

From Gödel to Trump: A Three-Step Resolution of Science's Emergent Crisis

'Fake News', Consciousness Science, and the Path to a post-Post-Truth Society

Nicholas M. Rosseinsky

FREE NON-TECHNICAL CONTENT

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To my father

With gratitude for the loving support,
and the inordinately-frustrating challenges

Contents

<i>Preface. This is not a popular science book, or a treatise in sociology!</i>	vii
<i>Author's Note. Who should read this book?</i>	x
<i>Reading Guide: Three-Book Collection</i>	xi
<i>Reading Guide: This Book as a Whole</i>	xii
<i>Reading Guide: Technical Content</i>	xiii
<i>Printing Guide: Duplicate Content</i>	xv
<i>Image Copyright Acknowledgements</i>	xvii
<i>Index, Errata, and Other Stuff</i>	xviii
<i>Part 1. Overview: Gödel-like theorems for dynamically-conventional biophysical science, and experimental resolution of the resulting scientific crisis</i>	1
<i>Part 2. The meter-Hamiltonian argument (1): conscious experience can't be explained scientifically under current physics</i>	n/a
<i>Part 3. The meter-Hamiltonian argument (2): why comparing actual brain-data to computer simulations must be consciousness science's first priority</i>	n/a
<i>Part 4. The meter-Hamiltonian argument (3): reliably-scientific foundations of physics depend on existence of a specific natural dynamical-order</i>	n/a
<i>Part 5. Afterword: Fake News, Trump, and the post-Post-Truth Society</i>	47
<i>Appendix A: The meter-Hamiltonian argument 'proper'</i>	n/a
<i>Appendix B: Sketching an $\langle s \rangle$-label-coupled conscious-experiential science</i>	n/a
<i>Appendix C: The Fragmented Scientist</i>	54

PLEASE NOTE: the complete book contains Parts 2, 3, and 4, and Appendices A and B (the technical content) *in full*.

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Preface: This is *not* a popular science book, or a treatise in sociology!

I wrestled long and hard with the title of this book. ‘From Gödel to Trump: A Three-Step Resolution of Science’s Emergent Crisis’ *might* suggest that this is a popular science book. Or, an addition to the numerous discussions of the post-Truth, ‘fake news’ phenomenon from a cultural, philosophical or sociological perspective. [For example, (Baldwin, 2020), (McIntyre, 2018), (Wilber, 2017).] In fact, it’s neither of these. Its central content comprises three extremely-technical, hard-core, science papers (Parts 2 to 4) in the computational neurophysics of consciousness – an approach to the scientific explanation of consciousness that combines computational neuroscience and theoretical physics.

The working title for this book was ‘Gödel-like theorems for dynamically-conventional biophysical science, and experimental resolution of the resulting scientific crisis’. (This ended up being the title for Part 1’s *less*-technical *Overview* of Part 2 to Part 4’s much *more* technical content.) Perhaps leaving that working title in place would have given a more accurate pointer to the overall thrust of this work.

So, why did I end up choosing the more accessible title?

Humankind is in a very tricky position right now. (And as I’ll explain shortly, it’s the nature of this position that drove my somewhat-difficult title-choice.)

On the one hand, ‘expertise’ is being given a bad rap, both directly (by claims that we don’t need it) and indirectly (by in-practice avoidance of expert-guidance in personal and collective decision-making). This tendency is strongly correlated with the post-Truth movement, which asserts there *isn’t* a dominant ‘truth’ in *any* situation – and therefore never *any* essential role for expertise to help guide us towards it. Clearly, this can be problematic. (Do you want your unqualified neighbor to ‘do his own research’ and then undertake your brain-surgery?!)

On the other hand, there *are* drastic, *serious*, problems with the way that mainstream expertise is being presented and wielded. These problems also apply to knowledge more generally – for example, in the form of *scientific* knowledge. One huge issue is the fragmentation, or silo-fication, of enquiry. (Arguably, the rigid division of academic disciplines was a sort of prototype for now familiar social-media ‘echo-chambers’.) Fragmentation of knowledge often results in partial solutions, creating unintended consequences in unaddressed dimensions. Another, related, issue is that culturally-mainstream institutions and movements of all kinds seem to have given up on any real exploration of what reality really is. (This *is* related to silo-fication, because the reality-issue only takes concrete form at the *intersection of fragmented* disciplines. For example, a real science of consciousness *does* require both neuroscience and physics, but there are no real, *deeply*-interdisciplinary, opportunities to work in this overlap. So fragmentation and lack of reality-enquiry co-exist in a sort of dysfunctional symbiosis.)

In my view (which seems to put me in a minority of approximately one, in the scientific field), the post-Truth attack on expertise is in large part a perhaps-unconscious *reaction to* deep and troubling knowledge-discipline problems. Those who identify with the science-and-expertise ‘side’ of current conflicts are often bemused by this observation. In no small part, this bemusement derives from a view of the post-Truth movement as driven *solely* by bad actors taking advantage of the poorly-educated. In this view, post-Truth has no real justification (apart perhaps from failures in parenting, psychotherapy, and/or educational systems!). However, this response by the science-and-expertise camp is tragic, because it prevents this group from *learning the real lessons* that post-Truth offers. The essence of

these lessons is that there *is* something profoundly-contradictory, and therefore – on science’s *own* metric of pristine logic – *broken*, in the current scientific enterprise. (This is *not* the same thing as saying that science *as a knowledge-method* is broken, or flawed. Again, it is a criticism of the *current* institutional, cultural, incarnation *of* that method. The ultimate gift of post-Truth to science is the catalysis of the next, great, phase of scientific enquiry, in the form of a twenty-first century renaissance which can embody all the gifts, and none of the flaws, of the present approach.)

With all that now on the table: back to the title.

If I had gone with the technical-monograph, ‘Gödel-like theorems ...’ title-style, this work would have lain neglected as an esoteric and difficult-to-comprehend approach to an abstract issue on a far-flung scientific frontier. Its real significance would have been overlooked. (This will still happen, in all likelihood! But there’s an ethical imperative, to give alternate futures the best possible shot ...)

The reason for linking the advanced technical content of this book with today’s post-Truth, Trump-influenced, sociopolitics is to connect an exquisitely-nuanced grain-of-sand lurking in the gears of the current scientific machine, and to the apparently-unrelated cultural tornado humankind finds itself in. This grain-of-sand – which the technical content of this work delineates – can catalyze two very different ways forwards. One irritates society into an often-vicious, sometimes-violent, usually-incomprehensible, post-Truth self-destruction. (This is already happening: clearly, self-destructive activity *doesn’t* need my technical analysis of its origins!) The other seeds the pearl of an entirely new incarnation of science. The latter path brings the *current* scientific machine to a halt, not by conflict, but simply because everyone leaves the old vehicle for a *new and unambiguously-better* mode-of-travel. (This *does* require an understanding of the technical issues *within* science, *by* scientists: science cannot be reinvented without the willing, even eager, participation of scientists themselves!)

This book is a plea to scientists to examine the possibility that science itself may harbor at least one of the roots of the post-Truth, fake news, explosion. Certainly, there are other roots. But any viable, sustainable, *post-post-Truth* world *must* include a radically-reinvented science – reinvented by scientists, on the terms and values of science: pristine rationality, congruence with experimental data, and overall structural-coherence. This reinvention *can’t* originate simply in *external* critiques or contextualizations of science, because science as a discipline *does* have an essential guardianship role over a certain kind of knowledge. Responding to *ungrounded* external critiques would involve deserting this role. But this book is a rigorous presentation to science of its own issues, *on its own terms*. To my knowledge, it is the first attempt to execute this vital but unpopular task.

I say that a real crisis for science is ‘emergent’, not because of the rise of post-Truth. It is emergent because this book can only be the first in a wave, pointing out fundamental issues. The superficial, societal, crisis is already obvious. It’s the radical source of that crisis that is and will be emergent.

The observation that deep (and beautiful!) problems in the foundations of science are *part* of the post-Truth outbreak does *not* deny that there *other*, far more obvious, problems with the other ‘side’ of the science/post-Truth relationship. But anyone who has gone through real relational difficulties knows that true transformation and rebirth can only occur when I am as prepared for self-examination, as I am for other-reflection. (Or perhaps more typically, for other-criticism!)

An extremely-controversial teacher once allegedly said, ‘Physician, heal thyself’. To coin a verb, this book is an invitation for science ‘to truth itself’.

References

- Baldwin, J. (Ed.). (2020). *Navigating Post-Truth and Alternative Facts: Religion and Science as Political Theology (Religion and Science as a Critical Discourse)*. Lanham, MD: Lexington.
- McIntyre, L. (2018). *Post-Truth*. Cambridge, MA: MIT Press.
- Wilber, K. (2017). *Trump and a Post-Truth World*. Boulder, CO: Shambala.

Author's Note: Who Should Read This Book?

In case the *Preface* didn't nail it: this book is **not written for armchair science-enthusiasts** (unless you got to that armchair via some combination of undergraduate or graduate mathematics, theoretical physics, computational neuroscience/psychology, computer science, or philosophy of mind!).

Having said which ...

I do have a dream. It goes a bit like this.

In 2120 (maybe 3120), when science-oriented kids ask their parents 'Why did they fight about "truth" a hundred years ago?', they'll be told to wait for their high-school class on consciousness, science, and Gödel. And the textbook for that class will contain some version of the content of this book. (Actually I hope the parents will give it a go themselves first. But sometimes deep change takes generations ...)

This isn't a grandiose egoic-fantasy about the significance of this work. (I do have those. But this isn't one of them!)

My dream-vision is reprised here to suggest that – **even if you don't have any of those undergraduate or graduate 'prerequisites' implied above – you could create your own curriculum around this book.** If this work will be within the grasp of high-school students in a hundred years, I'm sure it's not fundamentally beyond *your* reach, now. (To be clear, though, approaching the content of this book via a do-it-yourself approach, starting from low-to-no base, is no small undertaking. Minimally it calls for tremendous passion for the subject-matter and its implications, and a lot of time and energy to devote to research and self-education. If this approach calls you, I have two somewhat easier texts scheduled for publication by end-2022: *Towards a Real Science of Consciousness*, and *The Science We Need*. These books would be a useful warm-up for your project! See *Reading Guide: Three-Book Collection*.)

This book is (according to me!) **absolutely-required reading for those working professionally in the fields of consciousness science and AI.** (And for those hoping to, notably **undergrad and grad students, and post-docs.**) With respect: if you don't have the theoretical physics or computational neuroscience background – you could go back to college. Everyone's doing it these days! (I did.) And if you don't have the time – make it! (That is, if your professional activity is truly important to you.)

This book is **strongly-suggested reading for leaders, advocates, commentators, policy-makers and politicians involved in the science-vs-post-Truth slugfest, especially those taking the 'side' of science.** (Even *more* especially, for those who only see ill-will or a lack of education in the 'other' camp.) Of course, not everyone will have the inclination or capacity to acquire the required technical background. Parts 1 and 5 are non-technical, though. And anyone can get a sense of the gist and seriousness of the approach, by skimming Parts 2 to 4, and the Appendices.

Minimally, these pro-science folks *should* be aware that there *is* something profound for science to learn, from the post-Truth, 'fake news', onslaught. This 'something' can, should, and ultimately *will* catalyze the next great phase of scientific enquiry, via a twenty-first century renaissance equaling the Copernican-Galilean-Newtonian revolution, in intellectual scope and societal impact. This reinvention of science is vital, if we're to find our way to a *post-post-Truth* society. Some dawning glimmer of this fact might bring a little more mutual respect, and a greater quality of curious co-enquiry, to those perhaps presently-rare pockets of social intercourse vulnerable to an outbreak of constructive activity.

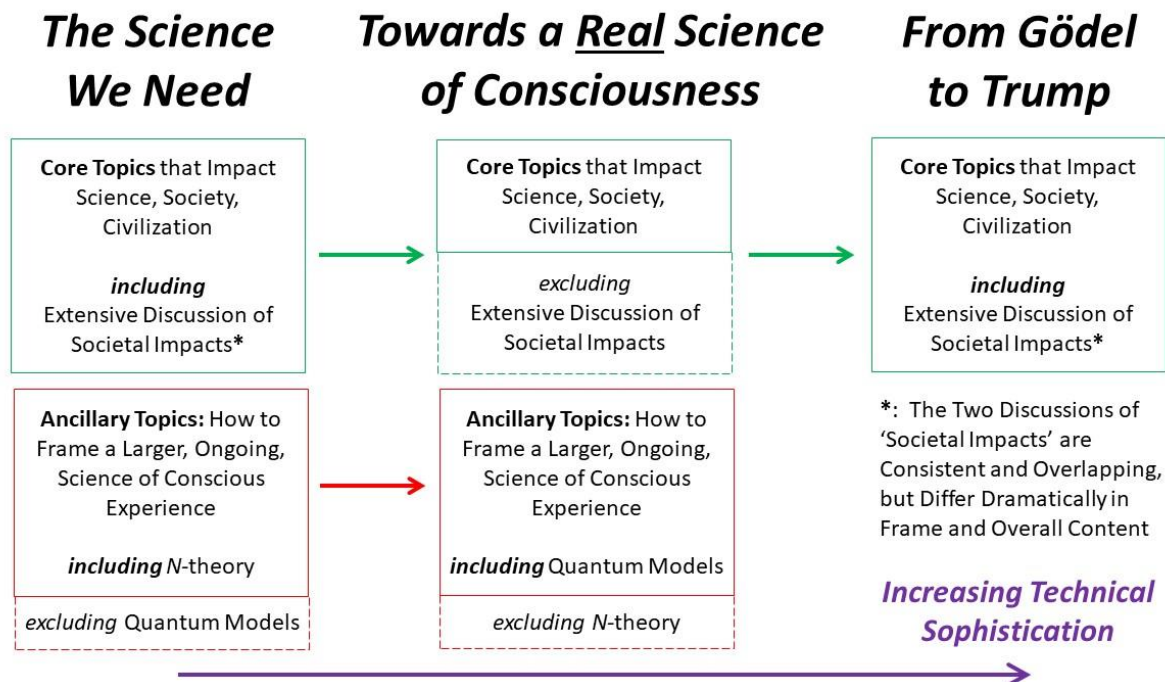
Reading Guide: Three-Book Collection

This book is the most technically-sophisticated and demanding member of a three-book collection. The three books are a ‘collection’ rather than a ‘series’: there’s no formal sequence dependence, or incremental development. Each can be read independently, and the three can be read in any order. The collection is best thought of as a set of free-floating viewpoints, all looking at the same topic: consciousness and conscious experience. Despite *reading-order* independence, the three viewpoints share a common vocabulary, approach, and outlook: they form a coherent, integrated, trinity.

The Science We Need is a conventional linear book (sequential chapters, written for a scientifically-literate layperson). It introduces core consciousness science topics related to science, society, and civilization, as well as surveying ancillary topics related to the overall development of a science of conscious experience. (The book you’re currently reading – *From Gödel to Trump ...* – does *not* address the latter topic, directly.)

Towards a Real Science of Consciousness combines eight intermediate-level scientific papers with eight related commentary chapters. Unlike *The Science We Need*, ‘*Towards*’ does *not* discuss science-and-society issues. (It does survey quantum-consciousness theories, which aren’t discussed in *The Science We Need*. Conversely, *The Science We Need* describes a central, coherent, theory-of-conscious-experience called ‘*N-theory*’, not discussed in ‘*Towards*’.)

From Gödel to Trump (this book!) combines three major, complex, advanced scientific papers with an introductory *Overview* and a closing *Afterword*. (See also ‘Other Stuff’ on p. *xviii* for links to a shorter paper, suitable for technically-advanced readers, distilling the essence of these three.) A primary focus of the non-technical content in this book is the relationship between technical material and the ‘fake news’, post-Truth attacks on science. Constructively, this book shows how leading-edge advances in science must be a vital part of restoring peace, and creating a *post-post-Truth* world.



Reading Guide: This Book as a Whole

This book is about consciousness science, science-as-a-whole, and science's place in society – especially its conflict with the post-Truth, 'fake news' movement, and how to get beyond that, to what I call the '*post-post-Truth*' society. It also establishes a relationship between the meter-Hamiltonian argument, a technical result at the nexus of all those topics, and Kurt Gödel's famous incompleteness theorems in mathematical logic.

This page suggests reading paths corresponding to four distinct reading-motivations:

- 1: You are mainly interested in the technical aspects of consciousness science, as a sub-domain of the larger scientific enterprise.
- 2: You are mainly interested in science-as-a-whole, and what the status of consciousness science implies for its technical foundations.
- 3: You are mainly interested in science's place in society, its conflict with post-Truth, and the path to a post-post-Truth society.
- 4: You are mainly interested in clarification of the heated controversies, concerning what Gödel's incompleteness theorems do or don't have to say about the human mind.

For motivation-1: I suggest focusing on Parts 2 and 3. You may find Part 1's *Overview* of those Parts helpful (sections 3 through 6 of Part 1).

For motivation-2: I suggest starting with Part 4. You may find Part 1's *Overview* of all the technical material associated with Part 4 helpful (sections 3 through 7 of Part 1).

For both motivations-1 and 2: I suggest complementing reading suggestions just given with a review of the 'Technical Core: Reading Guide', on the next couple of pages. The *Technical Core Reading Guide* explains the inter-relationships between various sub-components of the technical core (Parts 2 to 4, and Appendices A and B). It may provide useful contextual information, before you set out on either of the paths suggested above. (Technically-advanced readers may also consider starting with a shorter paper, distilling the essence of Part 2's meter-Hamiltonian logic. See 'Other Stuff', p. xviii.)

For motivation-3: I suggest starting with Part 1 (notably sections 1 and 8), Part 5, and Appendix C.

However, these Parts aren't independent of the technical core (*i.e.* Parts 2 to 4). They explain the role of that core in the societal context, and they also depend and draw on technical content. For example, I suggest the path to a post-post-Truth society *must* ultimately incorporate science's acknowledgement and exploration of the technical content of Parts 2 to 4. To fully understand and critically evaluate societally-related content of this kind, you'll need to engage with the technical core, to some degree. Please refer to the *Technical Core Reading Guide* (starting on the next page) before setting out on that journey!

For motivation-4: I suggest starting in Part 1, section 2. From there you will be able to determine your own path, through Gödel-related technical materials in Parts 2 to 4, and through Part 1's *Overview* of that material, in sections 3 to 7. (Again the *Technical Core Reading Guide* can be your friend and ally, in charting your own journey through Parts 2 to 4.)

Reading Guide: Technical Content

The technical core of this book is Parts 2 to 4, which are reviewed in outline (respectively) in sections 5 to 7 of the Part 1 ‘Overview’. Each of Parts 2 to 4 is a standalone scientific paper, although Part 3 also refers to Appendix A, and Part 4 to Appendices A and B.

Part 2 contains the core meter-Hamiltonian argument, which establishes the impossibility of a reliable science of conscious experience in a dynamically-conventional reality. (Parts 2 to 4 use the phrase ‘orthodox dynamics’ as a synonym for the *Overview*’s ‘dynamical conventionality’.) Technically-advanced readers may also enjoy a shorter paper on meter-Hamiltonian logic (‘Other Stuff’, p. *xviii*).

Part 3 explains an experimental program that determine whether the reality we inhabit is dynamically-conventional or unconventional (which is the pivotal issue for the viability of a scientific approach to conscious experience).

Part 4 relates the viability or otherwise of conscious-experiential science to the viability of physical theory, and therefore of science as a whole. (The issue here is that consciousness plays a pivotal role in the conduct of science of every kind. If we can’t study consciousness scientifically, then we can’t study scientific activity using science. Hence, we can’t scientifically assert the reliability of science.)

The visual map of Reading Pathways below outlines three different ways to traverse core content. (After concluding any trajectory shown in the Reading Pathways map, navigation would typically proceed to Part 5’s *Afterword*, and its associated Appendix C.)

Path-A works sequentially through Parts 2, 3 and 4, finishing with Appendix B. (Because Appendix A is an abbreviated *distillation* of Part 2, it’s not necessary to visit it on this Path, which already includes Part 2 *in full*.) Path-A is suitable for those with a detailed interest in the theoretical foundations of consciousness science (Part 2), or those who just prefer to work through material in a linear theory/experiment/generalization way (theory = Part 2, experiment = Part 3, generalization = Part 4).

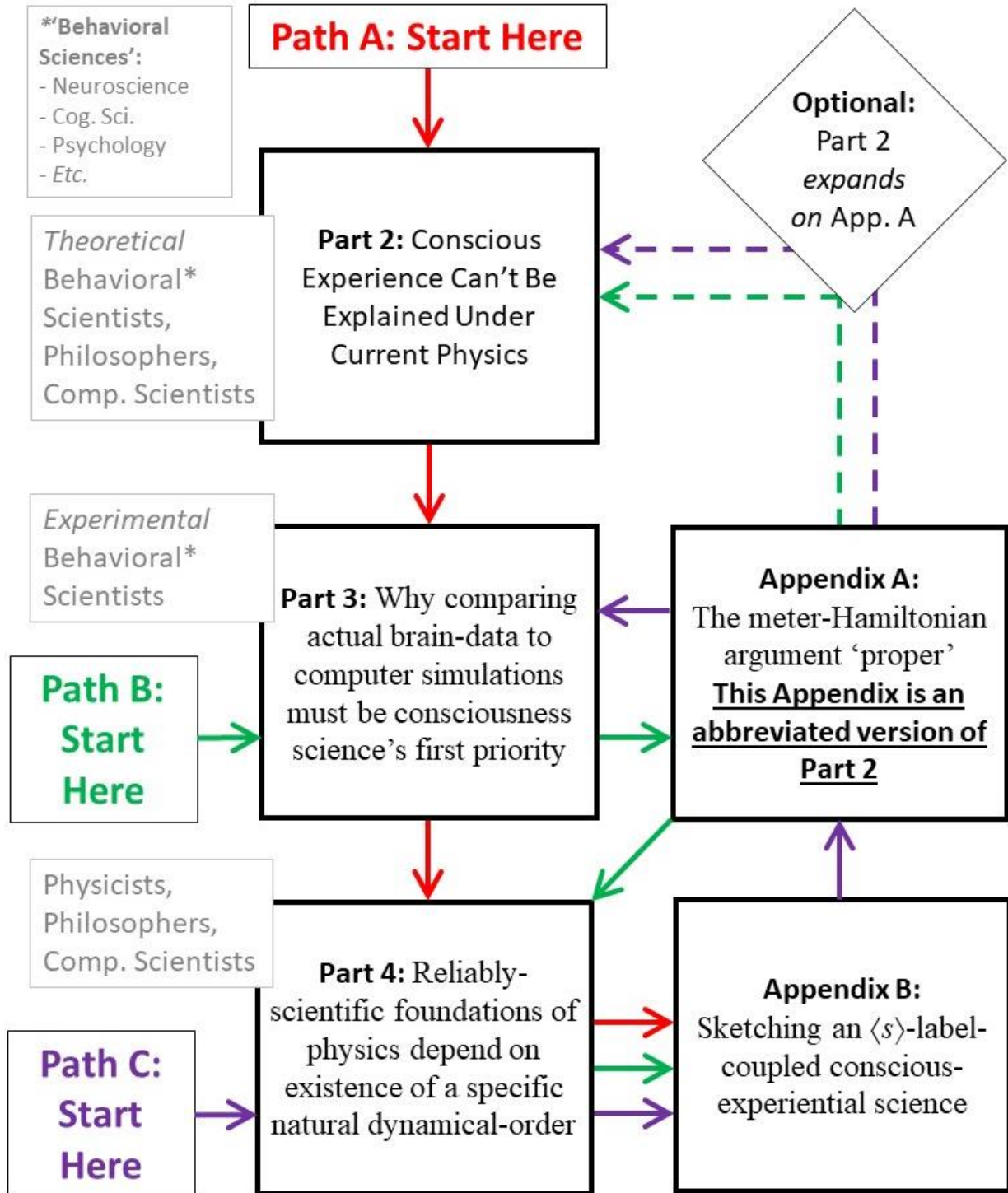
Path-B starts with Part 3’s experimental focus, and then visits Appendix A (and optionally Part 2) for theoretical background, before concluding with Part 4’s expansion-of-analysis to the context of science as a whole (plus Appendix B’s sketch of a potentially-viable approach to consciousness science).

Path-C begins with Part 4’s consideration of physics and science-in-general, before a quick fly-by through Appendix B’s viable science-of-consciousness. It then proceeds to Appendix A’s summary of the theoretical foundations of consciousness science (again within an optional visit to the slightly-expanded treatment of the same material, in Part 2). It concludes with Part 3’s experimental program, which can resolve theoretical uncertainties for both consciousness science and science as a whole.

Because Part 2, Part-3-and-Appendix-A, and Part-4-and-Appendices-A-and-B are all readable as standalone modules, other paths are also possible. (In designing your own pathway, please bear in mind that Part 2 and Appendix A cover the same territory, with different word-counts.)

For example, a Path-D variant of Path-C would start in Part 4, then proceed to Part 3, Appendix-A/Part-2 and finally Appendix B. (This path might leave the reader on tenterhooks about the nature and validity of the theoretical foundations of the entire edifice, covered in Appendix-A/Part-2. But some people enjoy the tension of leaving the whodunnit to the last chapter! Or, here, the last Appendix/Part combo!)

Technical Reading Pathways. Parts 2, 3, and 4 are each standalone papers, addressing a common topic from different viewpoints. Parts 3 and 4 depend on Part 2's content, but this content can also be accessed via Appendix A (which is an abbreviated version of Part 2). Three illustrative pathways A-B-C are shown here, starting respectively at Part 2, Part 3, and Part 4. Path-A starts with theoretical foundations of consciousness science, Path-B with experimental resolutions of the foundational crisis in consciousness science (and science more generally), and Path-C with the foundations of physics. (Grey boxes offer an *indicative* matching of papers/paths with various academic disciplines/interests.)



