DETERMINACY, CHANCE, FREEDOM

© Jeremy Fiennes jeremyfiennes@gmail.com

(rev: 17/02/2020)

ABSTRACT

We conceive the universe as determinate, subject always to the Laws of Nature. We cannot prove this, but it can be shown to be our only viable opption. In which case there is no such thing as chance, and objectively speaking we are all determined. But since in practice we cannot predict the universe's future course – principally because we ourselves are part of it – subjectively we experience the universe as indeterminate and ourselves as free.

CONTENTS

GENERAL

The "we" in the text is the 'authorial we' comprising the author and himself, a device used by authors to surreptitiously solicit the complicity of their readers. When we say "we say", what we really mean is "I say", if you see what we mean.

To leave the body of the text as uncluttered as possible, 'asides', biographical sketches, etc. are put in foot-notes. The end notes contain source references only. In the internet case they comprise the main site address, with the year and month of access in brackets.

CONTINUITY

Big Bang[a]

According to the currently orthodox *Big Bang*[b] *theory*, the universe[c] originated 13.8 b.y.a.[d] as an incredibly small (believe it if you can), incredibly dense, incredibly high-temperature pinpoint-sized ball of pure energy, the so-called *primordial fireball*, Fig. 0-1a, and has been expanding ever since.

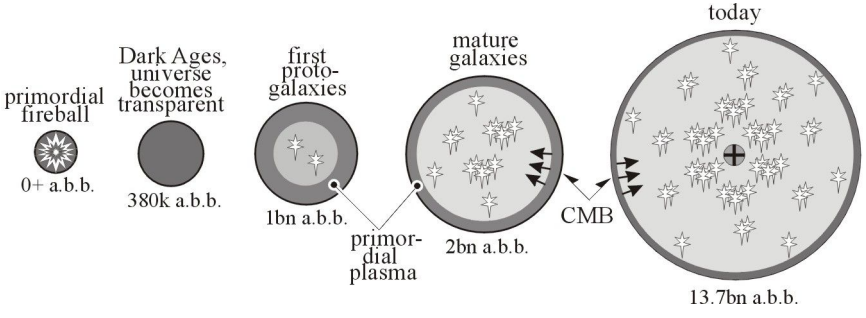

Fig. 0-1. Big Bang.

According to the $E=mc^2$ equation, energy and matter are[e] different forms of the same thing, like steam and water. Energy is vaporised matter. Matter is condensed energy. The primordial fireball was so concentrated, however, that no matter as such could exist. Everything was *pure energy*.

As the fireball expanded its temperature fell rapidly. At 10^{-6} sec. a.b.b. [f] *protons*[a] and *neutrons* were forming. And after three minutes the first *complex*

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[a] Those already familiar with, or not interested in the Big Bang details can omit this section with no loss of continuity.

[b] The hypothetical origin of everything (don't ask where *it* came from!)

[c] Always in the sense of the *physical* universe.

[d] Billion years ago. Figures in general are estimates and/or rounded off.

[e] "Are conceived as being" or "are said to be". "Is/are" normally have these senses. To avoid endless reminders, such instances are tagged with an '*i*' superscript.

[f] After Big Bang.

nuclei, mainly helium, deuterium[b] and a small amount of lithium. Due to the very high temperatures there could as yet be no atoms as such[c]. Any electron that attached itself to a nucleus would immediately get knocked off again. What existed at that point was a *plasma* of stripped hydrogen and helium nuclei, and free electrons, in a "sea" of energy photons.

Twenty minutes later the temperature had fallen to the point where no further nuclear reactions could take place and the primary conversion of energy into matter was over. Some 10^{80}[d] *elementary particles* – protons, neutrons and electrons – had been formed. The proportion of the original energy that condensed into matter was however very small. For every particle of matter created, there remained a billion photons of uncondensed radiation energy.

As the universe expanded further its temperature continued to fall. By 380k[e] a.b.b. it was low enough for electrons to remain permanently attached to nuclei, forming *atoms* of hydrogen and helium gas. At this point the universe ceased to be incandescent and became *dark*. And also *transparent* to photons, which could now travel freely though space.

The *Dark Ages* had begun. The photons from this point now reaching us comprise the *cosmic microwave background* (CMB').

But although dark, the universe was not inactive. Under the action of gravity the hydrogen and helium gases were slowly concentrating into vast *clouds* with increasingly dense *clumps* at their centres, Fig. 0-2a,b.

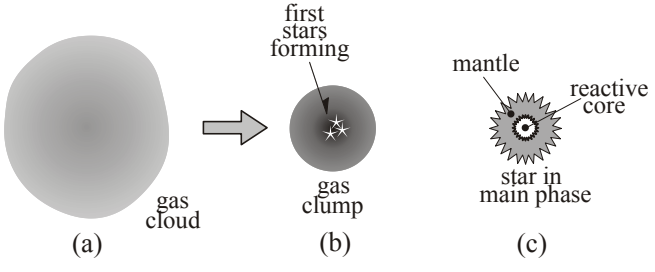

Fig. 0-2. Birth of a star.

