Seeking Ultimate Answers: An Explorer's Guide

Asking the Right Question

For as long as human thought has been recorded, human beings have contemplated the universe and wondered why anything exists. We have asked the ultimate question: ***Why?***

Why is a treacherous question, lacking the precision of *When* or the limited scope of *How.* It is subject to many kinds of answer, and muddling up different kinds of answer can tie us up in logical knots. For example:

Why did the brick break the window?

- Bricks are heavy.
- The window was fragile.
- She threw it at the window.
- I needed to rescue someone from the burning house.
- Because it wanted to.

In the natural way we use the English language, all of these statements are legitimate answers to the question, though the last one conjures up a cartoon image of a self-mobile anthropomorphic brick wielding a little hammer or head-butting the unfortunate pane. What seems like one question is in fact many, depending on where we put the emphasis…

- Why ***did*** the brick break the window?
- Why did the ***brick*** break the window?
- Why did the brick ***break*** the window?
- Why did the brick break the ***window***?

When we ask ***Why*** we need to be clear about what kind of answer we are seeking.

Four Causes

The Greek philosopher Aristotle helps us refine our approach to ***Why*** questions by distinguishing four kinds of 'causes' – material, efficient, formal and final.

Material cause forces us to rigorously state the thing(s) being studied. The brick (not a pebble) and a fragile window (not a sheet of toughened safety glass) are the material causes of this pane-breaking incident.

Efficient cause refers to the initial state of motion of the thing(s) being studied. It creates a self-contained problem, where *given* this starting point, we can follow through the chain of cause and effect. In this case, the brick was launched towards the window. Had it not been so launched, the window would have remained intact. The efficient cause is that the brick was propelled, say, at 10 mph in a north-easterly direction – regardless of whether that was done by a human hand ("She threw it at the window!"), a computer-controlled catapult, or a chance impact from a boulder rolling down a hill.

Of course we can ask the ***why*** question again concerning the efficient cause of the starting impulse, and so on. This kind of cause, efficient cause, is explicitly temporal; it presupposes we live in a universe where effect follows cause. The philosophical issues around this kind of causation were explored by David Hume, and there are innummerable popular physics books about "the arrow of

time" exploring why time runs forward and the physics implications of effects following from causes. Adding to the complexity, Einstein's Special & General Theories of Relativity show that in some circumstances, event A can be before or after event B depending on the perspective of a traveller moving close to the speed of light or in an ultra-strong gravitational field; but that need not concern us here.

Formal cause refers to the rules which a system obeys. Only a nerd would answer the brick question by saying: "Because when a heavy object (like that brick) is launched towards the window at that speed, it will fly in a trajectory curved by the Earth's gravity and slowed by air resistance in such a way that it will inevitably arrive at the window with sufficient momentum to break the glass; and the reason the glass breaks is that it has a certain fragility, while the brick is a fairly rigid object incapable of containing the energy of the impact by squashing." However, this is also a perfectly legitimate and correct answer to "Why did the brick break the window?", the kind of answer that says *given these materials and that starting condition, this* ***will*** *happen.*

Final cause presupposes that an action has an intended purpose, and was carried out by an intelligent agent as a means to an end. The capricious will of our anthropmorphic brick, or the courageous action of our rescuer at the blazing house, are examples of final causes. Paradoxically, we will deal with final cause first.

The concept of "final cause" presupposes that an action has an intended purpose. Human brains are, to some extent, biased to assume that causes exist even when this is fallacious (see studies of developing children and their "intentionality bias") and professional astronomers engaged in SETI (the search for extra-terrestrial intelligence) have had to think professionally about how to determine whether a complex signal would be proof of an intelligent sender. Famously the first detection of a pulsar was labelled LGM (Little Green Men!) because it looked like someone had built a powerful radio beacon in the Crab Nebula. Only later did astronomers work out a perfectly natural mechanism whereby a spinning collapsed star could send us an exquisitely regular radio pulse each time it rotated in our direction.

Final cause is crucial in human law courts, where proving the intentions of the accused is a necessary step to convicting them of criminal behaviour. Scientific reseach usually proceeds by assuming that final cause does not apply to the system being studied, with the obvious exception of psychological studies of humans and animals.