Printing Guide: Duplicate Content

Paper is trees, ink is oil, and they're both energy and therefore climate change! (Well, maybe not: but this is how I think about it.) If you have an electronic copy of this book, please consider the environmental impact of printing it out. Because of its unusual modular design, this book does contain some duplication. (Most bigly, Part 2 and Appendix A overlap widely: see the *Reading Guide: Technical Content*. Please choose and print just one!) Having an awareness of where duplication occurs can help avoid unnecessary printing.

The following tables cross-index multiple appearances of the same Figure in Parts 2 to 4, and Appendix A. Although the 'legend' (text accompanying the Figure) does sometimes vary a little across different occurrences, it's broadly safe (with a little cross-checking insurance) *e.g.* to print out Fig. 1 from Part 2, and use that print-out in conjunction with text from Parts 3 and 4. (And Appendix A. But of course you didn't print *both* Part 2 and Appendix A. Because of their major overlap!)

There are 54 occurrences of Figures in the technical sections of the book. *But only 24 unique appearances.* So there's the opportunity to save 30 color-pages, by conscious application of this data!

Part 2 Figures Appearing in Parts 3 and 4, and Appendix A

Title	Part 2	Part 3	Part 4	App A
Schematic overview of the target of the meter-Hamiltonian argument.	<i>Fig. 1</i>	<i>Fig. 1</i>	<i>Fig. 6</i>	<i>Fig. Z1</i>
The role of meters in conventional and conscious-experiential research.	<i>Fig. 2</i>	-	-	<i>Fig. Z2</i>
Schematic overview of the logical flow of central (meter-Hamiltonian, level-0/'proper') reasoning.	<i>Fig. 3</i>	-	<i>Fig. 9</i>	<i>Fig. Z3</i>
Symbols <i>outside</i> conscious-experiential science properly refer to unseen (not-experienced) physical order.	<i>Fig. 4</i>	<i>Fig. 6</i>	<i>Fig. 3</i>	<i>Fig. Z4</i>
Schematic illustration of two competing theories-of-conscious-experience (theories I and II).	<i>Fig. 5</i>	-	-	<i>Fig. Z5</i>
Neural-correlates approaches cannot arbitrate between theories I and II under orthodox dynamical-closure and U2-information-transmission constraints.	<i>Fig. 6</i>	<i>Fig. 3</i>	<i>Fig. 7</i>	<i>Fig. Z6</i>
Synthetic-lesion experiments cannot provide in-experiment data that publicly informs consciousness research, under orthodox dynamical-closure and U2-information-transmission constraints.	<i>Fig. 7</i>	<i>Fig. 4</i>	<i>Fig. 8</i>	<i>Fig. Z7</i>
Neural-correlates approaches cannot arbitrate between theories III and IV that relax U2-constraints on information-transmission, under orthodox dynamical-closure.	<i>Fig. 8</i>	-	-	<i>Fig. Z8</i>
Basic symbolism for conscious experience is physical-theory-analogous and ontologically-general.	<i>Fig. 9</i>	-	-	<i>Fig. Z9</i>
<i>Every</i> basically-coherent naturalistic theory-of-consciousness can be given succinct <i>metaphysically-neutral</i> statement via present symbolism.	<i>Fig. 10</i>	-	-	<i>Fig. Z10</i>

Phenomenon-symbol approach coheres with the methodological foundation of physical theory.	<i>Fig, 11</i>	-	<i>Fig, 4</i>	<i>Fig, Z11</i>
Symbolism for hierarchy of scales in the visual environment.	<i>Fig, 12</i>	-	-	<i>Fig, Z12</i>
Chalmers’ ‘error report’ solution to verifying report-reliability cannot rescue D4-orthodox science.	<i>Fig, 13</i>	<i>Fig. 9</i>	-	<i>Fig, Z13</i>
Problems for D2-scientifically-reliable definition of conscious experience under D4-orthodox dynamical-closure; no problems under D7- $\langle s \rangle$ -label-coupling.	<i>Fig. 14</i>	<i>Fig, 5</i>	<i>Fig. 11</i>	-
Exteroceptive audio-visual experience is <i>still</i> private (although perhaps not ‘ <i>as</i> private’ as thoughts-and-feelings).	<i>Fig, 15</i>	-	-	-
The unfolding argument does <i>not</i> rule out <i>all</i> D4-orthodox-dynamical causal-structure theories, because it doesn’t apply to D4-non-algorithmic possibilities.	<i>Fig, 16</i>	<i>Fig. 8</i>	-	-

Remaining Part 3 and Part 4 Figures (*not* in Part 2/Appendix A)

Title	Part 2	Part 3	Part 4	App A
Four variants or ‘levels’ of the meter-Hamiltonian argument.		<i>Fig. 2</i>	<i>Fig. 10</i>	
Exteroceptive audio-visual experience is surprisingly comprised of <i>multiple, private</i> , instances.		<i>Fig. 7</i>	<i>Fig, 2</i>	
Idealized experiment to arbitrate between orthodox-dynamical-closure and virtue-of- $\langle s \rangle$ -coupling.		<i>Fig. 10</i>	<i>Fig, 13</i>	
Different brain-coupling scenarios for conscious experience and (hypothetical) non-algorithmic computation.		<i>Fig. 11</i>	-	
The meter-Hamiltonian arguments induce deep interdisciplinary changes, and changes for the whole of science.		-	<i>Fig. 1</i>	
Conventionally-interpreted data-collection in <i>not</i> -conscious-experiential-science uses conscious experience, and is therefore subject to privacy concerns.		-	<i>Fig, 5</i>	
Various trajectories for physical theory, according to choice of target-phenomena and dynamical regime.		-	<i>Fig. 12</i>	
$\langle s \rangle$ -coupled-reality opens an array of new frontiers for physics and science-as-a-whole.		-	<i>Fig, 14</i>	

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Part 1	Fig. 4
Part 2	Fig. 2, Fig. 4, Fig. 9-11, Fig. 15
Part 3	Fig. 6-7, Fig. 10-11
Part 4	Fig. 2-4, Fig. 13
Appendix A	Fig. Z2, Fig. Z4, Fig. Z9-Z11, Fig. Z15

Index, Errata, and Other Stuff

Index

In the internet era, it's probably more helpful to give readers an electronically-searchable resource, than to create an index of terms that may or may not include a specific item-of-interest. Purchasers of the print copy can order a PDF at <http://www.cfdis.org/books/fgtt/freePDFcopy>.

Errata

I maintain a list of known mistakes, misprints, *etc.* at <http://www.cfdis.org/books/fgtt/errata>.

Please let me know if you find anything I should add to this list! (Contact details on first pages of Parts 2 to 4.)

Other Stuff (1): More on 'Science and Society'

If you're interested in the 'implications for society' angle of this book, I have three related initiatives that you might want to check out:

www.liveyourdeepestself.com: transformational coaching for high-rational folks. (If you're skeptical about the relationship of personal transformation to the future of science and society, please see Appendix C, especially subsection 4.1!)

www.thebigfivecourses.net: the future of civilization, in five bite-size pieces!

www.knowledgemysteryproject.org: a community of enquiry, at the leading edge of human capacity.

Other Stuff (2): The Shortest-Possible Presentation of Meter-Hamiltonian Logic

If you're primarily interested in the scientific reasoning at the heart of Parts 2 to 4 (*i.e.* 'the meter-Hamiltonian argument'), the most succinct (thirteen page!) but technically-complete presentation can be found in:

'True Consciousness Science Requires Strongly Dynamically-Unorthodox Physics', available at <https://psyarxiv.com/v9yrp/> (and at <http://www.cfdis.org/papers/trueSci>).

For a ten-minute video presentation introducing and summarizing this paper, please see <http://www.cfdis.org/papers/trueSci/video>

Part 1.

Overview:

Gödel-like theorems for dynamically-conventional biophysical science, and experimental resolution of the resulting scientific crisis

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1. Is There an Emergent Crisis for Science? What Is Its Origin?

1.1 An Orienting Imagination

Imagine two Systems, built on a common ground (Figure 1). Each system has its own foundations, but they also share a common under-structure. Say there is a crack in this common foundation, which extends into both systems. Say that in System-1, the crack in its own foundation remains there, as a subtle fracture, hidden from sight. In contrast, in System-2, the crack is amplified, and becomes the source of a tornado. (This *is* an imagination, after all!) And now the tornado attacks System-1. Finally, *imagine* that these Systems are *thought*-systems, and that large groups of people use System-1 or System-2 as their natural, default, thinking-mode. (In actual human activity, things are of course more complex! This imagination only presents a crude, orienting, model, in order to introduce the work presented in this book. In reality, there are more than two systems. And we can't typecast actual people into those who solely use a specific system, for example, *only* System-1 or *only* System-2.)

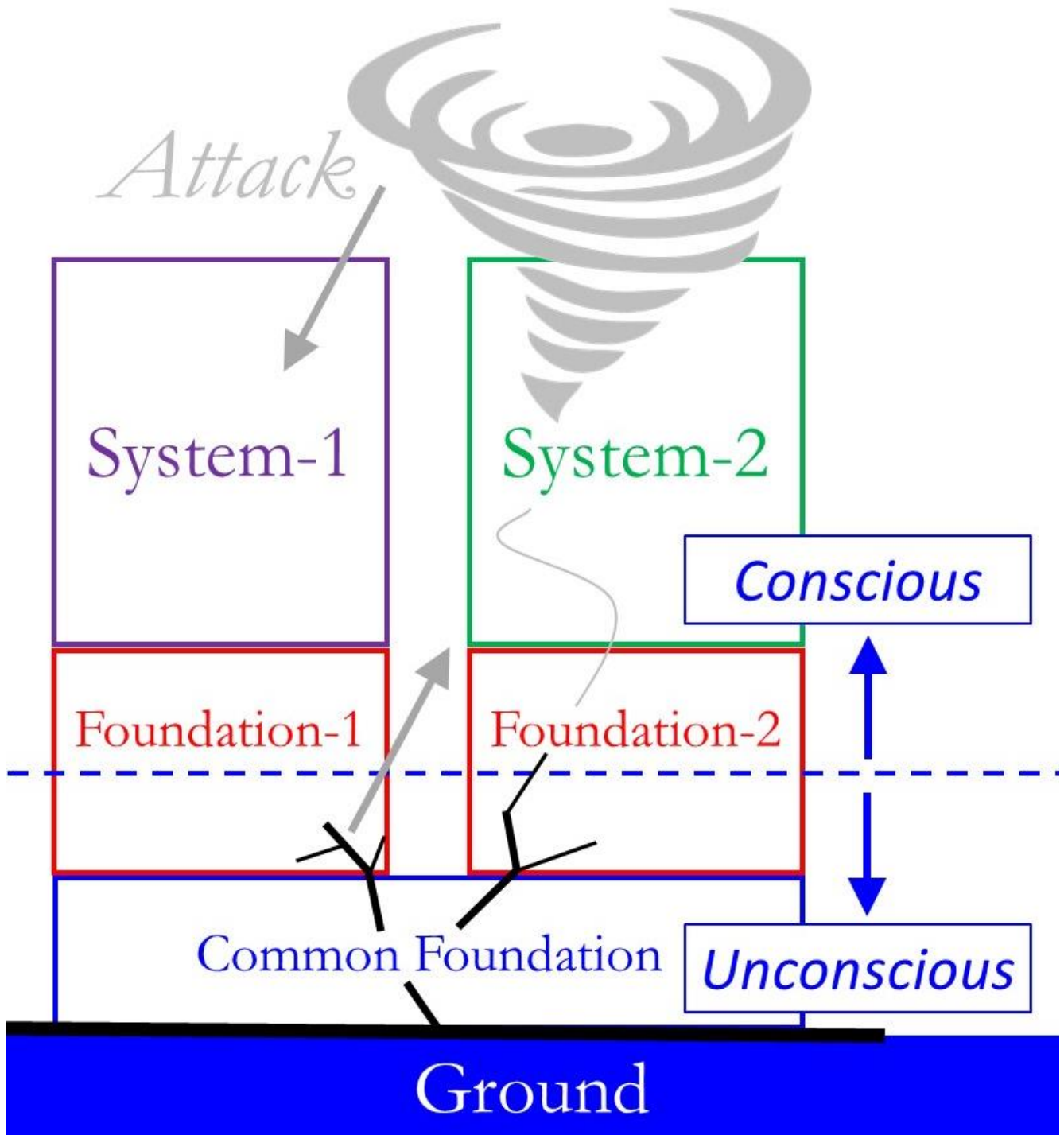
The System-1 tribe can only see the tornado coming from the System-2 folk. They can't *fully* see its immediate origin, in the crack in System-2 foundations. They can't see the crack in the common foundation, *at all*. And they don't *currently* see the crack in the foundation of their *own* thought-system.

The System-2 folks are in a similar position. They have a sort of intuitive sense that something is *very* awry with System-1, with potentially huge consequences. (This is their version of System-1 thinkers 'seeing the huge tornado'.) But they can't explain exactly what it is that *is* awry. They certainly can't explain it in terms that System-1 adherents can even begin to comprehend. This intuitive sense plays a role in perpetuating the tornado: it gives some kind of justification for the attack. Just as for the System-1 tribe, however, System-2 adherents can't *currently* see that their own system also suffers from foundational problems. And they definitely can't see fault-line in the shared foundation.

As you probably read the book's title before getting to this *Overview*, it's likely no surprise that System-1 and System-2 are meant to illustrate the configurations and sociopolitical activities of mainstream science, and the post-Truth, 'fake news', movement. Perhaps it's also apparent that I mean for System-1 to depict mainstream science, and for System-2 to symbolize post-Truth. (I must state once again that this picture is a very crude approximation of my view. I could write a whole book disambiguating various real-world nuances that are glossed over in Figure 1's sketch. The only clarification necessary at this point is that neither science nor post-Truth – in the more general form of pluralism or certain kinds of postmodernism – need *necessarily* exist in fractured-foundation form. There is an *unfractured* science – it's just not the mainstream form we have now. There is an *unfractured* pluralism – it's just not the mainstream form we have now. Because this book is already *very* long, I'll refrain from further amplification.)

There's one key detail in Figure 1 (the grey arrow emerging from System-1's foundation) that I haven't expressed yet in the verbal description so far. And that's that System-1 (science!) also attacks System-2, but in a very very subtle way. When System-1 denies its own foundational flaws, it's prone to

Figure 1. Two Systems, Foundational Fractures. System-1 and System-2 stand on a single ground. They share a common foundation but also have their own system-specific foundations. A fracture between the ground and the common foundation spreads into the shared foundation, and from there into the system-specific foundations (black lines). The fracture in the System-1 foundation leads to a covert, base-level attack on System-2 (grey arrow). The fracture in the System-2 foundation leads to an overt, tornado-style attack on System-1 (grey vortex!). Almost all fracture-structure is hidden from typical conscious awareness (*i.e.*, that structure lies below the dashed blue-line), whereas attacks themselves are consciously witnessed (above the dashed blue-line).



claiming a sort of *completeness* that denies System-2 *any* basic validity. Post-Truth is related to postmodernism and pluralism, both of which question mainstream science's claims to (in-principle) complete explanation of natural phenomena. In fact, this kind of questioning is the quintessential, almost-definitive, quality of pluralism writ large. Failing to see its own foundational crack, mainstream science cannot see any reason why it can't be complete, *more-or-less in its current structural form*. (The issue of structural form is crucial, and will become a central focus, via the topic of dynamically-conventional and dynamically-unconventional forms of science. There *is* no reason why a science that's prepared to examine and if necessary reinvent itself can't achieve a *kind* of completeness. But science's resistance to examination and reinvention – despite its own frequent and strident claims to the contrary! – is at the heart of ongoing System-1/System-2 conflict.)

The reason for this book is to help System-1 (science!) see the crack in its own foundation. Remarkably, when this fracture is acknowledged and repaired, System-1 can move on to a vastly bigger and more significant expression: repair leads to massive growth, not restoration of the previously-perceived *status quo*. Put differently, even if science doesn't care about responding to post-Truth's implicit communications about fractures, it should care about its own foundation, if not from a concern for integrity, then simply from an enlightened self-interest in realizing its own future potential!

Without recognizing the shared/system-specific foundation-structure, and without any appreciation of the fractures in both shared *and* system-specific foundational levels, inter-System conflict looks like this *to both sides*. 'I simply can't understand why they do what they do, and why they say what they say. Can't they see? We just need to redouble our efforts to assert our view, in the hope of a victory in which *they* eventually submit to *us*.' At best, it's 'Can't they see the foundational flaw in *their* system?'

1.2 Clarifying the Misperceptions of the Healing Mirror

When I offer mainstream science a mirror in which its fundamental fracture can be seen, the response is often as if I am a post-Truth adherent, trying to tear down science. It appears that people only see me pointing the finger at science, and doing that from an anti-science, pro-post-Truth stance. This is a mistake in three directions. First, I'm not anti-science. I *am* against a fractured science claiming it has no fractures! I'm *so* for a fracture-free science, stepping into its unspeakably-extraordinary future! Second, I'm not pro-post-Truth. I *am* an ardent advocate of a fracture-free pluralism, mediating the pristine interplay of different worldviews. And I'm an equally ardent critic of dark, destructive, distortions of the postmodern stance (such as: post-Truth!). Third, reflection-of-fact in service of a better future for everyone is not finger-pointing! Appropriate attribution of responsibility is not blaming: it's part of authentic learning and growth. There *is* a fracture in the foundation of modern mainstream science, and it *is* the responsibility of science and scientists to fix it.

In a parallel fashion, mainstream science could start to view the post-Truth attack not *simply* as an irrational attempt to destroy, using irrationality. (There is undoubtedly irrationality in the post-Truth movement. But is there something more? Can science see beyond the irrationality, to the gift?) Mainstream science could start to investigate the possibility that attack is a best-efforts attempt to help science see its own fracture. (Not everyone involved in post-Truth is working on a best-efforts basis, *of course*. 'Helping to see' may not even be consciously recognized as a clear intention by 'post-Truthers' themselves. Nevertheless, is there an authentic communication to be found, somewhere in there?) This book offers a complete approach for scientists willing to explore these paths, ending in a three-step resolution of the fracture and the problems it causes (A1-A2-A3 in Part 5, page 49).

Naturally, post-Truth needs to go through a similar process of self-reflection, healing, and growth. But this is not the book for that. [Some steps in that direction can be found in (Wilber, 2017).] Certainly, a post-resolution science (that has implemented steps A1-to-A3 in Part 5) will be a much more powerful catalyst of post-Truth's own fracture-healing process. To use an interpersonal analogy, I help my relational partner much more effectively from a place of empowerment and understanding, than I do from a place of feeling threatened, and of not fully understanding the source of conflict either in myself or in the other. (Even this book's detailed presentation of the A1-to-A3 resolution for science doesn't give a *full* understanding, however. In Figure 1's depiction, it is limited to an understanding of the fracture in *System-1's* foundation. It doesn't investigate the analogous fault-lines in System-2. And exploration of the deeper common source of systemic fractures, for example in the separation between the common foundation and the ground, awaits the resolution of System-1/System-2 issues. A joint System-1/System-2 approach is ultimately called for. But this cannot take place constructively against a background of swirling conflict.)

To explicitly point to the need for post-Truth to set its *own* house in order, Part 5 reworks the three-step resolution from its science-centric form (A1-to-A3), to a society-centric form (B1-B2-B3, page 50). As well as declaring a balanced call for self-examination to include both 'sides', the B1-to-B3 form also points to the need for *relational* healing, after science and post-Truth resolve their *respective* foundational issues.

1.3 The Source of Crisis, in a Single Sentence

So what is 'science's emergent crisis', referred to in the title of this book? As noted in the Preface, it's *not* actually the science/post-Truth conflict (Figure 1's tornado and the grey attack-arrows). That's the *current* crisis, which takes place in a *societal* context. The *emergent* crisis comprises the problems for *science* alone, as it starts to examine fractures in its own foundations. (In Figure 1, this corresponds to System-1 extending conscious awareness down into the foundational arena, below the dashed blue-line.)

Why do I use the term 'emergent' to describe the process of uncovering science's fundamental fault-lines, and their implications? If the crucial material is currently beyond science's awareness, wouldn't 'hidden' be a better term? This book *is* the first detailed, rigorous accounting of foundational issues (and the first account of *any* kind of how to resolve them). But it builds on *previous* informal accounts of problems in *consciousness* science (which turn out to be pivotal). [See, for example, (Cohen & Dennett, 2011; Elitzur, 1989; Phillips, 2018; Rudd, 2000; Wilkes, 1988).] And problems are starting to *emerge* in fields other than consciousness science. Notably, there seem to be problems when quantum theory tries to look at quantum theory (Frauchiger and Renner, 2018), which is strikingly consistent with this work's theme: science must examine science, and resolve the collection of problems that then emerge – a collection which turns out to be crisis-scale!

What is the detailed nature of this emergent crisis? And what precisely are its origins? What *are* the System-1 fractures, pointed to in Figure 1? The rest of this book is concerned with answering these questions (as well as with the issue of *crisis-resolution*). However, there is a one-sentence summary-answer to the origin question: mainstream science in its current form *can't* explain or even talk *about* consciousness (Parts 2 and 3), so it can provide no basis or justification for the activities of science that *depend crucially on* consciousness – which is almost all of them (Part 4)! Sections 2 to 7 below unfold this issue (and its resolution!) in a little more detail, in the process providing an outline sketch of the

rigorous technical treatment in Parts 2 to 4. Section 8 returns briefly to the sociopolitical significance of this work, introduced in this section, previewing the parallel revisit in Part 5's *Afterword*.

2. Gödel-like Theorems for Dynamically-Conventional Biophysical Science

In the *Preface*, I shared my struggles with the choice of title – and content! – for this book. Instead of going for a purely-technical monograph about consciousness science and scientific foundations, the choice I ended up on included Trump, ‘fake news’, and post-Truth. The *Preface*, sections 1 and 8 of this Part's *Overview*, and Part 5's *Afterword*, all speak to the choice to include these topics.

Perhaps the most straightforward title/content mix I considered was ‘The meter-Hamiltonian argument for consciousness science (and its implications for science and its place in society)’. (As I'll explain later in this Part's *Overview*, the ‘meter-Hamiltonian argument’ is the core technical thread of the work presented in this book. It concerns the use of verbal-report-of-experience as a sort of ‘consciousness meter’. And it analyzes this *specific* ‘meter’ using the Hamiltonian formalism from mathematical physics, which is the rigorous foundation for the *generic* use of meters, or measuring-devices, in science as a whole. Hence: ‘meter-Hamiltonian’ reasoning!)

So – for example, relative to the ‘meter-Hamiltonian’ title-possibility – where did *Gödel* come in? In this section (*i.e.* section 2 of Part 1), I explain the headline billing of Gödel, which – on a first reading even of the complete technical content of Parts 2 to 4 – might seem puzzling, gratuitous, or perhaps just misleading.

Those interested in the study of mind, consciousness, and intelligence will likely have come across various heated debates concerning what (if anything!) Gödel's work has to tell us about human cognition. As I explain further below, *the connections I make between meter-Hamiltonian reasoning and Gödel are quite unlike any contained in previous analyses*. (Largely, this is because meter-Hamiltonian reasoning is quite unlike any previous analysis!) Nevertheless – as I will also explain! – I do see a hazy future potential for a *convergence* of *previous* Gödel/mind explorations, and *Gödel/meter-Hamiltonian* connections made here. Again unlike prior analyses, this work suggests that the ultimate key to clarity and resolution concerning alleged Gödelian-implications for mind (and even reality) may be via Part 3's *experiments*, rather than by further philosophical and theoretical debate. Of course, there's a certain amount of theoretical groundwork that's necessary, to make the case for any experimental program: in part, illuminating (novel!) Gödelian connections with the meter-Hamiltonian work is intended help the interested reader make sense of that theoretical context, and move us collectively towards Part 3's meter-Hamiltonian experiments.

2.1 Background: Gödel's Incompleteness Theorems

In the early 20th-century, Austrian logician Kurt Gödel famously proved two incompleteness theorems, concerning the limits of provability in mathematics (Raatikainen, 2021). At the time of Gödel's work in this area, the German mathematician David Hilbert was trying to address a foundational crisis in mathematics, by establishing a complete and consistent set of axioms (or starting assumptions) for all of mathematics (Zach, 2019). It's generally (although not universally) agreed that Gödel's incompleteness theorems show that Hilbert's program is impossible. (One reason for the lack of universal agreement is that there's a lack of universal agreement about what exactly Hilbert's program

was. But pop-science claims, such as ‘Gödel showed mathematics can never have a sound foundation’, are definitely wildly overdone. For example, this wasn’t Gödel’s *own* view of his work’s implications!)

At a minimum, Gödel’s theorems are a major contribution to the study of the foundations of mathematics. (Gödel proved a lot of different theorems! For brevity, ‘Gödel’s theorems’ in this book means ‘Gödel’s *incompleteness* theorems’.) And, as we’ll explore briefly later, these theorems have also been taken to establish or suggest a number of different things about the capacities of the human mind. Some philosophers have extended this kind of analysis to what Gödel’s theorems might imply for science, as a mind-based enquiry into reality.

So what are these theorems all about?

Gödel himself related his proofs to the famous liar paradox (Gödel, 1931), sometimes encapsulated in the statement ‘this sentence is false’. There are (at least!) two ways of looking at this sentence. One creates an endless sequence of contradiction: ‘true means false’, ‘false means true’ *etc.* Another way terminates this endless chase, saying the sentence is *neither true nor false*: it can’t be true (for then, as it asserts, it is false); nor can it be false (for then, it is true). I’d encourage you to take a moment to sit with two distinct subjective experiences, which these two frames often evoke. One offers the prospect of a frenzied and interminable series of conflicts, *rolling forward in time*. The other takes the energy of the first and converts it instead to a conflict-free *deepening of presence, now*. (I’ll return to these two frames, and their associated experiential character from time to time, as this section proceeds.)