The more gas a clump attracted, the bigger it grew. The bigger it grew, the stronger its gravity became and the more gas was drawn into it. The kinetic energy of the arriving gas molecules caused the temperatures of the clumps to rise. By 200mn a.b.b. those at the centres of the largest clumps had reached 10mn ^{O}C, the point at which the *nuclear fusion* reaction begins, where two hydrogen atoms

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[a] Hydrogen nuclei.
[b] Heavy hydrogen.
[c] Nuclei with attached electrons.
[d] A '1' followed by eighty zeros.
[e] 'k' = thousand; 'mn' = million; 'bn' = billion.

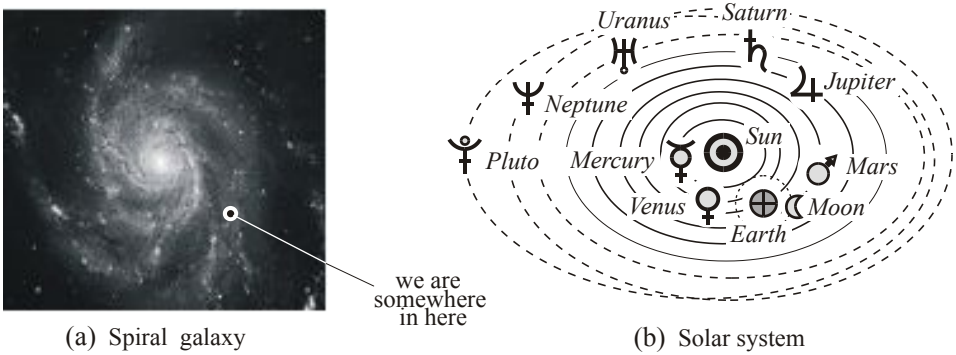
combine to form one of helium with the release of a large amount of energy – the principle of the hydrogen bomb.

The first *visible star*s were born. A star in its 'main phase' comprises a *reactive core* surrounded by an incandescent *mantle*, Fig. 0-2c.

Agglomerations of stars deriving from a single gas clump formed *proto-galaxie*s. Over the next 13bn years these grew in size and number to give *mature galaxies* which, again due to gravity, became grouped into *clusters*. The result is what we see in the night sky today.

Our present universe contains an estimated 160bn[a] galaxies, each with an average of 100bn stars. The total number of stars in the universe is thus enormous. And that is only *our visible universe*, what we see from planet Earth. What might lie beyond it we inherently cannot know.

Our own Milky Way galaxy is a large spiral type with 200bn stars, a diameter of 100k light-years[b], and a mass of a trillion suns. The solar system is situated out on one of its arms, Fig. 0-3. The three 'exterior' planets, Uranus, Neptune and Pluto, are invisible to the naked eye.



(a) Spiral galaxy (b) Solar system

Fig. 0-3. Solar system.

In spite of its 10^{80} elementary particles, the universe as a whole is a *virtual vacuum* with average density of one hydrogen atom for every four cubic metres of space. By earthly standards it is enormous. Light travelling at 300'000 km/s takes 1.3 s to reach us from the Moon; 8 min 20 s from the Sun; 5.5 hrs from the furthest planet, Pluto; 4 years from the nearest star, Alfa Centauri; 800 years from the Pole-star; 30 thousand years from the centre of our galaxy, the Milky Way; 2 million years from the nearest neighbouring galaxy, Andromeda; and 12 billion years from the earliest visible proto-galaxies.

If the solar system were the size of a football pitch, the Sun would be a miniature light bulb at its centre. The Earth would be 1 m away; Pluto 40 m; Sirius 300

[a] Some say it is as high as 400bn.
[b] Light takes 100k years to cross it.

km; and the Milky Way galaxy would have a diameter of 3 million km. If the Milky Way itself were the size of a football pitch, the entire solar system would be a particle of dust.

At the microscopic end, if an orange were blown up to the size of Earth, its atoms would be as cherries. If one of these was expanded to fill the dome of St Peter's, its nucleus would be a grain of salt and its electrons specks of dust[1]. If all empty space were eliminated, the whole of humanity could fit into the size of a sugar cube. All in all, things are pretty spaced out in space.

The range of densities is likewise enormous. At the centre of the most compact objects known, neutron stars, it is 7×10^{17} kg/m^3. A pinhead of the material would weigh a hundred thousand tons. Whereas the average density of the universe[a] is 10^{-45} times less than this.

We are accustomed to think of the Big Bang as something that occurred in the past, and our present universe as the result of it. In fact there is no dividing line. From the word "Go" (don't ask *Whose* word!) all there has ever been is an expanding configuration of energy/matter,, evidently with varying *characteristics*, but essentially one thing.

The Big Bang is still going on, and we are part of it. The photons from the primordial plasma are pretty much cooled down by now. But they are still around in the form of the microwave background. And when the signal to one's TV fails, the "scribbles" that appear on its screen are in part due to it. Not only is the Big Bang still going on, but like just about everything in this modern world:

you can see it on the telly!

Models

Having outlined this fascinating account of the origin of the universe, the next question is "How do we know?". To which the answer is of course "We don't". The Big Bang is a *hypothesis*, or *theory*, or *model*[b], a way of thinking about things that gives conceptual coherence to what we experience:

model = way of thinking that gives coherence to our experiencing

It is based on certain *assumptions*, which we now need to look at.

