

Preface

The idea for this book had its beginning some 15 years ago when our galah, at the age of 75, learned new words. If ever there was evidence of a plastic brain, he showed it convincingly but there was relatively little to which it could be related in Australian species at the time. There were few papers that discussed the cognitive ability of Australian cockatoos, or other birds for that matter. Of course, there had been important ideas and observations about the cognitive and emotional dimensions in a long and weighty history of avian behaviour as the writings by Charles Darwin (1890, 1965, 1981), then Niko Tinbergen (1953), W. H. Thorpe (1956), Konrad Lorenz (1966) and others attest. From the late 1970s onwards, it was once again raised as a possibility that some birds and other animals may have plastic brains (Kroodsma and Miller 1996), may have minds of their own and are capable of actions beyond those that are 'pre-programmed', adaptive or merely copied from others (Griffin 1984, 1992; Roitblat 1987; Ristau 1991; Rogers 1997; Basil *et al.* 1996; Balda *et al.* 1998).

The last decades have been extremely exciting for anyone in animal behaviour working with birds, primates or a range of other species. For a host of reasons, the last decades have seen many breathtaking discoveries that have changed forever the landscape of our knowledge about animal cognition and related fields. It is now hard to imagine how people thought before the 1980s, so vast have the changes been, be this in discoveries in field research or in the identification of new methods or theories resulting in robust data and clear evidence of complex cognition in birds.

Hence, my search for evidence of problem solving, tool use and other indices of 'intelligence' in Australian birds became a road of discovery, spreading the search for the printed record to well over 100 years, strewn with new and surprising insights and findings. This book is timely because there are new theories and novel experimental techniques and methods for data collection available that enable us to probe into cognitive processes of birds in previously unimaginable ways.

Vertebrates are able to perform cognitively complex tasks, solve complex problems and generally show behaviour suggesting much more awareness than had once been assumed. Indeed, it is now known that some birds have many of the attributes once thought to be specific to humans and great apes.

Who would have thought that the humble chicken understood object permanence, was capable of distinguishing biological motion, could perceive illusions, could perform basic arithmetic and geometry and even had referential signals for various alarm calls, or that pigeons understand principles of same/different and were capable of quite abstract generalisations as in identifying concepts such as 'forest' versus individual trees or shrubs? The problem of having been captive long term somehow seemed to suggest, however, that chickens and pigeons had been selected for these skills because of their long exposure to humans (i.e. their abilities were artefacts that might not pertain to birds in the wild). So the new wave of interest in cognitive ornithology was to find evidence of intelligence in wild-

caught birds, either by capturing them and seeing how they behave under experimental conditions in laboratories, or by somehow exposing their cognitive capacity in the wild. Ravens, crows and a few parrots have been riding on a crest of fame fanned by journalists worldwide about their amazing and newly discovered abilities of problem solving, tool using, episodic memory, planning and many other attributes.

There has been a different emphasis in Australia and one that is more than of marginal importance because it deeply altered the way in which avian evolution could be perceived. Eleanor Russell (1989) implored us to think from a Gondwanan perspective. The question is why one should, and the inspiring work in taxonomy gave the answer: birds evolved in Australia. In the last 10–15 years, large-scale DNA-sequence analyses have revolutionised our understanding of the evolution of the world's avifauna, as Christidis and Norman (2010) explained recently. It has led to an enormously active and exciting period in Australian taxonomy, continuing to correct misconceptions and wrong attributions. The evidence now makes it conclusive that there is a very special relationship between Australia and birds.

I was recently asked whether there is anything special about Australian birds. This was one of those heart-stopping moments when one feels one ought to be able to reply with a few well-expressed sentences and yet make the enormity of the implied misconception clear. But to answer it, I found it necessary to write a whole book in reply.

It will take a while for other countries and for Australians themselves to come to terms with the findings. The misconceptions have been substantial, both in the northern hemisphere and in Australia. One of them arose within the recent social history of Australia. Settlers arriving here in the 19th century, often from the British Isles and continental Europe, were confronted by a land so very strange that the simplest emotional response (of course not the only one) to the strange plants was to call them scrub (good for burning) and the animals inferior (good at best for shooting and eating) and, if possible, replace them with species known and familiar to the new settlers. These same well-meaning settlers produced the largest known transfer of invasive species and foisted on this continent the most large-scale and highly destructive onslaught known on the planet, both in flora or fauna. History must excuse their deeds for they believed indeed that the continent was a barren world where only the lowliest of plants and animals had persisted.