Gödel’s theorems center on a particular statement or ‘sentence’ G_F , in a formal mathematical system F with certain minimal qualities. G_F is analogous to the liar-sentence, when the issue of ‘truth’ is replaced by ‘provability’. G_F essentially states that ‘ G_F is not provable in F ’. (Here ‘provable’ means ‘mechanically provable’, *i.e.* we can put together a step-by-step proof leading from F ’s axioms to G_F . Something can be true but not provable-in-this-sense within a given system.)

Consider what happens if G_F is provable. A provable statement is true (crucially, *if* the system it’s proved in is consistent)! But the content of true- G_F is that G_F *isn’t* provable, leading to a contradiction.

Now consider the negation of G_F : ‘it’s not true that “ G_F isn’t provable in F ”’. Let’s call this H_F . If H_F is provable (in a consistent system), then it’s true. But the content of H_F is that G_F *is* provable in F . So if H_F is true, G_F is provable, and we end up right back in the contradiction of the immediately-preceding paragraph.

Gödel then reasoned roughly as follows: *if* reasoning in F doesn’t lead to contradictions (which is the same thing as saying that F is consistent), then neither G_F nor its negation are provable in F . (Because we considered both cases in the two preceding paragraphs, and in both cases provability led to contradictions.) In summary, if all the conditions we’ve collected along the way hold: the truth or falsity of G_F is *undecidable* in F .

(Technical aside: to avoid popular misinterpretations of both reasoning and implications, it’s important to note that ‘true’ and ‘provable’ in mathematical logic are *not* the same thing. If axioms are contradictory – sometimes in very subtle and non-obvious ways! – it’s possible to prove *both* a statement *and* its logical negation. Then, obviously, truth and provability have diverged! Another way of saying ‘ X is provable in F ’ is ‘ X is-a-theorem-in- F ’, a *theorem* being something that has been stepwise-established, starting from axioms. A more accurate version of the somewhat-loose synopsis

so far carefully distinguishes ‘truth’ from ‘is-a-theorem-in-a-system’. Notably, in the negation sub-reasoning, the statement of H_F as ‘it’s not true that $G_F\dots$ ’ becomes ‘it’s a theorem-in- F that “ G_F is provable in F ”’. Technically, this is *quite* different from *directly* asserting ‘ G_F is provable in F ’: we don’t know that the theorems F proves are always reliable! This point originally led to Gödel basing his arguments on something called ω -consistency, which is stronger than ‘simple consistency’ – which is in turn ‘reasoning in F doesn’t lead to contradictions’, as per the first sentence of the previous paragraph!)

The undecidability of G_F *does* more-or-less follow from the basic logical analysis of its character given so far (subject to technical nuances of the kind pointed to in the previous paragraph!). But this kind of analysis *by itself* doesn’t prove ‘any mathematical system that doesn’t lead to contradictions has undecidable statements’ (which is roughly Gödel’s ultimate conclusion). That only follows *if the system can write or state* the sentence G_F ! Without that, it’s a bit like saying ‘I’d be the next Camus ... *if I could speak French!*’. Gödel’s genius was to show that a G_F -sentence actually *exists in* any mathematical system F of a certain minimal character, thus *then* establishing that undecidable statements always exist in such systems – G_F being one such statement! It’s always possible to go to a ‘bigger’ system, F' say, where either proof or refutation of G_F can be established. But then there’s *always* a new Gödel-sentence, $G_{F'}$ say – which is itself undecidable *in F'* !

The implications for Hilbert’s attempt to create a complete, consistent, set of axioms for *all mathematics* can be put like this: Gödel proved any system of axioms (of a minimal character) can never be based on itself – statements from outside the system must be used in order to prove its consistency. (This is actually Gödel’s *second* incompleteness theorem, which follows from the first one outlined above, concerning undecidable statements.) ‘Minimal character’ throughout includes ‘the ability to embed basic arithmetic’. So one way to avoid incompleteness (the first theorem) and un-self-provable–consistency (the second theorem) is to leave out basic arithmetic – *e.g.* the integers! But that’s a pretty compromised sort of ‘mathematics’, to say the least! For Hilbert’s program, we could headline all this as ‘mathematics including the integers can’t prove its own consistency *if the reasoning-basis of mathematics satisfies the conditions for Gödel’s theorems.*’ Nevertheless, despite pop-science headlines, this does *not* mean ‘mathematics will never be able to establish its own consistency’: it simply means that to do so, it would have to use what we could call ‘trans-Gödelian reasoning’!

2.2 And the *Practical Significance* is ...?

This may all be very (intellectually!) interesting. But we might also wonder, what is its practical significance, in a world of starvation, poverty, climate change, and societal conflict? Bluntly: why should we care about issues in the foundations of mathematics?

To follow just one track in answer to this question, take *abuse* of Gödel’s results. For example, consider this Gödelian non-sequitur: ‘if we can never establish that *mathematics* – the temple of logic! – doesn’t lead to contradictions, we can’t really know *anything*, can we?’. (As noted at the end of the previous sub-section, Gödel did *not* show ‘never’!) Reasoning of this and similar kinds (Sokal & Bricmont, 1999) has been part of the foundation of destructive postmodernism (System-2 in Fig. 1, roughly speaking). Of course, Gödelian distortions are just one part, and a small one at that. And I’m not advocating a naïve strategy of ‘educating the post-Truth folk in Gödelian nuances, to take the wind out of “fake news” sails’! (But I *am* suggesting that following through on valid critiques buried in post-modernism *can* and *will* lead to a science and a society that’s immune to destructive distortions. And,

as I'll say shortly, the *ultimate target* of that follow-through can, astonishingly, be related to foundational issues in mathematics.)

On another track, Gödel's work *did* lead to a number of closely-related, fundamentally-significant results in the theory of computation and computability, in the work of Turing, Church, Chaitin and others (Church, 1936; Turing, 1950; Chaitin, 1974). Given that this body of a work *as a whole* was pivotal in the emergence of digital technology, we could say the modern world has *already* been impacted by Gödel. But it's also fair to say that we can't really trace the existence of the internet (to choose just one digital-landmark), in any *direct* way, to his incompleteness theorems!

If we keep going along the digital-society track, however, we do hit a *potential, future, direct* impact of Gödel's theorems. This lies in the connection between his work, and theories (and at some point perhaps, technological *practice*) in the realm of mind, consciousness, and intelligence. Specifically, and perhaps very surprisingly, Gödel's theorems have been related to the question of whether a machine (a modern digital computer, for example) can ever be artificially 'intelligent'. Going back to Figure 1's foundations of conflict, I suggest fiery attacks on science from without are powerfully fueled by the assertion from some subset of modern science that 'humans are just machines' (and therefore that artificial intelligence is a real possibility). Of course, some subset of modern *scientists* will assert 'it's a *fact* that humans are machines, so there's nothing to be done about that'. The rest of this book offers in return that crucial attributions such as 'machine' must be well-defined, that well-defined facts are amenable to experiment, and that things in general are *far* less clear than mainstream science is prone to assert.

To bring this back to Gödel, the *machine-like* character of *humans* at issue in these debates can be related to step-by-step *mechanical* proof, starting from axioms, in *mathematics*. As I'll come to, there's a remarkable *experimental* program (outlined in Part 3 and introduced in various places in this Part's *Overview*), that can gather *data* on whether humans *are* only capable of this kind of mechanical activity, or whether they can in fact go beyond it. But before getting to this *experimental* investigation of the humans-are-machines hypothesis, let's briefly look at how *theoretical* arguments have tried to relate Gödel to machine-like and beyond-mechanical intelligence.

2.3 Gödel in Mind/Consciousness/Intelligence Contexts

The relationship between Gödel and the mind/consciousness/intelligence domain has been explored by Putnam, Lucas, Hofstadter, and Penrose, amongst others (Putnam, 1960; Lucas, 1961; Hofstadter, 1979; Penrose, 1989). Very briefly, one central issue here concerns whether humans have a 'non-algorithmic' capacity. If they do, then that capacity puts human intelligence beyond the reach of necessarily *algorithmic* computers. (At least, all current silicon computers are necessarily algorithmic. A 'non-algorithmic' capacity or action performs a task *without* using a mechanical recipe, whereas every silicon computer *only* uses mechanical action. It doesn't matter if it's neural networks or deep learning or whatever: on a conventional silicon-based computer, *all* these things are algorithmic, *including* so-called 'artificial intelligence'.)

What is the relationship between the non-algorithmic human possibility, and Gödel's work? Recall that Gödel's theorems concern provability, which specifically means step-by-step, mechanical, *algorithmic*, proof, starting from a mathematical system's axioms. The first theorem says (for the right kinds of system!), 'there are always mathematical statements that can't be mechanically proved in the system,

and whose negation can't be mechanically proved, either'. (That is, we can neither prove nor refute these statements in the mechanics of the system. So, they are *undecidable*.)

Clearly, then, Gödel's work considers a kind of algorithmic capacity. Where does the 'non-algorithmic' come in?

Consider what I call the 'Lucas/Penrose argument' (Lucas, 1961; Penrose, 1989), which goes *something* like this, in its simplest form: 'Humans can "see" the truth of the Gödel-sentence G_F . That is, they can "see" that it's "true" that G_F can't be proved in F . Since – by Gödel's first theorem – this proof *can't* be achieved algorithmically (in F), humans must be capable of non-algorithmic action!' If this reasoning held together logically, it *would* indeed be a beautiful and paradigm-shattering result! For example, it would put human intelligence always and forever beyond the reach of merely-algorithmic computers. Those of us who yearn for reality to hold a meaning-beyond-mechanism are perhaps tempted, therefore, to shout this reasoning from the rooftops. Sometimes, though, the strength of such yearnings may lead us to forego required due-diligence ...

Sadly, perhaps, this first-pass version simply does *not* hold up. For example, it's not *sound* to reason ' G_F must be true, because if it were false, that would be a contradiction – and only us non-algorithmic humans can reason like this, and see that!'

For one, the *ordinary everyday* true-false contradiction appealed to here isn't sustainable in the innards of mathematical logic. (See the technical aside in subsection 2.1 for an entry-point into this. Substituting 'theorem-in- F ' for 'true' as we then have to in ' G_F must ...' above, we get ' G_F must be a theorem-in- F , because if it were not, that would be a contradiction'. But actually '*being a theorem-in- F* ' does contradict the content of G_F ! We can't escape contradiction with loose true/false handwaving!)

For another, if G_F is 'true' (a theorem of some consistent system) ... then it *can* be proved *algorithmically*, in *that* system! (No non-algorithmicity required! One possibility is that humans are examples of this system, necessarily distinct from F . Then human-seeing *doesn't* establish non-algorithmic human capacity.)

And for a third strike: in the most general mathematical case, it need not even *be* the case that G_F is 'true'! (For example, sometimes we can extend F so that G_F is *false*.) In this case, given that it has assigned truth to something that may not be true, this alleged human non-algorithmic superpower isn't reliable! (A more complete review is given in subsection 2.6.4, where it's pointed out that the *truth-or-falsity* of G_F is *synonymous with* the *consistency-or-inconsistency* of F . So, informal "seeing of G_F 's truth" is just plain wrong, unless it's informal seeing of F 's *consistency*, which is a *huge* and different matter ...)

Suffice to say, these kinds of critique of the first-pass non-algorithmic-human argument have led to second- and later-pass refinements, leading to further critiques, and so on. One point of ongoing contention concerns the larger system F' in which the actual status of G_F is actually (correctly!) resolved. If the human 'machine' is *just an implementation of F'* , then (correct!) human resolution could just be algorithmic. If the human machine is 'less than' F' , then human-resolution *could* be non-algorithmic. Equally, it could just be lucky guessing, from an inconsistent and error-prone system! Debates continue. (And many parties to many conflicting sides believe debates have been decisively resolved in their favor. Obviously, they can't all be right ... if reality itself is non-contradictory!)

2.4 Penrose and Quantum-Brains: *Nothing to do with Meter-Hamiltonian Logic (But ...)*

Somewhat famously, Nobel Laureate Roger Penrose has argued for the existence of non-algorithmic action in the human brain, based on the human capacity to do certain things, notably (but not exclusively) various kinds of Gödel-related math (Penrose, 1989). In the previous subsection, I offered the view that the Gödel appeals are at best an unresolved controversy.

Penrose uses the argument for human non-algorithmicity to reason further that there must be a quantum-mechanical component in human intelligence. Further still (in conjunction with Stuart Hameroff), he has proposed a specific neuro-biophysical substrate for this quantum-mechanical brain-action. The Penrose/Hameroff approach suggests that microtubules, a specific component of a cell's 'skeleton', are where the quantum-mechanical, non-algorithmic, action takes place.

Let's briefly look at these two 'further' steps, into quantum intelligence and its microtubule-implementation.

The reasoning from a (hypothetical) non-algorithmic mathematical capacity to macroscopically-amplified *quantum* action is entirely logical, *in a given context*. That context is: everything in the human body either follows quantum or classical physics. Since classical physics (*e.g.* billiard balls bumping into each other) is mechanically-predictable (*including* dynamical chaos), the only logical dynamical substrate for *non-algorithmic* action is the quantum realm. This is watertight. But the *context* isn't: it needn't necessarily be the case that we have discovered everything about the dynamical order of the Universe. (In fact, the meter-Hamiltonian argument – section 5, later in this Part – forces us to consider new and exciting dynamical options!) Here, there is a third option, which is 'something beyond the quantum/classical divide'!

What about the microtubule suggestion? Of course, there are other places where non-algorithmic action could emerge. But making a definitive suggestion has the massive (scientific!) advantage of being amenable to experimental investigation. [And indeed experimental work is underway *e.g.* (Sahu, Ghosh, Fujita et al., 2014).]

Consider the Penrose/Hameroff reasoning in this form: 'Some forms of human mathematical activity may be consistent with non-algorithmic action. This would be non-classical, and therefore in principle detectable experimentally. One plausible locus for such action is in microtubules. Therefore, let's look there for non-algorithmic signatures'.

I find *this version* unobjectionable, in the sense that it doesn't have glaring logical flaws, and doesn't limit possibility-sets unnecessarily. (For example, it avoids asserting that non-algorithmic action must be quantum. It avoids over-stating Gödelian consequences. And so on. I call this version 'the generalized Penrose/Hameroff approach', to distinguish it from the 'Gödel must mean quantum' form.)

To be clear, Penrose's work is completely dissociable from the meter-Hamiltonian argument. The meter-Hamiltonian argument doesn't argue for or appeal to quantum-brain theories. (Nor does it rule them out. It's specific-brain-theory neutral. As explained in Parts 2 to 4, it applies to *all* theories.) It's true that Penrose uses Gödel to motivate his work, and that I draw analogical connections between Gödel and various features of the meter-Hamiltonian approach (subsections 2.5 and 2.6 below). But these two styles of 'connecting to Gödel' are *totally* different.

Nevertheless, there is a potential overlap between the Penrose/Hameroff school and the meter-Hamiltonian approach. This is not Gödelian, but experimental, in nature. The experiments suggested in Part 3 look for *dynamically-unorthodox brain-activity*. And it so happens that non-algorithmic action in the brain would *also* be detected in Part 3's experiments. (Section 3 of this *Overview* introduces dynamical orthodoxy/unorthodoxy, which are defined in technical detail in Part 2. Section 6 of this *Overview* reviews Part 3's experimental program.)

To disambiguate these two potential signals in a Part-3 experiment, consider the view that consciousness (notably in the form of conscious *experience*) and intelligence (in the form of reasoning capacity) are not obviously 'the same thing'. Although Penrose/Hameroff self-attributes a 'quantum consciousness' title, really a more appropriate label would be 'quantum intelligence': the argument is that the *reasoning activity* of the brain must (or might) take non-algorithmic turns. This would cause divergence from the kind of dynamically-orthodox brain-activity that is Part 3's benchmark. The meter-Hamiltonian argument is about the relationship between brain-activity and *conscious experience*. Dynamically-unorthodox behavior derived from this relationship could be *another*, distinct-and-distinguishable, divergence from the dynamically-orthodox benchmark.

In summary, the Penrose/Hameroff approach is one of a number of lines of reasoning relating Gödel and human cognition. Despite very real critiques that can be made of Gödel-related theoretical arguments *e.g.* in the Penrose/Hameroff approach, there is a plausible way of stating the *experimental* case. And despite the lack of *any* connection between Penrose/Hameroff and meter-Hamiltonian theory, Part 3's experiments may reveal signatures of *both* (generalized-Penrose/Hameroff) non-algorithmic intelligence *and* (meter-Hamiltonian) dynamical-unconventionality.

2.5 Overview: Analogies between Gödel's Theorems and Meter-Hamiltonian Arguments

Emphatically, there is *no* direct reference to Gödel's work in the technical developments of meter-Hamiltonian reasoning, in Parts 2 to 4. (There is one *indirect* reference, in a discussion of the Lucas/Penrose-interpretation, in Part 4. But the content of this discussion is to disambiguate 'consciousness' and 'conscious experience', not to base meter-Hamiltonian reasoning in any way on Lucas/Penrose-arguments, on Penrose/Hameroff, or on Gödelian results or implications.)

So, if you hate the *contextual* analogies I'm about to draw (mainly in subsections 2.6.1 to 2.6.10 below), that should have no impact on your view of the technical correctness of the meter-Hamiltonian work I'm about to 'analogize'.

If meter-Hamiltonian/Gödel connections are *not* fundamental – if meter-Hamiltonian arguments neither originated from Gödelian considerations nor depend on them – why am I going to such great lengths to explain such connections as there are?

There are two main reasons.

The first reason is as a warm-up, for what may *seem* to be paradoxical implications in technical meter-Hamiltonian reasoning. Some intermediate results in meter-Hamiltonian analyses put various parts of science into 'unknowable' status, and even put some technical terms into an 'unspeakable' category. If you're unfamiliar with Gödelian *undecidability*, these kinds of attributions may seem bizarre – *unscientific*, even. (Because some scientists recoil at connecting the word 'science' with foundational mathematics, the strategy of a Gödelian warm-up is not without its own risks! In the absence of any

solid strategic risk-assessment method, this just seemed the more-fun way to do some cognitive stretching...)

The second reason is to point towards a civilization-scale *future* in which a complex of inter-related issues are solved. Delineating future targets as precisely as possible can be a vital part of navigation, because they can be a sort of guiding-star in the darkness. Gödel *must* be mentioned in framing this target, because it includes resolving issues in the mathematics-of-mathematics, which was arguably his main concern. The meter-Hamiltonian argument also relates to this target, because the target includes resolving issues in the science-of-science, which is where meter-Hamiltonian implications hit hard. The third component of the target involves examining and perhaps transforming the *inner activity* of the mathematician doing mathematics, the scientist doing science, and the layperson ‘doing’ society. This controversial third-dimension is often left out of exploration at mathematical and scientific frontiers. As I briefly speculate in subsection 2.7, there are good grounds to believe that my own ‘inner clean-up’ – as a scientist, mathematician and/or society-member – maybe as or more important than the next great theoretical advance, or the next paradigm-shattering experimental observation. (See Appendix C for further commentary on the inner condition of practicing scientists.) In fact, *creating* these new theories and observations – and *recognizing* them for what they are, when they occur – may *depend* on inner hygiene and reconfiguration.

2.6 Parallels Between Gödelian Incompleteness and the Meter-Hamiltonian Arguments*

[This subsection is (more than usually!) optional, as denoted by the asterisk (*). One alternative reading-path is to jump ahead to section 2.8, read the rest of the book, and then return here. Analogies and parallels may then be more relatable. Some of the following sub-subsections also rely on some level of familiarity with the structure of Gödel’s proofs. So another useful reading detour might be to look at some of the excellent introductory expositions of his incompleteness theorems.]

This subsection highlights various parallels between Gödelian incompleteness and the meter-Hamiltonian arguments, in terms of reasoning-styles, conclusions, and broader implications-and-interpretations. These parallels justify the Gödel-*like* description of meter-Hamiltonian reasoning. Being Gödel-*like* is clearly not the same as being Gödel-*based*, which is the character of prior ‘Gödel-connections’ in the mind/intelligence/consciousness domain (e.g. Penrose/Lucas, p. 10).

Naturally, whereas Gödel’s theorems occur in the context of *mathematical logic*, meter-Hamiltonian reasoning concerning conscious-experiential science takes place in the *biophysical sciences*. Thus, the meter-Hamiltonian work establishes ‘Gödel-like Theorems for Dynamically-Conventional Biophysical Science’, as pointed to in the titles of both this Part and this section (*i.e.*, section 2)!

Where appropriate, this subsection (including subsections 2.6.1 to 2.6.10 below) emphasizes *differences* between the two bodies of work (Gödel and meter-Hamiltonian), as well as parallels. Sometimes, analysis simultaneously points out both parallels *and* nuanced distinctions that pertain within those very parallels.

2.6.1 The Big Picture Parallel*

Gödel uses the inherent properties of a mathematical system to show that something (the status of a particular theorem) can’t be decided, within that system. Nevertheless, in a larger system that something (theorem) may be decidable.

The meter-Hamiltonian uses the assumptions and structure of a particular form of science to show that something (conscious experience) can't be investigated, within 'that' science. Nevertheless, in a different (experimentally-validated) form of science, that something (conscious experience) may be investigatable.

2.6.2 Reflexivity Parallels*

Reflexivity concerns the act of self-reference (for example, as in p. 7's liar-sentence!).

2.6.2.1 Macro-reflexivity*

Gödel uses mathematics to study mathematics, in a very unusual way. A major innovation is new symbolism in which numbers can stand for mathematical statements.

The meter-Hamiltonian argument (in its Part 4 expression) uses science to study science. A major innovation is new symbolism in which standard-scientific-symbolism-for-physical objects is embedded in a new 'angle-brackets' symbolism, to stand for conscious experience of the object.

(Illustratively, if *chair* is a symbol in conventional physical theory, denoting a collection of atoms and molecules that make up a chair, $\langle chair \rangle$ is a symbol for conscious-experience-of-*chair*. See Part 2 for more details; ' $\langle chair \rangle$ ' is spoken as 'angle-brackets chair'. Obviously, it's not usual to state symbols *exactly* like *chair*, in science. But the conceptual status of such symbols, as synonyms or labels for collections of more-conventional symbols *e.g.* for atoms and molecules, should be clear and uncontroversial.)

2.6.2.2 Micro-reflexivity*

Gödel uses a sentence that refers to itself. More profoundly, in the workings of the proof for the first theorem, the reflexive sentence points to a statement-number that is shown to be its own number, using the prime number factorization theorem. The provability-status of this sentence comes under scrutiny.

The meter-Hamiltonian argument implicitly introduces *e.g.* the reader's conscious experience of this sentence (the one you're reading right now!) into science via the symbolism $\langle this\ sentence \rangle$. Although not developed in this book, further application of this symbolism leads to pointing to the 'conscious self' of the reader, via the symbol-string $\langle entity\ who\ has\ \langle this\ symbol-string \rangle \rangle$ (where *this symbol-string* is now a label for, or pointer to, ' $\langle entity\ who\ has\ \langle this\ symbol-string \rangle \rangle$ '!). The physical character of this entity comes under scrutiny (although again, not directly in the papers presented here).

2.6.2.3 Stepwise Establishment of Reflexivity*

Gödel uses a series of steps that establish the reflexive property of the sentence. This involves identifying the number of a specific mathematical statement, and then writing a formula whose value is the (new) number of that statement, after certain substitutions are made. Repeated substitution is then a four-step process, when the count includes the initial number-identification.

The meter-Hamiltonian argument (in its level-0 to level-3 forms, Part 3) uses a series of steps that point the analysis methods (reflexively) back at its first step. This involves moving from problems with two different *aspects* in conscious experience, to problems with all *content-theories* of conscious experience, to problems with *state-theories* of conscious experience (*e.g.* sleeping vs. awake). Finally,

the ‘level-0’ form denies the capacity of dynamically-conventional science to even *speak about* ‘conscious experience’.

(The parallel here is the stepwise, *four-step* movement, establishing a crucial aspect of reflexivity.)

2.6.3. Entering ‘Suspension’: Arrival in ‘Un’ Status*

(This sub-subsection expands the first aspect of ‘The Big Picture Parallel’, subsection 2.6.1 above.)

In subsection 2.1 above, I noted the parallels between the liar’s paradox and Gödel’s incompleteness theorems. There, I suggested a radical difference between temporally-endless ‘true means false, false means true, ...’ reaction to the liar-sentence, versus framing it as ‘neither false nor true’. Notably, the latter interpretation arises from the former if we insist that ‘reality can’t be contradictory’: the only logical solution is then to create a third ‘truth’ state, ‘neither true nor false’, for the liar sentence. (‘Reality is not contradictory’ is an informal analogy of the consistency hypothesis for the system F in Gödel: ‘*if F doesn’t prove contradictory theorems, then it must contain undecidable statements*’.) I call the second way of holding the liar sentence ‘suspension’, because it *suspends* the need for everything to be *either true or false*. (Note that Gödel’s theorems do *not* suspend *true/false* in this way: rather, they force us to suspend a prior expectation of either *provable* or *refutable*, via the assignment of a third ‘undecidable’ status.)

Gödelian suspension has two parallels in meter-Hamiltonian reasoning.

In the level-1 to level-3 arguments (Part 3), we suspend the capacity of dynamically-conventional science to investigate different categories of conscious experience. This doesn’t mean that dynamically-conventional theories are wrong (*untrue*). It means that they must exist in a simultaneously unverifiable-and-unrefutable status (analogous to the undecidability of the Gödel sentence).

In the level-0 argument (Part 3), we suspend the capacity of dynamically-conventional science to speak meaningfully of conscious experience. This doesn’t mean that conscious experience exists or doesn’t exist: it means that public speech acts about it are scientifically uncertain (including speech acts about whether it exists or not!). They may or may not be valid, with validity only occurring under specific kinds of dynamic unconventionality.

