

# **The Fine-Tuning of the Universe: A Philosophical Analysis**

by

**Graham Wood**

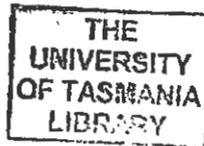
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## Abstract

This thesis is a philosophical examination of the *fine-tuning* of the Universe. It is in two parts, the first part examines the apparent improbability of the fine-tuning and the second examines responses to that apparent improbability.

I begin part one by examining the physical theories that have generated the fine-tuning debate. I argue the debate presupposes a realist interpretation of numbers, scientific theory and laws of nature. Without these presuppositions the concepts of *slightly different* laws and initial conditions of the Universe should be interpreted as mathematical artifacts. I then go on to analyse the *possibility space* of universes. Physical possibility is excluded and logical possibility is unsatisfactory, so I introduce *ontic* possibility space to examine the possibility of other universes. I consider the evidence that slightly different universes are not life-allowing, and I suggest two theories that could explain this evidence. Ontic possibility space may be *chaotic* such that ‘neighbouring’ universes are substantially different in structure from our own. Alternatively ontic possibility space may be *quantised* such that slightly different universes are not ontically possible. I then consider the claim that this fine-tuned universe is improbable. I analyse the role of probability in the debate and use partitions of the *probability space* to examine the fine-tuning. I conclude that the fine-tuning can be considered improbable only if it is taken to be objectively significant. Without this the fine-tuning is *isoprobable*, meaning that it is as probable as any other outcome.

In part two I consider the responses to the improbability. Two responses are attempts to *explain away* the improbability, either by postulating many universes or God. I also consider the possibility that this universe is the isolated result of an indeterministic ontic process. I examine the role of probability in explanation, focusing on the impact of indeterminism on this process. Often explanations are favoured that raise the probability of events. However I show that this can lead to error when considering isolated events in indeterministic systems. To avoid this error I apply the *conformity maxim* – explanations should generate epistemic probabilities that match ontic probabilities. I then go on to consider what triggers the need for explanation including an analysis of *surprising* and *specified* events. In considering the explanations of the fine-tuning, I analyse the *multiple universe* and *design* explanations. I conclude that the best response to the fine-tuning is to consider the universe as an isolated outcome of an indeterministic ontic process, possibly grounded in chaos or quantum theory.

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