Fading Foundations: Probability and the Regress Problem. By David Atkinson & Jeanne Peijnenburg. (Springer, 2017. Pp. xi + 238. Price: Open Access.)

David Atkinson and Jeanne Peijnenburg, hereafter 'A&P', are explicit on their overall purpose in *Fading Foundations*. They write:

> Our overall purpose here is to show how our understanding of infinite epistemic chains benefits from an analysis of justification in terms of probability theory. It has been often assumed that epistemic justification is probabilistic in character, but we think that the consequences of this assumption for the epistemic regress problem have been insufficiently taken into account. (p. vii)

I am happy to report that A&P succeed in spades. *Fading Foundations* is an excellent book. It is elegantly written (with most technical details relegated to appendices), and jam-packed with careful argumentation and fascinating results.

I. CHAPTER-BY-CHAPTER OVERVIEW

There are eight chapters in *Fading Foundations* along with four appendices. I shall ignore the appendices in what follows, and focus on the chapters.

In Ch. 1 and Ch. 2, A&P tend to preliminary matters. In Ch. 1, they introduce the epistemic regress problem (with some historical background), explain coherentism, foundationalism, and infinitism, and discuss the issue of vicious versus benign infinite regresses. In Ch. 2, they examine several distinct ways of understanding the expression 'A_j justifies A_i'. They do not settle on any particular way of understanding it. But they argue against each of the following theses:

> A_j justifies A_i only if A_j entails A_i.
>
> A_j justifies A_i only if A_j normically supports A_i.

They further argue for the following alternative thesis:

> A_j justifies A_i only if A_j probabilistically supports A_i in that $\Pr(A_i \mid A_j) > \Pr(A_i \mid {\sim}A_j)$.

They stress that the right side of this conditional is a purely formal condition in that it is neutral between different ways of understanding A_j (as a belief, as a proposition, as a fact, as an event, as a perceptual experience, as a neural state, etc.) and between different ways of understanding probability.

Ch. 3 and Ch. 4 together constitute the core of *Fading Foundations*. A&P show that:

(*) There are infinite chains $A_1, A_2, \ldots, A_n, \ldots$ such that (i) A_i is probabilistically supported by A_{i+1} for all i and (ii) A_1 has a high unconditional probability.

Take some infinite chain $A_1, A_2, \ldots, A_n, \ldots$, and suppose, for example, that:

$$\Pr(A_i \mid A_{i+1}) = \alpha > \beta = \Pr(A_i \mid \neg A_{i+1}) \text{ for all i.}$$

They show that given this supposition, it follows that:

$$\Pr(A_1) = \frac{\beta}{1-\alpha+\beta}.$$

If β is held fixed at, say, 0.04, then $\Pr(A_1)$ tends to 1 as α tends to 1. Hence (*).

This result is ingenious (and, as A&P note, bears on an old debate between C. I. Lewis and Hans Reichenbach). But it might seem puzzling. How can an *unconditional* probability be fully determined by an infinite number of *conditional* probabilities?

It will help here to turn briefly from infinite chains to finite chains. First, take a 3-link chain A_1, A_2, A_3 such that:

$$\Pr(A_i \mid A_{i+1}) = 0.99 > 0.04 = \Pr(A_i \mid {\sim}A_{i+1}) \text{ for all i = 1, 2.}$$

If $\Pr(A_3) = 0.9$, then $\Pr(A_1)$ has a high value (roughly 0.890). If $\Pr(A_3) = 0.1$, then $\Pr(A_1)$ has a low value (roughly 0.168).

Now consider a 100-link chain $A_1, A_2, \ldots, A_{100}$ such that:

$$\Pr(A_i \mid A_{i+1}) = 0.99 > 0.04 = \Pr(A_i \mid {\sim}A_{i+1}) \text{ for all i = 1, 2, …, 99.}$$

If $\Pr(A_{100}) = 0.9$, then $\Pr(A_1)$ has a high value (roughly 0.801). If $\Pr(A_{100}) = 0.1$, then, unlike in the prior case, $\Pr(A_1)$ still has a high value (roughly 0.796).