Physics, chemistry and geology are quite content to rely on the other three causes alone: material (what system am I studying?), formal (what rules does it follow?) and efficient (if it started in state X, what will it do now; or reversing the process, if it's in state Y now, what was it like earlier?). Typically a science develops by choosing a material, describing observable changes from state X to state Y as a mathematical rule, and testing whether that tentative rule is valid in other circumstances.

When scientists ask "Why does that happen?" they are usually seeking a formal cause – exactly the kind of nerdy answer you'd never give to the brick question in a casual conversation. Science also has an implicit working assumption that the universe behaves consistently and coherently according to rules that we can express in words and usually in a mathematically precise way.

Science also bears another implicit working assumption: Should there be a Divine Being capable of interfering in the chain of cause-and-effect, that Being will allow the normal workings of cause-and-effect to continue in the usual way throughout the experiment (with the obvious exception of statistical studies of the efficacy of intercessory prayer).

God as First Cause

Is it ever legitimate to introduce God as the answer to a "why?" question posed by science? To consider that, we must first distinguish the different kinds of question.

Could God be a material cause? As far as Christianity is concerned, no, because God is not a thing that interacts with other things according to set rules; except that while God is incarnate (in the person of Jesus of Nazareth or in the form of the Blessed Sacrament) there is a material object, which is God, which interacts with the material world in the usual way. (Some primitive religions believed the universe to be formed from the body of some divine being.)

Could God be an efficient cause? If divine intervention occurs within the normal rules of the physical world, with God giving a seemingly random event a nudge in a particular direction to guarantee a desired outcome, yes, this is God as efficient cause. This might even be a testable hypothesis given that there are statistical tests for randomness; if we had some independent revelation of what God's desired outcome was, we could test for non-randomness in that direction.

God as formal cause would apply when the usual laws of the universe are suspended. Multiplying loaves and fishes, or changing water into wine, go beyond nudging allowable events in the right direction. These kinds of miracles, together with instantaneous healings of physically verifiable ailments, would clearly point to God as the formal cause of the transformation.

God as final cause would imbue the universe, or some system within it, with a purpose in the divine plan. Given the Christian understanding that God wants human beings to live in friendship with him eternally, every aspect of the universe which allows humans to exist is part of this final cause. Science doesn't generally test for the presence of a final cause – though forensic science uses what we already know about human beings to assess whether, say, the trajectory of the brick might reveal something of the emotional state of the person throwing it, or her intended purpose.

Within the frameworks of physics, chemistry, geology, and evolutionary biology, there are no internal mechanisms for testing for a final cause. That doesn't mean a final cause can't exist; it's just not relevant to the questions which can be asked within these disciplines.

Considering Irreducible Complexity

Let us turn to the question of whether our complex world contains sufficient evidence for an intelligent designer. One school of thought proposes the idea of "irreducible complexity", arguing that there are certain complex systems which could never have come into being by the working of nature alone, requiring the direct intervention of a hands-on Creator.

The original case was made by William Paley imaging that finding a discarded watch would force him to believe in the existence of a Watchmaker. Dawkins responded by publishing *The Blind Watchmaker* showing how evolution by natural selection could result in the presence of many species seemingly complex enough to need a designer, but in fact the result of the workings of evolution over hundreds of millions of years. ***Once a self-replicating organism with a genome capable of mutation exists, evolution is inevitable and provides the 'crane' to future complexity.*** In the face of further challenges about the "unlikeliness" of evolution coming up with certain designs, Dawkins published *Climbing Mount Improbable.* The "irreducible complexity" proponents continue to seek examples of biological systems where they make their case that evolution couldn't have got there by random processes alone.

There are two kinds of objections that might cause us to call on the "God of the gaps" to explain a physical system. One is that there is "no known mechanism", requring a miracle as the formal cause. The other is that although theoretically possible, it is "overwhelmingly statistically unlikely in the timescale involved", requiring a divine nudge as efficient cause. However, the lessons of history (see LGM, and the B^2H paper, as well as Darwin's theory) tell us that science has an uncanny knack of coming up with mechanisms we hadn't thought of before, and of refining our understanding of systems (or noticing constraining factors) that change the odds from "overwhelmingly unlikely" to "plausible".