2.6.4 Exiting ‘Suspension’: System-Expansion*

(This sub-subsection expands the second aspect of ‘The Big Picture Parallel’, subsection 2.6.1 above.)

In some cases, the Gödel sentence can exit the previous subsection’s ‘suspension’, by moving into a larger system. Various stereotypical maneuvers are possible. In one style, we extend F by adding either the Gödel sentence or its negation as a new axiom. Either way, G_F becomes decidable, in the latter case because the provable truth of its negation decides *against* G_F . In another, we add the consistency of F as an axiom, in which case G_F is provable in the larger system.

(G_F is *true* if and only if F is consistent. This if-and-only-if relationship isn’t self-evident, but it is typically provable *in* F . It explains some of the widespread confusion about the ‘truth’ status of G_F . Gödel’s proof as a whole involves *assuming* F -consistency, as asserted explicitly in statement-forms such as ‘*If F doesn’t prove contradictory theorems, ...*’. But the ‘actual’ truth of G_F stands or falls with the *actual* consistency of F , which opens a whole ‘nother can of mathematico-philosophical worms. At least, we can see that, since F was an almost arbitrary choice, we could choose – by design, if we like!

– an *inconsistent* F . Then G_F is *false*, because of the if-and-only-if fact. In this case, it’s also provable, because *anything* is provable in an inconsistent system! Finally, it is valid to say ‘*In any consistent system* F , ... there are true but unprovable statements’. However, the *actual* consistency of any *actual* F is always *somewhat* at issue, because – amazingly to many – there is *no proof* that arithmetic itself doesn’t lead to contradictions, and F *contains* arithmetic! Many mathematicians and philosophers believe there is overwhelming evidence in favor of the consistency of arithmetic, so its *assumption* is well-justified. Of course, assumption is not proof.)

Similarly, things that are ‘suspended’ under *theoretical* meter-Hamiltonian reasoning can exit ‘suspension’, with additional information. The apparent Gödel/meter-Hamiltonian *difference* here is that ‘additional information’ is to be established *experimentally* for meter-Hamiltonian work, as opposed to *axiomatically* or *by reasoning*, in the Gödelian case. Specifically, if Part 3’s meter-Hamiltonian experimental program reveals that our Universe is dynamically-unconventional *in specific ways*, then conscious-experiential science acquires a reliable experimental methodology, and speaking about conscious experience becomes scientifically meaningful. (Whether there’s actually a *concrete* Gödel/meter-Hamiltonian difference here takes us further into mathematico-philosophical wilderness. There are those who believe that mathematics has a human-independent ‘reality’. Then, for example, establishing the consistency of arithmetic may be a matter of discovering a fact in that reality. I’m not suggesting this discovery would be made experimentally! But this view softens the distinction between *theoretical* mathematics as a purely-human invention, and *experimental* science as a reality-grounded discovery-method.)

2.6.5 Two Foci: Completeness and Consistency*

Gödel’s two theorems respectively address completeness (whether every statement in a system can be decided) and consistency (whether a system can establish its own capacity to not prove contradictory statements).

Meter-Hamiltonian reasoning can also be viewed as addressing both completeness of science, and its consistency (not making contradictory statements). Meter-Hamiltonian completeness speaks to whether science can address all natural phenomena, specifically focusing on the phenomenon of conscious experience. (Under dynamical-conventionality, science is incomplete, because conscious-experiential science lacks a reliable methodology.) Meter-Hamiltonian consistency speaks to whether statements in science about conscious experience contradict other content of scientific theory (specifically, content that asserts dynamical-conventionality).

2.6.6 The Need for Extreme Care! ‘Truth’, and In/Out-of-System Reasoning*

As developed over the last few subsections and sub-subsections, extreme care needs to be taken with drawing inferences from Gödel’s work. (The biggest problem here concerns assertions such as ‘we can see G_F is true’. We can only see this if we can see the consistency of F . Suffice to say, this point is usually completely overlooked! In the rare cases it isn’t, consistency-in-general is a huge and controversial topic. For example, Hilbert had to propose an entire program to address it!)

Similarly, extreme care needs to be taken with the implications of meter-Hamiltonian reasoning. For example, theorems show that ‘conscious experience’ is not a scientifically-meaningful reference in a dynamically-conventional Universe. But many publications in leading journals start with appeals to ‘obvious’ features of conscious experience. (For example, ‘we can tell when another system is

conscious – it is awake, and so on’. Such moves are almost exactly analogous to careless and unexamined assumptions of consistency, in the mathematical arena.) Introducing such statements without acknowledging they could be only meaningful in specific dynamically-unconventional realities introduces contradiction into everything that follows.

2.6.7 Foundational Significance – But: *Extreme Care ...!**

Both Gödelian and meter-Hamiltonian theorems are foundationally significant in their respective domains (mathematics and science). But in both cases, extreme care needs to be taken in interpreting their *actual* implications.

Gödel’s work does establish that the foundational consistency of mathematics can’t be established by a *specific* kind of mathematics. But it *does not* (as often claimed in popular publications) ‘destroy the possibility of mathematics establishing its own foundations’.

Meter-Hamiltonian arguments do establish that *dynamically-conventional* science is flawed in its foundations. But it *does not* (as post-Truth advocates may want to say) ‘establish that science is flawed, and can *never* make any definitive-and-reliable statements’.

2.6.8 Mechanical and Non-Mechanical Dynamics in Mathematics and Human-Brains*

As discussed above, various unsupportable arguments have been made about how Gödelian reasoning and results ‘prove’ that there ‘must’ be a non-mechanical (non-algorithmic) action in human cognition. What, if any, are the rational analyses that *can* be made about Gödel and non-algorithmic action? And what, if any, are the corresponding features of meter-Hamiltonian reasoning?

We *can* say that Gödel points to the need for something new, if mathematics is to establish its own consistency. We can say that this ‘new thing’ *may or may not* correlate with non-algorithmic activity in a human brain. (That is, reality may or may not contain the possibility of non-algorithmic human cognition. Mathematics may or may not need a non-algorithmic solution to its foundational crises. These two may/may-not possibilities then may or may not turn out to be related!)

We *can* say that Part 3’s meter-Hamiltonian experiments *should* be able to detect non-algorithmic human brain-activity, *if* it exists. So there is a scenario in which all these things come together! But there’s no *proof* that they will. (Similarly, there was no proof that the Standard Model of particle physics would be a descriptively-accurate theory to a given level, until it was postulated and verified! Somewhat unfortunately, the choice of which scientific agendas to pursue is often a largely intuitive matter. And intuition seems to be significantly affected by Figure 1’s foundational fractures.)

2.6.9. 'Psycho-active' Theories?!**

[This subsection’s *double-asterisk* status derives from one-star for ‘optional’, and another for ‘unusually speculative’!]

Let’s return to the ‘suspension’ of the liar sentence (subsection 2.6.3, p. 7). Anecdotally, people report different *subjective experiences* of suspension (‘neither true nor false’) as opposed to endless conflict (‘true means false, which is contradiction ... false means true, which is contradiction ... true means ...’). Without going into the large number of conceptual possibilities about the origin and significance of these contrasting experiences, let’s just explore the *hypothesis* that experiential differences

correspond to meaningful differences in psychological configuration (without defining what that really means, either!).

Many people describe Gödel's work as 'mind-bending', or 'mind-opening', Of course, some of this may be a report of the cognitive load associated with grappling with unfamiliar territory. In some cases, some of it clearly derives from a mistaken appreciation of results and implications! And of course, technically speaking, learning *anything* 'changes the mind' (because it changes the brain). But perhaps *part* of the experience of 'bending' and 'opening' has to do with something very significant, concerning the capacity to convert endless conflict in time to present-moment depth.

Are there qualitatively-significant, sustained, changes in psychological configuration created by different kinds of learning? And can some of these qualitative shifts (but not others) have significance *e.g.* for current societal conflicts?

The possibility I'm about to explore here relies on a non-standard view of mind, brain, and reality. However, the entire gestalt of meter-Hamiltonian reasoning is that, if reality is of the dynamically-*standard* kind, the science of that reality is fatally *unreliable*. This contingency *doesn't* mean 'we get to assert anything we want to about reality'. It *does* mean that the stakes are high. In turn, that calls for an appropriately open-minded exploration of every avenue.

We do know that minds seek coherence: they try to create a single unifying framework that can harmoniously integrate all knowledge and experience. (This is why one powerful experience, positive or negative, or one strongly held-belief, constructive or destructive, can profoundly affect well-being and behavior. Everything else shifts and re-organizes, to cohere with that experience-or-belief.)

So learning that is both profound and incontrovertible *can* have a major impact on a mind, even in a conventional reality-theory.

With that prelude in hand, now I'll start into the 'unconventional' bit!

Say, for example, that human minds *do* have the potential capacity for non-algorithmic ('*n.a.*') activity of the kind discussed in subsections 2.3 and 2.4. (That's one part of the unconventional hypothesis.) Depending on the precise mechanism and power of the congruence-seeking function (here comes more unconventionality!), conditioned belief in the absence or non-*existence* of that *n.a.*-capacity could shut it down, or prevent its growth.

If there is anything to this kind of informal hypothesis, then even engaging in a highly-invested way with the *possibility* of *n.a.*-cognition might help shake conditioning loose, and bring suppressed capacities online,

I use the term 'psycho-active' to label the kinds of theory that might engender these kinds of shift, in the direction of bringing latent and significant psychological capacities online. If psycho-activity of this kind is a real thing, it's likely shared by Gödelian and meter-Hamiltonian reasoning. [Even shifting the liar-sentence from an endless-conflict to a suspended 'neither true nor false' interpretation might have a dose of this kind of psycho-activity. Perhaps the key issue here is the capacity to relax *inappropriate* or *universal* division of phenomena into true/false, right/wrong, good/bad, while retaining the capacity to make such discernments when they're *appropriate* to *local* context. Although it's beyond the scope even of present informal speculation, there's some reason to believe that division

and non-division might be profoundly related to crucial resources such as compassion, creativity, and intelligence (Harvey, 2013; Bohm, 2004; Krishnamurti, 1987).]

What evidence do we have for psycho-activity related to *non-algorithmic* capacity? None at all, as far as I know. But we *could*, if we did Part 3's experiments, and then parsed any dynamical innovations observed there into those attributable to a coupling between conscious experience and brain-activity, and those due to a potentially-distinct non-algorithmic action (subsection 2.4, above). Then we could look at whether there is a correlation between non-algorithmic capacity and exposure to potentially psycho-active concepts, across the subject population.

One problem we may face is that, if there's widespread conditioned suppression of non-algorithmic cognition, this may extend to suppressing experiments that could unleash it. (If theoretical engagement with meter-Hamiltonian arguments is psycho-active, reading this book might be a partial antidote to that suppression. That could then start to crack open the door to experiments. Whether suppression is too rampant to allow even for that beginning, remains to be seen.)

Mystical mumbo-jumbo? *Maybe*. But after the meter-Hamiltonian arguments, as we'll see, what we have to face up to is that *dynamically-conventional* science's claim to be a reliable reality-method is nonsensical mumbo-jumbo! One alternative to entrenched mutual name-calling between allegedly-mystical and allegedly-scientific camps might simply be *to find out what reality is*.

In subsection 2.7 ('Putting Down a Marker'), I'll draw a line under the more-speculative musings I just launched into. (These musings have *nothing* to do with the technical grounds for meter-Hamiltonian reasoning, or the logical implications of meter-Hamiltonian reasoning for science as a whole.) Before that, in the next subsection, I'll complete the account of Gödelian/meter-Hamiltonian parallels.

2.6.10 Attribution of *Both* Over- and Under-Significance to Gödel and meter-Hamiltonian*

Both Gödelian and meter-Hamiltonian reasoning are often given either less or more significance than appropriate.

Both kinds of reasoning are often thought to be esoteric arguments, at extreme (and irrelevant) frontiers, or in deep (and irrelevant) foundational basements. The entire thrust of this book is that 'small' glitches, wherever they occur, can create huge consequences. (Example: just one self-replicating viral particle can kill an organism – or even an entire population.) And, I suggest in this book that glitches pointed to by Gödelian and meter-Hamiltonian logics are of exactly that kind. (For example, they are *both* related to the societal conflict between science and post-Truth.)

If that thrust is accepted, however, the pendulum can swing too far in the other direction! For example, it might be easy to conclude that this book is recommending everyone on the planet should be fully educated in the character of glitches, and their resolutions. This *would* be a logical conclusion, if the thesis here were that *lack of explicit intellectual understanding* of these glitches were the primary *proximate source* of societal conflict. Instead (although again this relies on a non-standard reality-theory), the hypothesis is that the perpetuating power of post-Truth attack originates in a sort of (possibly unconscious) *intuitive apprehension* of contradictions within the current form of science.

In this view, it's *primarily* sufficient (per the second sentence of the preceding paragraph) for cultural gate-keepers *in science* to become 'fully educated in the character of glitches', and then *implement* 'their resolutions'. If the structural hypothesis about conflict-dynamics is correct, these steps would

take the heart out of the conflict. [I don't expect this to be *totally* sufficient, because there's more to the conflict than a relatively-pure non-verbal reflection of dysfunction in science. Even if there were not, it would be natural to expect the significant momentum invested in attack to take some time to empty itself. And as I repeatedly state elsewhere in this work, it's not just science that has glitches and dysfunctions to fix: obviously, there's a lot of work to do on the postmodern, post-Truth, side of things *e.g.* (Wilber, 2017).]

2.7 Putting Down a Marker**

Whether or not there's anything to 'psycho-active' speculations (subsection 2.6.9), *other* Gödelian/meter-Hamiltonian parallels (subsections 2.6.1 to 2.6.8, and 2.6.10) are too numerous and striking for there to be nothing to *them*. Put constructively, perhaps 'there's *something* going on' that leads to these parallels.

What might that 'something' be?

To begin with, this book sets *extremely* precise and rigorous meter-Hamiltonian content (Parts 2 to 4, and Appendices A and B) in a *very* informal meta-context, which contains speculative hypotheses about the science/post-Truth conflict, and its origins in foundational fractures in thought-systems or worldviews. (See section 1/Figure 1 of this *Overview*, and Part 5/Appendix C.) This is the formal/informal, precise/loose, rigorous/speculative, overall setting in which we look for the 'something'!

Next, Gödel's work concerns foundations of *mathematics*. Although in the first instance, meter-Hamiltonian reasoning is about the methodological foundations of *consciousness* science, it turns out to be more deeply about the foundations of science *as a whole*. So these are structural (as opposed to contextual) features of our overall search setting.

Now, the foundational relationship between mathematics and science is a controversial issue (at least in science and mathematics!). In outline, I suggest the 'something' here is that *both* Gödelian and meter-Hamiltonian reasoning are grasping dimly towards a common fault-line at the science/mathematics/reality intersection. (Splitting these three domains up is a loose linguistic convention. Their deep *actual* relationship is exactly at issue. For example, is mathematics a part of human activity that's in turn a part of reality? Or does mathematics have an independent existence *in* reality, *as well as* in human mental activity? Of course, such possibilities have a long philosophical history: I'm not the first to voice them. But, as we'll see shortly, I do take them in a radically-unusual, brain-dynamical/frontiers-of-reality, direction.)

Furthermore, one of the *most* striking parallels between Gödelian and meter-Hamiltonian reasoning concerns the pervasive occurrence of reflexive or self-referential motifs. Speculatively then, I further suggest that the 'something' *also* has to do with *concepts* or *theories* of 'self', as potentially opposed to or in *conflict* with *actuality* of self. (The suggestion that *conflict* – and its resolution! – is also part of the 'something' comes from two directions. At the micro-level, it originates in the pervasive occurrence, suspension, and resolution of *contradiction* in Gödelian and meter-Hamiltonian reasoning. At the macro-level, it originates in the proposal that the science/post-Truth *conflict* is itself related to unresolved 'glitches', in the same domains and at roughly the same levels as those in which Gödelian and meter-Hamiltonian reasoning are situated.)

Crucially, I suggest that the self-aspect of the ‘something’ goes beyond self-reference in theories. It also relates to what a human-self *really is*, and – in contrast – our conceptualizations and theories of that reality. Thus (and again acknowledging the extremely speculative, intuition-driven, character of this sub-section’s explorations), we should look not only into the foundations of mathematics, and the foundations of science, and their joint foundational meeting, and the meeting of that joint foundation with reality. We must *also* look into the foundations of *our selves* – of the scientist, of the mathematician, and of the everyday societal actor ... at what these selves actually are, and what conflicts arise between that actuality and ‘self image’, and between that actuality and scientific/philosophical theorizing. Only in this joint and several investigation, I suggest, will we discover the curious ‘something’ that Gödel/meter-Hamiltonian parallels point towards.

If I had to speculate about how all this resolves, in relation to Gödel and the meter-Hamiltonian work, I’d *guess* it would be something like this. Gödel points to the need for a radically-innovative solution to proving the consistency of mathematics. My conjecture concerning that issue is that mathematics *is* provably consistent, and humans *can* and *will* understand that proof. However, I hypothesize that a human who truly understands that proof will also display both dynamically-unorthodox and non-algorithmic brain-dynamics. Thus, meter-Hamiltonian and generalized Penrose/Lucas-reasoning are pointing towards what must be going on in any natural system that comprehends the trans-Gödelian reasoning required to establish the consistency of mathematics. Finally (!), when all this is going on (!), the relationships between mathematics, science, reality, and the human mathematician/scientist will *all* become clear and harmonious! (At least, it will be clear to that trans-Gödelian being!)

I’ve undoubtedly achieved ‘crackpot’ status in the eyes of the mainstream at this point. (If I hadn’t already, simply by pointing out the meter-Hamiltonian program.) So I might as well go for broke! I further speculate that the truth of the Riemann hypothesis (‘RH’) will play a pivotal part in this whole confluence! In outline, this may play out as follows.

There’s a growing understanding that the RH is intimately related to the quantum properties of some unknown chaotic physical-system [see extensive references in (Watkins, 2015)]. I speculate this system will come to be understood as some fundamental aspect of our Universe, specifically something to do with the relationship between physical reality and some inner-dimensions of mind. (As will become clear in Parts 2 to 4 if it’s not already, I can speak of ‘physical reality’ and ‘mind’ in a contrastive way, without asserting any kind of dualism, substance or otherwise.) RH-*truth* will then turn out to declare that this physical-mind relationship *must* attain a specific change-in-state, in a *finite* time. (This ‘temporal prediction’ feature of the RH will be related to the *quantum break-time* of the quantum-chaos system it describes. The quantum break-time is the temporal point at which such a system shifts from a conventional combination of quantum-unpredictability plus chaotic-sensitivity, into the rather beautiful union of the two. This union is the characteristic feature of ‘quantum chaos’.) The physical/mind relationship that the RH describes will turn out to be exactly what needs to shift *in* the mathematician/scientist, to understand and *participate* in all this! (‘This’ here includes the trans-Gödelian capacity and associated dynamically-unconventional/non-algorithmic brain-activity, hypothesized a couple of paragraphs back.) Taking everything together, RH-*truth* will put a finite-time bound on reality-shifts that include its *own* understanding and proof (more reflexivity!). Thus (in a sense) RH-*truth* will state that the resolution of all this is *destined*, because something that has to happen *in a finite time* is destined to happen! Put differently, I conjecture that RH-*truth* is intimately associated with an inevitable end to chaos and conflict in thinking, including thinking about thinking-and-thinkers!

At least, that's *my* best guess about the 'deeper something' behind the numerous and striking Gödel/meter-Hamiltonian parallels! This speculative outline is exactly the 'target' I mentioned in subsection 2.5, as one of the reasons for going into these parallels in the first place. It could in principle become the tentative central hypothesis in a major research program in consciousness science, computational science, pure mathematics, the foundations of mathematics, and the foundations of science. To give this behemoth a name, I call it the 'G/mH/RH program', or *GmHRH* for short (where 'G' stands for Gödel and 'mH' for meter-Hamiltonian). [It's important to remember this program is not just about the three G-mH-RH theoretical constructs involved, but also about the very *theorists* and *experimentalists* who are working with those constructs! (Recall the real-self/image-of-self speculation from a few paragraphs ago.) Put differently, the program has to *explicitly* see both the theoretical constructs involved and those examining them as embedded in the context of reality-as-a-whole, while simultaneously putting the basic nature of that reality under enquiry. I try to avoid the temptation to use the alternative name 'GmHRH/R/ists', which memorializes these points, by adding another 'R' for 'reality', and the 'ists' suffix to reflexively include the project-members!]

According to this book, the *motivation* for *GmHRH* is far more than its *intellectual* significance and its abstract beauty. (Certainly, this program is both an Everest and a moonshot, which we should take on both 'because it's there' and 'because we can'!) I've suggested that present societal conflicts can be partially traced to fractures in science that the meter-Hamiltonian program *by itself* can primarily resolve, without the envisioned fruits of the *GmHRH* enterprise. (Again, as Part 5 reiterates, the path to a post-post-Truth society *also* involves resolution of fractures in the thought-systems of *other* parties to current conflicts.)

But even the post-post-Truth society will be vulnerable to *other* kinds of conflict, resulting from further intellectual fault-lines that the meter-Hamiltonian project by itself does *not* resolve. (For example, fractures between science and mathematics, and between the mathematics/science complex and reality itself ... fractures which *are* addressed in *GmHRH*!)

Thus, the ultimate *societal* motivation for *GmHRH* will not be 'merely intellectual'. It will be to take the successful conflict-resolution benefits of the meter-Hamiltonian program in relation to current societal battles (once these have been proven successful!), and extend them to conflicts yet to come. Because the conflicts *GmHRH* resolves will likely not yet have emerged to macro-scale expression in everyday human experience, it could be described as a program aimed at conflict-*avoidance*, rather than conflict-resolution. Either way, because peace *is* the absence of conflict, *GmHRH* – in some form – will be a vital pillar for a future human civilization that flourishes *in enduring and unshakeable peace*.

2.8 Back to 'Reality'

In subsection 2.5, I laid out two reasons for exposing Gödel/meter-Hamiltonian parallels. One was a warm-up – introducing the 'neither *X* nor not-*X*', 'suspension', motif (subsection 2.6.3), which is pivotal in Gödel's first theorem, and occurs repeatedly in meter-Hamiltonian reasoning. The other was to frame a Gödel/meter-Hamiltonian-related future-target, which I laid out in the preceding subsection (with a good dose of ungrounded speculation!).

Before wrapping things up in the next subsection's summary, this subsection fills in some middle ground, between the direct and undeniable suspension-parallels (subsections 2.6.1 to 2.6.8, and 2.6.10), and the controversial and speculative *GmHRH* target-program (subsection 2.7). This subsection *is* a

step back to present-moment ‘reality’ from the previous subsection’s speculations, because it relates a Gödelian feature and the meter-Hamiltonian work, to here-and-now societal dynamics.

Consider the following version of the liar-sentence: ‘Nothing is true’. (This *is* a version of the *explicitly-reflexive* ‘*this sentence* isn’t true’, because ‘nothing’ includes the sentence itself!) Now, this sentence could be taken as the founding statement of the postmodern movement, from which post-Truth (and the conflict with science) has sprung. More accurately, postmodernism’s motto might be: ‘everything’s a social or personal-subjective construction, so no one perspective can be said to be more true than another’. But ‘nothing’s true’ is more fun, and more punchy ...

A simple sophomoric refutation of ‘nothing’s true’ is, of course: ‘if nothing *is* true, then that declaration isn’t true, either’. If ‘nothing’s true’ is false, on the other hand, then there’s no contradiction. (This is *unlike* the liar-sentence case. Here falsity implies ‘*something’s* true’, and ‘something’ *need not* include the original ‘nothing’s true’ sentence!) If we see the root of suspension (subsection 2.6.3) as a basic insistence that reality isn’t contradictory, we’re tempted to reject ‘nothing’s true’ outright. (That is, the truth of ‘nothing’s true’ creates contradiction; taking ‘reality isn’t contradictory’ as an axiom, this suggests the falsity of ‘nothing’s true’.) In fact, simplistic attempts to ‘refute’ postmodernism take this tack. (More fairly, these are really attempts to refute post-Truth, which is better represented by an absolutist ‘nothing’s true’ than postmodernist nuances are!)

But what can we do with the following *refinement*: ‘nothing is true, *apart from this sentence*’? Or put differently, ‘the human-system is incapable of truth-assertion, apart from correct assertion of that very fact’. This seems far less amenable to sophomoric strategies. To the contrary, it seems to invite further engaged-investigation. What is meant by ‘truth’? What properties must a system have to be capable of ‘truth’-assertion? Does a typical human-system possess those properties? And so on ...

Now consider an apparently-uncontroversial foundational motto for the *science* side of current conflicts: ‘everything at the everyday human-level of experience can in principle be explained by the current version of modern science, given enough data and computational power’. (This is the claim that remaining scientific mysteries – about dark matter, unified field theories, and so on – don’t and can’t make any difference to everyday life. However these are resolved – or *not* resolved! – hydrogen is still hydrogen, the Earth is made up of known elements, and so on. And – allegedly – we know the mathematical regularities governing all these things ‘well-enough’ already, at least in principle.)

Meter-Hamiltonian reasoning (section 5, below) *refutes* this apparently-uncontroversial motto, if the ‘current version of modern science’ is dynamically-conventional (which it is!). (Again, ‘dynamic-conventionality’ is explained further in the imminently-upcoming section 3 of this *Overview*) In fact, meter-Hamiltonian reasoning more-or-less *agrees with* the nuanced ‘human-system’ version of the *post-Truth* motto, stating something like: ‘*if* reality is dynamically-conventional, the human-system can’t even speak about its conscious experience in a meaningful and reliable way, and even the speech act “conscious experience” in this sentence isn’t sound’!

