

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

by

**Graham Wood**

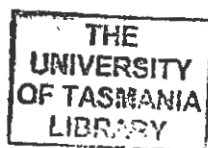
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## Abstract

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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## Chapters

<b>1</b>	<b><i>The Thesis and the Fine -Tuning Debate</i></b>	<b>1</b>
<b>2</b>	<b><i>Cosmological Physics</i></b>	<b>28</b>
<b>3</b>	<b><i>Numbers, Theories and Laws</i></b>	<b>42</b>
<b>4</b>	<b><i>The Possibility Space of Universes</i></b>	<b>60</b>
<b>5</b>	<b><i>The Nature of the Possibility Space of Universes</i></b>	<b>83</b>
<b>6</b>	<b><i>Probability Space</i></b>	<b>98</b>
<b>7</b>	<b><i>The Probability of the Fine - Tuning</i></b>	<b>124</b>
<b>8</b>	<b><i>Indeterminism, Probability and Explanation</i></b>	<b>150</b>
<b>9</b>	<b><i>Probability and Explanation Choice</i></b>	<b>171</b>
<b>10</b>	<b><i>Explanation Indication</i></b>	<b>196</b>
<b>11</b>	<b><i>Explaining the Fine-Tuning</i></b>	<b>221</b>
<b>12</b>	<b><i>References</i></b>	<b>260</b>

## Contents

<b>1</b>	<b><i>The Thesis and the Fine -Tuning Debate</i></b>	<b>1</b>
<b>1.1</b>	<b><i>Introduction</i></b>	<b>1</b>
1.1.1	<i>Thesis issues</i>	2
1.1.2	<i>Thesis boundaries</i>	4
<b>1.2</b>	<b><i>Possibility and Probability</i></b>	<b>5</b>
1.2.1	<i>The basic fine-tuning conditional</i>	6
1.2.2	<i>Possible universes?</i>	8
1.2.3	<i>Defining possible universes</i>	9
1.2.4	<i>Different numbers, theories and laws?</i>	10
1.2.5	<i>The nature of ontic possibility space</i>	11
1.2.6	<i>Is the fine-tuning improbable?</i>	13
1.2.7	<i>Partitioning the probability space, and isoprobability</i>	15

<b>1.3 Indeterminism and Explanation</b>	<b>18</b>
1.3.1 Responses to the apparent improbability	18
1.3.2 Indeterminism	19
1.3.3 Probability and explanation	20
1.3.4 Probability and explanation choice	21
1.3.5 Explanation indication	22
1.3.6 Explaining the fine-tuning	25
1.3.7 Choosing a response to the improbability of the fine-tuning	27
<b>2 Cosmological Physics</b>	<b>28</b>
<b>2.1 Some preliminary remarks</b>	<b>28</b>
2.1.1 Four elementary particles	28
2.1.2 Four fundamental forces	29
2.1.3 The assumptions of modern cosmology	29
2.1.4 Understanding the term "fine-tuned"	30
<b>2.2 The origin of the Universe</b>	<b>31</b>
2.2.1 In the beginning ...	31
2.2.2 The inflationary phase	32
2.2.3 After inflation	35
2.2.4 Stellar nucleosynthesis	36
2.2.5 Resonance	38
2.2.6 The process of nucleosynthesis	39
2.2.7 Super novae and the heavy elements	40
2.2.8 And then there was life	41
<b>3 Numbers, Theories and Laws</b>	<b>42</b>
<b>3.1 A counterfactual universe?</b>	<b>42</b>
3.1.1 Different tuning?	42
3.1.2 Epistemic versus ontic possibility	45
3.1.3 Realism versus antirealism	46
3.1.4 The map is not the territory	48
<b>3.2 Realism, antirealism and numbers</b>	<b>49</b>
3.2.1 How does mathematics hook onto the world?	50
3.2.2 Different universes as mathematical artifacts	52
<b>3.3 Scientific theories: statements or models?</b>	<b>53</b>
<b>3.4 What is the nature of laws of nature?</b>	<b>55</b>