So, anyone entering the arena of debate around Intelligent Design and Irreducible Complexity neeeds to take account of the following:

- We human beings are "wired" to be biased towards expecting actions to be meaningful, and expecting complex systems to have a designer.
- Within the working rules of science, it is possible to make a statement that "given our present state of knowledge, there is no known mechanism or no statistical likelihood, for this system to exist."
- As science progresses, we discover new mechanisms and this changes the odds of certain pathways being followed.
- Evolution by Natural Selection provides a very versatile mechanism for diverse forms of life to come about, but there are legitimate questions about the time it takes for a new species to evolve, and identifying the steps that lead to a particular form of organism.
- The greatest unknown is how the first living organism came into being in the first place. There are many tentative theories but little evidence and not much prospect of evidence being found.

This is as far as science can go. It then becomes a matter of faith. Do you believe that science will one day come up with a mechanism to explain what is currently inexplicable? Or, if you believe in a God who has the power to intervene and an ultimate purpose for the universe, do you invoke the God of the gaps to fill that gap and hope science doesn't knock God out of that gap in the future?

Anthropic Approaches

There's one final class of arguments we need to consider – anthropic arguments. When it comes to ultimate questions, what bias is introduced by the fact that we are here to ask the question?

The Drake Equation takes all the relevant probabilities and timescales, and tries to estimate the number of intelligent civilisations likely to be present in our galaxy at any given time. Some of the factors in there are educated guesswork, such as the probability of self-replicating life getting going, or the time before an intelligent species discovers weapons of mass destruction and annihilates itself. But other numbers are now derived from hard data. During the last two decades, the existence of millions of planets in our own galaxy has changed from a theoretical conjecture (because we hadn't found any planets beyond our own solar system) to a reasonable extrapolation from recent observations. We can at least make a resonable estimate of how many planets in our galaxy are in the "Goldilocks zone" where liquid water is present. Running the numbers, we find it's not unreasonable that there's intelligent life somewhere in our galaxy.

The "weak" anthropic principle says that the creature asking any ultimate question must be in a part of the universe which is capable of supporting the life of that creature. I am not floating in the cold

vacuum of space or in the blazing heart of a star. I am not on sun-scorched Mercury or some radiation-baked satellite orbiting Jupiter. I am in the temperate region of a planet orbiting in the Goldilocks zone around the Sun, the Earth. The laws of nature (formal cause) which allow my body to exist are the same throughout the universe. The raw elements needed to make my body (material cause) are also ubiquitous. But one answer to "Why am I here?" would be to trace the chain of efficient causes from the Big Bang, to the supernovae which created the heavy elements in planet Earth, through the formation of our planet, through the first cellular life, its evolution to multicellular organisms, the emergence of mammals after the dinosaur extinction, to the conception of one particular human mammal in South Wales in 1973.

The anthropic principle is a partial solution to why we might find that something has happened even though it is "overwhelmingly statistically unlikely in the timescale involved". As long as we have a sufficiently large universe – or if we are dealing with the fine-tuning of the physical constants affecting a whole universe, then a sufficiently large sheaf of variously-tuned multiverses – then the vast range of locations on offer compensates for the tiny chance of the event conducive to human life actually taking place. This makes us privileged observers – if intelligent life has only evolved once in our entire cosmos, we get ringside seats! We might also reverse the argument and say that if we can show the odds of life evolving are very small, that might be evidence for the universe (or multiverse) having to be large enough to allow it to happen, rather than proof of a Creator. The multiverse hypothesis in particular pits one untestable explanation (a disconnected set of universes) against another (a Divine Creator)... at least until we figure our a way to perform a test. It wouldn't be the first time in science that two things we thought were disconnected turn out to be very weakly connected, and therefore testable.