The experimental basis for the Big Bang model is Edwin Hubble's[c] 1929 discovery that the galaxies are all moving away from us at speeds that increase with their distance, Fig. 0-4a. The furthest galaxies recede at velocities approaching that of light. The universe as a whole is *expanding*.

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[a] One hydrogen atom for every four cubic metres of space.

[b] Treating the terms as equivalent.

[c] Edwin Hubble (1889–1953), American astronomer.

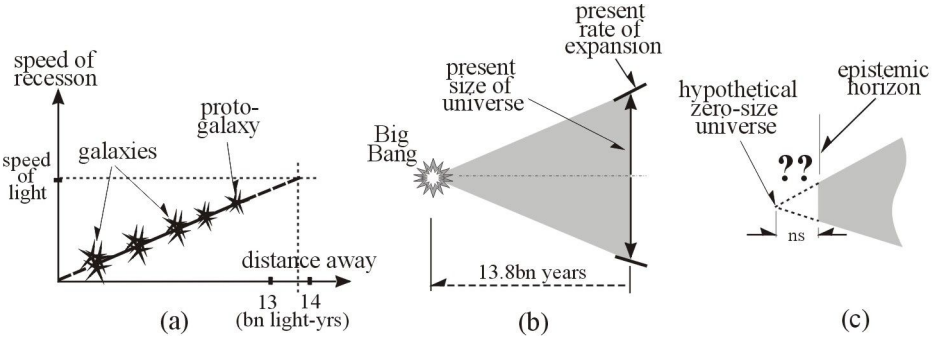

Fig. 0-4. Expanding universe.

If today things are all moving away from each other, in the past they must have been closer. Assuming that the Laws of Nature as we know them have always held; and calculating the present size of the universe, and also its rate of expansion; extrapolating backwards gives a hypothetical zero-size universe 13.8bn years ago, Fig. 0-4b. This is what we call the 'Big Bang'.

So it's not that the Big Bang *caused* our present universe. But rather the other way around: our experiencing of our present universe – from which we derive the Laws of Nature – caused our Big Bang model for it.

present universe $\Rightarrow$ *our Big Bang model for it*

We effectively *define* the Big Bang as "that which, in accordance with the Laws of Nature, could have resulted in the way things are today":

Big Bang = that which, in accordance with the Laws of Nature, could have resulted in the way things are today

To be able to reconstruct in our minds the conditions existing[a] in the primordial fireball, we need to know how energy/matter behaves at the very high energies that prevailed then. We get this information by colliding particles together in particle accelerators. The maximum energies attainable in today's most powerful accelerators, however, correspond to those theoretically existing *a few nanoseconds after* the Big Bang.

This point is effectively our *epistemic*[b] *horizon*. We can speculate with reasonable confidence about what happened *after* it. But not before. The reason being our lack of knowledge about how energy/matter behaves at the very high temperatures presumed to have existed then:

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[a] Conceived as existing (cf p.2, note).

[b] 'Epistemic': "relating to knowledge".

epistemic horizon: a few ns a.b.b.

Steven Weinberg[a]:

> "Our ignorance of the physics of elementary particles in the primordial *melange* stands as a veil, obscuring our view of the very beginning"[2]

By 'Big Bang' we thus in practice mean *our epistemic horizon* Big Bang, the one existing a few ns after the hypothetical singularity, the only 'Big Bang' we can say anything about with any degree of confidence:

'Big Bang' = epistemic-horizon Big Bang

Discussion about the nature of the Big Bang *itself* is therefore senseless. As is evidently also speculation on what might or might not have come *before it*.

Intervention (1)

The Big Bang model assumes that the Laws of Nature have always held, Fig. 0-1a:

Big Bang model: assumes that the Laws of Nature have always held

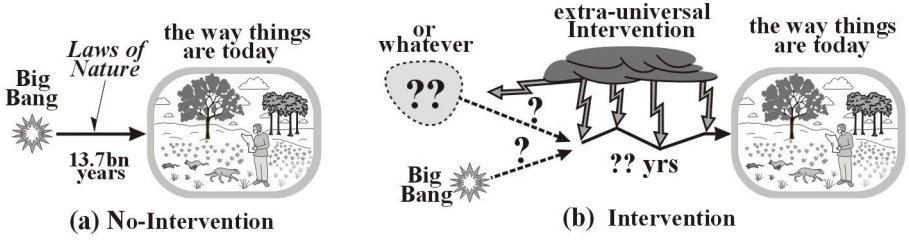

Fig. 0-5. Intervention.

A 'law' is defined in the dictionary as "1) a rule established by authority; 2) a regularity in natural occurrences". A Law of Nature is the second kind, summarising our experiencing. When we say that "according to the law of gravity[b]" a glass knocked off a table will fall down and smash on the floor, this summarises our experiencing of such events to date.

Based on the Laws of Nature, we define *Intervention* as anything contravening them:

Intervention = anything contravening the Laws of Nature

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[a] Steven Weinberg (1933−), American theoretical physicist.

[b] One of the Laws of Nature.