In the first case, where n = 3, $\Pr(A_n)$ has a significant impact on $\Pr(A_1)$. High values for $\Pr(A_n)$ lead to high values for $\Pr(A_1)$. Low values for $\Pr(A_n)$ lead to low values for $\Pr(A_1)$. In the second case, in contrast, where n = 100, $\Pr(A_n)$ has very little impact on

$Pr(A_1)$. Both high values for $Pr(A_n)$ and low values for $Pr(A_n)$ lead to high values for $Pr(A_1)$.

This pattern continues: the impact of $Pr(A_n)$ on $Pr(A_1)$ approaches zero as n approaches infinity. Its impact, as it were, fades away to nothing (thus the expression 'fading foundations'), so that $Pr(A_1)$ is fully determined by $Pr(A_1 \mid A_2)$, $Pr(A_1 \mid {\sim}A_2)$, $Pr(A_2 \mid A_3)$, $Pr(A_2 \mid {\sim}A_3)$, ….

The remainder of *Fading Foundations* is organized as follows. In Ch. 5, A&P address the 'Finite Minds Objection'. This objection (or at least one version thereof) is based on the claim, roughly, that finite minds cannot handle infinite chains. A&P argue, drawing on certain parts of Ch. 3 and Ch. 4, that oftentimes a *finite* chain with a relatively small number of links is enough to get $Pr(A_1)$ within a suitable range of values so that an infinite chain is unnecessary. In Ch. 6, A&P address several 'conceptual' (as opposed to 'pragmatic') objections to infinite chains and probabilistic regresses. In Ch. 7, they turn from probabilistic regresses to regresses of *higher-order probabilities*, and argue that the latter are formally equivalent to the former. In Ch. 8, they consider *loops* and *multi-dimensional networks*.

There is a lot more to *Fading Foundations* than what is noted above. I cannot do it justice in a brief chapter-by-chapter overview.

II. A CRUCIAL CLARIFICATION

Return to (*). A&P consider a worry about the conditional probabilities at issue. They write:

> First, how do we know that the conditional probabilities in our chain are 'good' ones, i.e. make contact with the world? What is the difference between our reasonings and those occurring in fiction, in the machinations of a liar, or in the hallucinations of a heroin addict? Or, applied to our example about bacteria, how can we distinguish the regress concerning Barbara and her ancestors from a fairy tale with the same structure in which, instead of the heritable trait T, there is an inheritable magical power, M, to turn a prince into a frog? (p. 96)

They then try to answer it:

> The distinction is not far to seek. It lies in the mundane fact that in the former, but not in the latter, the conditional probabilities arise from observation and experiment. (p. 96)

This is fine as far as it goes. But how exactly does perceptual justification work?

There is a large literature on this question. Different theorists give different answers. Some hold that perceptual beliefs can be justified by perceptual experiences. Others deny this and claim instead that perceptual justification, as with all justification, is ultimately a matter of coherence. Others appeal to reliability. And so on.

A&P, though, offer no worked out view on this front. They simply assume that there is a perception-based story to be told in terms of how the various conditional probabilities at issue in (*) are justified, and then show that the probabilities in question can lead in surprising ways to further justified probabilities. They write:

> We realize perfectly well that this answer will not convince the confirmed sceptic …. We do not have the temerity to aim at refuting the claim that all our perceptions might be illusory, or at outlawing evil demon scenarios, old and new. We simply assume that there is a real world, and that empirical facts can justify certain propositions, or more generally can sanction the probabilities that certain propositions are true. (p. 96)

They never show, or even try to show, how to get justification in the first place. They show, rather, how to use justification already on hand to get—in some quite surprising ways—more justification.[1]

This should be borne in mind when considering passages like this:

> In the end we somehow try to get it all, sketching the contours of an infinitist version of coherentism, which also acknowledges the foundationalist lesson that we should somehow make contact with the world. (p. 11)

This should be read as '… sketching the contours of an infinitist version of coherentism *on how to use justification already on hand to get more justification* …'.

This is a clarification, not a criticism, of *Fading Foundations*. It is a first-rate piece of epistemology. I highly recommend it.[2]

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[1] For further discussion of this point, see W. Roche, 'Foundationalism with Infinite Regresses of Probabilistic Support', *Synthese*, forthcoming.

[2] Thanks to Jeanne Peijnenburg and David Atkinson for helpful feedback on a prior version of this review.