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Institute of Philosophy
Center for Ecology and Ecophilosophy

STUDIA ECOLOGIAE ET BIOETHICAE

21/4 (2023)

STUDIA ECOLOGIAE ET BIOETHICAE

2023, 21, 4: 97-101
p-ISSN 1733-1218; e-ISSN 2719-826X
DOI: http://doi.org/10.21697/seb.2023.18

I See the World Through Other 'Eyes'. Review of *An Immense World*, by Ed Yong

Widzę świat innymi „oczami". Recenzja książki autorstwa Eda Yonga pt. *An Immense World*

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Received: 10 Jun, 2023; Revised: 03 Jul, 2023; Accepted: 04 Jul, 2023

One need not be a biologist, zoologist, herpetologist, ichthyologist, entomologist, ornithologist or an academic counterpart of any of these, to be drawn towards crawling, swimming, flying, arboreal and quadruped fellow-inhabitants of Mother Earth. For that matter, you need not even be a poet, painter or writer, looking for your Muse out there in the wilderness. Indeed, *An Immense World* by Ed Yong – a 'magic-suffused' 13-chaptered, 450-pager – may appeal a little more to the scientifically-inclined, considering that Yong is essentially a Pulitzer-Prize-winning science writer. The immensity he addresses in this gem of a book makes a reader feel miniscule in the scheme of things on *Terra Firma*.

The author welcomes readers into the book, using Rebecca as a representation of us *Homo sapiens*, and a gym-occupying 'imaginary menagerie' – mosquito, spider, bumblebee, mouse, robin, owl, bat, rattlesnake and elephant – to introduce the Uexküllian[1] concept of the '*Umwelt*'[2] – sensory bubble or perceptual ambience – which is very different and diverse for different life-forms. For instance, the elephant, we learn, sees only in shades of blue and yellow; and on a lighter note, is well-poised to identify the flag of Sweden fluttering at a distance, for instance. While empathy entails 'putting yourself in another's shoes', revering Nature entails 'trying to see and understand the world through others' eyes (and perhaps also noses and ears)'.

Olfaciunt, ideo sunt[3]

Cogito, ergo sum. Yes, fair enough! Thank you, Descartes! That ought not to give humans a superiority complex. It is, at its best, an ability to be used to be, think and do good … also to other life-forms around us.

Talking of noses, he dwells on the olfactory sense of dogs, which defines their Umwelt for them, enabling them to not just 'smell' the present, but also 'sniff' into the past and divine the future by being chemoreceptive to the odorants – molecules of chemicals carried by the wind. The future may be less of a mystery to canines than it is to us. A request to dog-owners: Respect your canine's need and curiosity to 'know' its

1 Jakob Johann von Uexküll (1864-1944) – Baltic-German biologist.

2 Literally translates to 'environment' or 'surroundings' in German.

3 *They smell, therefore they are*, in Latin.

Umwelt through its nose – put yourself in the dog's 'nostrils', so to say, while you are in your shoes, walking the animal, instead of merely capitalising on that ability. We humans lag behind many of the quadrupeds when it comes to the gift of olfaction. Undoubtedly, we are not superior to all of them in all respects, are we?

The sway pheromones (odorant chemicals), which are in sooth 'tailored messages', have over tiny ants as well as huge elephants, is explained by Yong in graphic detail, and despite the scientific jargon you read through, the visualization it permits, takes you to an anthill somewhere yonder in elephant-country Africa. What is invisible to the eye, is evident to a sniffing nose, and in the case of a snake, to its odorant-amassing, forked tongue it flicks from time to time. While remarking that there are creatures which smell by tasting, or taste by smelling, or taste and smell using the same organ – the olfactory depending on air as a carrier, and the gustatory on liquids or solids carrying the odorants, Yong surprises readers by stating that photoreception happens, thanks to modified chemical receptors. Off and on, through informative footnotes, he reminds 'intelligent *Homo sapiens*' (you, the reader being one of them) that many things discovered in the 20th and 21st centuries (and a lot more which have not yet been discovered), were known to animals, aeons ago – powered by their powerful senses. Ground yourselves, fellow humans. After all, you cannot take off and fly thousands of miles, at the drop of a hat, like humble avians can, time and again.

Photoreception – UV and them…

In words which border on the metaphysical (or ecophilosophical for that matter), Yong remarks that vision can extend in any and every direction, envelope and surround, varying in time and space, filling empty voids between us. The word 'omniscient' which we use in our attempts to describe and understand and praise God, comes to mind, when the 180°-plus field of vision of some animals is referred to. While some outdo humans olfactorily, some others do so, by seeing wider, further and sharper, without actually seeming to see, so to say! While trying to see the world through the senses of animals, birds, reptiles, fishes and other life-forms, goads us to tap into our spiritual senses to comprehend God's creations better (while reconciling with Charles Darwin's soul at the same time), expecting all of them to be guided by what we regard as our dominant sense – vision – 'tastes' or rather 'smells' not only of perceptual bias but also of a haughty and anthropocentric view of the world. Let us not forget to use our mind's eyes too to concede that they came long before us… several aeons ago! Yong's adoption of metaphors to drive home complex scientific truths is a mark of his prowess as an ace science writer. For instance, the chromophore in the photoreceptor is the 'car key', the opsins (protein molecules) represent the 'ignition switch', the optic nerve is the connection to the engine, and response of the creature to what it has spotted, is the beginning of the motion of the car!

