

“The” Anthropic Principle

John Worrall

“The” Anthropic Principle

- Back to a recurrent theme:
- Do Humans have a special role in the universe?
- Both Copernicus and Darwin significantly challenge any anthropocentric view of the universe
- BUT?
- What do we make of relatively recent claims like these?

“The” Anthropic Principle

- " ... the Universe (and hence the fundamental parameters on which it depends) must be such as to admit the creation of observers within it at some stage". (*Brandon Carter*)
- "The Universe must have those properties which allow life [in particular human life] to develop within it at some stage in its history." (*Barrow and Tipler*)
- "... the answer to the question "why is the universe isotropic?" is "because we are here". " (*Hawking and Collins*)
- Why do all the fundamental constants of physics lie in the ‘Goldilocks zone’: ‘The anthropic answer ... is that we could only be discussing the question in the kind of universe that was capable of producing us. Our existence therefore determines that the fundamental constants of physics had to be in their respective Goldilocks zone.’ (*Richard Dawkins*)

“The” Anthropic Principle

- Dawkins ties this to the evolution of ‘life’ - or the building blocks thereof: self-replicating molecules like DNA (or – more likely initially – RNA)
- Admits that this is a very low probability event
- Which Darwinian theory just takes for granted –
- I.e. for which it supplies no explanation
- He agrees with the Creationists (ID-ers) that it needs some explanation
- God is one explanation
- But the ‘anthropic explanation’ is a rival (and superior)

“The” Anthropic Principle

- These all seem to be giving some explanatory role so far as fundamental features of the universe are concerned to the existence of humans.
- Early history: Eddington, Dicke, etc (concerns desire to interrelate the fundamental constants involved in the laws of physics)
- More recently two main sources of ‘anthropic’ thinking:
 - 1. “Sensitive” constants
 - 2. “Unlikely” initial conditions

“The” Anthropic Principle

- Example of 1:
- Rees (*Just Six Numbers*) points out that the constant associated with the ‘strong force’ (which essentially measures how difficult it is to ‘split’ atoms or to form new ones by nuclear fusion):
 - A. Is around 0.7
 - B. If it were just a little bit lower, say 0.6, then fusion of hydrogen atoms to form more complex atoms would never have occurred
 - C. If a bit higher, say, 0.8 then all the hydrogen would have fused into more complex atoms

“The” Anthropic Principle

- D But either C or D is inconsistent ‘with life as we know it’ and so in particular with our life
- E But we know we are alive!
- F. So ??
- Rees/Dawkins: ‘Our existence therefore *determines* that the fundamental constants of physics [and in particular the constant associated with the strong force] had to be in their [its] respective Goldilocks zones [zone].’(my italics)

“The” Anthropic Principle

- Example of 2:
- A. We can work out that the value of the ‘escape velocity’ at Planck time 10^{-38} seconds after the Big Bang had to be in a very narrow range; because
- B. had it been a tiny bit larger than it was (‘must’ have been?) then stuff would have been flying away from other bits of stuff at such a rate that no galaxies would have formed
- C. Had it been a tiny bit smaller than it was (‘must’ have been?) then stuff would have recollapsed on itself back into the singularity of a ‘big crunch’
- D. Again both B and C are plainly inconsistent with life ‘as we know it’
- F. Again: we know ‘life as we know it’ exists! SO..?

Explanation and “The” Anthropic Principle

- So let’s think a bit more analytically about the Rees/Dawkins claim in particular:
- Why do all the fundamental constants of physics lie in the ‘Goldilocks zone’: ‘The anthropic answer ... is that we could only be discussing the question in the kind of universe that was capable of producing us. Our existence therefore determines that the fundamental constants of physics had to be in their respective Goldilocks zone.’ (*Richard Dawkins*)
- Is this really an *explanation*?

Explanation and “Indication”

- Think of Bromberger’s flagpole (counter) example
- $\tan \Theta = h/s$
- Geometrical optics plus height of flagpole (h) and elevation of the sun Θ , explains the length of the shadow (s)
- Geometrical optics entails $s = h/\tan \Theta$
- But equally:
- Geometrical optics entails $h = s \tan \Theta$
- But s (plus G. o. and Θ) does *not* explain the height of the flagpole
- It does ‘indicate’ what that height ‘has to be’; indeed it ‘determines’ that height

The “Weak Anthropic Principle” (WAP)

- Similar (lack of) logic seems to be involved in anthropic reasoning
- Certainly any theory about the universe to be acceptable must* have the correct empirical consequences
- {Or at least – if we are not talking about a complete theory- must fail to be incompatible with correct empirical statements }
- And one of these is the existence of humans
- (Others are the existence of dung flies, HIV, ...)

The “Weak Anthropic Principle” (WAP)

- Barrow and Tipler separate out ‘the’ AP into principles of differing strengths
- What we have in the first place is the WAP:
- ***“The observed values of all physical and cosmological quantities are not equally probable but they take on values restricted by* the requirement that there exist sites where carbon-based life can evolve and by the requirement that the Universe be old enough for it to have already done so.”***
- This is
- (a) true; but
- (b) trivially so – providing no sort of explanation of anything
- (and (c) not at all anthropic ..)