3.5	The need for ontic possibility	59
4	<i>The Possibility Space of Universes</i>	60
4.1	Are other universes possible?	60
4.2	Various possibility spaces	61
4.2.1	Physical possibility	62
4.2.2	Logical possibility	63
4.2.3	Ontic possibility and epistemically responsible speculation	63
4.3	The nature of possibility space	65
4.3.1	Conceptualising possibility space	65
4.3.2	Is possibility space discontinuous or continuous?	66
4.3.3	Discontinuous possibility space: measurement and mathematical artifacts	67
4.3.4	Partitioning possibility space: demonstrative and non-demonstrative partitions	68
4.3.5	Non-demonstrative & demonstrative as objective & subjective partitions	68
4.3.6	Choosing and justifying a partition: demonstrative or non-demonstrative?	70
4.3.7	Identifying the members of a demonstrative partition	71
4.4	Possible universes	72
4.4.1	The possibility space of universes: continuous or discontinuous?	72
4.4.2	Partitioning the space of possible universes	73
4.4.3	Life-allowing universes	75
4.4.4	Is life objectively significant?	76
4.4.5	Partitioning life-allowing universes	77
4.4.6	What universes are life allowing?	78
4.4.7	Leslie's 'local area' argument	79
4.4.8	Life-allowing or fine-tuned for life?	81
5	<i>The Nature of the Possibility Space of Universes</i>	83
5.1	Preliminaries	83
5.1.1	Responsible speculation?	83
5.1.2	Note on the graphical illustrations	83
5.1.3	Possibility spaces consistent with the fine-tuning data	85
5.2	Getting to know the territory	86
5.2.1	Is the fine-tuning necessary or contingent?	86
5.2.2	How 'slight' is a slight difference?	88
5.2.3	The fine-tuning as contingent	89
5.2.4	Beyond the local area	90

<b>5.3 Chaotic and quantised possibilities</b>	<b>91</b>
5.3.1 Chaotic logical possibility space	91
5.3.2 Logical possibility space or ontic possibility space?	93
5.3.3 Quantised ontic possibility space	94
5.3.4 An illustration of logical possibility versus ontic possibility	96
5.3.5 Quantised ontic possibility space: a proposal	97
<b>6 Probability Space</b>	<b>98</b>
<b>6.1 Preliminaries</b>	<b>98</b>
6.1.1 Contingency and isolated events	99
<b>6.2 The probability calculus</b>	<b>100</b>
6.2.1 The relation between the calculus and interpretations of probability	101
<b>6.3 The interpretations of probability</b>	<b>102</b>
6.3.1 Classical	103
6.3.2 Relative frequency	104
6.3.3 Propensity	106
6.3.4 Subjective degrees of belief	107
6.3.5 Logical	108
<b>6.4 Probability: objective or subjective - ontic or epistemic?</b>	<b>109</b>
<b>6.5 Probability space</b>	<b>111</b>
6.5.1 The nature of the probability space	111
6.5.2 Demonstrative and non-demonstrative partitions of the probability space	113
6.5.3 Determining the probability of a particular partition	114
<b>6.6 Improbability, isoprobability, expectation and surprise</b>	<b>115</b>
6.6.1 Absolute and relative improbability	115
6.6.2 Differential probability	116
6.6.3 Isoprobability	117
6.6.4 Probability, expectation, improbability and surprise	120
6.6.5 Isoprobability and surprise	121
<b>7 The Probability of the Fine - Tuning</b>	<b>124</b>
<b>7.1 An assumption</b>	<b>124</b>
<b>7.2 Probability and the fine-tuning</b>	<b>124</b>
7.2.1 The fine-tuning and the standard interpretations of probability	124
7.2.2 Interpretations in the current debate	128

7.2.3	Is the fine-tuning improbable?	132
<b>7.3</b>	<b>The probability space of universes</b>	<b>133</b>
7.3.1	Considering the probability space	133
7.3.2	What probability space are we talking about?	138
7.3.3	The local area argument	139
<b>7.4</b>	<b>Partitioning the probability space</b>	<b>143</b>
7.4.1	Justifying the demonstrative partition	145
7.4.2	Is 'life' objectively significant?	147
7.4.3	Is the fine-tuning surprising?	148
7.4.4	A probabilistic ontic proposal	148
<b>8</b>	<b><i>Indeterminism, Probability and Explanation</i></b>	<b>150</b>
<b>8.1</b>	<b>Responding to the improbability of the fine-tuning</b>	<b>150</b>
8.1.1	Rejecting the improbability	150
8.1.2	Accepting the improbability	151
8.1.3	The implications of indeterminism	152
<b>8.2</b>	<b>Considering explanation</b>	<b>153</b>
8.2.1	Significance	153
8.2.2	Explanation	154
8.2.3	Ontic grounds and epistemic reasons	155
8.2.4	Explanatory errors	155
8.2.5	What is the appropriate response to error?	156
<b>8.3</b>	<b>Understanding indeterministic explanation</b>	<b>157</b>
8.3.1	Indeterminism and explanation	158
8.3.2	Explanatory expectations: accepting improbable indeterministic events	161
<b>8.4</b>	<b>The conformity maxim</b>	<b>164</b>
8.4.1	The conformity maxim applied	165
8.4.2	The advantages of the conformity maxim	167
8.4.3	The disadvantage of the conformity maxim	168
<b>8.5</b>	<b>Explaining indeterminism</b>	<b>169</b>
<b>9</b>	<b><i>Probability and Explanation Choice</i></b>	<b>171</b>
<b>9.1</b>	<b>Choosing an explanation</b>	<b>171</b>
9.1.1	Inference to the best explanation	171
9.1.2	Self-evidencing explanation	172