Should one day a glass knocked off a table float up to the ceiling, rather than smashing on the floor, this would contravene the Laws of Nature, and would by definition be[i] Intervention.

If there *has* been Intervention, occasions on which the Laws of Nature *weren't* respected, Fig. 0-1b, then we cannot say anything definite about the past at all, not even if there was a Big Bang.

Intervention (2)

To determine whether there has in fact been any post-Big-Bang Intervention, two kinds need to be considered. Firstly *blatant Intervention* that is obvious to everybody: seas miraculously divided to enable Chosen Peoples to escape from sticky situations they had got themselves into, etc. For many people there is ample evidence that such Intervention has occurred.

Others, however, maintain that all these things happened a very long time ago. And that our accounts of them have come down to us through generations of priests, clerks, scribes, etc, all with a vested interest in our believing in Intervention. And so are not conclusive.

The other possibility is *surreptitious Intervention* that occurred, but went unnoticed. A surreptitious Intervener's one-and-only act of Intervention could have been, on that very first-ever April Fool's Day (01/04/00 a.b.b.), to have surreptitiously nudged one wee little electron just one wee little bit over to the left. Thereby, however, changing the whole subsequent course of the universe, and not leaving anyone the wiser, least of all us.

In practice, therefore, we cannot prove conclusively either that there *has* been Intervention or that there *hasn't*. So when in the early 19th century the first evolutionists came up with the idea that the universe hadn't been created during the week ending 23rd October 4004 b.c. – as was generally held till then[a] – but had evolved slowly over a much longer period of time, one of the many creative arguments used by its creationist opponents was that the Creator had deliberately placed the rock-strata, fossils, etc. in the earth to confound future evolutionists, geologists and others of little faith.

To this there is no answer. We live in the present, and no-one will ever return to the past to verify what happened there[b3]. Any theories we construct about the past based on present evidence remain just that: *theories* about the past based on present evidence. And as such are subject to overthrow by any new evidence that might turn up tomorrow or sooner.

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[a] The date calculated in 1650 by James Ussher, Archbishop of Armagh, Ireland, based on biblical genealogies.

[b] Time travel is discussed in a companion article.

On the Intervention question each has to make up his own mind. With the *chagrin* of knowing that he cannot prove himself right, and the *consolation* of knowing that he cannot be proved wrong.

Since neither the Intervention nor the no-Intervention hypotheses can be proved, to be fair *both* must be considered. However, if there *has* been Intervention, then to our fundamental philosophical question, that effectively lies behind all the others:

> "Why are things the way they are today?"

the answer is simply:

> "Because that is the way the Intervener wanted them. Or at least is prepared to tolerate".

Because if there was anything an omnipotent Intervener *wasn't* prepared to tolerate, He would change it there and then.

The only case worth discussing is thus the *no-Intervention case*. It is the one considered here:

no-Intervention is the only case worth discussing

Remembering, however, that it is *only half the story*.

A no-Intervention model doesn't, therefore, necessarily preclude a Big-Bang-creating Creator, personal or otherwise[a]. But it does require that from our epistemic horizon[b] at a few ns a.b.b. onwards, there has been no Intervention, no departures from the Laws of Nature.

Continuity

A Big Bang originating no-Intervention Laws-of-Nature-respecting universe is one subject to the *continuity principle*, which says that "everything comes from something according to the Laws of Nature":

continuity principle = everything comes from something according to the Laws of Nature

A metaphor for a continuous universe is the *ocean*, where every water molecule affects its neighbours, and they their neighbours, and so on around the globe. When I give a shout, the sound waves I emit will travel around the world, and will eventually return to me, even though now imperceptibly. David Bohm[c]:

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[a] He/She/It could have been responsible for the Big Bang.

[b] The earliest point at which the known laws of physics apply.

[c] David Bohm (1917–1992), American quantum physicist.

> "The fundamental reality is an unbroken wholeness, an inseparable interconnectedness of the whole universe, where relatively independently behaving parts are merely contingent forms within this whole."[4]

In a continuous universe, today's state is a direct and inevitable consequence of yesterday's state; which was a direct and inevitable consequence of the day-before-yesterday's state; and so on all the way back to the Big Bang.

Because in a continuous universe the Laws of Nature are always respected, it is[i] *determinate*. Its states succeed each other in – at least in principle – *predictable determinable* ways. This being the *definition* of 'determinate':

determinate = at least in principle predictable/determinable

CHANCE

Dice-playing

In a continuous universe where everything comes from something according to the Laws of Nature, there is evidently no place for *randomness* or *chance*. As Albert Einstein[a] famously declared:

> "God does not play dice"[b]

However, although Albert was indubitably right in asserting that in a continuous universe God is a clockmaker *outside* it, rather than a dice-player within it, this is not the real reason for His not-dice-playing.

Secretly He is dying for a game. His problem, however, is that being omniscient, He knows all one's future throws. And being omnipotent, He throws Himself anything He likes. He needs a Divine Straight Flush? Well, He simply throws Himself one.

The real and sad reason for God's not-dice-playing is not His inherent lawfulness, as Albert seems to have assumed. But simply that He cannot find anyone willing to play Him. Really Albert! You're not telling us you fell for *that* one! With *your* intelligence! And *your* family background!![c]

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[a] Albert Einstein (1879–1955), German theoretical physicist.