The author dissects and elucidates the physics, chemistry and biology of colour vision, colour-blindness and takes us back in time to explain the how and the why. We learn that we are 'trichromats'- endowed with retinas equipped with three types of cones capable of sensing the wavelengths of the visible VIBGYOR spectrum of light to different degrees. We also learn about marine creatures – mantis shrimps – which are equipped with the ability to polarize light (linearly and circularly) by reflecting it, and also see it oscillating. Ultraviolet light (UV) which is beyond ('ultra' means beyond) the VIBGYOR spectrum, is 'visible' to many animals. If you thought that trichromacy was a sign of high-evolution, and thereby something to be proud of, humility is advised. Little birds are endowed with tetrachromacy, and they see not just UV but numerous shades in the red-to-UV spectrum which we would not be able to. 'Colour is subjective, it is what the photoreceptors-neurons-brain

trio tell us, writes Yong, and that may throw some of us who tend to take things for granted, off balance. Readers will also find their minds wandering to comprehend how visually-challenged humans are compensated by God, with stronger senses of smell and/or taste and/or hearing (echolocation; and a reference to Daniel Kish – Google and learn about him) and/or touch.

'Flowers evolved colours that ideally tickle insect eyes.' Yong takes the readers to a different plane, and though he does not seem to imply anything metaphysical or divine, readers are compelled to believe in the existence of a divine creative force. One cannot help but wonder – if flowers evolved colours, to ensure that pollination occurred, who guided or helped them to do so?

A's pain, B's analgesic – heat and cold, pain untold

One human's food is another's poison, as the Bible says. While humans thereby ought to understand that all living beings – plants included – are nociceptive, it is also to be realised that what is not a source of pain to a human, may well be so, to an animal or bird or fish or insect. *(The reviewer recalls his late wife who herself endured a lot of pain bravely before succumbing to cancer, telling him that she had wept for many days as a little girl, while taking care of a wounded squirrel…she was an empath, and could actually sense the animal's pain, and continued to do so in later life whenever she used to spot an injured bird or a wounded animal…perhaps this was more than mere anthropomorphism?).* Descartes was wrong! This truth has given animal welfare supporters (yours sincerely being one of them) their ammunition to remedy the ills that need to be done away with, while spurring the tendency to become a vegan or a vegetarian. Unlike us who can ask for help when pain follows nociception, they cannot. Yong, without explicitly stating it, conveys this truth, using empiricism and scientific evidence, of course, by communicating with algologists. While vision, smell and sound help animals to avoid proximity to predators, nociception aids them to avoid agents of pain.

Moving on, heat and cold can also trigger discomfort – a form of 'pain', if one may label it so, the sensors in this case being thermoreceptors (or the so-called TRP channels) on the skin. It is known that different creatures have different temperature ranges, beyond which it gets 'discomfortingly hot' at one end, and 'discomfortingly cold' at the other. It is good to be aware of the marvels of evolution (which Yong labels as the greatest innovator) – psychrophiles and thermophiles, which together can be clubbed as extremophiles. Not just that, even some parts of the human body are more sensitive to heat, and others more to cold. The TRP sensor which detects painful heat in humans is reported to fire at 42°C, a temperature which, courtesy climate change, has become commonplace in many parts of the world. Yong applauds the little 13-striped ground squirrel from North America, for being a rare extremophile straddling a wide temperature range from sub-zero to temperatures in excess of 50°C. Whoever said that 13 is an unlucky number (and triggered triskaidekaphobia[4]), reconsider please! A message to readers who are keen on learning from the fauna around us – *tweak your senses, adapt, adjust and make the most of where you are and what you are…. let the metaphorical cold rage on, let the metaphorical sun fire on all cylinders.*

The 'seek and you shall find[5]' from the Bible is evoked (not by Yong, but by this reviewer) when the author refers to the firechaser beetle, priming its infra-red receptors by setting out and flapping its wings, 'seeking actively'. The author explains lucidly how sensing infra-red keeps ticks ticking, so to say, vampire bats biting cows and pigs at the right areas on their skins, and pit vipers spotting edible rats scurrying past.

