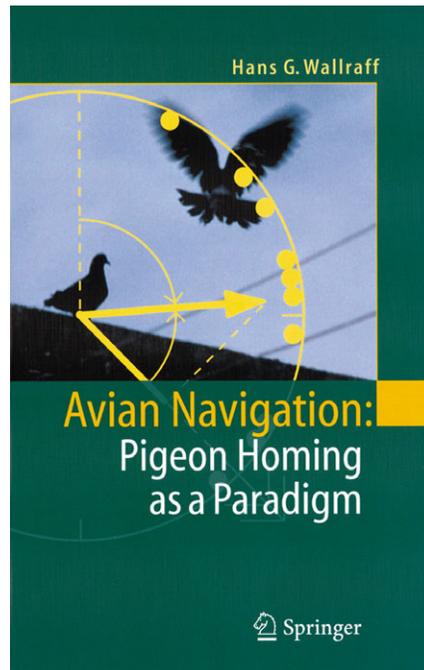


PIGEON NAVIGATION

**Avian Navigation: Pigeon Homing as a Paradigm**

By Hans G. Wallraff

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The mechanisms underlying the ability of homing pigeons to navigate from unfamiliar sites have been the subject of research for half a century; research that has sometimes been accompanied by heated debate over findings and emergent hypotheses. Hans Wallraff's book is the first to be entirely dedicated to the subject, recounting the salient steps in the history of research on homing pigeon navigational mechanisms from the very beginning up to the present. Since the homing pigeon constitutes an invaluable model for investigating the basic mechanisms involved in animal orientation and homing, this book is indeed a precious tool for any student in the field of bird navigation. It provides a detailed survey of the hypotheses proposed to explain the phenomenon, the critical experiments carried out to test them and a rich list of references. Wallraff's book is also suitable for a general reader, who may be tempted to skip some of the more complicated figures but will still gain a rewarding understanding of this remarkable behavioural phenomenon. On the other hand, a specialist in the field will find

fuller commentary on the details of some experiments and more thorough critiques on controversial results in the Appendix.

The main issues reviewed in this book concern the nature of the cues used by displaced pigeons to determine their position with respect to the home loft, the so-called 'map step', and for taking up a directional bearing, the so-called 'compass step'. Although not all the mysteries of this behaviour have been resolved, the results of numerous experiments have clarified the role of four basic categories of stimuli critical for pigeon navigation: sun azimuth, orientation of the geomagnetic field, visual landmarks and environmental odours dispersed in the atmosphere. While the first two categories of signals are used exclusively for determining compass directions, the other two are involved in the position-finding mechanism over familiar and unfamiliar areas, respectively. There has always been general agreement on the nature of the compass mechanisms used. By contrast, the map issue, in particular the role of atmospheric odours, has been at the centre of a fierce debate. Due to the relevance of this debate, and the research contributions by Wallraff himself testing the olfactory navigation hypothesis, this book is largely devoted to illustrating the role of olfaction in pigeon navigation: how olfaction was unexpectedly discovered by Papi and co-workers to be critical for pigeon homing, what the olfactory navigation hypothesis predicts, the experiments supporting it, the arguments against and open questions. Because Wallraff has directly participated in the research on pigeon navigation and in the debate on the nature of the navigational map, his book provides a personal and critical view of the accumulated knowledge in the field. Nevertheless, he does not shy away from discussing controversial findings and thoroughly presents criticisms raised and hypotheses advanced by opponents of the olfactory navigation hypothesis.

The first chapters (1–4) of the book are introductory and particularly useful for the general reader and also for a Masters or PhD student looking for an authoritative introduction to the field. The chapters mainly describe the methods used and the parameters observed in homing studies, reviewing the basic features of the phenomenon from motivation to temporal, geographical and inter-individual variability, as well as providing some basic concepts and terminology. The next chapters (5–8) contain a detailed description of some of the most important experiments outlining the role of the sun,

the geomagnetic field, atmospheric odours and visual landmarks in the homing process. These chapters are definitely the most important part of the book and contain the main story of homing pigeon research. Chapter 9 is a brief overview of the principal findings of neurobiological studies designed to investigate the role of different brain regions in the homing process. Chapter 10 focuses on what is known and, more often, what is not known about wild birds, which, during the last step of their migratory journey, confront the problem of finding their

home. Reading this chapter, one realises how important the work done on homing pigeons has been in relation to the general topic of avian spatial behaviour. Migratory species and pigeons do share some of the basic homing mechanisms, which are definitely better investigated in the latter.

Finally, Wallraff ends his book with a history of the research on pigeon navigation (Chapter 11) and a synthesis summarising the present state of the field (Chapter 12), as well as a description of

future challenges, which can be overcome only by “*interdisciplinary research teams comprising not only behavioural biologists but also neurobiologists, and most importantly, experts in atmospheric chemistry.*”

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