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BOOK REVIEW

Other stars, other planets, and other life: a primer that goes two-thirds of the way

Niall Deacon: Twenty worlds: the extraordinary story of planets around other stars. London: Reaktion Books, 2020, 216 pp, $22.50

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Traditional astronomy, being focused on stars, is relatively straightforward: aim your instrument at the right place, then take stock of what you see. Planets, however, do not emit (much) radiation, so their presence in far away systems has to be inferred by other means. Coupled with the fact that results are more reliable when they come from different sources, this has led to a proliferation of indirect detection methods. Niall Deacon has built a truly accessible ramp to those methods, jam-packed with useful analogies and explanations. I know of no other book that does this as ably.

Thanks to advances in astronomical measurement and computer modeling, "now we know thousands of worlds" (7). By contrast, "in 1990 all we could say was that one star, the Sun, out of hundreds of billions, definitely hosted planets" (18). The word "definitely" does a lot of work here. Knowledge does not require and indeed rarely attains certainty, so we might rephrase the foregoing as "in 1990 all we could say *with sufficient assurance* was that one star, the Sun, out of hundreds of billions, hosted planets".

Yet, long before recent breakthroughs, many suspected that other planets orbited other stars. Far from being fanciful, this suspicion rested on a respectable inference. In predicate logic, for example, universal generalization infers a general conclusion from a particular premise—provided there is nothing special about the thing that we are using as our sample. The question, then, is whether there is something special about our planet and solar system. If the answer is no, then empirical developments have confirmed in a more specific way what reason could establish all along.

Aristarchus held that the stars we see at night were in fact *suns* like ours (11). Giordano Bruno, who defended the same idea (but does not figure in Deacon's sketches), went a step further and held that these other suns had *planets* too. Bruno even suggested that these far away worlds were *inhabited*. For this bit of inferential

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work, he was burned alive (Martínez 2018). The history of ideas nevertheless suggests the following (unfinished) learning curve: other stars, other planets, and other life.

This progression is reasonable, so why are so many hesitant to go all the way? As we just saw, the inference only goes through if we construe Earth as some random place, which we happen to live on. There is an undeniable sense in which we *are* special, so that premise generates pushback. Still, given that "today's planetary scientists refigure the night sky as teeming with worlds" (Messeri 2016, 1), parents would give birth to a radically different outlook if they told their children that it was also teeming with life.

Twenty Worlds does not go in that direction. Deacon is a gifted writer. He makes talk of gas pressures sound exciting. Yet, as someone who does not buy into the disinterested-pursuit-of-truth story, I must ask: what is the motivation for understanding distant planets? Much astronomical research is driven by a desire to find other life and/or worlds to settle. In scientific circles, however, this drive must be kept latent because we cannot currently say *with sufficient assurance* that life exists or could be supported elsewhere. Epistemological standards thus fix what we can talk about in polite company.

The Nobel-winning exoplanet scientist Michel Mayor said that, due to the vast distances involved, it is "completely crazy" to think that we will eventually visit an extrasolar world. He was asked about this at the close of an interview with Agence France-Presse, so the concern could be considered an afterthought or a teleological end. Like all humans, scientists can hide from others and themselves their real motives, so I would say that concerns with life and habitability are an end masquerading as an afterthought. I wish these topics were at the forefront of discussions, without stigma. Alas, we have to wait 82 pages before *Twenty Worlds* addresses the search for "A world like ours"—the only chapter with a humorous cartoon. Deacon alludes to the Drake equation (89), but it feels like a box he had to tick before rapidly moving on. Habitability will make a brief return around page 140, only to be left behind. *Twenty Worlds* is thus a book that one can mention at the dinner table without attracting frowns. Nothing crazy here, folks.

One should be mindful, though, that what counts as crazy changes over time. Indeed, the very subject matter of *Twenty Worlds* became acceptable only after certain individuals went rogue (see Boss 2009). Planet hunting may now be the new space race (see the funded projects listed by Deacon, 180–184), but only a few decades ago it was a career suicide. R. Paul Butler of the Carnegie Institution for Science recounts on a blog that, in the late 1980s, "when asked by other astronomers, 'What are you working on?', one could not respond, 'I am searching for extrasolar planets.' Depending on the person, they might laugh in your face, or slowly move away from you like you were pitching a new age religion or alien conspiracy theories." The human-made obstacles initially confronting exoplanet research are arguably also part of *The Extraordinary Story of Planets around other Stars*. Deacon opens his vignettes with sundry tidbits from culture, but this bit of recent—and relevant—history does not show up.