Let’s stop for a moment, and track this through. We began with a self-referential sentence (‘nothing’s true, including this sentence’), with is at least *quasi*-Gödelian. We then modified it a bit, appealing along the way to a non-contradictory reality stance (*metaphorically* reminiscent of Gödel’s ‘*if* a system is consistent ...’). This gave us the nuanced ‘human-system’ version of *post-Truth*’s foundational motto. Then we took an apparently uncontroversial foundational motto for *science*, and saw that *it is*

refuted by meter-Hamiltonian reasoning (for any science that asserts a dynamically-conventional reality). In fact, according to meter-Hamiltonian logic, dynamically-conventional science must take a motto-stance that's *almost identical to post-Truth*. (More precisely, to a *nuanced version* of post-Truth.)

What does this establish? It does *not* show 'Gödel proves the post-Truth stance to be correct', *nor* that 'meter-Hamiltonian logic proves the post-Truth stance to be correct'. It shows we can make some *loose, metaphorical, relationships* between some aspects of post-Truth, and some aspects of Gödel. In order to do even this, we have to tighten up post-Truth a bit. (*E.g.* we have to move from the caricature-motto 'nothing's true', to the more-defensible 'human-system' version.) Then, applying meter-Hamiltonian logic to the foundational motto of current mainstream science, we see that post-Truth and dynamically-conventional science *must roughly say the same thing*.

So the first thing this establishes is a basis for *mutual understanding* between tightened-up post-Truth and dynamically-conventional science! Surely, this is a *huge* thing. It's the *fundamental reason* I assert that meter-Hamiltonian reasoning is a crucial paving-stone in the road to a post-post-Truth society.

The second thing it establishes is the absolutely-vital place for *experiments* testing whether reality *is* dynamically-conventional. *If* it is, then we are left in roughly the place that (tightened-up) post-Truth asserts – because dynamically-conventional science roughly agrees with that post-Truth! But if it isn't – as I firmly believe – then post-Truth and science can move ahead together, into a world where 'truth is a thing', again! (This is not a trivial process. But it is *possible*, in specific dynamically-unconventional realities.)

Finally, this loose, metaphorical analysis must both be *distinguished* from the parallels of subsection 2.6 (which are more in the nature of analogical comparisons than metaphors), and be seen to *complement* that prior analysis.

Handwaving over-generalizations of Gödel in the general area of postmodernism and post-Truth have been rightly eviscerated (Sokal & Bricmont, 1999). I believe I've taken enough care to make clear that reasoning *in this subsection* related to Gödel is *metaphorical* – that is, closer to poetry than mathematical logic. That protects this subsection from the Sokal/Bricmont critique, and distinguishes it from subsection 2.6, where the converse applies: parallels are generally closer to mathematics than poetry. (This perhaps doesn't apply to subsection 2.6.9, where the free-running speculation could perhaps be fairly characterized as science-fiction, rather than analogy or even metaphor! Sci-fi is sometimes curiously *predictive*, though ...)

Even though the approach in this subsection *is* metaphorical, it nevertheless *adds something*, over-and-above subsection 2.6's parallels. The analysis of analogies there never went anywhere near post-Truth (again excluding subsection 2.6.9's 'psycho-active' explorations). Metaphor here leads to a new sort of parallel: if post-Truth is *metaphorically* related to Gödel, and if science is viewed through meter-Hamiltonian reasoning, then (tightened-up) post-Truth and (dynamically-conventional) science end up taking more-or-less the same human-truth view. (To be totally fair, the post-Truth side of all this could be explained without ever referencing Gödel! That's why it's metaphor. But equally, a lengthier account starting from 'nothing's *provable*' would be much more Gödelian.)

I tentatively suggest that all this may be a present-moment, societal-conflict echo of the 'something' reached for in subsection 2.7: both Gödelian and meter-Hamiltonian reasoning are indirectly related to a common deeper origin. And this common source makes itself known, albeit dimly and vaguely,

through the metaphor. (If we don't do anything proactively to clarify it, though, for example via *GmHRH*, it will likely make itself made known to us more clearly, through some new, exciting, and currently-unforeseeable form of conflict.)

2.9 Summary of Section 2: 'Gödel-like Theorems ...'

Gödel's incompleteness theorems have been the source of numerous claims about mind, intelligence, consciousness, and the capacity of science (subsection 2.3). Almost all of these are unsupportable in their extreme forms, such as 'Gödel's theorems *prove* that [insert claim about non-algorithmic cognition here]'

Meter-Hamiltonian reasoning (the technical core of this work) does *not* depend on or originate in Gödel's work, *in any way*. Thus, references to Gödel here are quite unlike appeals in, for example, Penrose's work (subsection 2.4). Rather than using Gödel as a foundation (an axiomatic *basis* for reasoning), meter-Hamiltonian reasoning has a number of striking *parallels with* the structure and implications of Gödel's incompleteness theorems (subsections 2.5 and 2.6).

One illustration of parallels draws on a relationship between the liar-sentence ('this sentence is false'), Gödelian incompleteness, and meter-Hamiltonian logic. The 'neither true nor false' frame for the liar sentence (subsection 2.1) 'suspends' true-or-false binary-logic (subsection 2.6.3). Similarly, Gödel's first theorem suspends any prior expectation that statements in a mathematical system should be either provable or refutable. And meter-Hamiltonian reasoning shows, for example, that conscious-experiential science is neither methodologically-valid nor methodologically-invalid, until Part 3's experiments are done. (Even then, 'neither/nor' status *may* persist.)

As subsections 2.5 and 2.6 explain, parallels between Gödelian and meter-Hamiltonian reasoning-structures and conclusions go far beyond this simple illustration. Some of the parallels pointed to in these subsections may be illusory, or coincidental. But the number and – more strikingly – the *character* of parallels is strongly suggestive that 'there's something deeper going on here' (to paraphrase subsection 2.7). I speculate that this 'something' is to do with common and mutual resolution of foundational issues in mathematics and science, and that these resolutions must also involve a shift in the 'inner' state of scientists and mathematicians (specifically, a shift to do with image-of-self as opposed to actual or 'true' self). In subsection 2.7, I pulled all these speculative threads together into the *GmHRH* program, which I suggest (rather astonishingly!) will be a vital component for enduring peace-on-Earth.

The meter-Hamiltonian program is a crucial paving-stone in the road to a post-post-Truth society (subsection 2.8), because it shows first that dynamically-conventional science and a defensible version of post-Truth actually share common ground! This is the basis for *mutual understanding*. But the meter-Hamiltonian *experimental* program (Part 3) will, I predict, move science and postmodernism on from that common ground, into what we could call the *resurrection of truth*. In tracking this journey, a *metaphorical* relationship between Gödel's work and post-Truth can be discerned (distinct from but complementary to subsection 2.6's *parallels*). Metaphor (subsection 2.8) thus induces another kind of Gödel/meter-Hamiltonian relationship, perhaps a present-moment *foreshadowing* of subsection 2.7's future exploration, which investigates the *deepest* common origin for Gödel's theorems and meter-Hamiltonian reasoning.

2.10 Preview: Brief Outline of Sections 3 to 7

Section 2 (what you're reading: 'Gödel-like Theorems for Dynamically-Conventional Biophysical Science') has traversed a vast territory – mathematically, philosophically, analogically, metaphorically, rationally, speculatively, and imaginatively. It's travelled into the last century, and likely (if the subsection 2.7's *GmHRH* program takes off) into the next century – perhaps the next millennium!

In the following sections, Part 1's *Overview* takes a turn away from section 2's fascinating 'Gödel-like' territory. Motivated by the potential significance of meter-Hamiltonian reasoning established thus far, the next chunk of this Part dives into a sketch of the technical developments behind the 'Theorems for Dynamically-Conventional Biophysical Science'

First, in section 3, I explain the dynamically-conventional/unconventional distinction, at the heart of meter-Hamiltonian explorations, in a bit more detail. (Finally!)

Next, in section 4, I address the rather distressing topic of anti-scientific diatribes *from within mainstream science itself*, which tend to be evoked by even *mentioning* the *hypothetical possibility* of a dynamically-unconventional Universe. (Surely, the scientific stance is: the dynamical character of our Universe is an *experimental* matter!)

Then, sections 5 to 7 respectively sketch the primary features of Parts 2 to 4 of the book, which contain the three technical papers that comprise the meter-Hamiltonian work. (Notably, section 6 reviews Part 3's *experimental* program: the meter-Hamiltonian approach is definitively *scientific*, in the true sense!)

Bringing Part 1's *Overview* to a close, section 8 gives a very brief outline of the equally-brief Part 5 (the *Afterword*). Part 5 simply pulls together those few threads which will not yet, at that juncture, have been fully woven into the beautiful tapestry of this book!

3. What does 'Dynamically Conventional' mean?

In this work, 'dynamically conventional' means any form of science that axiomatically excludes the influence of consciousness on matter. This definition in turn demands a raft of further definitions, which are addressed in detail in the technical developments of Parts 2 to 4.

But for present introductory purposes, two immediate questions must be addressed.

The first is, what is meant by 'consciousness' here? Briefly, the word consciousness is used colloquially and scientifically to label a wide variety of states, ranging from 'an apparent knowing that a "self" exists', to 'a certain kind of high-level information processing, notably including the ability to report verbally on inner and outer states', to 'the existence of conscious experience' – for example the shapes and colors appearing to you right now (if you have typical visual function). The specific variety of consciousness that's the initial and central focus of this work is the third kind in this brief list, *i.e. conscious experience*, or what philosophers call *phenomenal consciousness* (Chalmers, 1996). [As the work develops however, the second kind – what's sometimes called *access consciousness* (Block, 2005) – also becomes an indirect concern.] So, to clarify, 'dynamically conventional' science excludes the influence of *conscious experience* on matter-states, specifically on *the matter-states of the brain* that's 'having' those conscious experiences.

The second question derives from mainstream science's ungrounded conjecture that consciousness – almost however it is defined – *must* be a 'weakly-emergent property' (Chalmers, 2008) of the brain. If

we use a way of speaking that attributes causality to higher-level weakly-emergent properties – for example to say that a temperature of 373K is causally-implicated in the boiling of water – then it seems that consciousness *is* endowed with matter-influence by mainstream science. But that then seems to contradict the central thrust of this work, in which modern mainstream science is identified with dynamic conventionality. The second question then takes the following form. If mainstream science views consciousness as weakly- or conventionally-emergent, and if such emergent properties can be said to have effects on matter-states, then how can it be said that mainstream science is ‘dynamically conventional’? (*I.e.*: ‘*excludes* the influence of consciousness on matter’.)

The answer to this question lies in what it *means* for ‘consciousness to affect matter’. Specifically, in the definition of ‘dynamical conventionality’, this means to affect matter in ways *over-and-above* those in which consciousness-labelled mater-states would otherwise (conventionally!) have material effects. For example, in the mainstream view, we can give a complete account of brain-function – including reports of conscious experience – purely in terms of conventional-physics dynamical interactions. These accounts can be given without referring to consciousness at all! For consciousness to ‘affect matter’ (in present usage), there must be dynamical innovations in brain-activity over and above the conventional-physics dynamical account, by virtue of the presence or existence of conscious experience. Thus, it is clear that modern mainstream accounts *are* dynamically-conventional, precisely because weak-emergence does *not* involve such dynamical innovations. In fact, weak emergence is a way to explain high-level ‘apparent’ causal-interactions as simply being a way of seeing or describing low-level ‘actual’ causal-interactions. For example, we can say ‘heat flowed from one body to another’, but this is just language for statistically-characterized kinetic-energy transfers between atoms or molecules. We can view weak-emergence exactly as a means of *avoiding* unnecessary dynamical innovations in physical theory, by explaining high-level phenomena solely in terms of (*e.g.* statistical aggregates of) a dynamically-orthodox lower-level. [The core technical development of meter-Hamiltonian reasoning goes far beyond this somewhat loose verbal exploration of low- and high-level causality, notably – beginning in Part 2 – employing the carefully developed ‘e-causality’ concept from (Gamez, 2014).]

4. The Anti-Scientific Character of Denying Scientific Status to ‘Unconventional’ Dynamics

Unfortunately, the study of conscious experience has been plagued by various rigidities and dysfunctions in reasoning, which have held back its advance into truly scientific status. (However, it would be wrong to single out consciousness science as the *origin* of these rigidities and dysfunctions, which can actually be traced to issues in the overall structure of modern science. It’s simply that these issues make themselves most clearly *visible* in the study of consciousness.) Somewhat ironically, in the larger sociopolitical context, these rigidities and dysfunctions aren’t totally dissimilar to *some* of the kinds of rationality deficits that pro-science advocates point to, in the post-Truth movement. (See Appendix C for a brief but somewhat more-nuanced exploration of this controversial observation.) If, as Figure 1 suggests, cracks in the foundations of science and of post-Truth share a common deeper origin, it’s perhaps not surprising to see cross-system parallels in the nature of respective dysfunctions.

The act of defining ‘dynamical conventionality’ typically flushes out some versions of the issues for consciousness science. Notably, dynamical-conventionality is defined in order to point to a contrasting class of dynamically-*unconventional* theories, and to encourage the scientific (experimental!) investigation of whether conventionality or unconventionality *actually exists in the natural order of*

the Universe we inhabit. Typically, before we get anywhere near doing or even discussing experiments, dynamical-unconventionality is deemed impossible, or illogical, or derided as ‘supernatural’. These kinds of mindset are somewhat curious, given the wonders and mysteries of modern science. (Is quantum entanglement supernatural? What about spacetime curvature? To paraphrase Arthur C. Clark, any natural feature beyond current understanding could be denied as ‘supernatural’.)

Although completely accounting for and deconstructing the illogical, anti-scientific, objections to dynamic-unconventionality would take at least another book, it would be wrong to proceed without characterizing and refuting the major classes.

To begin, what are the basic grounds for ‘unscientific’, ‘supernatural’ objections to dynamic-unconventionality?

Dynamically-unconventional theories of conscious experience *do* suggest there is something going on dynamically in the brains of conscious humans that is not accounted for by current physical theory. (For non-specialists: dynamical-unconventionality means that the movement, or ‘wiggling around’, of brain-activity would differ from that expected under current physics.) It *would* be unscientific to assert that such beyond-conventional *hypotheses* ‘must be true’, without either (or both!) experimental support or rigorous reasoning. However, that kind of unscientific assertion is nowhere to be found anywhere in this work. But it’s *definitely* unscientific to rule out such hypotheses ... without experimental support or rigorous reasoning! The generally-*alleged* basis for theoretical rejection of dynamic-unconventionality is that ‘we don’t need dynamically-unconventional theories to explain conscious experience: we already have the weakly-emergent explanation, and that is totally sufficient’. If this claim *were* true – if it were true that weak-emergence could in fact be the basis for a scientifically-reliable approach to conscious experience – then this rejection of dynamically-unconventional hypotheses might have *some* merit. (Nevertheless, the natural-order fact-of-the-matter concerning what’s *actually* going on in the brain would remain an experimental question.) I’ll return to the ‘we have a simpler, sufficient, explanation’ objection at the end of this section. (Before moving on, though, I should just clarify that weak-emergence *could* in principle be the actual, natural-order, basis of conscious experience. That may seem to flatly contradict what I just suggested. However, it does not, because if conscious experience *is* weakly-emergent as a natural-order fact, then we can simply *never have a scientifically-reliable, experimentally-based, investigation or verification of that fact!* This subtle, seemingly-paradoxical, and beautiful point is what Part 2 takes fifty-odd pages to rigorously establish.)

The ‘supernatural’ objection (if such an emotionally-laden defense can be called an objection) seems to derive from a 17th-century debate about ‘substances’, which is surely irrelevant to the modern scientific dialogue. This objection goes along the following lines. Anything that has an effect on matter – but isn’t accounted for by the current dynamical laws of physics – must be ‘non-material’. In this account, non-material means non-physical, and therefore supernatural! In a context where fully 95% of the *known* matter-energy content of the Universe isn’t accounted for by ‘the current dynamical laws of physics’, what are we to make of such an objection? That most of the Universe is supernatural? *Or that we simply don’t yet have a full account of what’s going on?* It is *not* necessary for conscious experience to be ‘non-material’ for it to have a dynamical influence not in the *current* laws of physics. (In fact, one entirely plausible and quite amusing possibility is that the contents of conscious experience – the shapes, colors, sounds and other sensory and proprioceptive components going on for you *right*

now – are themselves *made out of* ‘dark matter’. This speculative possibility is not central to or in fact mentioned anywhere in later technical developments. It’s just given here to point out the fallacy in the ‘not understood means supernatural’ objection, which is the real essence of ‘dynamically-unconventional means supernatural’.)

Related to the supernatural objection is the equally-fallacious ‘dualism!’ claim. This alleges that, if conscious experience has a dynamical impact not accounted for in current physical law, it must be made of a consciousness-stuff that’s different from matter-stuff. (‘Dualism’ here labels a class of philosophies in which reality is composed of two fundamentally substances or stuffs.) Again, according to seventeenth-century ghosts, ‘how are these two inherently-different stuffs to interact?’. First (and again), ‘not-accounted-for in current physical laws’ does *not* imply ‘fundamentally-different stuff’. (Is dark matter a fundamentally-different stuff?!) Second, even if that implication *did* hold – do we know what ‘stuff’ electrons and muons are made of? Maybe they’re made of electron-stuff and muon-stuff. But they interact perfectly well via the exchange of photons (in this account – made of photon-stuff!). Most fundamentally, ‘stuff’ and ‘substance’ are completely irrelevant to modern physics. Modern physics can be viewed as the mathematical characterization of dynamical regularities with reference only to defining-properties of fundamental entities (charge, color, spin, and mass, for example), *without* any philosophy-of-stuff. Of course we can hypothesize, if we want to, that all these entities are made of a common stuff. But, *if* conscious experience leads to some *dynamically*-innovative character, we’re equally free – if we want to – to hypothesize that conscious experience is ‘made of’ that *same* stuff! (It may or may not have mass-energy. It *must* have some way of coupling with the fundamental constituents of the brain – if it does couple! Coupling can utilize existing charge/color mechanisms, or – more likely, for technical reasons – involve new, hitherto-undiscovered, channels.)

Finally – for the present introductory-review of the objection-avalanche – let’s consider two related responses to the possibility of dynamically-*unconventional* reality: the ‘wildness’ claim and the ‘Occam’ objection.

The ‘wildness’ claim attempts to ‘disprove’ the possibility of dynamical-unconventionality by asserting that ‘new physics in the brain is just a wild, ungrounded, approach’. But ‘wild’ is not scientific. It speaks rather of a deep-rooted psychological distaste for the hypothesis. (This distaste can be traced to real psychological origins. But these are not *well-justified* origins! ‘Feelings aren’t facts’! See Appendix C for a little more on this point.)

‘Ungrounded’ deserves more consideration, though. It is both reasonable and scientific to ask ‘why should we make such a hypothesis?’. After all, it is possible to make a hundred different hypotheses in just a few minutes, without any of them having any scientific merit. (Reality is made of turtles. Reality is made of rainbows. Reality is made of elves ... Reality is made of matter. Reality is made of mind ... All of these could be true. It’s not that they lack merit ‘because we can see they’re untrue’. They lack *scientific* merit because they are untestable: we can’t see *anything* about them, experimentally! Relatedly – even if true – they typically don’t give us anything useful!)

I’ll address the ‘ungrounded’ issue shortly, after looking at the ‘Occam’ objection. We already touched on a form of this attempt to rule out consideration of dynamic-unconventionality, earlier in this section. It says ‘we have a *simpler* explanation of conscious experience in terms of *current* physics, without dynamical innovations; so, more complex explanations – involving *dynamical-innovations* in physical theory - are therefore unnecessary’. (A peculiarly-distorted version of this objection takes the form

‘simpler explanations tend to be true’. There is no place for this in science. Newton’s gravity is simpler than Einstein’s, and is ‘true enough’ for many terrestrial contexts. But Einstein’s is undoubtedly ‘truer’. The proper scientific place for Occam’s Razor – which these ‘simplicity’ arguments derive from – is simply in the selection of theoretically-simplest exemplars from competing hypothesis-classes, for mutual experimental testing. Conversely, once a theoretically-simplest in-class candidate has been experimentally-supported, it shouldn’t be complicated by the additional of untestable features.)

Unlike ‘unscientific’, ‘supernatural’, ‘dualism!’ and ‘wild’, the ‘ungrounded’ objection and the related claim that ‘we already have a simpler, sufficient explanation’ *do* have some scientific merit. We *do* need some reason for investing precious time and attention (and eventually, experimental resources) in novel hypotheses. But ‘ungrounded’ and ‘already have a simpler explanation’ objections *fail logically*, on scientific grounds. They both depend absolutely on the claim that current physics *can* give an *experimentally-based, scientifically-reliable* account of conscious experience, *within a dynamically-conventional framework*. However, this claim is *provably* false: this proof is the central content of Part 2!

Part 2 is where the technical content of meter-Hamiltonian reasoning begins. And its surprising primary focus is a rigorous refutation of the explanatory power of dynamically-conventional physics, in relation to conscious experience.

5. Sketch of Reasoning: Part 2’s ‘meter-Hamiltonian argument’

Proving that a genuinely-scientific account of conscious experience is impossible within a dynamically-*conventional* framework, refutes both the ‘ungrounded’ and ‘already simpler’ objections to dynamically-*unconventional* frameworks. More generally, consider the first-cut parsing of possibilities for reality itself, into dynamically-conventional and dynamically-unconventional kinds. (Other reality-kinds are clearly possible, for example, a reality that shifts between conventional and unconventional dynamics! But a two-kind account is good enough to start with.) *If* a genuine science of conscious experience is impossible in a dynamically-conventional reality (as Part 2 proves), two major logical possibilities then ensue, in this reality-categorizing.

First, if reality itself *is* dynamically-*conventional*, then trivially no science of conscious experience is possible. But this turns out to have extraordinary consequences for the viability of trustable *science*, as Part 4 – reviewed imminently below, in section 7 – shows. That is, the viability or otherwise of a science of *conscious experience* turns out, remarkably, to be synonymous with the viability or otherwise of *science* as a whole, as a trustable means for exploring *reality* as a whole.

Second, if reality is dynamically-*unconventional*, a science of conscious experience (and a trustable scientific enterprise) *may* be possible. (Not every kind of dynamic unconventionality results in the possibility of reliable science. We would have to discover – experimentally – the exact kind that exists in our Universe.)

So (subject to section 7’s explanation below of the science-of-conscious-experience/science-as-a-whole relationship!) the stakes concerning the possibility of a science of conscious experience are tremendous. But why would anyone think that a science of conscious experience *is* impossible under dynamic conventionality? The modern renaissance of mainstream consciousness science – beginning in the 1990s with Crick and Koch’s pioneering leadership (Crick & Koch, 1990) – has all taken place

within a dynamically-conventional setting. Can all the extremely-clever minds involved in this effort have been profoundly mistaken?

The rigorous demonstration that conscious-experiential science *is* in fact impossible under dynamical conventionality is no small matter. (Even in the relatively-succinct scientific presentation style of Part 2, it takes about fifty pages – although a lot of that is preliminary set-up.) If this proof were simple and obvious, it would have been discovered long ago. It requires the creation of an entirely new symbolism in scientific theory, so that the object of study – conscious experience – can be integrated with the formal methods of theoretical physics, notably that part of physics which characterizes the transmission of information via dynamical activity. [The core technical feature appealed to in Part 2’s proofs is physics’ Hamiltonian-based characterization of how scientific measuring devices, or ‘meters’, function (Bohm, 1951). Hamiltonian formalism is simply a mathematical way of precisely characterizing the behavior of a given dynamical system, and is a familiar and uncontroversial topic *e.g.* in undergraduate mathematics and physics curricula (Goldstein *et al.*, 2001). Again, the overall method-of-reasoning this work is based around is therefore termed ‘the meter-Hamiltonian argument’ (for consciousness science).]

