Ornithology from the Flatlands

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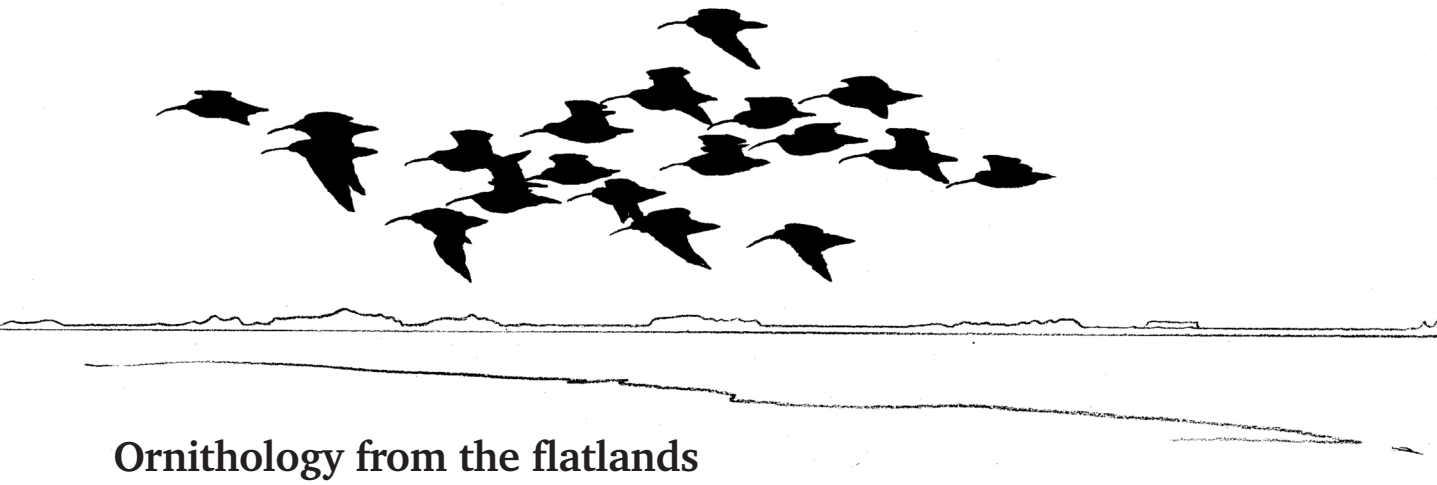

Ornithology from the flatlands

Humans guiding the first migration of hand-raised ibises: on social learning and culture in birds

As this editorial is written in late summer 2024, the Waldrappteam (www.waldrappteam.at) is engaged in guiding, for the second time, a group of 36 young, hand-raised, Northern Bald Ibises *Geronticus eremita* from southern Germany to southern Spain. Hatchling birds from a free-flying population at Zoo Rosegg in Austria are hand-reared in southern Germany by two foster-mothers (always wearing yellow pullovers and T-shirts). At fledgling-age, the ibises are taken outside to an aviary, and then, as their flight abilities mature in May and June, they are trained to fly as a flock behind an ultralight paraplane – a powered parachute, really (Figure 1 top). The ultralight is a two-seater, with a pilot and a foster-mother trying to coordinate the flights of the ibises with their own (Figure 1 bottom). At some point in their training (on 21 August 2023 and on 13 August 2024), the young ibises are gauged to be ready to start southward migration. They will then go all the way to Andalusia, following a trajectory that takes the group around the Alps, across the Rhone valley towards, and then across, the eastern end of the Pyrenees, followed by a crossing of Spain along a northeast to southwest axis. The goal of the journey is Vejer de la Frontera, with a resident breeding population of the Northern Bald Ibis – and friendly folk to receive the ibises and care for them (see: www.uva-bits.nl/project/northern-bald-ibis-geronticus-eremita-reintroduction-programme-in-andalusia/) .

The travel updates at www.waldrapp.at report the struggles during days when the ibis-apprentices stray away from the route suggested by the yellow-parachuted ultralight with pilot and a foster-mother teacher. Part of the group may lag behind and eventually start flying back to the site of take-off that morning; or do even less predictable things. That young birds don't always do as their teachers tell them is noteworthy and may have consequences. A study on Barnacle Geese *Branta leucopsis* showed that although adults are in the lead in migrating family groups, it was juveniles that made the switch to an alternative staging site during spring migration (Oudman *et al.* 2020).

