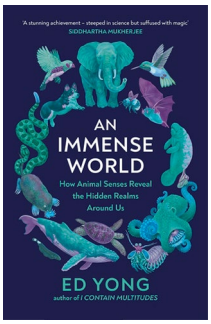
Making sense of animal senses



An Immense World: How Animal Senses Reveal the Hidden Realms Around Us

By Ed Yong

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Our senses define our reality; they are the window through which we perceive just a small part of a vast and complex physical environment. Our perceptual world differs in unimaginable ways from the perceptual worlds of the millions of other animals with which we share the same physical reality. Trees of green and roses of red are not part of the wonderful world of a tick, which does not sense colour, but instead senses body heat and odors emanating from skin. This perceptual world was coined 'umwelt' (from the German word for environment or surroundings) by Baltic–German zoologist Jakob von Uexküll in 1909. In a new popular science book, Pulitzer Prize-winning science writer Ed Yong uses the concept of umwelt as a uniting theme, and takes us on a journey into the sensory worlds of animals.

This is no small feat. As Thomas Nagel, the American philosopher, argued in his famous 1974 essay "What is it like to be a bat?", if we imagine what it is like to be a bat, it is a "caricature of us as a bat." We cannot know what it is like for a bat to be a bat because it is so far from our human experience — and beyond our imagination. But the science of animal senses has come a very long way since Nagel wrote his essay. We understand a great deal more about different types of sensory receptor, whether and where they occur in different species, how signals from those receptors are processed by the nervous system, and how this information is used by animals for the complex business of survival. We can now glimpse — or at least appreciate — the wildly varied sensory worlds of other animals.

Yong synthesizes a vast literature on all types of sensing — of light, colour, pain, heat, contact, air and water flow, surface vibrations, sound, echoes, electric fields and magnetic fields. For each sense, Yong weaves stories around particular species. Touch, for example, features the star-nosed mole, among others. This odd creature has an eponymous touch organ that "looks like a fleshy flower growing out of the animal's face, or perhaps a sea anemone impaled on its nose." Its pitch-black world of underground tunnels is revealed in exquisite detail by dabbing the arms of the star-shaped touch organ against the tunnel walls at the unimaginable speed of a dozen times a second — much faster than humans can process visual information. The level of detail revealed to the star-nosed mole is not perceived by other moles — even different mole species have very different umwelten. But through recent scientific discoveries, we can now glimpse the star-nosed mole's perceptual world of touch.

In this comprehensive exploration of animal senses, Yong tackles questions that many of us have wondered about. What is the difference between taste and smell? How do animals experience pain? Can pain exist without consciousness? Why do snakes have forked tongues? Why are zebras striped? Why do spiders have eight eyes? Every reader will find the answer to questions that have sparked their curiosity. The answers to more esoteric questions — such as why most humans don't see UV, why seals don't echolocate, and why sperm whale calls are so ridiculously loud — are found in the extensive footnotes, which provide fascinating additional information for those who seek it. This is a book for everyone, and it is a page-turner; Yong skillfully uses relatable analogies to conjure vivid mental images of worlds so different from our own.

Throughout, Yong weaves stories and conversations with many leading scientists working on animal sensory systems. He reveals the people behind the science: their insights, challenges, years of perseverance, moments of epiphany. In doing so, he describes how scientists approach the wickedly difficult question of how other animals perceive the world. We can only infer perception from the behaviour of animals, and understand it in the context of their ecological present and evolutionary past. Some of the experiments are ingenious, and Yong provides rare insight into the process of scientific discovery, not just the product. As a scholar and teacher of animal behaviour, I would recommend this book as a must-read to students, colleagues and friends alike.

By weaving in the stories of the science and scientists, Yong also gives us an appreciation of how much we don't know. It is no coincidence that the senses that were discovered or recognized most recently and are least understood are the ones that are absent or least developed in humans, such as sensing of polarized and infrared light, electric and magnetic fields, or seismic vibrations. Many of us who teach sensory ecology are guilty of perpetuating these biases, glossing over the lesser-known senses. Unlike most books on animal senses for a general audience, Yong devotes similar space to each type of sensory perception, providing a greater appreciation of the true diversity of animal senses, and how much we have yet to discover.

Any current book on animal diversity cannot neglect to mention increasing and pressing anthropogenic threats; this one ends on the topic of sensory pollution. In a poignant passage, Yong writes, "We have filled the night with light, the silence with noise, and the soil and water with unfamiliar molecules." These many forms of pollution are insidious because they disrupt the 'sense-scapes' on which species depend for survival in numerous and unappreciated ways. Yong argues that it is our privilege to be able to step into the worlds of other animals through science, curiosity and imagination — and our greatest hope to ensure their survival. It will take more than understanding, or even an extension of empathy, to address the existential threats to animal sense-scapes. But wider public understanding is an essential first step, and Yong's book makes an important contribution to that endeavour. ❐

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