4 Fear of the number 13.

5 Matthew 7:7-8, *The Holy Bible*.

The Midas touch…

That was a touch which turned everything to gold. For fauna, blessed with highly sensitive mechanoreceptors on their 'vacuum cleaner' noses (star-nosed mole), 'Swiss-knife' stingers (wasps), whiskers (rats), and beaks (ducks), the 'gold' is either finding the way around challenging terrain or delicious hidden prey. Direct touch apart, vibrations, pressure waves and ripples are sensed by the mechanoreceptors of some – useful in seeking prey or avoiding becoming one. Nature's cues all around – pick 'em up if you should, can and will!

As many zoologists have observed, Nature always has something up her sleeves to outwit humans, and techno-biomimicry has its limits. The air around you, the ground below you and the water yonder all carry signals which humans do not know about! Schooling fish communicate through ripples in the water (hydrodynamic wakes), thanks to a group of sensors called the 'lateral line'. Teeth on skin and bumps on jaws serve as mechano-sensors for cave-dwelling catfish and alligators respectively – a purpose in the plurality of forms, a method in the maddening diversity! The revelation that the resonant frequency of a peacock's crest – 26 Hz – matches that at which the male peacock shakes its tail-feathers, is verily a 'Eureka' feeling. Tiny hairs on bats' wings or the so-called filoplumes at the base of a bird's feathers help them manoeuvre changes in wind currents, in flight; while trichobothria on a tiger wandering spider's legs or the spiny hairy cerci on a cricket's hindside, alert them to breeze. Mechano-sensors help both prey and predator – the former to survive and the latter to thrive, so to say. Yong reminds us of our physics lessons from school when he refers to transverse air-borne vibrations and longitudinal surface waves. 'Down-to-earth' (in both a literal and metaphorical sense), the author says, puts humans at a vantage point, to decipher, decode, and discover truths about both megafauna and microfauna, that they never knew before.

The less he spoke, the more he heard[6]

'Lend me your ears, barn owls and grey owls.' Being nocturnal, they are endowed with asymmetric super-ears – to detect airborne waves (more so at night), quite expertly as spiders sense surface vibrations running along the spokes of their webs. The sensory hairs in human ears, Yong tells us, is similar to those in the lateral lines of fishes referred to earlier. After all, life originated in the water! Hearing is verily the queen of the senses, and most animals depend on it, while surprise of surprises, many do not need to. Further, it is also not that these 'queenly sensory organs – ears in other words' need to be two in number and located on the faces of creatures. This amounts to anthropomorphism which the author wants to banish from the minds of readers.

Revelations interspersed by Yong here and there, are almost philosophical in their implication. For instance, what one says/sings/sounds to soothe/seduce may also simultaneously be a giveaway inviting danger and death, from some other quarter or quarters. And yes, if as human readers, you would like to feel proud of your 'inherited ear for music', stay grounded. Songbirds like zebra finches may beat you effortlessly, while also being melodious vocalists at the same time. Indeed, birds have been a musician's muses for long. Yong's description of a whale's 'infrasound' echolocation ('swimming alone but acoustically connected) takes readers on a chimerical submarine tour, while the exposition of the same ability in bats – ultrasound nevertheless – opens up the mysteries of the night to the imagination.

Yong compares echolocation in whales, dolphins and bats, with electrolocation in knifefishes (electric eels for instance). The latter, to use a pun, is more 'current' and instantaneous unlike echolocation which entails playing a 'waiting game' awaiting

6 A line from the English nursey rhyme recorded first in the 1870s – *A Wise Old Owl*.

the echo to return. However, electrolocation which is almost an all-conquering sense, is close-range, compared to echolocation which enables the creatures named to sense over very long distances. He leaves us wondering what conductors (salt water) and insulators (stones and rocks in the water) would feel like to electro-locating knifefishes. Just as the knifefishes are gifted with electroreceptors, birds like the robin are endowed with magnetoreceptors capable of sensing the earth's magnetic field. Imagine smell first (chemoreceptors), vision next (photoreceptors), the lateral line thereafter (mechanoreceptors sensing the hydrodynamic wake), and finally the electroreceptors guiding a 'multisensory' shark in the ocean towards its prey – four friends helping it to answer the 'what' and 'where' questions!

They came before us…

…and they know more about the world around us, in their own unique ways, than we do. It is our duty to get to know that, and thereby respect the fact that the earth we inhabit would be worthless and 'senseless' if the biodiversity it was blessed with is eroded by our ignorance, arrogance and nonchalance.

I am drawn to ending the review with this observation and praise – Ed Yong knows exactly when, amidst a lucid scientific account of the sense organs of fauna, witticism is needed to keep the readers latched on …. eyes on the page! Get a copy, read, visualise, and see the world through the eyes of the fauna around us.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Conflicts of Interest: The author declares no conflict of interest.

Acknowledgements: As with every article and every journal paper I will publish ever since my dearest wife Varshita departed to her heavenly abode, this one too is fondly dedicated to her. More so because of the soft corner she had for fauna and flora. Both thrived in her presence!

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