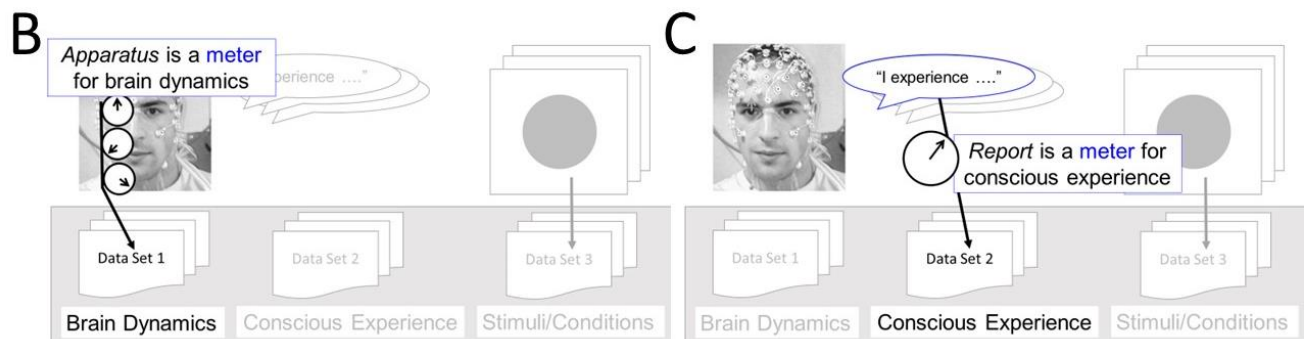
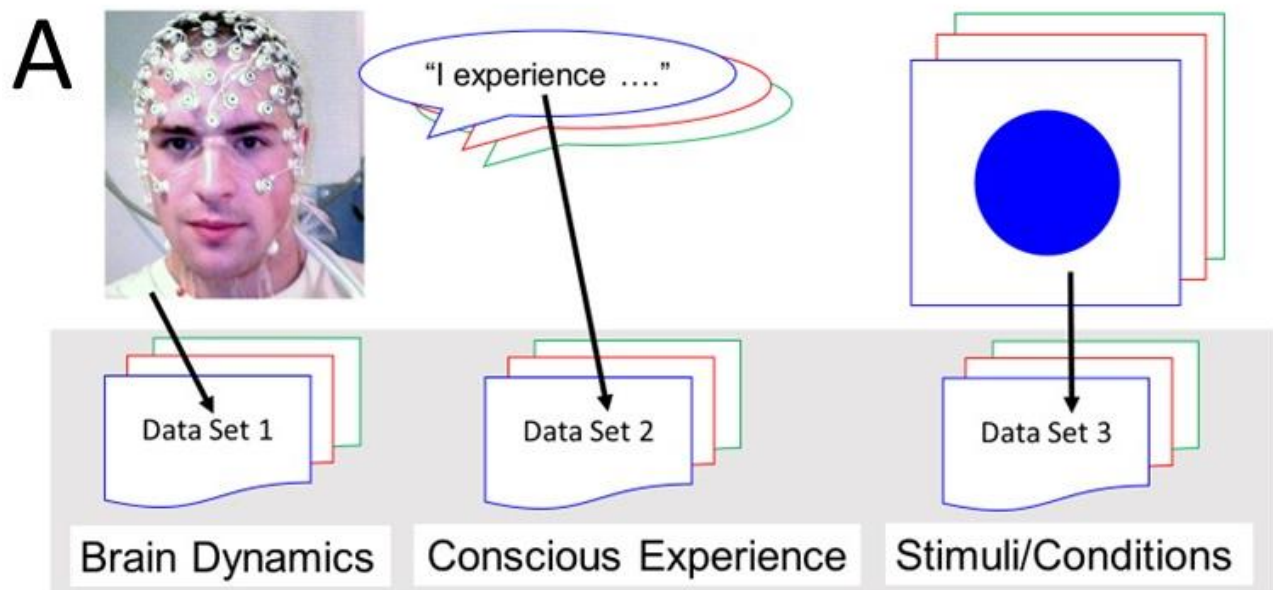
Despite necessary technical complexities of Part 2’s rigorous meter-Hamiltonian logic, it is possible to sketch the overall flow of reasoning, which goes as follows.

One typical scientific explanation of one phenomenon in terms of others broadly involves using two kinds of measurement-apparatuses, or meters. (Naturally, what follows is a huge simplification. But it speaks to the essential character of current *consciousness* science.) We make a number of distinct experimental preparations, and collect meter-readings. Then we try to explain the readings of one meter in terms of the readings of the other. (For example, *in principle*, we explain thermometer readings in terms of readings of a molecular kinetic-energy meter. Of course, the latter meter-kind doesn’t *directly* exist. But the principle applies.)

Thus, to establish a scientific explanation of conscious experience in terms of brain-activity, we need two meters: a conscious-experience meter, and a brain-activity meter. Reading brain-activity is difficult for a number of technical reasons, but we have a variety of complementary ‘meters’: EEG, MEG, MRI, and so on. But what is the ‘meter’ for conscious experience? It must be some sort of ‘report’ by a subject who is presumed to have conscious experience. Various types of report are used in practice, but they all suffer from the same fatal methodological flaw, *in a dynamically-conventional framework*. This common flaw can be most easily demonstrated by considering the case of in-experiment *verbal* report. (But again, all approaches share the same flaw, as explained in detail, in Part 2.)

Conscious-experiential science is supposed to work stylistically in the following way (Figure 2). The experimenter presents a line-drawing of a tree, say, to the experimental subject. The experimenter simultaneously records brain-activity. The subject then verbally reports ‘I saw blue circle’ – and this report corresponds to the conscious-experience ‘meter’. At first sight, it *seems* as if this is broadly the same set-up as a temperature/molecular-kinetic-energy experiment. After all, we have two sets of data (brain-data and conscious-experiential reports). There seems to be nothing *in methodological principle* that prevents us from correlating the two datasets, and discovering at least ‘the neural correlates of conscious experience’ (Gamez, 2014).

Figure 2. The Two-Meter Approach in Mainstream Conscious-Experiential Science. **A.** The basic experimental set-up in mainstream conscious-experiential science involves presenting various stimuli (depicted by the blue circle), and collecting two kinds of additional data: brain-dynamical information, and data about conscious experience, which is collected typically *e.g.* by verbal report. I call this a ‘two meter’ approach because it compares data from a brain-meter, and from the meter-of-report. **B.** Apparatus such an EEG set-up is a meter for brain-dynamics. This is the first of the two meters. **C.** Report is a meter for conscious experience. This is the second of the two meters. Obviously, ‘report’ does not look the same as an EEG apparatus or an MRI scanner. Nevertheless, its *functional* role in the experiment is the same: it’s a meter. Once this is accepted, meter-‘readings’ from the report-meter can be analyzed in the same way as those from standard physical-apparatus. In particular, the meter-of-report must be connected to the phenomenon it is gathering data on, just as a thermometer gathering data on the temperature of a beaker-of-water must be in the water, not on the shelf!



However, closer examination reveals a crucial difference with the temperature experiment. Temperature-state directly affects the temperature-meter. But conscious-experiential state does not affect the matter-brain, under the assumption of dynamical-conventionality (because dynamical-conventionality *is* the assumption of no-effect, in the way described in section 3, above). And it's the matter-brain that makes the report. So the conscious-experience meter isn't actually dynamically-connected to the natural phenomenon being reported. It's like doing a temperature experiment where the thermometer is left on the shelf in the instrument cupboard, but the molecular-kinetic-energy meters are connected to the beaker of water we're heating in the lab. This is not reliable science!

Now the issues here are a bit delicate. It *seems* ridiculous to suggest a subject's report, such as 'I experienced a red square', isn't reliable. After all, I *know* when I'm experiencing a red square! There's no doubt (apparently). But this is *science*. Subjective appearance isn't enough, if there's a theoretical reason to doubt it. (Not that theory should override data, either. Still, conflicts have to be resolved.) When 'I know' there's a red square in my conscious experience, how does that knowing take place? To do science, we have to examine the scientific properties of the 'knowing-system', to verify that it can in fact 'know' the proclaimed fact. But if conscious-experience-of-red-square *can't affect any dynamics* in my matter-brain (as it *can't*, under dynamical-conventionality), there's logically, *scientifically*, no way for that brain *to* know.

Something curious has happened here in the science of consciousness. Either scientists completely gloss over this problem. (Which doesn't resolve it!) Or they seem to rely on the reassurances of philosophers. Philosophers then try to solve the meter-of-report problem in ways that violate dynamical conventionality – and call the resulting framework dynamically-conventional! [The most prominent example of the latter approach can be found in David Chalmers' seminal *The Conscious Mind* (Chalmers, 1996). This text appeals to a non-physical knowing of the reliability of conscious-experiential report – and calls the resultant approach 'causally closed', meaning causally-closed in the domain of conventionally-physical entities! This is clearly self-contradictory, because it invokes a non-physical process that must affect the brain, for the scheme to resolve methodological problems. See Part 2's Figure 13 for a detailed analysis of Chalmer's specific suggestion in *The Conscious Mind*, and Part 3's section 3.4 for a broader discussion of the more general idea of 'bridging principles' as a way of resolving meter-of-report problems.]

Certainly it seems hard to deny *my* subjective knowing of the content of my own conscious experience. But – if we are going to do *reliable science* – we have to give some account of *how* we can reliably know that. The answer is clear. (Although it's perhaps only *rigorously* clear, after a lot of work, in Part 2!) In a dynamically-conventional framework, there is no 'how'. Two possibilities ensue. Either our knowing is an unreliable illusion. Or reality is not dynamically-conventional.

Presuming for the moment that Part 2's reasoning is correct, the simple consequential logic ('illusion or unconventionality') is stark. If we stick to the knowability of our own experience (*i.e.* we deny the 'illusion' logic-branch), we're left with the conclusion that reality is dynamically-*unconventional*, despite what current physics says! But for institutional reasons (if not others), there's no way that fundamental physics is going to accept the existence of novel physical dynamics, simply based on subjective claims that 'I know for sure the contents of my own experience'. (For example, there is still the logical possibility – likely preferable to fundamental physicists! – that knowing-of-conscious-experience *is* an illusion.) Fortunately, though, we do not simply have to rely on logic here. *If* there is

dynamically-*unconventional* activity in the brain, we can observe it experimentally. The character of an experimental program that can make such observations (if they are there to be made!) is the focus of Part 3 (reviewed in section 6, immediately below).

Before pressing on into experiments, let's just revisit the entry-point to this section, and underline the answers meter-Hamiltonian reasoning establishes (if correct!), to the 'ungrounded' and 'already have a simpler explanation' objections.

Concerning 'already have an explanation', Part 2's reasoning demonstrates that we don't – and *can't* – have *any* scientifically-reliable explanation, *in a dynamically-conventional setting*. (This 'don't and can't' proof applies to weak-emergence explanations – the mainstream go-to – *and to every other explanation that presumes dynamic-conventionality*.)

And, contrary to 'ungrounded' allegations, this point establishes the 'grounds' for hypothesizing and seriously considering dynamically-*unconventional* realities: conscious experience is a fundamentally-significant natural phenomenon, and we want to have a scientifically-reliable account of it. *And we don't, and can't, under dynamic-conventionality*. If nothing else, we want to have an answer to the question of whether or not we actually 'know' the contents of our conscious experience! Again, this work does not reason from these wants to the *truth* of dynamical-unconventionality. It reasons from wants to Part 3's *experimental program*, which can *discover* what sort of reality we *actually* live in – dynamically-conventional or unconventional.

6. Sketch of Reasoning: Part 3's Experimental Resolution of the Crisis for Science

The story so far: Part 2's meter-Hamiltonian argument shows that no scientifically-reliable *experimental* approach to conscious experience is possible, under dynamical-conventionality. This does not refute weak emergence as a potential explanation: it refutes our ability to do experiments on conscious experience, *whatever* its dynamically-conventional explanation. Thus, it refutes the possibility of any *scientific* exploration of the relative descriptive-accuracy of the many competing explanations (including the multiple variants of weak emergence the mainstream field is fixated on).

A slightly more-complete account recognizes that scientific exploration need not depend on new experimental data: theoretical advances can take place relative to existing data, or even in the almost complete absence of it! (In fact, the meter-Hamiltonian argument is itself a theoretical advance of this kind.) So, ruling out experiments doesn't *in principle* exclude scientific advance on conscious experience. However, as Parts 2 and 3 establish, the fact-of-the-matter for conscious-experiential science is that the only advance currently and foreseeably available *is* the meter-Hamiltonian argument.

But (fortunately for the scientific enterprise as a whole!), this is not the end of the story. It simply frames the only currently-relevant question for the current form of conscious-experiential science: is our reality dynamically-conventional? This is not a theoretical question, but an empirical, experimental one. By definition, the difference between dynamic conventionality and unconventionality has to do with dynamic coupling (or otherwise) of information in conscious experience with the matter-brain [over and above the sorts of e-causal coupling that weak emergence can be said to bestow (Gamez, 2014)]. In principle at least, the kind of dynamically-based information flows that actually occur in the human brain can be established experimentally. Put directly, whether or not our reality is dynamically conventional can be established with *data*.

Before outlining the relatively straightforward of nature of the experimental program that can collect this data, we should ask: why is this experimental program not *already* the focus of consciousness science? One answer could be: because the meter-Hamiltonian theorems are new results, and it takes time for science to re-orient to deep and subtle innovations. While there may well be something to this, I personally believe the far more significant factor concerns deep and subtle dysfunctions in institutional science. According to Figure 1, mainstream science is functioning in a distorted way, due to foundational flaws. These flaws have a kind of self-defensive activity, so they act to prevent their own discovery. This may sound a bit paranoid. ('Mainstream science is out to get the meter-Hamiltonian program!') But self-defensive activity of a deep psychological structure is obvious and familiar to any psychotherapist who practices at any level beyond the everyday shallows. As I briefly explore in Appendix C, the proclaimed stance of institutional science is that training, experimental replicability, and peer review eliminate the possibility of psychologically-biased process. My own view is that this stance is just *another* form of foundational defense, and that science's refusal to look deeply into itself in these directions is *one* of the reasons post-Truth has whipped itself into such a fury. One major risk for society, then, is that science continues to dogmatically insist that there's 'nothing to see here', to deny meter-Hamiltonian logic, and to refuse to engage with Part 3's experimental program.

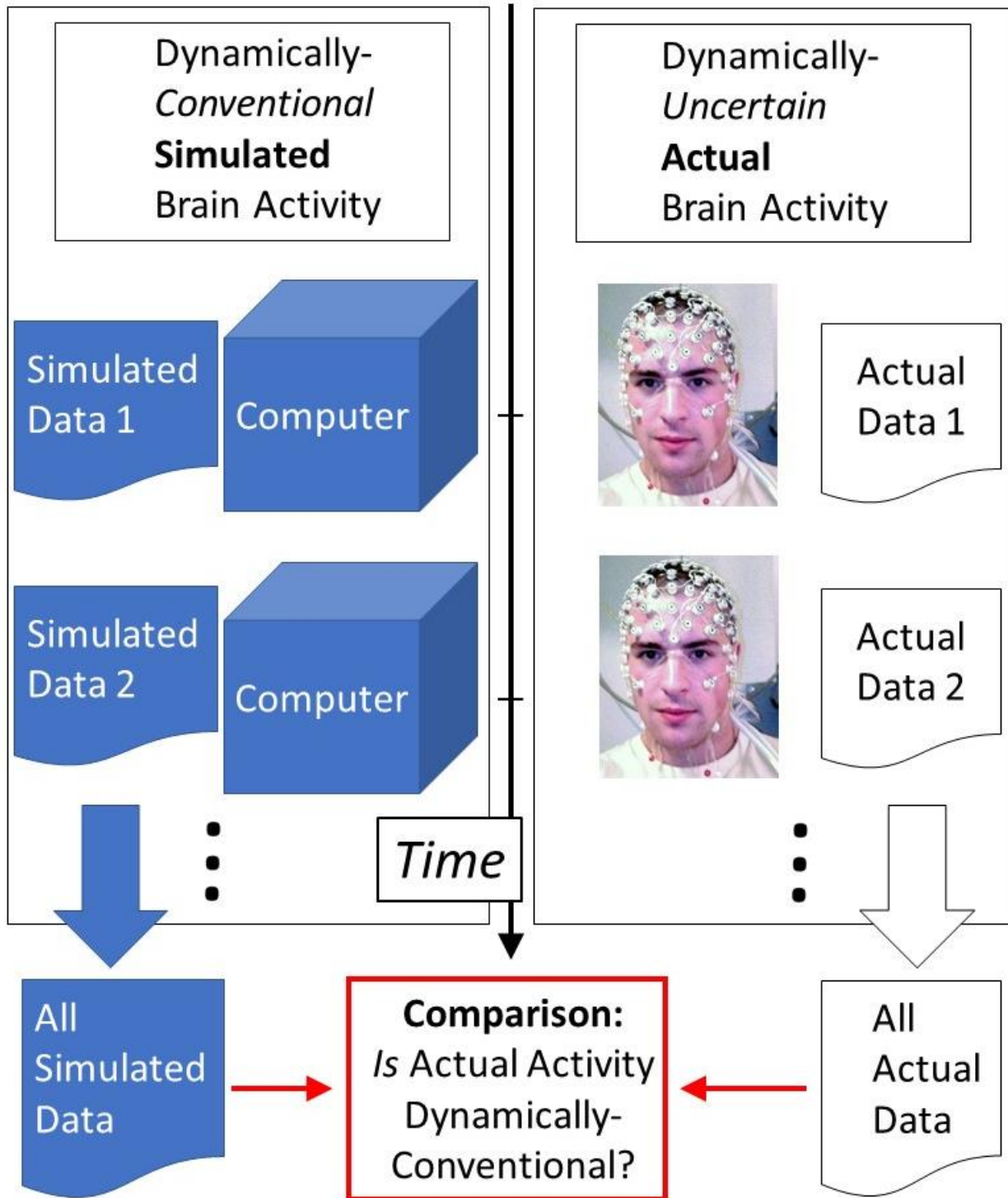
In the face of that risk, all I can really do is to continue to present meter-Hamiltonian reasoning and its experimental implications as calmly as I can, and continue to engage with the hearts and minds of scientists who are (unbeknownst to them) entangled with Figure 1's fractures and fault-lines. (This is not finger-pointing, or a grab for superior psycho-cognitive-emotional status. *I* am entangled with those same splits, as – clearly! – are most if not all of the post-Truth crowd. If there is a difference, it's only that some of us have a dim and dawning awareness of these schisms, and their consequences. What's needed is for us *all* to turn and look at what's going in the depths, *together*.)

In that vein, let's press on with the presentation, for those who are willing and able to listen ...

As Figure 3 illustrates, Part 3's experimental program is straightforward in essence (although undoubtedly challenging in practical execution). The first issue is whether dynamical-activity in a conscious human brain displays features over and above what a conventional-matter brain would show. So, let's simply look. To do this, we collect brain-data during report of conscious experience (exactly as we do during section-5/Fig.-2's currently-standard conscious-experiential science experiment!). The additional, *pivotal*, feature is that we then compare this brain-data with a *detailed-enough* computer-simulation of what 'should' be going on in a dynamically-conventional brain, in the same experimental setting. If dynamically-unconventional innovations exist, due to transmission of information from conscious experience to brain activity, these will be visible in the *difference* between actual and simulated brain-data.

Before *briefly* exploring the practical challenges, I should sketch the second issue that such a program must shed light on. Say we do reliably establish the presence of beyond-conventional-physics dynamics in brain-activity. Undoubtedly, this would be paradigm-shattering. It would be the first fundamentally-surprising experimental data, since the discovery of dark matter and dark energy, thirty-odd years ago! More shockingly, it would be the first-*ever* discovery of new *fundamental* physics in a relatively *high-level biophysical* system.

Figure 3. Actual-vs-Simulated Comparisons Can Reveal Reality's Dynamical Character. The essence of Part 3's experimental program is straightforward, conceptually. Two parallel streams of time-indexed data are generated, by detailed-enough computer simulations of dynamically-*conventional* activity, and by experimental collection of actual brain-data (whose dynamical character is hypothetically *uncertain*). Actual and simulated data must show structured differences if reality is dynamically-*unconventional* (i.e. if conscious experience influences brain-activity in an orderly way).



As extraordinary as this would be, it still wouldn't quite *yet* establish that we can do conscious-experiential science (which is the immediate motivation for experiments). We would still need to establish that the precise details of dynamical innovation do in fact correspond to the transmission of the precise details of the contents of conscious experience. (For example, one kind of dynamical innovation would simply be the transmission of the data 'conscious experience is occurring' – while it is! But what we need for a reliable, detailed, science of conscious experience is, for example, transmission of 'now a blue circle is occurring in conscious experience ... now a red square is occurring in conscious experience ...'. Only this latter *kind* of dynamical innovation can establish verbal report of 'blue circle ... red square' as a reliable component of a *subsequent* experimental approach to details of the brain/conscious-experience relationship.)

Both first and second stages of this experimental program do present significant technical challenges. (The first stage being the identification of *any* kind of dynamical innovation, and the second being the analysis of the *exact* information-transmission character of such a discovery. Notably, as discussed in subsection 2.4, non-standard dynamics might have two possible sources: non-algorithmic reasoning-related activity, and dynamically-unconventional transmission of experiential-data. Given that we could call these two potentials 'intelligence' and 'consciousness' respectively, the third and most fascinating possibility is that dynamical innovations come from both sources, and that intelligence and consciousness are not in fact separable!) Part 3 addresses technical challenges at length, and I refer you in particular to Part 3, section 6.4, for a detailed investigation.

For present introductory purposes, I just want to cover one issue – the almost universal rejection of Part 3's proposals, by neuroscientists. One reason for this is the slew of poorly-conceived (reviewed in section 4 above) objections to dynamically-unconventional hypotheses. Despite their illogical character, these *theoretical/conceptual* irrationalities still seem to taint responses to an *experiment* that's simply designed to test the natural order of things.

Relatedly (and the issue I want to focus on now), Part 3's program seems to typically evoke the rather curious response, 'technical challenges can't be overcome'. (Actually, this is not so curious when seen in the light of Figure 1: the response is just another way for fracture to express.) As with every major technical challenge that science and technology have ever faced – we won't know until we try. (And in fact, as Part 3 argues, most of the allegedly insurmountable obstacles are either non-existent, or immediately evoke eminently-plausible solution-methods!). It does seem as though defeatists miss the whole point of meter-Hamiltonian reasoning, and in particular its implications for science as a whole (Part 4). If we don't even look, if we don't even *try out* Part 3's approach – all we are left with is the presumption of dynamic conventionality. That means no reliable conscious-experiential science (Part 2). It also means no reliable science, full-stop (Part 4). Lacking the foundational antidote of grounding in experimentally-established dynamically-unconventionality, science will continue to be vulnerable to post-Truth attacks. My own view is that these attacks will intensify, rather than abate, with the passage of time. (This is not a pessimistic orientation, but a view that reality itself is actually deeply constructive. In this view, it's not a stretch too far to see some attempt at 'sideways'-communication from post-Truth to science. If science fails to respond – for example by throwing up its hands before starting Part 3's program – this attempted communication will only get louder.) Even if the odds of Part-3 success were a million-to-one against (which they most definitely are not), and the cost of the program were a billion dollars (which it probably isn't!), we should *still* execute the proposal. Why? Because what's at risk is the very fabric of human society!

Given that that societal fabric is a pre-requisite for *every* future financial flow, on any rational decision-method, the purely-financial cost-risk-benefit analysis of Part 3's program is compellingly in its favor. (And that doesn't take into account the compelling scientific character of the program, in terms of pristine theoretical underpinnings and the possibility of making new and unexpected *reality-definitive observations*! See Part 4 for more on the latter potential, whose value is arguably at least the same order of magnitude as the sum-total of *all* present expenditures on *basic* science research.)

Finally, before moving on to Part 4's implications from the meter-Hamilton argument for science-as-a-whole (as opposed to its implications for *consciousness* science), it's important to note two things.

One is that, before executing Part 3's program, consciousness science is in an extremely curious position. (And Part 4 shows that this same curious position applies to science-as-a-whole.) We don't know that consciousness science is viable. And we don't know that it isn't! It exists in a curious sort of limbo. (This limbo-status does *not* apply to the *current mainstream* flavor of consciousness science, which assumes *both* dynamically-conventional reality *and* the validity of its two-meter methodology. This is not in limbo: it is decidedly and definitely impossible, and a flat-out contradiction at odds with the contradiction-free essence of science ... assuming, of course, that Part 2's meter-Hamiltonian reasoning is correct!)

The second thing to highlight is the way in which *science*, as an experimental activity that grounds itself in the specific reality we inhabit, can potentially diverge here from the Gödel theorems in *mathematics*. Briefly again, one parallel with Gödel goes like this. Gödel shows that any mathematical system of a specific minimal character contains statements that can be neither proven nor refuted. The meter-Hamiltonian argument shows that any dynamically-conventional reality can neither prove nor refute any specific theory-of-conscious-experience. So far, so parallel! In section 2 above, I said that we can step out of Gödelian implications in a variety of ways. (For example, *if* the system is *actually* consistent, the Gödel sentence is actually true.) And I said that we can step out of meter-Hamiltonian untestable-theory implications in a parallel way, by 'adding more information', so to speak. Now I'm simply re-emphasizing that the *ways* we 'step out' are conceptually distinct. In mathematics, we need more axioms or theorems. In science, we need more experimental data. (However, I also implicitly suggested in subsection 2.7 above, 'Putting Down a Marker', that we need to investigate more deeply the differences between Gödelian-*theoretical* and meter-Hamiltonian-*experimental* moves here, by investigating the relationships between science, mathematics, and reality. It may turn out that the two kinds of move are 'less different' than we currently think, in some sense.)

7. Sketch of Reasoning: Part 4's Explanation of the Consciousness-Related Crisis for Science

Subject to your verification of the correctness of reasoning in Part 2 and Part 3, here's the latest story-so-far recap. We've seen that an authentic (contradiction-free!) science of conscious experience depends on the existence of a specific kind of dynamically-unconventional reality (Part 2). Further, there is an experimental program that can in principle determine the actual dynamical quality of the reality we inhabit (Part 3). This is fascinating and *field*-revolutionary. But its relevance to wider science and society may not be immediately apparent. In what I call 'the pyramid of science', chemistry is constructed on top of physics, biology on top of chemistry, and neuroscience in a sense sits at the pinnacle of biology. Consciousness science is then a small, recent, and controversial sub-field in neuroscience. All of which seems to rather limit the impact of Part 2's meter-Hamiltonian argument,

and Part 3's experimental investigations. They *seem* to refer to a far-flung frontier of the scientific enterprise. It *appears* that science and society will proceed pretty much unaffected, regardless of how things turn out for meter-Hamiltonian edifice.

These seemings and appearances are plausible, at first glance. But in fact they are incorrect. They are incorrect because science currently lacks an adequately-scientific analysis of *itself*! The view that the rest of science can carry on perfectly well, whatever happens with consciousness science, depends on an inaccurate and unscientific neglect of the role of consciousness *in* science. The postmodern critique (in both the calmer *non*-post-Truth form and the furious post-Truth outpouring) starts with a pointer to that role. The essential claim is that science is a process in human consciousness (or a collection of human consciousnesses), and that it need not therefore have anything to do with actual reality. This claim is incomprehensible to most scientists (and many science-friendly laypeople), because it seems that science is obviously 'about' actual reality. As a simplistic example: the sky is blue. Science has a theory of why the sky is blue. Therefore science is about reality.