[b] To which Niels Bohr is said to have retorted "Stop telling God what he can do!"

[c] As one of the Great Not-Dice-Player's chosen people.

Fig. 6. Anyone for dice?

Although universally taken as the paradigm of a *random* process, however, dice-throwing is in fact *strictly deterministic*[a], rigorously subject to the laws of classical mechanics. If one knew precisely the initial position, velocity and angular momentum of the dice; and also the frictional coefficient, elasticity, etc, of the table; and could feed all this data in time into a sufficiently powerful computer; one could infallibly predict which number would come up.

It is interesting that our prefered metaphor for a *random* process is one that *we ourselves* conceive as determinate. This maybe reflects the general confusion that the freedom:determination question[b] creates in our minds.

In practice, of course, we don't have all this data on the dice. The best we can do is to reason that since the numbers on a dice's faces don't affect the way it falls, by the laws of statistical probability for a large number of throws, each number should come up equally often.

This is what happens. Dice-throwing is an inherently deterministic phenomenon, rigorously subject to the laws of nature. Our inability to predict the outcome in an individual case is not due to any randomness in the *process*. But rather to *our own lack of knowledge* of it:

apparent randomness ⇐ *our own lack of knowledge*

We *conceive* dice-throwing as deterministic. But we *experience* it as indeterminate. The same holds for the overall universe that God created for our benefit. We conceive it as determined[c] and experience it as indeterminate[d].

Dice-throwing and the overall universe are thus *strictly analogous*. And on this basis we would have to say yes, God *does* in fact play dice:

God does play dice

This fortunately doesn't conflict with Albert E's famous utterance. He was using 'dice-throwing' in its popular sense of something inherently random. Whereas we

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[a] Determinate.
[b] Below.
[c] On a continuous model.
[d] Below.

use it in the more sophisticated sense of something *conceived* as determined but *experienced* as random.

Because for God *everything* in our universe, including dice-throwing, is determined (by Him), from His viewpoint too He does play dice[a].

Indeterminacy

If something is apparently *random* for us, is *unpredictable*, *indeterminate and uncertain* for us. We cannot predict/determine its outcome with certainty[b]. The terms 'indeterminate', 'unpredictable', 'uncertain', 'random', etc. are all effectively equivalent. We will call the *indeterminacy terms*, in general using 'indeterminate' to stand for them all:

'indeterminate' = unpredictable, uncertain, random, etc.

On a continuous universe model, however, where everything comes[i] from something according to the Laws of Nature, the idea of 'absolute' indeterminacy – something happening for no reason at all, not coming from anything – is senseless:

'absolute' indeterminacy: a nonsense

When we say that something "is indeterminate", what we really mean is firstly that it is *apparently* indeterminate *for us*[c] – *we ourselves* cannot predict it.

Secondly, that its indeterminacy is *limited*: it has an *indeterminate component*. Because if something were *truly* indeterminate – i.e. indeterminate *in all respects* – it would have no consistent characteristics and we wouldn't discriminate or have a concept of it.

And thirdly, its apparent indeterminacy is ultimately due to *our own lack of knowledge*. If we could know the exact initial Big Bang conditions[d], and also *all* the Laws of Nature, we could in theory predict precisely the future course of the universe and would experience no indeterminacy:

indeterminacy: 1) apparently for us; 2) within limits;
3) due to our own ignorance

The indeterminacy terms always carry with them the explicit or implicit rider "apparently for us".

Tomorrow's weather, for instance, is for us essentially indeterminate. *We* cannot predict it with certainty. But its apparent indeterminacy is firstly *limited* by the general climatic conditions for the time of year. In England in November, for

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[a] Certainty dice.

[b] Defining 'indeterminate' as "what cannot be determined with certainty".

[c] There being no such thing as 'absolute' indeterminacy, it is *always* 'apparent'. The 'for us' is then in fact redundant.

[d] Or those at any other point in time.

instance, one can predict with almost 100% certainty that the morrow will not usher in a 40^{O}C heatwave of the kind occasionally met in June.

And secondly, is conceived as being ultimately due to *our own lack of knowledge*. Meteorology is in principle an exact science. With precise information on weather conditions all over the globe, and a sufficiently powerful computer, we could conceivably always predict the morrow's weather exactly, and would experience no uncertainty.

The indeterminacy question is highlighted by *random number generation* Two principal methods are used[5]. In *pseudo-random* generation a computer algorithm produces a sequence of seemingly random numbers. However, knowing the algorithm and its initial value one could predict the entire sequence. The 'randomness' is 'apparent', 'for us', and 'due to our lack of knowledge'.

The second method uses an *external phenomenon* perceived as random – atmospheric noise, radioactive decay, etc. On a continuous universe model, however, these things are also conceived as being essentially determinate, and predictable with exact knowledge.

Again, in a continuous universe there is no such thing as 'absolute' indeterminacy.