After their arrival in Andalusia, the young Northern Bald Ibises are hosted first in a large flight aviary, where at night they have the company of resident ibises coming to the site to roost (some of them sleeping *on* the actual cage). Having been together for seven months, the hand-reared birds must be weaned from their foster-mothers (and their foster-mothers from them!), so that later in the year, after the birds have established contact with the sedentary colony, the aviary can be opened and the birds released into the wild. Then, by living among the resident ibises, the young birds from Germany have to learn the local ecology and so become independent. The idea that they will follow the same route north to where they grew up has been tested before in experiments to re-establish a migration corridor across the Alps from Austria and Germany to southern Tuscany, Italy (Fritz *et al.* 2017, Fritz 2021, Drenske *et al.* 2023). This first northward migration may happen after the first winter, but is more likely to happen in the years thereafter as few ibises breed as one-year olds. The hope is that the successfully migrating birds become the nucleus of a population of proper seasonal migrants between southern Germany and southern Spain.

Perfecting these procedures over two decades, with the 2024 effort being the 19th guided migration, the Waldrappteam of Johannes Fritz has made great use of the opportunities to be with, and fly with, hand-raised birds. Just like other ibises and spoonbills in the Threskiornithidae, flocks of Northern Bald Ibises tend to arrange their group flights as echelons or as V's. When travelling with the ultralight, the ibis usually fly in such formations as well (Figure 1). When they fly

Figure 1. Formation flying by an ultralight and Northern Bald Ibises. The foster-mothers in yellow give encouragement and instruction to the hand-raised birds they know so well, and with which they spend much of the on-the-ground time too (top photo Helena Wehner, bottom photo Anne-Gabriela Schmalstieg).

close behind another bird, they can benefit from the upwash of wingbeats made by the bird in the lead (Portugal *et al.* 2014). With data collected by GPS-loggers fastened to their backs, it was discovered that the individuals take turns in accepting the more demanding front position, being carefully reciprocal to one another (Voelkl *et al.* 2015, Voelkl & Fritz 2017). Not only do they actively cooperate to make flight easier (or at least less energetically costly), young Northern Bald Ibises also strategically use thermal soaring to gain altitude and alternate the more demanding phase of flapping flight by short stretches of gliding (Wehner *et al.* 2022). Clearly, the birds manage to master lots of skills during their first months of life.

The reciprocal collaboration in flight indicates that individual ibises know each other intimately and are acutely aware of each other's activities; they take that knowledge into account when deciding on what comes next. It seems likely that they not only learn things *about* each other, but also *from* each other, i.e. that they exhibit social learning (distinguished from 'asocial' learning as the learning that is facilitated by observation of, or interaction with, another individual or its products; Hoppitt & Laland 2013). The comprehensive review by Newton (2024) in this issue of 'Ardea' shows that social learning of, and during, seasonal migration occurs in pretty much all types of migratory birds, thus eclipsing the special status of taxa migrating in family groups (such as the cranes, geese and swans, e.g. Mueller *et al.* 2013, Kölzsch *et al.* 2020). Migratory birds do not necessarily have to learn from family members, they may learn from unrelated conspecifics (Loonstra *et al.* 2023) and even accept information from other, co-occurring, species (Cohen & Satterfield 2020). The Waldrapp project is a case of the latter, as it demonstrates that young Northern Bald Ibises, just like cranes (Teitelbaum *et al.* 2019), can learn from their human companions. How this works in practice is illustrated by a published update of 6 July 2024 (www.waldrappteam.at/en/hlm2024/): "Exciting news, today was the first day our microlight plane took off and had a practice flight around the migration camp, landing in a nearby field. The flight went incredibly well, and the birds started to understand how to follow the plane. One of the foster mothers rode in the plane while the other called for the birds from the landing field. The birds are able to recognize the foster mother's call, which teaches them to follow the plane." Northern Bald Ibises go to school, in this experimental case with human teachers.

This brings us to culture. Typically defined for humans only, and referring to "the ideas, customs, and social behaviour of a particular people or society" (https://languages.oup.com/), biologists now commonly use the culture concept too. The 'biological definition' of culture boils down to "behaviours that are socially learnt and acquired, shared by members of a group or community and persistent over time" (Aplin 2019, Aikens *et al.* 2022). Clearly then, the privilege of the supposedly brainier corvids and parrots (Olkowicz *et al.* 2016) as the only bird taxa intelligent enough to show social learning of behaviours (e.g. Emery & Clayton 2004, Martinho-Truswell 2022) needs qualification. The ibises live by the statement of Byrne *et al.* (2004) that "culture can be exhibited by any animal with a mind that allows social learning".