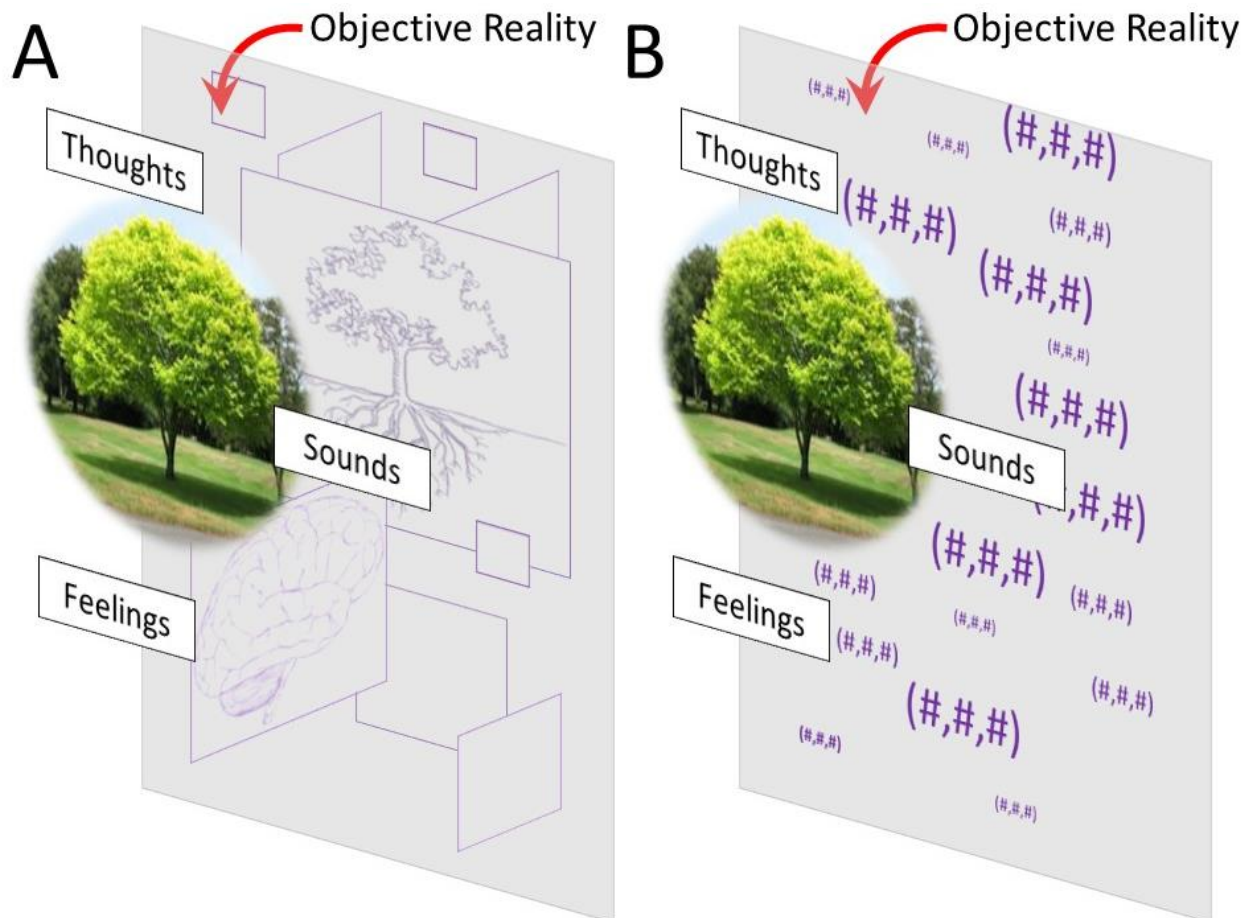
On closer examination, however, dynamically-conventional science *doesn't* (and *can't*) explain why the sky is blue, if 'the sky is blue' means 'I have a conscious experience of blueness in the spatial area of my experiential realm that I call "sky"! (If all this seems like pedantic wordistry to you, I'm sympathetic. I will move as quickly as possible to concrete implications. But just as it's important to get the nuances right in quantum field theory, relativity, materials science, pharmaceutical development and so on – it's important to get the nuances right in a scientific analysis of science. Please bear with me.)

The idea that science is already about *consciously-experienced* reality (e.g. blueness) often depends upon a confusion between conscious experience, and the background reality that generates or leads to conscious experience. We don't actually have to assume there *is* a background reality. We can do science on the basis that 'conscious experience occurs *as if* there were some stable background reality', and then investigate the hypothetically-stable regularities of that as-if reality. (Equally, we can hypothesize there *is* a real reality 'out there' somewhere. This work isn't dependent on either way of conceiving of reality, or, to put it differently, holds whatever the 'actual' character of background reality is!) Here, the crucial point is that conscious experience and the (as-if) background-reality are *not* the same (Figure 4).

'Naïve realism' is one name for the idea that the green, conscious-experience *of* a tree in Figure 4 is the *same thing as* the matter-tree that participates in generating conscious experience. This work takes the view that naïve realism is false. This view is also the default stance of mainstream science, when push comes to shove. (There are some philosophical hold-outs on this point. There does sometimes seem to be some disconnect between disciplines too: the only place where naïve realism is *reliably* rejected is in the neuroscience of consciousness, which might explain some of the neglect of bigger-picture issues for science-as-a-whole, e.g. per Part 4. In any case, it's *really* hard to see how to do rational science at the same time as using naïve realism as the background frame.)

Denying naïve realism, we can now see why mainstream science doesn't explain 'why there is blueness in the sky-region of conscious experience'. Blueness-in-the-sky occurs in the *experiential* realm, and *all* of mainstream (non-conscious-experiential) science is about orderly regularities in background reality. Mainstream science *lacking a science of conscious experience* (as must be the case for any science presuming dynamical-conventional reality) can certainly give an account of why blue-

Figure 4. Experiential and ‘Unseen’ (or ‘Background’) Realities. A. *Two-realm depiction of reality.* Semi-transparent grey rectangle schematically separates ‘unseen reality’ from ‘conscious experience’. ‘Conscious experience’ includes thoughts (and imaginations), audiovisual experience of the unseen environment (depicted here schematically by a colored image representing visual experience, plus the placeholder text ‘Sounds’), and feelings of all kinds (emotional, sensory, and proprioceptive). ‘Unseen reality’ contains all the objects studied by conventional science (*i.e.* science *excluding* the study of conscious experience!). Purple rectangles schematically depict *the entire physical Universe*. Two unseen-realm objects are schematically-emphasized: the physical tree (purple line-drawing) that is re-presented centrally in the experiencer’s visual experience, and the physical brain (purple line-drawing) of the experiencer (who is experiencing thoughts, sounds, feelings, and colored visual-experience of the tree). **B.** *We have no knowledge of the ‘actual constitution’ of ‘unseen reality’.* Exactly-the-same conscious-experiences are *completely*-consistent with an alternative view, in which ‘objects’ in the unseen realm exist as numbers (‘#’-symbols), which are recomputed according to the laws of physics. (For example, some subset of the numbers depicted corresponds to the physical state of the experiencer’s brain. As well as the capacity to recompute unseen-realm numeric-content, Nature contains the capacity to ‘project’ specific experiential-content, according to the numeric-state of the experiencer’s brain). Note that ‘two realms’ doesn’t imply dualism, but simply reflects logical features of reality. All conventional science concerns inter-relationships *between purple entities in a single realm*; conscious-experiential science concerns inter-relationships *between realms*.



wavelength photons are pervasive in the sky-region of background reality. But it cannot even *speaking about* ‘experience of blueness’, while remaining non-contradictory. Why? Because dynamical-conventionality implies that ‘blueness’ (or any other experiential speech acts) are delusions. We *think* the blueness *itself* is generating the words, but that can’t be so, under dynamic-conventionality. And we are supposed to avoid delusory statements, in science.

Now this limitation of scientific reasoning to background reality is not in itself fatal. *At this point*, there is in fact a way of constructing science in which we presume (as an axiom) that conscious experience is a sort of faithful representation of background reality. Then we can translate scientific understanding into features of own conscious experience. ‘Science doesn’t explain blueness, but it does explain blue wavelengths, and I can reasonably assume that blueness-experience is the visual-experiential correlate of scientifically-explained blue-wavelength.’

Nevertheless, there are vital nuances that have to be acknowledge and respected in this view of science. When I am ‘talking to myself’ – *i.e.* thinking about! – blue and blueness, this process cannot be taking place in brain activity! That is, I must have the capacity for a sort of ‘disembodied’ (not-matter-generated) thinking. Why? Because a *brain-generated* thought of ‘blueness’ must again be a delusion [if reality is dynamically-conventional – which is the (untested!) assumption all along, in the analysis that began at ‘blueness’, a few paragraphs back]. If I’m not deluding myself about blueness-thoughts, then the thoughts must be taking place independent of brain-activity. Thus, this reconstructed-science can only exist if there is a new feature of Nature (non-brain-generated thought), not included in *present* mainstream science. (Many or even a vast majority of professional scientists would throw up their hands in horror at this point! Which is fine, for my reasoning here: rejecting this reconstructed-and-extended science simply leads us directly to a conclusion that there’s no way of relating mainstream science to *experiential* reality. Since experiential reality *is* our direct reality, this immediately creates a crisis of relevance for science. What I’m doing in following the reconstruction/extension path is trying to give mainstream science its best shot at avoiding that crisis. Reconstruction, and the extension into non-brain-thought, are simply logical necessities for mainstream dynamically-conventional science. Not accepting them is valid. But that non-acceptance leads immediately to the crisis we’re about to hit anyway!)

The unavoidable crisis for dynamically-conventional science occurs when we start to examine the role of conscious experience in *doing science*, in the reconstructed/extended form. For example, consider the creation and validation of the blue-wavelength theory itself, as part of the explanation of blueness-experience in the sky-region. Say an experimentalist is using some kind of light-meter, and recording readings. She says to herself something like, ‘Yes, I see the meter is reading 5 [or whatever it is], so I will write that 5 down in my dataset, and that process is reliable and scientific because – look! – I’m seeing myself seeing the “5” on the meter, and I’m seeing myself writing down the “5”, and I’m seeing the obvious logical-flawlessness of this simple but essential scientific process’. The *problem* is that the brain can’t be involved in any of that! If the basis of science is scientists’ *conscious experiences* of meter-readings and of logical-consistencies, a dynamically-conventional science denies the ability of those scientists’ *brains* to know anything about any of that.

It’s just like the logic towards the end of section 5. There I said:

“Either our knowing [of the content of my own conscious experience] is an unreliable illusion. Or reality is not dynamically-conventional.”

In this section, I've expanded the theoretical background a little, to allow for the conceptual *possibility* of a 'knowing' that isn't sourced in brain-activity, and can't influence brain-activity. In this expanded possibility-space, that section 5 sentence I just quoted now *doesn't* hold for *knowing*, because there could (hypothetically) be a reliable *non-illusory* knowing of experiential-contents (albeit in a non-brain, non-material, cognition). However, *speaking* requires specific, matter-instantiated, brain-activity. And under dynamic-conventionality a non-material cognition can't couple with or animate such material processes, thus preventing a putative reliable-*knowing* from being *spoken* in the matter-domain. Thus, what does hold, even in the present expansion-of-context, is the following restatement of section 5's assertion:

"Either our speaking [about the content of my own conscious experience] is an unreliable illusion. Or reality is not dynamically-conventional."

This means that the last refuge for dynamically-conventional science is a world in which scientists are conducting science in private, unspeakable, mental bubbles. Every thought and inference that's about conscious experience – our direct reality – must take place in this bubble. And the results of this bubble-process can't be spoken (or written about, or communicated in any way through the matter-body).

Of course, this completely contradicts the asserted view of science, in which scientists can openly share their thought processes, rely on the fact that those processes originate in the brain (which can be examined to make sure it 'runs truly'), and depend on things like peer review (conducted by other matter-systems – *i.e.* humans!) and experimental replicability (where other human matter-systems are supposed to report on experienced meter-readings that might diverge from original reports). None of these things are actually possible, if dynamically-conventional science is correct about its assertion of a dynamically-conventional reality!

Now you may well feel – as I did when I first stumbled into this kind of reasoning – that there's a lot of room in all that, for smoke-and-mirrors trickery or simply mistaken inference (even with the best intention). That's why in Part 4 (and in Part 2, and in Part 3!) conclusions are stated in the form of precisely-defined *theorems*. Assumptions or axioms are clearly stated, and logical steps leading from axioms to theorems are shown explicitly. In terms of precision and rigor, the very *informal*, little-bit handwavy, sketch-outlines in this introductory *Overview* should in no way be taken to substitute for actual technical developments of Parts 2 to 4. This *Overview* is offered as a way to get a sense for the overall flow and relationship of technical reasoning, as if from a helicopter ten thousand feet above the actual terrain. Necessarily, previews, overviews, and reviews are abbreviated. And, necessarily (for technical work), abbreviations neglect detail. If you detect a gap or inconsistency in the work as presented in the *Overview*, I urge you to note that alleged deficit, and see if it actually exists in the full presentation (Parts 2 to 4). (If it does, I'd love to hear about that! My contact details are on the first page of each paper, *i.e.* the first non-title page of Parts 2 to 4.)

To conclude: in section 5, I followed up the quote above shortly afterward with (something close to):

'If we incontrovertibly assert the *speakability* of our own experience ... we're left with the conclusion that reality is, after all, dynamically-*unconventional*'.

(I've amended the original text, changing 'knowability' to 'speakability', to align with the restatement a few paragraphs earlier, that replaced 'knowing' with 'speaking'.)

The analogue of this statement for science as a whole is:

‘If incontrovertibly assert the *reliability and functionality of communal, inter-subjective, speaking-mediated science* ... we’re left with the conclusion that reality is, after all, dynamically-*unconventional*’.

Put conversely, once we clearly set aside naïve realism, and identify the two-realm reality in which science functions, all roads lead to this conclusion: science as we know it is not possible in a dynamical-conventional reality. This massively raises the significance of the meter-Hamiltonian argument, and of associated experimental programs. They’re not just about our ability to carry out an investigation of conscious experience that deserves to be called ‘science’ (as hugely significant is that investigation is, on its own merits). They’re about our ability to carry out a recognizable science *of any kind*.

8. Why Does It *Really* Matter? Part 5’s Societal Significance, and a ‘post-Post-Truth’ World

Of course, the theoretical foundations of consciousness science are important (Part 2). *Of course*, experimental programs that might reveal astonishing new features of our inhabited reality are important (Part 3). *Of course*, the logical foundations of science itself are important (Part 4).

However, these might all be seen as, well, *academic* issues: things that might usefully absorb ivory-tower intellectuals, but with little direct impact on everyday human life.

In section 1 above, I sketched links between the technical work that forms the core of this book, and real, pressing, and *non-academic* issues for humankind. Arguably, it’s not an over-exaggeration to say that the very fabric of society is currently at risk. Quite extraordinarily, the meter-Hamiltonian argument and associated elaborations (Parts 2 to 4) will be a crucial element in our successful navigation of present perils. In this section, I briefly return to the societal significance of the technical core, now with section 5 through 7’s outline understanding of technical developments in hand. (Part 5 of the book, the *Afterword*, plays a similar role in relation to Parts 2 to 4, briefly re-linking their extensive content to the societal context we began with in Part 1, section 1.)

No-one who’s been paying attention to the sociopolitical arena over the past ten years can deny the extraordinary impact of ‘post-Truth’ viewpoints. But what’s the power-source perpetuating post-modern, post-Truth, ‘fake news’? And what’s the constructive antidote, to restore integrity to the fabric of society? There have been many answers to these questions, and this work is not meant to be a comprehensive comparative analysis, leading to suggestions for a complete program.

Instead, this book presents a strikingly-unusual response to the fragmentation of present-day society, starting in the strikingly-unusual place of technical theorems in computational neuroscience, theoretical physics, and consciousness science (Part 2). I do not mean to suggest that this style of analysis, and the results and suggestions it generates, comprise the one true answer to the science/post-Truth conflict, replacing all other analyses and responses. But I do suggest that this book identifies an absolutely crucial piece that’s missing *from* all other analyses, without which we won’t be able to find our way into a prosperous, stable, *post-post-Truth* civilization.

Theorems here prove that the ‘dynamically-conventional’ science of mainstream institutions is actually contradictory and unreliable (Part 4). This is post-Truth’s immediate power-source: the *scientific* truth of dynamically-conventional science’s *unreliable* foundations. I’m not suggesting that most or even

any of the emotionally-charged activities of the post-Truth movement originate in post-Truthers' intellectual familiarity with the content of this book! But I am suggesting that a major component of post-Truth energy is maintained by a sort of *unconscious intuition* of the foundational flaws in dynamically-conventional science. This book brings these same flaws directly to conscious awareness, in precise and rigorous intellectual detail. Poignantly, this very act of intellectually validating a liminal intuition bridges *a specific form* of the 'facts vs. feelings' schism. In this particular case, I establish *new* facts that support *some* currents of post-Truth feeling.

But this is *not* a pro-post-Truth manifesto! Notably (Appendix C), I vociferously argue for a sane integration of intellect and intuition, in the form of real intelligence, not for the wholesale slaughter of facts on the false altar of feeling! Establishing a single (and crucial) instance of a new-fact validating an intuitive-feeling does *not* excuse the blatant instances of distorted-and-ungrounded feelings destructively discarding obvious data. What we need to do is identify and clean up the dysfunctions on both sides of the Truth wars, and create new, pristine, and constructive ways of integrating the real gifts of both camps. This book focuses on what science needs to do. However, that does not mean there is no clean-up for the post-Truth side! (Or for other parties, in other, parallel, conflicts.)

So, to what is called for on the part of science ... By establishing experimental support for the dynamically-*unconventional* nature of our reality (Part 3), we can birth a new form of science. This is the antidote, creating immunity to post-Truth's attacks. However, it can only be created after understanding an ultimately accurate and constructive message for modern science, deeply buried in vicious fake-news onslaughts.

References

- Barnes B, Bloor D, Henry J (1996) *Scientific Knowledge: A Sociological Analysis*. Chicago, Illinois, USA: University of Chicago Press.
- Block, N. (2005). Two neural correlates of consciousness. *Trends in Cognitive Sciences*, 9(2), 46–52.
- Bohm, D. (1951). *Quantum Theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bohm, D. (2004). *On Creativity*. London, UK: Routledge.
- Chaitin, G. J. (1974b). Information-theoretic limitations of formal systems. *JACM* 21, 403–424.
- Chalmers, D. J. (1996). *The Conscious Mind: In Search of a Fundamental Theory*. New York: Oxford University Press, USA.
- Chalmers, D. J. (2008). ‘The varieties of emergence’, in P. Davies & P. Clayton (Eds.), *The Re-Emergence of Emergence: The Emergentist Hypothesis from Science to Religion* (pp. 244–256). Oxford: Oxford University Press.
- Church, A. (1936). An unsolvable problem of elementary number theory. *American Journal of Mathematics* 58 (2): 345–363. <https://doi.org/10.2307/2371045>.
- Cohen, M. A., & Dennett, D. C. (2011). Consciousness cannot be separated from function. *Trends in Cognitive Sciences*, 15(8), 358–364.
- Crick, F., & Koch, C. (1990). Towards a neurobiological theory of consciousness. *Seminars in the Neurosciences*, 2, 263–275.
- Elitzur, A. C. (1989). Consciousness and the incompleteness of the physical explanation of behavior. *The Journal of Mind and Behavior*, 10(1), 1–20.
- Feyerabend, P. (2010). *Against Method*. New York, NY; London, UK: Verso.
- Frauchiger D, Renner R. (2018). Quantum theory cannot consistently describe the use of itself. *Nature Communications*. 9:3711. doi:10.1038/s41467-018-05739-8.
- Gamez, D. (2014). The measurement of consciousness: A framework for the scientific study of consciousness. *Consciousness Research*, 5, 714. <https://doi.org/10.3389/fpsyg.2014.00714>.
- Gödel, K. (1931), Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme, I. *Monatshefte für Mathematik und Physik* 38: 173-198. <https://doi.org/10.1007/BF01700692>.
- Goldstein, H., Poole, C. P., & Safko, J. L. (2001). *Classical Mechanics*. San Francisco: Addison-Wesley.
- Harvey, R. (2013). *Your Essential Self: The Inner Journey to Authenticity & Spiritual Enlightenment*. Woodbury, MN: Llewellyn.
- Hofstadter, D. R. (1979). *Gödel, Escher, Bach: An Eternal Golden Braid*. New York, NY: Basic Books.

- Krishnamurti, J. (1987). *The Awakening of Intelligence*. New York, NY: Harper Row.
- Latour, B. (2010). *On the Modern Cult of the Factish Gods*. Durham, NC: Duke University Press.
- Lucas, J. R. (1961). Minds, Machines and Gödel. *Philosophy* 36, 112–127.
- Penrose, R. (1989). *The Emperor's New Mind*. Oxford, UK: Oxford University Press.
- Penrose, R. (1990). Précis of *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics*. *Behavioral and Brain Sciences* 13(4) 692 – 705. <https://doi.org/10.1017/S0140525X0008105X>.
- Penrose, R. (1994). *Shadows of the Mind: A Search for the Missing Science of Consciousness*. Oxford, UK: Oxford University Press.
- Phillips, I. (2018). The methodological puzzle of phenomenal consciousness. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 373(1755), 20170347. <https://doi.org/10.1098/rstb.2017.0347>.
- Putnam, H. (1960). 'Minds and Machines' in *Dimensions of Mind: A Symposium*, Hook, S. (ed.). New York, NY: New York University Press.
- Raatikainen, P. (2021). 'Gödel's Incompleteness Theorems', in *The Stanford Encyclopedia of Philosophy* (Spring 2021 Edition), Zalta, E.N, (ed.). <https://plato.stanford.edu/archives/spr2021/entries/goedel-incompleteness/>.
- Rudd, A. (2000). Phenomenal judgment and mental causation. *Journal of Consciousness Studies*, 7(6), 53–66.
- Sahu, S., Ghosh, S., Fujita, D. *et al.* (2014). Live visualizations of single isolated tubulin protein self-assembly via tunneling current: effect of electromagnetic pumping during spontaneous growth of microtubule. *Sci Rep* 4, 7303 <https://doi.org/10.1038/srep07303>.
- Sokal, A., & Bricmont, J. (1999). *Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science*. London, UK: Picador.
- Turing, A. (1950). Computing Machinery and Intelligence. *Mind* 49 (236): 433–460. <https://doi.org/10.1093/mind/LIX.236.433>.
- Watkins, M.R. (2015). *Prime Numbers, Quantum Physics, and a Journey to the Center of Your Mind*. Alresford, UK: Liberalis. [Author's note: I feel compelled to note, for those unfamiliar with Matthew Watkins' work, that this text is *not* a woo-woo New-Age wilderness, despite inferences the title may evoke. It is the third text in an extremely well-reviewed series on the Riemann Hypothesis, by a mathematics PhD who maintains an authoritative website on RH advances!]
- Wilber, K. (2017). *Trump and a Post-Truth World*. Boulder, CO: Shambala.
- Wilkes, K. V. (1988). —, Yishi, , duh, um, and consciousness. In A. Marcel & E. Bisiach (Eds.), *Consciousness and Contemporary Science* (pp. 16–41). Oxford: Clarendon Press.
- Zach, R. (2019) 'Hilbert's Program', in *The Stanford Encyclopedia of Philosophy* (Fall 2019 Edition), Zalta, E.N. (ed.). <https://plato.stanford.edu/archives/fall2019/entries/hilbert-program/>.

Part 5.

Afterword:

Fake News, the Three-Step Resolution, and
the post-Post-Truth Society

Afterword: Fake News, The Three-Step Resolution, and the *post-Post-Truth Society*

1. A Survey of Implicit Front-Cover Promises

The front-cover of this book implicitly promises a coverage of Gödel, Trump, an emergent crisis for science, a three-step resolution of that crisis, fake news, consciousness science, and a path to a *post-post-Truth* society.

Up to this point, the book has heavily covered science's emergent crisis, and the role of consciousness science in clarifying and resolving that. I touched on Gödel, Trump and fake news in the *Preface* and in Part 1's *Overview*. But there are still some loose ends to tie up. And even if the three-step resolution and some of the milestones on the way to *post-post-Truth* are dimly visible through the (crucial!) technical haze, those too could use some clarification.

Dotting these 'i's and crossing the remaining 't's is the agenda for this *Afterword*.

2. From Gödel to Trump: The Letter!

The headline 'From Gödel to Trump' can be interpreted in a number of ways. As an arc in historical time. (From the 1920s to the 2020s). As a semi-causal link between mathematical provability and contingent uncertainties about reality. (From Gödel's theorems to issues in the foundations of science. And from there – via the postmodern critique of science – to the foundations of Trumpian *post-Truth* politics.) Or, as a (fictional, imaginary) letter from Kurt to Donald:

'Dear Mr. Trump,

I have been reflecting deeply on the viewpoints and energies expressed by you and some of your allies and supporters, as well as on the responses from some of those who seem to strongly disagree with the positions you apparently stand for.

On the one hand, you do seem to have taken the whole thing a bit too far. While I can understand the origins of your movement's passions in the dangerous and dangerously-subtle overreach of the 'science knows' camp, I do wonder if a more constructive way forward may come from calmer, deeper, dialogue. (Having said which, I can also recognize very little propensity for the 'other side' to come to the table, in any meaningful way.)

On the other, your adversaries (if I can use that term) have also taken the whole thing a bit too far. Society is dominated by science-like thinking – which wouldn't be a problem, if current mainstream science were not profoundly flawed, and self-contradictory. The alleged-certainties of modern science are clearly without foundation, with consciousness science and theoretical physics in their current forms. (And the tiny prospect of any change on those fronts is surely – if subtly – a major ongoing stimulant to the emotional furor your movement evidences.)

There is a curious way in which your movement is highlighting a parallel between my own seminal work, in applying mathematics to mathematics, and the vital need for science to look at science, with an equal rigor. For that I'm grateful. But ... maybe enough, already?!