COMPREHENSION

Comprehension

The word "comprehension" derives from the Latin *con-*+ *prehendere*, meaning to "grasp" or "seize". It is defined in a dictionary as "to grasp mentally, hold in the mind". The basic image for *mental* comprehension is *physical* grasping:

comprehension = mental grasping

This metaphor is found in other languages. The French *comprendre* has the same Latin root as the English *comprehend*. The German *Begriff* (concept) derives from the verb *greifen* (to grasp); and so on.

Other physical images for comprehension are to "take in", or "get one's head around" something.

The "grasping" image could well derive from our experience of trying to comprehend an elusive *mental concept* such as the Theory of Relativity, being like trying to grasp an elusive *physical object* such as the soap in the bath.

And when we *do* succeed in grasping the elusive object, physical or mental, in both cases we say we "get" it. So 'get' becomes a synonym for comprehension. As in the story of two nuns where one was explaining to the other about sex. When she finished the other one said "I don't get it".

Self-incomprehension

For the basic 'grasping' image for comprehension[a] to make sense, the *grasping subject* must be distinct from the *grasped object*. The concept of a hand grasping something other than itself such as an egg is senseful, Fig.0-7a. But that of a grasping hand grasping itself is not, Fig.0-7b;.

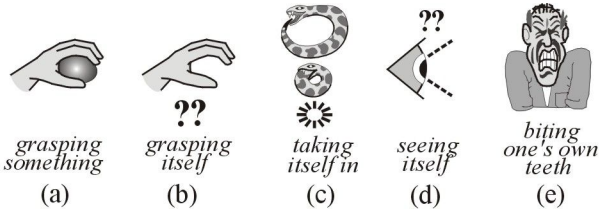

Fig.0-7. Self-incomprehension (1).

The same applies to something 'taking itself in', Fig.0-7c. Or to an eye 'seeing itself', Fig.0-7d. Or to a head "getting itself around itself". Maurice Merleau-Ponty[b]:

"We cannot sit in the window and watch ourselves go by in the street."[0]

Alan Watts[c], Fig.0-7e:

"Trying to comprehend oneself is like trying to bite one's own teeth."[6]

So it's not that one *cannot* comprehend oneself in the sense of *not being able* to. But rather that our concept 'comprehension' is such that the idea 'self-comprehension' is senseless. We will call this the *self-incomprehension principle*:

'self-comprehension' is a nonsense

Imagine that in a valiant attempt to comprehend my own mental state I wire all my 100bn neurones up to a giant TV screen, Fig.0-8. But I can never mentally grasp the image before me, because it is being continually modified by the neural impulses involved in my attempts to do so. I cannot comprehend myself.

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[a] p.13.
[b] Maurice Merleau-Ponty (1908–61), French philosopher.
[c] Alan Watts (1915–1973), English philosopher.

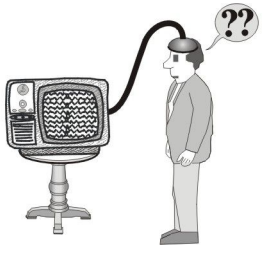

Fig.0-8. Self-incomprehension (2).

A further approach. Comprehension of myself would need to include that comprehension of myself; and hence my comprehension of my comprehension of myself; and hence my … (Ok, thank you, that's enough. I already got the point).

The idea 'self-comprehension' is *interminable*. With no limit it is *indefinable*[a], and hence *not-rational*. No finite mind – not even one with 100bn neurones – can grasp an infinite series of such 'comprehension of comprehensions'[b]:

$$interminable \Rightarrow indefinable$$

Apart from these conceptual objections to 'self-comprehension', there is a further *logistical* problem. To comprehend oneself, in the sense of being able to predict one's own behaviour, would require among other things knowing the states of all the neurones in one's brain. All one's brain neurones would then be taken up storing the states of all one's brain neurones, leaving no space for anything else.

Even if the idea of self-comprehension weren't *conceptually* senseless, nothing could comprehend itself for *logistic* reasons due to lack of computational capacity. St Augustine[c]:

> "I cannot grasp all that I am. The mind is not large enough to contain itself."[7]

Lyall Watson[d]:

> "If our brains were so simple that we could understand them, we would be so simple that we couldn't."[8]

So when the ancient Greek oracle at Delphi put its famous "Know thyself" up over its entrance, this could seem to have been counterproductive. A potential client could well have concluded that the one who best knew himself was not the

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[a] Deriving from the Latin *finis*, an 'end' or 'limit'.
[b] The author's limit is about four.
[c] St Augustine (354–430), bishop of Hippo in modern Algeria.
[d] Lyall Watson (1939–2008), South African anthropologist.

oracle, but he himself who had lived with himself all his life. And would have turned around and gone back home again, having wasted a journey to Delphi but at least saved his oracle fee.

Having got home, however, and set to work on knowing himself, he would soon have found himself on an existential wild goose chase. And would have gone running desperately back to the oracle as his only hope of sorting himself out.

This "Know thyself" could well not be our first example of Early Greek Zen, but simply wily marketing. No flies on the old Ancient Greeks!

