feeds both on and under the water surface, ventured off on the deep side only 13 per cent of the time, while the Wood duckling, which very seldom dives for food, chose the deep side in 54 per cent of its responses. It seems therefore that the drop side of the visual cliff was not interpreted as water. Instead the results make more sense if they are correlated with the normal position of the nest in which the young bird hatches. Species that hatch on the ground, like the White-eye, the Pheasant and the Partridge, markedly preferred the shallow side of the apparatus, while ones that hatch in holes in trees, such as Mandarin, Comb ducklings and Wood ducklings, appeared to choose either side at random. However, hole-hatching ducklings did not react as if they were unable to detect the difference between deep and shallow; they ran off the shallow side and jumped right out on to the deep one—just as they must when leaving a hole in a tree. Similarly, 23 per cent of the Mallard, which at Slimbridge occasionally hatch in trees, did not "mistake" the deep side for the shallow; they did not jump so vigorously from the edge but bent forward very low and pushed off with both feet. Results in Table I are given both for the first response and for the sum of the responses by the ten individuals of each species. As far as they go, the figures indicate that the direction of the first movement did not influence those that followed and that the birds were not applying learning to the situation.

Gibson and Walk (1960) have shown that a number of young mammals, including human babies, and certain birds such as domestic chicks, can discriminate depth as soon as their locomotory powers are developed, even if locomotion starts at a day old. None of these experimental animals stepped out on to the glass covering the drop. The only creature that showed a poor performance in their tests were aquatic turtles, but even 70 per cent of these crawled off the central board on to the shallow side. The relatively large minority that chose the deep side suggested to Gibson and Walk either that the turtle had inferior depth-discrimination to other animals, or that its aquatic habitat gave it less occasion to "fear" a fall.

With the ducklings there is no reason to believe that powers of depth discrimination in ground-nesters, hole-nesters and intermediate species are very different. In general, the ability to see and avoid a sharp drop must help in survival, but it would clearly be disadvantageous if a Mandarin or Wood duckling hatched with an invariable disinclination to jump into a chasm and thereby failed to join its mother at the bottom of the tree. It is interesting, too, that it does not positively prefer the drop; if it did, it might perhaps hurl itself over every cliff it met.

More research will be undertaken to discover what cues the youngsters respond to in recognising depth and distance and whether there are critical ages at which the behaviour of the various species changes. For instance, it is possible that a few days experience of swimming will modify a young bird's reactions. The advantages need not be stressed of having access to the bird collection of the Wildfowl Trust, in which nearly 100 related species with different habitat requirements breed successfully.

Reference

GIBSON, E. J. and R. D. WALK. 1960. The "visual cliff". *Scient. Amer.* 202 : 64-71.

Table I. Reactions of recently-hatched individuals of some nidifugous species to a visual cliff.

	First Response (by each bird)		*Total Responses (10 by each of 10 birds)*		*Feeding environment of young*	*Nest site of parent*
	Shallow	*Deep*	*Shallow*	*Deep*		
Partridge *Perdix perdix*	9	1	94	6	on land	on ground
Australian White-eye *Aythya australis*	9	1	87	13	on and under water	„
Pheasant *Phasianus colchicus*	9	1	86	14	on land	„
White-faced Tree Duck *Dendrocygna viduata*	7	3	81	19	on and under water	mainly on ground, sometimes in hollow trees
Moorhen *Gallinula chloropus*	9	1	81	19	on water and land	mainly on ground, rarely in trees
Marbled Teal *Anas angustirostris*	9	1	79	21	on and under water	quite often in holes, but not often off the ground
Red-billed Tree Duck *Dendrocygna autumnalis*	8	2	78	22	„	more often in hollow trees than *viduata*
Mallard *Anas platyrhynchos*	8	2	77	23	on water	8-10% off the ground
Muscovy Duck *Cairina moschata*	7	3	64	36	on water	always in holes at ground level or above
Mandarin Duck *Aix galericulata*	5	5	54	46	on water	in holes above ground
Comb Duck *Sarkidiornis melanotus*	5	5	51	49	„	„
Wood Duck *Aix sponsa*	5	5	46	54	„	„