Sincerely, Kurt Gödel'

Dear reader, please do not mistake me here. I'm not saying that people stormed the Capitol because they had sat at home studying the consciousness science literature, and could find no other way to vent their outrage at the contradictions! Nor am I apologizing for blatant lying, in the darker corners (and centers!) of the post-Truth movement. (But where we point to blatant lying, we must also surely look to fictional-Gödel's 'dangerously-subtle' untruths, in the opposing camp.)

I *am* saying that the tremendous sociopolitical currents we find ourselves swept away by have their deep roots in conflicts within, and between, reality-theories or worldviews. This is not a new observation. [See, for example, (Wilber, 2017) and McIntyre (2018).] But the detailed technical reflection of a specific issue *in* science plus the sketch of an experimental investigation *of* that issue is completely new, to my knowledge. It's these new features that offer a three-step resolution of science's emergent crisis, and a crucial segment of the bridge to a *post*-post-Truth planet.

3. The Emergent Crisis, and Two Forms of the Three-Step Resolution

As noted in the *Preface* and in Part 1's *Overview*, the emergent crisis for science is *not* the fake news, post-Truth, explosion. That has already *emerged*, and can be construed as an attack on science from the *outside*. But why does this attack have so much strength? Naturally, there are always many ways of answering such questions. This book offers one partial but vital answer: the attack gains one major component of power from pushing on a real fracture *within* science: contradictions associated with the use of consciousness *in* scientific activity, and the treatment *of* consciousness by science.

The *emergent* crisis has to do with science's own growing recognition of its own issues. As noted in Part 4, it's not just consciousness science where these problems are starting to be felt. The application of quantum theory to quantum theory – another sort of scientific self-reflection – also points to contradictions (Frauchiger and Renner, 2018). But consciousness science is the only place where science-of-science issues can be *resolved*. This section lays out two versions of a three-step resolution process, starting respectively from a science-centric viewpoint (how does science recognize and resolve problems *in itself*), and from a society-centric viewpoint (taking a broader perspective, notably acknowledging and seeking to heal the conflict *between* science and post-Truth ... if at all possible).

From the viewpoint of science as a discipline, the three-step resolution of its own emergent crisis broadly follows the tripartite structure of Parts 2 to 4:

- A1. Because science wants to 'do consciousness', engage with and accept meter-Hamiltonian logic, concerning methodological foundations of consciousness science (Part 2).
- A2. Because the meter-Hamiltonian argument leads to a pivotal crossroads for science's ability *to* do consciousness science, execute actual-vs-simulated experiments that can resolve the nature of our reality, and so determine whether consciousness science is possible (Part 3).
- A3. Disseminate the consequences of the meter-Hamilton argument and related experimental investigations in consciousness science, to other scientific disciplines (notably, including fundamental physics) (Part 4).

(In practice, A2-required experimental programs will likely incur significant expense, and therefore attract significant inter-disciplinary scrutiny. Thus, initial concerns of physicists and others will likely have to be addressed in the run-up to A2, rather than after-the-fact in A3, as the outline above implies.)

The complementary, society-centric, perspective sets the same essential steps in a larger context:

B1. Accept that there may be *something awry in science* that's fueling the science-*vs*-post-Truth conflict. (At the same time, identify and address things that are awry in the post-Truth side of the conflict!)

B2. Investigate B1's 'something', find it (if it exists) and fix it (if possible). (Spoiler: it does exist, and it can be fixed. See Parts 2 to 4, and steps A1 to A3!).

B3. Repair society. For example, have both sides acknowledge the valid points the other side was trying to illuminate, as well as accepting and remedying their own dysfunctions revealed in this process – as well as any others that come to light! (This is framed as if societal conflict were taking place between just two individuals. Of course, it's not exactly like that. Equally, it's not completely *unlike* that, either!)

4. Fake Science, Fake News, and the *post*-Post-Truth Society

The claim that *dynamically-conventional* science *can* give a complete and consistent account of reality – including an account of science itself – is ... well, 'fake science'. Many scientists (and non-professional advocates for science) deny that science asserts either completeness or rigorous self-account. But that position doesn't stack up with positions taken in the science-*vs*-post-Truth conflict. If science is incomplete or unreliable, then isn't there room for 'alternative facts'?! When push comes to shove, both societally and institutionally, what's lurking in the ultimate background is – implicitly or explicitly – the view that *dynamically-orthodox* science *can* be complete (at least in principle), and *is* demonstrably a reliable approach (*e.g.* when examined scientifically!).

To understand what I mean by the 'institutional' background, you will have to have spent some significant time working in mainstream scientific institutions. Perhaps most of the people reading this are science-friendly, and can clearly see illogical shifts of attention and behavioral rigidities in the post-Truth camp. But these same things happen in the seminar rooms and tea-rooms of scientific institutions, if the conversation ever gets anywhere near methodological challenges for science. Senior faculty will change the topic. Or communicate their disapproval through subtle or not-so-subtle body language. Or offer junior scientists limited research options, signally steering clear of any methodological issues.

The point I'm trying to get at here is that there are two versions of the scientific process: the publicly-proclaimed one, in which scientists are all open-minded and put everything to experimental test, and the actual one, in which psychological conditioning plays the same role in science as it does in the post-Truth movement. (I'm not saying the kinds or scale of conditioning are the same. I'm saying both sides are subject to the same issue: psychological conditioning distorting the accuracy and trustability of process.) The tricky thing is that the public version *is* a reasonable representation of the actual conduct of science, as long as the topics under consideration go nowhere near methodological foundations! (For example, nowhere near the issues in, and evoked by, consciousness science, described in Parts 2 to 4.) Thus, when I say 'there are two versions of science', many scientists are bemused and/or outraged, because they don't recognize *my* account in *their* practice. What I'm explaining here is that my account

isn't meant to apply to describe *all* practice – only those that approach the latent limits, which may not have been evoked in everyone's experience.

Fake news and fake science share a deep common origin (as do all forms of inauthenticity). This is not the place to explore that common origin. (Notably, the obvious issues in both science and post-Truth have to be addressed, before we can go further.) But surely we can see that two parties calling each other fake, and not recognizing their own flaws, is a recipe for endless fighting. For the last of many times (in this book!), I'll say that science's flaws are *not* the sole and single source of the science/post-Truth conflict. But they are something that 'we' (science-friendly, science-passionate folks) *can* fix. Sometimes we have to just do what we can do, whether or not 'the other side' are taking care of their issues. In this case, though, addressing science's flaws isn't just a matter of relational repair, so to speak. It leads to a profound re-invention of science, and must usher in an extraordinary new era of scientific exploration and discovery. It's not merely a question of trying to fix what's broken in a desperate attempt to restore the previous state-of-play. It's a matter of stepping into the future, whether or not the others want to come with us.

This book suggests that a previously-unknown step must be taken, if we are to move ahead collectively, to what lies beyond the 'Truth wars'. Elsewhere, it's been suggested: that the postmodern group must own and fix their dysfunctions (Wilber, 2017); that people should escape echo-chambers and 'flood the conversation with truth' (presuming 'truth' is *always* clear and unambiguous!) (McIntyre, 2018); or, that we should simply promote critical thinking (Levitin, 2017). Most or maybe all of these and similar steps are worthwhile, perhaps even vital. This book adds one more: find and fix the dysfunctions in science. And the points the way to how to do that!

Many who aren't professional scientists or policymakers may feel this task is beyond them – that they have little or nothing to do with what's accepted in the mainstream institutions of science, what scientists attend to, or what experiments are done. They may therefore feel completely disempowered, in the face of roiling societal discontent. But this is not true: this book *also* offers a doorway into empowered activism of an unusual kind.

Say you deeply reflect on the technical content here, and see the truth of it. (Not because I say it's true, but because it *is* true – in your own determination. This isn't the place to go into how that perception of truth arises, or whether it is trustable. For present purposes, suffice to say that science is actually founded on the existence of such a perceptual capacity in humans.) Next, reflect deeply on relationship between a societally-powerful version of science that denies truths communicated here, and the energetic and emotional responses of those whose views science generally discounts or denies. (This isn't about whether those views are 'truthy' or not. Consider someone accurately perceiving – perhaps subconsciously - the foundational flaws in dynamically-orthodox science. How will they feel when dearly-held views are powerfully suppressed by what they see – *in some ways accurately* – as a fundamentally-false institution?) Then, translate this from *personal* response to science, to *societal* conflicts between science and post-Truth. Start to consume media with this understanding and sensitivity alive in you. Get a deep, intimate, feeling for the whole drama. See outer attack on science, sourced in the fury of 'being misrepresented by a liar'. See the inner crack in science, where strident claims for reliability are unsupportable, by dynamically-orthodox science's own self-analysis. See all the other pieces, too: the dysfunctions in postmodernism, the bad actors taking advantage, and so on.

Then talk to someone. Someone who takes the other side, in the Truth wars. What now do you hear? Do you have new responses? What ensues? ...

Here, I suggest, is the power you've been looking for.

References

Baldwin, J. (Ed.). (2020). *Navigating Post-Truth and Alternative Facts: Religion and Science as Political Theology (Religion and Science as a Critical Discourse)*. Lanham, MD: Lexington.

Frauchiger D, Renner R. (2018). Quantum theory cannot consistently describe the use of itself. *Nature Communications*. **9**:3711. doi:10.1038/s41467-018-05739-8

Levitin, D. *Weaponized Lies: How to Think Critically in the Post-Truth Era*. New York, NY: Dutton.

McIntyre, L. (2018). *Post-Truth*. Cambridge, MA: MIT Press.

Wilber, K. (2017). *Trump and a Post-Truth World*. Boulder, CO: Shambala.

Appendix C

The Fragmented Scientist

APPENDIX C: The Fragmented Scientist

1. Introduction

Rightly in my view, trying to give ‘fair and balanced’ bandwidth to both a science-based view and a post-Truth account is often criticized as a real mistake. For example, there’s been a lot of controversy in the UK about the BBC’s historic tendency to give climate-deniers airtime, in almost any discussion of climate change [1]. Similarly, saying something like ‘there are problems on both sides’ of the science/post-Truth conflict *could* be taken as a wishy-washy, mealy-mouthed invitation for post-Truth to continue its destructive attacks, without challenge.

To be clear: I don’t subscribe to ‘fair and balanced’ as an over-arching rule. (Except when it’s appropriate!) This book is *not* an apology for post-Truth. Nor is it an invitation for post-Truth advocates to try to use meter-Hamiltonian arguments to claim ‘we were right all along’.

The way to avoid wishy-washy ‘problems on both sides’ is to be very clear and precise about *actual* problems. That is the point of the meter-Hamiltonian arguments: they *do* establish that there is *something* to postmodern critiques of science. And they are *definitive* about what that something is, and how to remedy it. This stance can *boundary* the otherwise endless post-Truth onslaught, *learn* from it, and *generate* remedial action. (*Again*, dynamically-conventional science isn’t the *only* party with things to fix. Of course, post-Truth has those too, in spades. It’s just they’re much more obvious, and much easier, in the post-Truth case – *once* science puts its house in order, or commits to that process!)

The purpose of this Appendix is to try to introduce some nuance into the tendency amongst scientists and friends-of-science, to point the finger at post-Truth without seeing instances of the same flaws in themselves. I’ve prefaced this declaration-of-purpose with an attempt to clarify the balance issue, because trying to introduce nuanced self-reflection into finger-pointing can easily degrade into the ridiculous. Let’s say *X* occasionally lights a match, to start a barbecue. But *Y* is going around burning down houses. Asserting that *X* and *Y* are ‘the same’ because they ‘both play with fire’ is obviously disingenuous in the extreme. It’s ‘inappropriate balance’ – to put it mildly!

On the other hand, sometimes a single careless match *is* enough to burn down a forest (or a society!). So *which is it*, in the case of science: innocuous barbecuing, or unaware, unconscious, fire-starting? Without any benchmark or metric, these kinds of enquiry rapidly degrade into pointless ‘science said, post-Truth said’ attack and counter-attack. It’s perhaps too much to ask, to expect fired-up post-Truth proponents to enter into a measured, sensitive, barbecue/fire-setting analysis. But science *can* engage with that style of self-analysis, using meter-Hamiltonian reasoning as a concrete reference point.

This Appendix *illustratively sketches* just *some* of the possible features of such an investigation. The structure of the exploration is to identify typical characterizations of post-Truth (typically negative or derogatory) made by scientists and friends-of-science. And then to see – actually, concretely, relative to meter-Hamiltonian insights – in what ways might these *also* be true of science?

The goal here is *not* to conclude ‘science and post-Truth are “the same”, so science should give up and allow post-Truth an equal seat at the table’. One aim is for science to learn lessons about itself that are latent in its own finger-pointing, but currently unrealized – because of the *nature* of finger-pointing! (Learning, of course, is one of science’s own self-proclaimed goals!) Another is for science to stop stoking the fires of mutual conflict by making accusations that also apply to it. (In any relationship, it’s

OK for me to say ‘you are doing *Z*, please stop’. Consider a scenario where, at the same time, I’m asserting ‘I *never* do anything like *Z* at all’ – perhaps non-verbally. If that assertion *isn’t actually true*, minimally the relationship degrades, bit-by-bit. Often, the other party reacts strongly, perhaps angrily. If my denial of my own *Z*-behavior and that behavior itself are both unconscious to *me*, and the grounds for the other’s angry reaction are unconscious to *them*, the dynamic of apparently-innocuous request and sometimes-vicious reaction can go on interminably ... In case it’s not blindingly clear by now, ‘doing *Z*’ here means ‘being contradictory and irrational’. And the one who asks for the end of *Z*-doing, *while still practicing it*, is dynamically-conventional science.)

Of course, it’s up to you – if you’re a scientist or friend-of-science – how much self-examination you want to put yourself through. I would point out, however, that one of the self-proclaimed virtues of science is exactly this kind of self-scrutiny! So, an unwillingness to engage in this style of self-reflection on the part of scientists might already be an example of *the kind of blatant contradiction that science is prone to point fingers at, in the post-Truth movement!*

2. Outline

This Appendix is *not* meant to be an academically-rigorous analysis. (To put it mildly!)

The ‘methodology’ (if it can be dignified with that term) begins by simply collecting about half-a-dozen common characterizations, explanations, or rejections of the post-Truth movement. [‘It’s the Dunning-Kruger effect’. ‘We just need to teach critical thinking’. And so forth. I’ve ‘collected’ these from personal experience, and from a handful of popular and semi-popular responses to the post-Truth phenomenon (Wilber, 2017; McIntyre, 2018; Levitin, 2019; Baldwin, 2020). Again, this Appendix is *not* a comprehensive or rigorous analysis, even of these few texts!]

Then, *without* rejecting the possible (likely!) *partial-accuracy* of these statements *in relation to post-Truth*, I use the meter-Hamiltonian argument to illustrate ways in which they also apply *to science*. *Again*, such observations do not seek to make science and post-Truth ‘the same’. But if science wants to live up to its *own* claims of integrity and precision, it needs to see where claims that ‘*Z* applies to post-Truth and *not* to science’ *actually* fail to hold. Seeing these failings, and taking remedial action, *makes science even stronger*. In the absence of remedy, society will continue to be prone to current conflicts.

3. Some Illustrative Cases

3.1 ‘They’re a Cult’ vs No Science of Science

A common science-oriented explanation of persistent ‘irrational’ thinking or behavior is to appeal to the existence of a ‘cult’. (Of course, cults of all kinds can be real and dangerous problems.) I put irrational in quotes because rationality is in the eye of the beholder – or more accurately, the axiom-holder. It can be *entirely* rational to reason to *different* conclusions, if those differences simply result from *different* starting axioms, or assumptions.

Especially in post-Truth debates, of course the claim of science is often that it has ‘the right axioms’ or data, whereas ‘the others’ don’t. Mechanisms such as experimental replicability and peer-review are supposed to protect it from cult-like closed-mindedness. However, it’s clear that these mechanisms have *not* led science to apply scientific examination *to the basis of science itself!* (This examination, via meter-Hamiltonian reasoning, is the content of Part 4.)

In my view, dynamically-conventional science *is* a sort of cult. In the best *non-academic, unrigorous*, tradition of this Appendix, I pulled a random definition of ‘cult’ from the internet, and edited it to suit my thesis:

‘A cult is a group or movement held together by a shared commitment to a[n] ... ideology. It has a belief system that has the answers to all of life's questions and offers a special solution to be gained only by following the [leader's] rules’.

Here, the ideology is ‘reality is dynamically-conventional’. (This *is* an ideology because no-one – yet! – is prepared to do Part 3’s experiments *to test it*. Or even to *discuss* those experiments.) It *does* claim in-principle answers to all of life’s questions. (When mainstream science says ‘we can’t answer that’, it either means ‘... *yet*, but we can in principle’, or ‘that question is effectively irrelevant to human existence’. For example, dynamically-conventional science may say it can’t answer the question of whether God exists. But dynamic-conventionality itself asserts that *any* putatively-existent God *can’t* act in human experience!) Admittedly, science has no one ‘leader’, but any graduate student, post-doc or junior faculty will attest to the power structures that implement an as-if leadership, for example forbidding taboo enquiries – notably, Part 4’s scientific enquiry, within science, into science’s basis!

To be clear, *science* – as opposed to *dynamically-conventional science* – *need not* be a cult. (This one sentence completely divorces this book from any semblance of post-Truth science-attack.) However, concerning the transition to a non-cult status: sometimes the first step out of a problem is *to see that there is one!*

3.2. ‘They’re Unaware of their Irrationality’ vs No Science of Scientist

Another common response to alleged (or actual) irrationality in others is to emphasize the others’ unawareness of the flaws in their own cognitions. Often, this can be an implicit or covert pointer to inadequate education. This is a sort of micro, personalized, version of the previous subsection’s macro, group-level, attribution of ‘cult’ status. (Of course, actual irrationality and inadequate education *are* often real problems. They can be real problems in science, too!)

But Part 4’s amplification of the meter-Hamiltonian argument points out that science has failed to scientifically examine the ‘inner workings’ of the individual, personal, scientist, who ‘does science’. This failure itself is already a sort of irrationality: ‘everything is amenable to scientific method (apart from, it seems, science)’! What *further* biases and conditioning lurk in the scientists’ inner realms?!

3.3. The Dunning-Kruger Effect vs the Meta-Dunning-Kruger Effect (Reality Foundations)

The Dunning-Kruger effect is the scientific characterization of ‘a little knowledge is a dangerous thing’. It’s been used as a partial explanation for a growing post-Truth propensity to discard expert opinion, and ‘do your own research’. Technically, it’s a sort of cognitive bias in which people tend to over-estimate their own knowledge or competence.

In a post-meter-Hamiltonian view, dynamically-conventional science is *itself* prone to what I call the ‘*meta* Dunning-Kruger effect’. This is a sort of cognitive bias in which a scientist over-estimates the ability of dynamically-conventional science to give a complete, contradiction-free, account of reality. The meta-Dunning-Kruger effect can also be put as a bias that tends to *under*-state the importance of the foundations of reality to everyday life.

3.4 ‘Just Teach Critical Thinking’ vs Contradictory Axioms Prove Anything

One suggested remedy for, and antidote to, post-Truth problems is to ‘just teach more critical thinking’. That is undoubtedly useful, crucial even. But thinking – mechanical reasoning – can prove *anything* if its basis is contradictory. (For example, adding the axiom ‘ $0 = 1$ ’ to arithmetic means we can prove any number is equal to any other number!) The capacity to distil axiomatic data (the *basis* for reasoning) from reality is not thinking, but *intelligence*. Intelligence is not the same thing as intellect (no matter how much we might try to confuse the issue). Plausibly, intelligence *can’t* be taught: it is inherent, and we just have to avoid obstructing it! (And/or: remove such obstructions as have been created and become calcified – for example, the unquestioned acceptance of dynamically-conventional science!)

Concerning science, the meter-Hamiltonian arguments show that ‘critical thinking’ clearly hasn’t reached the scientific foundations, yet. As explained *e.g.* in Part 1’s ‘Back to Reality’ (section 2.8), when we do examine the foundations of dynamically-conventional science with critical rigor, we actually find they lead to more-or-less the same view of the human capacity for truth-discernment as occurs in a moderate statement of post-Truth! So, dynamically-conventional science is vehemently attacking post-Truth, while covertly holding the same view!

3.5 ‘Facts Don’t Care About Feelings’ vs Intuition as Non-Algorithmic Action

An alleged complement to the Dunning-Kruger over-estimation of personal competence (subsection 3.3 above) is an over-reliance on feelings, in post-Truth accounts. ‘I know the *numbers* are *A*, which implies *B*, but I just *feel* that the contradictory conclusion *C* is true.’ Obviously, that kind of ‘reasoning’ can be extremely problematic. On the other hand, non-algorithmic action (if it exists – Part 1, section 2.4) must present itself, at least in the first instance, as a sort of intuition beyond *immediate* cognitive unfolding. (It may be unfolded or parsed out into logical cognitive steps *subsequently*, over time.) Of course, if this kind of intuition seems to contradict facts, that must be worked out. But one of the huge questions of our time, I suggest, is whether facts/axioms and algorithms/mechanical-reasoning together are enough, for anything really worthwhile. Conversely, I suggest the assertion that ‘facts, randomness and mechanism is all there is’ (which is the view of dynamically-conventional science) profoundly damages what *is* really worthwhile.

To relate all this to meter-Hamiltonian reasoning, consider the fact (!) that its implications make many scientists *feel* extremely uncomfortable. It seems like meter-Hamiltonian logic *can’t* be right. Even if it’s right, it can’t *really* matter (can it?!). To deploy science’s anti-post-Truth stratagem against itself: the facts and implications of meter-Hamiltonian ‘don’t care about your feelings’!

4. Summary: The Fragmented Scientist

I titled this Appendix ‘The *Fragmented* Scientist’ because I want to emphasize this: the fractures that science and scientists point fingers at in post-Truth, reoccur in a specific, definable way *in them*. That is, science often decries partialness or contradiction in other thought-systems (such as post-Truth) and in contrast (and by definition!) proclaims its own ‘wholeness’. (For example, dictionary definitions of ‘science’ typically refer to ‘an integrated, coherent knowledge-system’.) But in its current dynamically-conventional form, science must *actually* lack this wholeness, as meter-Hamiltonian reasoning points out.

4.1 Intelligence Beyond the Fragmentation into Intellect and Intuition

One kind of fragmentation or fracture is the splitting of intelligence into intellect and intuition. Dynamically-conventional science almost can't avoid defining intelligence solely *as* intellect, and demoting 'feeling' to a primitive, instinctive capacity. Buried somewhere in the science/post-Truth conflict is a desperate call for the restoration (or disinterment!) of beyond-mechanical information-processing, in the form of true intuition, and for its re-integration *with* intellect. Only this integration gives us intelligence. And only the capacity to see intelligence expressing in different forms (when it is!), gives us the kind of mutual respect on which we can build a peaceful society.

4.2 Cognitive Biases and Psychological Conditioning in Both 'Sides': Who Will Look First?

The intention of this brief, informal, Appendix has been to give some specific and concrete bases for the proposal that cognitive biases and psychological conditioning exist on both 'sides' of the science/post-Truth conflict. (I have assumed readers of this book take it as read that there's bias and conditioning in the post-Truth camp!) The meter-Hamiltonian approach has played a pivotal role in this effort, because it grounds critiques of science in a definite way, and avoids spill-over into a vague and unhelpful 'science said, post-Truth-said' argument.

Those with a strong scientific training may feel that the issues this book points to for science are tiny technical glitches, whereas post-Truth is mounting an all-out, societal-scale, assault. Even accepting there are problems for science, and even accepting that these problems are a causative part of the post-Truth movement, the *nature* and *magnitude* of the post-Truth response seems disproportionate. However, we need to recognize that such assessments occur in an unexamined context, namely the view of *reality itself* that dynamical-conventional science subtly asserts and then reinforces [for example, by training scientists not to ask specific, 'wild' and 'ungrounded', questions (section 4, Part 1)].

It's true that the scale and intensity of post-Truth *cannot* be understood in an orthodox scientific *reality*-view. It's also true that *some* of that scale and intensity is disproportionate, and derives from dysfunctions within post-Truth. But not *all* of it.

The point is that reality *does not conform to* an orthodox scientific reality-view. In the first place, it is not dynamically-conventional, as Part 3's experiments will show. But dynamical-unconventionality has many possible reality-settings, and not all of these explain post-Truth (more precisely, those aspects of post-Truth that are not simply dysfunction).

The very scale and intensity of the post-Truth assault is *further data, over-and-above* the results of meter-Hamiltonian experiments. It concerns the *specific* dynamical-unconventional reality we inhabit, and will eventually lead to the formulation of further experiments of the usual scientific kind.

But science can't respond to this data when it can't see it. It can't see it when it points fingers at post-Truth without looking at itself, because this stance views the *totality* of scale and intensity *only* as dysfunction, and *misses the informative-data component*.

Bias and conditioning exist on both sides. The *Preface* called for science to 'truth itself' (p. viii). Truth exists when all bias and conditioning are eliminated (or, minimally, lie inactive). Which side will take a deep look at *itself*, first?

Endnotes to Appendix C

[1] For example, see this 2018 article from the UK newspaper *The Guardian*: <https://www.theguardian.com/environment/2018/sep/07/bbc-we-get-climate-change-coverage-wrong-too-often>.

References

Baldwin, J. (ed.). (2020). *Navigating Post-Truth and Alternative Facts: Religion and Science as Political Theology (Religion and Science as a Critical Discourse)*. Lanham, MD: Lexington.

Levitin, D.J. (2019). *A Field Guide to Lies: Critical Thinking with Statistics and the Scientific Method*. New York, NY: Dutton.

McIntyre, L. (2018). *Post-Truth*. Cambridge, MA: MIT Press.

Wilber, K. (2017). *Trump and a Post-Truth World*. Boulder, CO: Shambala.