The ironies in these responses were manifold and here is not the place to explore the attitudes to Australian wildlife. Suffice it to say that this new continent, in terms of nationhood and white settlement was truly young and even now perceives itself politically as a young, albeit small, nation. Such discourse of the 'youthfulness' of Australia's political history is in stark contrast to the ancient culture of Aborigines, who had inhabited this continent more continuously than perhaps any other living culture on the globe. The game of youthfulness and perhaps historical insignificance played out somewhere far away from the main theatres of the western world contrasts with the very old stage on which it is performed: that is, on a very ancient continent that still bears witness to the very beginnings of life on the planet.

Birds arose in the ancient supercontinent Gondwana, specifically in East Gondwana (now largely Australia) and the birds here today have a long claim to this continent as their

home and their only home. They are the avian inheritors of the world. They are unique. Birds evolved alongside dinosaurs but in Eastern Gondwana, unlike the rest of the world, they did not all go extinct 65 million years ago: they crossed that ominous extinction boundary (called K/T boundary) and then experienced long periods of isolation from any other landmass before some of them (the Passerida) managed to radiate out and crossed over the equator to the northern hemisphere and eventually populated the vast land masses of Eurasia and later North America.

Thus, an interest in birds in Australia is not just of regional interest or a quirky hobby that one may or may not pursue. Far from wanting to parallel the 'Out of Africa' story of human evolution and radiation, there is something like an 'Out of Australia' (or 'Out of Gondwana') story to tell about birds and it has now been told repeatedly and well over the past decades (Edwards and Boles 2002; Low 2014). Australia does not have the leftovers of extant birds of the higher latitudes of the northern hemisphere, but over millions of years the feathered species of East Gondwana developed and diversified. Australia is the cradle of all songbirds and many other groups of birds. When Gondwana split up over millions of years and in different stages – shed the South American and African continents, set whole subcontinents, such as India and the Middle East afloat, split off island nations such as New Zealand and New Caledonia – some of that feathered cargo was already on board (as was the case in New Zealand).

One of the compelling reasons for thinking that it is important to be assertive about Australian birds is for the benefit of science. For example, a recent review of a book on tool using in animals (Cunningham 2013) asks that we need to stop cataloguing tool use in animals and start interpreting the findings. This is all well and good for researchers in the northern hemisphere. They have, indeed, catalogued and researched bird behaviour extensively. The problem is that this extensive cataloguing of avian cognitive behaviour tends to include only half the world (largely the northern hemisphere) and, in fact, significantly less in terms of the number of species. The southern hemisphere and the tropics are the bird-rich areas of the world and there are still rather large blank areas of knowledge of South-American and South-East Asian and Austral-Papuan species, let alone a 'cataloguing' of their behaviour. The theoretical arguments we make, what various avian qualities we correlate with others, how these are of benefit to the species and when they evolved may, surely, be different for different climate zones. It is quite possible, as I had discovered in birdsong theories, that Australian species just defy the accepted models. The functions of song in magpies, for example, do not fit models constructed for sexually dimorphic and migratory songbirds of high latitudes and refute the conclusions reached by researchers in the northern hemisphere. I have discussed this in greater detail elsewhere (Kaplan 2008c). It is acceptable that some disagreements occur and ought not to surprise. What is less acceptable in my view is the risk that these theories arising in specific localities become universal, as if they stand in for all birds in all places.

Thus it is not good enough to say that the cataloguing can now stop because some people have tested a few species in European or North American laboratories. And these *are* only very few species indeed, representing possibly not even 1% of all extant birds (worldwide

there are about 5800 species of songbirds and a further 4000 avian species that are not songbirds). Leaving out the bird-rich areas of the world would be foolhardy. The southern hemisphere is not a mirror image of the north. There are no equivalents of a platypus in the northern hemisphere, for example, and hence it stands to reason that the behaviour of a platypus ought not to be fitted into theories about, say, small European mammals. Nobody would consider doing so, of course, nor should this happen as far as birds are concerned. The birds that evolved in Australia, and then remained on Australian soil, may have retained certain traits and may have evolved to solve problems in ways for which there may now be little or no correspondence elsewhere in the world. What we know is the tip of the iceberg only and, viewing the theoretical problems from a southern hemispheric perspective, it may not even be the same iceberg.

Australian birds – often beautiful and odd, resourceful and innovative – are not just ‘fair dinkum’ but tough, not just pretty things but also extremely clever, not just simple but remarkably complex and adaptable. It is not only time for a celebration of Australian birds but also time to bring together the scattered information and to develop an overall sense of the evolution, behaviour and life histories of Australian birds.