Resuming, the reasons why we can inherently never comprehend our universe, in the sense of being able to predict its future course, are:

– 1) *we ourselves* are part of the universe, and on self-incomprehension cannot predict our own behaviour
– 2) any computer to do so would have to store the state of every fundamental particle in the universe, and so would have to be larger than it

As Jean-Paul Sarte[a] could have said[b]:

we are condemned to indeterminacy

FREEDOM

Freedom

Contrary to what is often imagined, Freedom[c] cannot be conceived as freedom from *restriction*. Prisoners are deprived of their Freedom in cells behind walls. Monks seek their Freedom in cells behind walls. I myself will never fly from tree to tree like a bird, nor breathe water like a fish, even though I have dreamed of doing both. But that doesn't make me any less free than a bird or a fish.

Every creature is constrained by its *physical condition*, what the ancient Greeks called its *Ananké* (Necessity). But within the limits set by Necessity, every being has autonomy within the range of possibilities open to it. Just because I cannot resist the steamroller, doesn't mean I am not free. I can choose to get out of its way. Or I can choose not to, preferring to be rolled flat. Freedom is the *Freedom to choose*:

Freedom = to choose

---

[a] Jean-Paul Sartre (1905-80), French philosopher and the father of existentialism.
[b] Below.
[c] Freedom being a subjective/experiential concept, we capitalize it.

And since in general we *do* experience Freedom to choose – at least within a range of possibilities – on this basis we would seem to be free.

On a continuous universe model[a], however, we conceive of *everything*, including ourselves, as irrevocably subject to the immutable Laws of Nature, and hence as determined. In practice we act according to this concept. When I take an airplane, I assume that the laws of aerodynamics that held when the plane was designed will continue to do so until I myself at least have reached my destination.

An exercise for the reader: think back to some decision you made and later regretted. Now imagine yourself back at the original point of decision. The question is: could you have decided differently? …

Evidently not. The way you decided was the way it was *your nature* to decide in that situation. As is evidenced by that being the way you *actually did* decide. The only way you could have decided differently would be to have had a different nature – effectively to have realized Woody Allen's[b] dream and been someone else[c].

Just because we can take decisions doesn't mean we are free. We are 'constrained to decide' by our natures. Heraclitus:

> "A man's character is his destiny."[9]

So on the one hand we *experience* Freedom[d]. And on the other we *conceive ourselves* as part of a determined universe, and hence as determined. We have a rational contradiction.

Scientific view

Science confirms the view that our imagined Freedom is in fact illusory. In an experiment, patients undergoing open-brain surgery were asked lift their fingers and note the instant at which they decided to do so, while their brain waves were simultaneously recorded.

Comparing the reported instants of decision-making with the electrical motor-cortex activity that initiates finger lifting, the brain traces were found to *precede* the conscious decision by 0.35 sec[10]. It wasn't the conscious decision that caused[e] the finger lifting. But rather the other way around: the motor-cortex activity caused *both* the finger lifting *and* the conscious decision to do so[f].

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[a] p.9.

[b] Woody Allen (1935-), American film writer, director and actor.

[c] He once said "My only regret in life is not being someone else."

[d] A manner of speaking, since Freedom is not an experiencible physical object.

[e] Is always preceded by.

[f] It has been postulated that the decision could be taken unconsciously, before the motor-cortex activity. And that one only later becomes conscious of it. But this would imply a conscious decision being taken unconsciously, which is nonsensical.

In a similar vein, Eric Berne[a] tells of a man undergoing open-brain surgery. When the surgeon stimulated the finger-lifting area of his motor-cortex, he lifted his finger[b]. When asked why he had done so, he said "Because I wanted to"[11]. Again, the brain stimulation resulted in *both* the finger lifting *and* the conscious desire to do so[c].

Science thus proves conclusively that our subjective sense of autonomy is in fact illusory. Baruch Spinoza[d]:

> "People deceive themselves when they think they are free. They only think this because they are conscious of their actions. But they are ignorant of the effective causes of those actions."[12]

Arthur Schopenhauer[e]:

> "Man can do what he wants. But he cannot will what he wills."[13]

Clerk of the Book

Assuming that the scientists are right, the proverbial *Book of Destiny* wherein is written everything that has happened, is happening and ever will happen, either actually exists or at least *could* exist.

Due to self–incomprehension, however, the Book would evidently have to be compiled by a Being with a completely objective view of our universe. For instance a hypothetical *E.U.* (Extra-Universal) whom we will call *Euclid*.

Euclid obviously cannot *intervene* in our universe, because this would compromise both his E.U. status and also our own no-Intervention hypothesis[f]. Imagine, however, that for just this one wee little once the Universal Regulations have been temporarily relaxed. And that one sunny afternoon as I lie gently swinging in my hammock musing on the nature of Freedom and Destiny, the Clerk of the Book appears before me with the Book itself in his hand.

> – "Ha!" he says, "So you *imagine* you are free ? Let's just see. Three seconds from now, will you or will you not raise your finger? You're the boss. You decide."
> – "Yes, I will", I think, and raise my finger.

---

[a] Eric Berne (1910-70), Canadian psychiatrist and creator of Transactional Analysis.
[b] Actually his arm.
[c] In some cases the patient's finger lifts without his experiencing a desire, and he says "I don't know. It seemed to lift itself". Electrical brain stimulation is however a relatively crude procedure involving many neurones, and can result in a range of effects.
[d] Baruch Spinoza (1632-77), Dutch philosopher.
[e] Arthur Schopenhauer (1788-1860), German philosopher.
[f] p.9.