The “Strong Anthropic Principle” (SAP)

- In order to get some explanatory power, a stronger principle is needed
- SAP:
- **Brandon Carter:**
- *“The Universe (and hence the fundamental parameters on which it depends) must* be such as to admit the creation of observers within it at some stage.”*
- **Barrow and Tipler:**
- *“The Universe must* have those properties which allow life to develop within it at some stage in its history.”*

The “Strong Anthropic Principle” (SAP)

- But what is the status of the ‘must’ here?
- If it just means ‘*must given what we know empirically about the universe*’ then there is no strengthening it is just the (trivial) WAP
- But just asserting ‘physical necessity’ is entirely unscientific
- {And, pace RD, cries out for creatorly underpinning!}
- Otherwise would have to mean ‘must in the light of some deeper – independently testable – theory’
- {Cp. Planets must move in ellipses because of universal gravitation}

The “Strong Anthropic Principle” (SAP)

- The “Multiverse”?
- Unlike creator no principled reason why it couldn’t be independently testable
- BUT
- (i) it isn’t as it stands
- (ii) it is immensely non-anthropropic
- (iii) as it stands, metaphysically incontinent
- (iv) not clearly *explanatory* even of the ‘fact’ that we are in a miniverse with ‘nice’ initial conditions/parameters

Explanation and Coincidence

- So why not just be honest and say that we have no explanation of the ‘nice’ initial conditions/parameters
- After all the logic of explanation dictates that it must stop somewhere!
- View that drives all the anthropic enterprises seems to be that some features of the universe just can’t be put down to coincidence

Explanation and Coincidence

- BUT
- (i) ‘Coincidences’ are ten-a-penny and can be generated at will by allowing yourself to define weird random variables
- (ii) Even with respectable random variables, events with extremely low probability occur all the time.
- (iii) Certainly if we looked on every "coincidence" as *demanding* an explanation we should soon land in absurdity

Pyramidology

- Charles Piazzi Smyth (Scottish Astronomer-Royal and Professor of Astronomy at Edinburgh)
- *Our Inheritance in the Great Pyramid* (1864)
- *Life and Work at the Great Pyramid* (3 vols -1867)
- *On the Antiquity of Intellectual Man* (1868)

Pyramidology

- (1) $2 \times \text{base} / \text{height} \cong \pi$
- (2) $\text{base} / \text{width of a casing stone} \cong 365$
- (3) $\text{earth's polar radius} / \text{pyramid inch} = 10^7$

Pyramidology

- BUT real key is 5:
- Great pyramid has 5 corners and 5 sides;
- pyramid inch is $1/5$ of $1/5$ of a cubit etc, etc:
- "This intense fiveness could not have been accidental, and corresponds with the arrangement of God, both in Nature and revelation. Note the fiveness of the termination to each limb of the human body. The five senses, the five books of Moses, the twice five precepts of the decalogue."

Coincidence

- “Any coincidence” said Miss Marple to herself “is always worth noticing. You can throw it away later if it is only a coincidence.” (Agatha Christie)
- How can you tell?
- It’s a coincidence (so far as you can tell) if there is no underlying **and independently testable** theory that entails it
- {Dawkins seems to take this line:
- There *has to be* an explanation
- (Cp his remark in *The Blind Watchmaker*)
- But this is exactly an unscientific attitude – makes him no better than his theist opponents }

Explanation and ‘Brute Facts’

- Why there have to be brute facts
- (N.B. even if you accepted human existence as an explanation for the ‘unlikely’ initial conditions you could still ask for an explanation of human existence)
- But, it might seem, having to take it as a brute fact that every body attracts every other with an inverse square force is one thing, having to take it as a brute fact that the escape velocity had such an ‘unlikely’ value is another
- Some things are ok as brute facts others not
- Some things “cry out for explanation” some not

The ‘familiar’ doesn’t need explanation

- One claim is that it's the ‘familiar’ that needs no explanation:
- “.. examination will show that the essence of explanation consists in reducing a situation to elements with which we are so familiar that we accept them as a matter of course, and so our curiosity rests.” (Bridgman)
- There is something to this – science is a certain sense inherently conservative
- BUT
- (a) familiarity does nothing to remove objective mystery
- (b) empirical considerations always lead the way

Ideals of natural order

- Acceptable ‘natural starting points’ (ok ‘brute facts’) supplied by ‘ideals of natural order’
- But (a) subjective; and
- (b) even where inter-subjective for a while subject to variations historically
- (c) BIG mistake to think of science as revealing the ‘intelligibility’ of the universe (rather science learns to find ‘intelligible’ what proves to be best empirically corroborated); that is
- (d) **as always empirical considerations lead the way**

Unification

- Another plausible reaction:
- ‘OK we always need some ‘brute facts’ but a science is genuinely explanatory to the extent that it minimizes the number of such brute facts.’
- (Friedman, Kitcher)
- A more sophisticated version of the familiarity view
- And so subject to same reaction
- (a) something to the view; but
- (b) **empirical considerations lead the way**
- (Einstein ‘ Physics must be as simple as possible, but not more so.’)

Explanation and Coincidence

- Only “rule” seems to be ‘suck it and see’
- But ‘seeing’ requires independent evidence
- DON’T get so carried away by your explanatory zeal that you accept non-explanations as explanatory
- Returning to ‘anthropic reasoning’:
- There seems to be no current reason to think that the existence of humans explains *anything* about the universe
- In the end, Barrow and Tipler in fact identify 4 versions:

Anthropic PrincipleS

- THE WEAK ANTHROPIC PRINCIPLE (WAP): (essentially) any adequate cosmological theory must be consistent with the existence of human observers.
- THE STRONG ANTHROPIC PRINCIPLE (SAP): The universe *NECESSARILY* has those properties that allow human observers to develop within it at some stage in its history.
- THE PARTICIPATORY ANTHROPIC PRINCIPLE (PAP): Observers are necessary to bring the universe into being.
- THE FINAL ANTHROPIC PRINCIPLE (FAP): Intelligent information-processing must come into existence in the universe, and, once it comes into existence, it will never die out.

Anthropic PrincipleS

- WAP is uninteresting,
- SAP entirely unjustified while
- either PAP or FAP could equally well have been called
- THE COMPLETELY RIDICULOUS ANTHROPIC PRINCIPLE (CRAP)