The description by primatologist Jane Goodall (van Lawick-Goodall & van Lawick-Goodall 1966) of Egyptian Vultures *Neophron percnopterus* using stones to crack the eggs of Ostriches *Struthio camelus* to access the nutritious content, is one of the first examples of birds showing tool use. In their story a subordinate, and possibly young and inexperienced, individual started what looked like 'practicing': dropping rather than throwing stones previously used by the two dominants on an already cracked and half-empty egg. This strongly hints at social learning and 'vulture culture' (a term coined by Arrondo *et al.* 2023). Since, many examples of avian cultural behaviour have been published with respect to foraging, vocalizing, nest building, movement behaviours, habitat selection and, indeed, seasonal migration (Table 1). However, descriptions of culture always referred to single behavioural expressions. In 1973 Clifford Geertz, a canonical figure in the field of cultural anthropology, explained that "The concept of culture I espouse, …is essentially a semiotic one. [Semiotics is the systematic study of signs, symbols, and the communication of meaning] Believing, …, that man is an animal suspended in webs of significance he himself has spun, I take culture to be those webs, and the analysis of it to be therefore not an experimental science in search of law but an interpretive one in search of meaning." (Geertz 1973). If we accept this for birds, it mandates an interrogation of the cultural *meaning* of behaviour, a search for 'webs of significance' in the life of birds. One wonders whether the rather 'piecemeal approach' to culture (Table 1) may have inhibited interpretations of meaning, or indeed the discovery of evidence that birds also spin 'webs of significance'.

At this point, Godfrey-Smith's (2024) reminder of a conversation between a Martian space traveller and a Venusian time traveller, a story dreamed up by Hansell (2007), becomes relevant. When they meet, the time-

travelling Venusian has returned from a trip to the Earth several million years into the future. He was impressed by the complex technology on that planet, and said it was engineered by apes. The Martian, who had just travelled to Earth too (but not in the future), was greatly surprised. "What, [by] that lot? You're kidding me. They don't build anything. I had a stick waved at me once or twice… I would have put my money on the birds. I brought back a nice bird nest from Earth last time… Clever craftmanship using several materials." Which brings us to guineafowl (Numididae), birds which are hardly known for their (collective) intelligence (and not for their advanced nest building either). In fact, according to https://collectivenounslist.com/guineafowls/ "when guineafowls come together collectively, they form a unit called a 'confusion'. This term encapsulates both the mesmerizing sight of multiple guineafowls gathered in one place and the natural confusion that arises when witnessing their simultaneous movements and unpredictable patterns." Fascinating work on individually tagged Vulturine Guineafowl *Acryllium vulturinum* (Papageorgiou & Farine 2020a,b, Papageorgiou *et al.* 2019, 2024) shows how utterly misplaced this label is. These guineafowls live their lives in complex societies, with individuals being just as acutely aware of each other's identities, ranks and personalities as suggested for Northern Bald Ibises (Pegoraro & Föger 2001, Szipl *et al.* 2014, Voelkl & Fritz 2017). Clearly, all birds may be deeply cultural in Geertz' sense of the word, living in webs of significance, in worlds of meaning, even in worlds of beauty and values (Skutch 1992, Prum 2017). This has radical implications for biology as well as the humanities (Foster 2021).

The project in which humans guide young Northern Bald Ibises along an extinct migration route (from central to southwest Europe and probably beyond to West Africa; Fritz & Janák 2022) is now opening many windows of enquiry, including the nature of intra- and interspecific social learning and the nature of migration cultures. Indeed, the growing sophistication of the technologies with which to track individual migrants and to map the context of their flights (Flack *et al.* 2023), carries the promise to make us see birds, and our joint world and future, with new eyes. There is work to do.

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Table 1. Examples of bird behaviours interpreted as learned and potentially 'cultural' (in chronological order, extended from review by Aplin 2019).

Behavioural 'trait'	Taxon	Source
Foraging style affecting prey choice	Eurasian Oystercatcher	Norton-Griffiths 1967
Predator recognition	European Blackbird	Curio *et al.* 1978
Bird song	songbirds	Slater 1986
Courtship	Japanese Quail	White 2004
Contact calls	Yellow-naped Amazon (parrot)	Wright 1996, Dahlin *et al.* 2024
Tool manufacture and use during foraging	New Caledonian Crow	Hunt & Gray 2003
Use of nonbreeding sites	Brent Goose	Harrison *et al.* 2010
Use of twigs to collect wool	Egyptian Vulture	Stoyanova *et al.* 2010
Movement pattern	Great Bustard	Palacín *et al.* 2011
Migration pattern and performance	Whooping Crane	Mueller *et al.* 2013
Way of opening a food cache	Starling	Boogert *et al.* 2014
Accessing waxworms by tearing or flipping a top	Blue Tit	Aplin *et al.* 2013
Direction of pushing a door to access food	Great Tit	Aplin *et al.* 2015
Homing efficiency	Domestic Pigeon	Sasaki & Biro 2017
Migration pattern	Caspian Tern	Byholm *et al.* 2022
Diet preference	Griffon Vulture	Arrondo *et al.* 2023
Building of 'nests' to breed and sleep	White-browed Sparrow Weaver	Tello-Ramos *et al.* 2024

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