This shortcoming to the side, *Twenty Worlds* is an excellent introduction to exoplanet research. Not only is Deacon's prose crystal clear, he inserts (coloured!)

diagrammatic reinforcements just when his verbal descriptions come short. You do not need to know the following when you start reading, but you will once you are done: radial velocity (19), red shift (21), exoplanet naming conventions (26), regular (29) and grazing transit (70), tidal locking (33), star brightness (38), transit spectroscopy (42), microlensing (62), binary star blending (71), adaptive optics (102)—and the list goes on. The book even takes notes for you, by providing a handy table summarizing stats of all the exoplanets discussed.

Deacon does not assume much prior knowledge. Everything is qualitative, without a hint of math. His introduction even begins by recapping the planets of our solar system. This is crucial, since comparisons with terrestrial planets, gas giants, and ice giants are made in the remainder of the book. I wonder, though, about the intended audience. If one has so little interest in the subject that one does not know the basics, will one really work through nearly 200 pages of planetary descriptions? The eclectic anecdotes peppered throughout make the content more relatable. However, those with an interest in Earth-like planets are disparaged as "British tourists on holiday searching for a restaurant that sells fish and chips" (84). This counterproductive remark betrays a shallow appreciation of the human condition. Although we can intellectually appreciate any topic we wish, we will never commune in an embodied way with an environment ill-suited to our biology. I will never eat rocks (or shed the need to eat), no matter how enlightened I strive to be. Concern with habitability is not a form of narrow-mindedness.

As the book's title indicates, twenty planets are discussed, one per short chapter. Why twenty? And why *those* twenty? We are never told. Although the first chapter is devoted to the first exoplanet "officially" discovered (Mayor and Queloz 1995), the sequence is mostly pedagogical. Deacon keeps close tabs on what he has explained, so later chapters mention previous ones but never the other way around. He also groups chapters thematically into "Alien worlds," "Toward Earth," "Birth," "Life," and "Death." This division reduces the vertigo of twenty straight chapters but does not provide as much structure as one would hope.

Each chapter discusses a problem that astronomers and astrophysicists had to solve in order to confirm a particularly puzzling planet. However, the names of the actual persons who solved those problems are quarantined in the endnotes' references. Mayor and his colleague Didier Queloz become simply astronomers "using a telescope in Haute-Provence in France" (24), while Sir Arthur Eddington and his colleagues become "teams of astronomers [who] travelled to remote locations to observe a solar eclipse" (57). Einstein, though, gets mentioned by name for transitioning from "a lauded academic to a global celebrity" (59).

Maybe Deacon did not want to burden readers with too much history. There is also wisdom in sticking to what one knows (and likes?) best. Yet, the strategy gives the impression that natural science is busy covering its tracks with a triumphant "Whig history." Of course, a reader unaware of scholarly critiques of science will not suspect any air-brushing—and this is what is troubling. Deacon's twenty cases of problem-solving all have happy endings, more or less. As a result, despite occasional allusions to "invalidated assumptions" (185), one walks away from *Twenty Worlds* feeling that scientists were in control and on the same page all along. This, of course, is simply not true. Just ask Bruce Campbell, Gordon Walker, and Stevenson

Yang, who pioneered the wobble technique that triggered today's revolution and who discovered, with qualified caution, the first exoplanet (1988, 921). They did not get a Nobel Prize and are not mentioned in *Twenty Worlds*, not even in the references. A distinction is often made in the field between genuine confirmation and mere detection, so as was said at the outset, a lot turns on what counts as sufficient assurance.

In sum, *Twenty Worlds* is a terrific starter kit for the complex and still evolving subject of exoplanets. It reminds one of the writings by Carl Sagan—minus Sagan's thrilling connections to the Big Questions.

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