– "Ha!", he says gleefully, thumbing through the pages, "See, it is written here: 'He - will - raise - his - finger'."

Fig.0-9. "He will (not) raise his finger.

Had I done the contrary and *not* raised my finger, he would have said equally gleefully:

– "Ha! See, it is written here: 'He - will - not - raise - his - finger'."

So basically it's like this. I do whatever I want: I raise my finger or not as I please. And whatever I do, *he* – the miserable little Clerk of the Book of Destiny – is predetermined to say gleefully:

– "Ha! See, it is written here: 'He will (not) raise his finger'."

The essence is a *perceiver effect*. From Euclid's impersonal viewpoint *outside* our universe, he could well perceive me as irrevocably determined. But from my own personal viewpoint *within* the universe, I experience Freedom. Two different viewpoints. Hardly surprisingly, two different views:

the universe is determined; I am free

Returning to the open-brain surgery patient[a], in *objective* terms the Big Bang 13.8bn years later resulted[b] in a surgeon applying an electrical impulse to his motor-cortex, causing both his finger to lift and him to experience a conscious desire to do so, Fig.0-10a. *Subjectively*, he experienced a desire to lift his finger and did so, Fig.0-10b.

[a] p.18.
[b] Is conceived as having resulted (cf p.2, note).

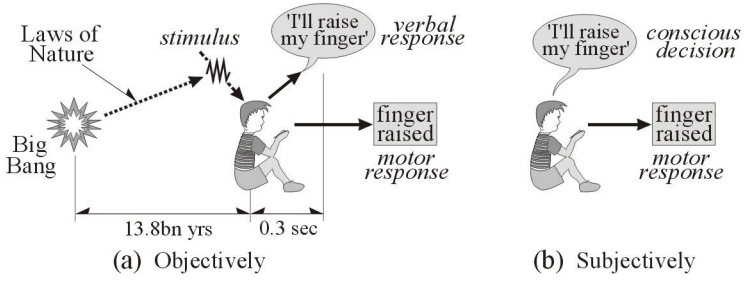

Fig.0-10. Decision.

We *conceive* our overall universe as essentially determined. But since we ourselves are part of that universe, we experience those parts of it that depend on us as *indeterminate*[a], and hence as subject to our intervention. And to that extent we *experience* Freedom:

we conceive *the universe as determined*
we experience *Freedom*

Our experiencing Freedom doesn't therefore depend on whether, objectively speaking, the universe is in fact determined or not. But simply on *our* own *inability* to predict the outcomes of those parts that depend on us.

Imagine how free I would feel if I could predict in advance, not only everything that was going to *happen* to me, but also everything that *I myself* was going to do! One could say, with apologies to J.C.[b]:

> "It is *not* knowing the truth that makes us free"[14]

Or to paraphrase an old adage[c]:

ignorance is Freedom

As Jean-Paul Sarte actually said:

> "We are condemned to Freedom."

All of this is nicely summed up by Ashleigh Brilliant[d] in his brilliant:

> "Due to circumstances beyond my control, I am master of my fate and captain of my soul."[15]

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[a] Self–incomprehension (p.14).
[b] Jesus of Nazareth (~4b.c.−30 a.d,) Jewish carpenter, itinerant preacher and healer. He died of crucifixion.
[c] "Ignorance is bliss".
[d] Ashleigh Brilliant (1933-), English epigramist.

During the time I was thinking over these Freedom/determination questions, a friend said he reckoned himself to be free around half of his time and not-free the other half. Under the circumstances this was like a red rag to a bull. After half an hour's hard conceptual tussling, using the above and other irrefutable arguments, I finally convinced him that he was free not just half but *all* of his time.

My friend was then fourtyish. Assuming he had another fourty years to live, that meant that at the cost of a *mere half hour's* argument with me, he had gained for himself half of fourty years, i.e. *twenty whole years* of additional Freedom.

And you know what? Not only didn't he thank me, but even seemed peeved to have lost the argument! As William S[a] so justifiably lamented:

"Blow, blow, thou winter wynde
Thou art not so unkynde
As Man's Ingratitude!"[16]

Before I could remonstrate, however, his wife came in to remind him it was time for him to go and fetch her mother. Maybe just as well. Because on later reflection I realized that his attitude could not have been callous ingratitude. But simply yet another example of how little store we in fact set by our rational constructs.

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[a] Shakespeare, William (1564-1616) English poet, playright and actor.

Endnotes

[1] map.gsfc.nasa 0908; Goldsmith 1981, p.367; Capra 1992, p.75.
[2] Riordan 2006.

[3] Fiennes 2020c, p.18.
[4] Capra 1992, p.149.
[5] en.wikipedia (1901).
[6] Spiegelman 1973, p.149.
[7] Resurgence July/Aug.1996.
[8] Superinteressante ? 1991
[9] Oxford 1994.
[10] Dennet 1993, p.163.
[11] Berne 1976, p.217.
[12] Strathern 1998, p.57.
[13] en.wikiquote (0011).
[14] John 8:32.
[15] Brilliant 1979, p.90.
[16] *As You Like It*, Act II, Scene 7.