The source materials for this book were vast as the very lengthy, but by no means exhaustive, reference list attests. In some cases, the sources are of the often unnoticed but extensive research publications and observations by Australian ornithologists over the last 100 years, often not duly acknowledged or appraised overseas, with the result that many observations made in Australia have remained either entirely unknown outside Australia, or have been ignored. The sources also include the many excellent papers produced by Australian scholars and published overseas in learned journals for specialists. Somehow not all of that information makes it back to Australia to inform the friends of native birds, let alone the Australian public generally. Many do not always have access or time to follow the complicated paths of academic publishing.

By bringing the information together here in one narrative, a range of Australian avian qualities will be exposed, showing surprising levels of intelligence. Gone are the days when derogatory expressions such as ‘bird brain’, ‘galah’ or ‘parroting’, while deeply embedded in our language, are analogies for Australian birds, or any birds for that matter. Birds have small brains because they need to be aerodynamically designed but, as we know at least since the invention of the microchip and the ever-increasing capacities of devices to store memory, a substantial amount of information can fit into a very small space. And for this reason, in the first decade of the 21st century some of the most advanced thinkers in neuroscience, ornithology, comparative psychology and ethology set out to show that the neural structures of brains of humans and birds are not all that dissimilar. The last 10 years have seen major breakthroughs in our knowledge of the avian brain and behaviour and we now have a biological underpinning to many of the claims that were speculative before (e.g. about learning, remembering and even the reason for evolving a larger brain and how to maintain it).

The book is organised around several familiar and important topics and theoretical positions in cognitive research concerned with innovations, tool use, problem solving and cooperative breeding, and at the same time deals with these topics in the context of the life

histories of Australian landbirds, sometimes also referred to as 'bush birds', meaning any bird not deriving its entire food from water environments. Appendix 1 is an additional tool to summarise and systematise our knowledge on these topics. Australian birds are long lived and most of them are social. Moreover, it claims that birds in Australia are intelligent and, by and large, may need to be more so than elsewhere in the world. Of course, any generalisation such as this would be rightly subject to substantial criticism. Invariably, exceptions can be found and perhaps even many. The point of this position is rather to test whether the assumption captures something significant about Australian fauna or something of significance about the Australian continent and climate that shaped its evolution in specific ways. This book can only pose the question and present some suggestive evidence in support of some theories of intelligence in birds and perhaps bring to light the extraordinary skills acquired and adaptations that birds have had to make in Australia.

I am grateful for the consistent and sustained efforts of thousands of ornithologists and the many editors of small journals, often entirely based on voluntary work, of the bird banders and the armies of those who counted the number and species of every bird they saw, who have kept meticulous records of their observations and contributed to *The New Atlas of Australian Birds* (Barrett *et al.* 2003) and also to those who contributed to HANZAB, the first comprehensive *Handbook of Australian, New Zealand and Antarctic Birds* in eight large volumes (HANZAB 1990–2006). There are many more people in Australia who are willing to donate their time to such efforts than probably anywhere else in the world. Lending a hand for a good cause is almost a national characteristic. This is now called community science and has been hotly debated and found to be of major value (Cohn 2008; Cooper *et al.* 2007; Bonney *et al.* 2009; Hecht and Cooper 2013). Much of that has been done under expert guidance but there are many observations that are fleeting and unique, some of which cannot yet be explained. Let it never be said in a derogatory way that anecdotal evidence is no evidence. Without this background, we would often not be able to begin any consolidated research efforts. Hence, armed with the tools of ethology and the advances in avian neuroscience and the great advances in avian ecology (behavioural and conservationist), we can and must investigate the abilities and the behaviour of birds, not just for scientific reasons but to improve their chances of survival in a dramatically changing world of the present.

On a personal note, I would like to thank and express my gratitude to those who had a direct and personal input of time into this book, including the entire publishing and production team at CSIRO Publishing. Prof. Lesley Rogers was kind enough to read through the entire manuscript making many valuable and critical suggestions; Nicholas Alexander gave me the opportunity to develop the ideas in this book so that this topic could find a home at CSIRO Publishing. Finally, a special and sincere thank you also to the anonymous international reviewers from the USA and Europe who took the time to make detailed and very constructive comments, contributing to a better outcome of the project that is so close to my heart. I am very appreciative of these generous signs of engagement.

Gisela Kaplan
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