9.1.3	Confirmation theory	173
9.1.4	Confirmation theory and competing hypotheses	175
<b>9.2</b>	<b>Indeterminism and confirmation</b>	<b>176</b>
9.2.1	A problem for confirmation theory	176
9.2.2	Indeterminism, determinism, ontic probability and epistemic probability	186
9.2.3	The limitation of confirmation theory in dealing with isolated events	190
9.2.4	The implications for self-evidencing explanations	192
9.2.5	Solving the problem	193
9.2.6	The problem of confirmation	194
<b>10</b>	<b>Explanation Indication</b>	<b>196</b>
<b>10.1</b>	<b>The desire for explanation</b>	<b>196</b>
10.1.1	Why do we want explanations?	196
10.1.2	What do we want explained?	196
<b>10.2</b>	<b>Improbability, contingency and significance</b>	<b>197</b>
10.2.1	Improbability versus contingency	197
10.2.2	Significance	198
<b>10.3</b>	<b>Surprise</b>	<b>199</b>
10.3.1	Horwich on surprise	200
10.3.2	The conformity maxim and surprise	201
10.3.3	Expectation, surprise and isolated ontically probabilistic events	202
10.3.4	Is the fine-tuning surprising?	202
<b>10.4</b>	<b>Specification</b>	<b>203</b>
10.4.1	The explanatory filter and the design inference	205
10.4.2	The law of small probability	206
10.4.3	The event, its description and explanation	206
10.4.4	Specification versus fabrication	207
10.4.5	Specification and explanation	209
10.4.6	Prior and posterior specification and fabrication	209
10.4.7	Posterior specification, fabrication and explanation construction	210
10.4.8	Is the fine-tuning a case of posterior specification or fabrication?	211
10.4.9	Self-evidencing explanations called into question	213
<b>10.5</b>	<b>Analogies</b>	<b>213</b>
10.5.1	Analogies to prompt explanation	214
10.5.2	Is the fine-tuning analogous to the 'analogies'?	217
10.5.3	Making the 'analogies' analogous	218

10.5.4	Begging the question	219
<b>11</b>	<b><i>Explaining the Fine-Tuning</i></b>	<b>221</b>
11.1	Considering the options	221
11.2	Multiple universes	223
11.2.1	Versions of the 'multiverse' theory	224
11.2.2	The general form of multiverse explanations	225
11.2.3	The probability of this fine-tuned universe and confirmation theory	227
11.2.4	The inverse gambler's fallacy	228
11.2.5	Cause and effect problems	229
11.2.6	The die roll analogy and an 'immaterial chance set up'	230
11.2.7	The anthropic principle versus anthropic reasoning	230
11.3	Design	231
11.3.1	Swinburne's argument	233
11.3.2	The contingency of the existence of intelligent organisms	235
11.3.3	The problem of contingency	237
11.3.4	Determinism	240
11.3.5	Miraculous divine intervention	241
11.3.6	Non-miraculous divine intervention	242
11.3.7	Non-miraculous divine intervention and freewill	243
11.3.8	Probabilistic limits on non-miraculous divine intervention	244
11.3.9	Empirical indistinguishability and metaphysical scepticism	246
11.3.10	God and the multiple universe explanation	246
11.4	An ontic field explanation	247
11.4.1	Quantum vacuum fluctuation explanation	248
11.4.2	Does quantum vacuum fluctuation explain the fine-tuning?	249
11.4.3	Considering the ontic field explanation as a single universe explanation	252
11.4.4	Does the ontic field explanation raise the probability the fine-tuning?	254
11.4.5	The ontic field explanation and the conformity maxim	254
11.4.6	The ontic field explanation does not imply other universes	256
11.4.7	The next step?	257
11.5	In conclusion	257
<b>12</b>	<b><i>References</i></b>	<b>260</b>