These kinds of anthropic arguments are *post-hoc* statistics; our existence is a consequence of foregoing causes over which we have no influence. Quantum Mechanics leads us to another kind of anthropic principle, one where the eventual existence of intelligent life might actually be an efficient cause of the universe taking a certain statistical path. There are difficult and unresolved questions about how and when an "observer" forces a quantum system to enter a well-defined state, and we do not have a good way to treat an observer who is within the system (i.e. the whole universe) rather than an external observer (e.g. an experimenter looking at a lab bench). Nevertheless, it is plausible that a quantum universe "tastes" all the possible random pathways forward, and settles on the pathway with the earliest or strongest development of intelligent life, because the presence of life on that pathway anchors that in reality as the chosen pathway. This could be a mechanism to fix free-floating physical constants at the creation of the universe and cause some rare pathways that look like (but aren't) irreducibly complex organisms to come into being along the way. This is speculative stuff, but within the bounds of what serious physicists can propose based on the known mechanisms of Quantum Mechanics.

Any argument for the existence of God *because we can't explain the state of things **IN** the universe* is always hostage to us gaining a better understanding of the universe. We can amass evidence for the existence of phenomena we can't explain right now. The weight of evidence might sway a reader emotionally to put more or less trust in science, or in God. But such an essay could never prove that science won't come up with an adequate explanation in the future.

Another possible approach might be to create a scientifically rigorous "God hypothesis" proposing a model of God and the kind of interventions which this God would be expected to make in the universe. If this model had genuine predictive power and actually predicted a biological result which could be verified, then science would have to take the God hypothesis seriously.

Why Anything? – Understanding Nothing

We now come to a different class of arguments – not about the explanation of why things IN the Universe are a certain way, but the ultimate why, the question of why the Universe (all physical things taken together) actually exists. We are dealing with the origin of time and space.

If the universe was formed *from* something else, we are simply kicking the can down the road, and have to explain the previous something (material cause). And we cannot account for the first moment of time as the consequence of something in a previous moment (efficient cause), since there is no previous moment. In the absence of material and efficient causes, we have NOTHING.

Let us define NOTHING, as used in this discussion, to mean the physical state of no matter, no space (so no vacuum) and no time. If NOTHING exists, it needs no explanation, just as I don't need to explain why I don't have a 20-legged 4-foot turquoise turkey in my office.

We know that matter, space and time do actually exist. This means we are seeking a ***formal cause*** which can account for the existence of matter from non-matter, and for the first moment of time without an efficient cause. Formal causes exist in the form of logic and mathematics, arguments about things which can be true in and of themselves, even if there is no universe for them to be true in.

In some philosophical way, ***truth exists.*** It is true that a proposition cannot be true and false at the same time. It is true that the angles of a triangle on a flat plane will always add up to a half-turn. It is true that 1+3=2+2. It is true that if you are currently reading these words, you must exist. The question is, are there any philosophical truths which are powerful enough to call anything beyond a philosophical axiom into existence?

One relevant class of such formal arguments are the so-called proofs for the existence of God. By defining God to be the uncaused cause, the unmoved mover, the perfect self-existent being, we can explore the logical consequences. In particular, the ontological argument argues that existing is more pefect that not existing, therefore the most perfect entity must actually exist.

Another class of formal arguments are the mathematical descriptions of possible physical worlds. Mathematics has a strong track record here. The job of the physical sciences is to create mathematical descriptions of how the world actually works. Once we have the mathematical model we can use it to ask "what if" and predict things we have never previously encountered in nature. We can predict antimatter, gravitational waves and the properties of nanomaterials. We predict the existence of virtual particles, and it has been experimentally verified that so-called empty space seethes with subatomic particles enjoying a momentary existence (see "Casimir Effect").

Is the mathematics merely a description of the physical world, or is the physical world the outworking of some fundamental truth embodied in the mathematics? We can ask where the maths "comes from", and we can deduce some powerful results based on simple assumptions. For instance, there are "symmetry arguments" requiring that if the basic rules governing things in the universe are to be the same regardless of your time, location or orientation, then linear momentum, energy and angular momentum must always be conserved.

No explanation of the world we live in can be complete without a treatment of Quantum Mechanics. It is a verifiable fact that subatomic particles follow rules which are statistical. We can calculate the odds that a particle will take one pathway or another; when dealing with many particles, we can accurately predict the overall distribution. But it is impossible ***in principle (and not merely in practice)*** to predict the pathway of an individual particle (see Bell's inequality, "hidden variables").

In some real sense, the Universe only decides which pathway has been taken when an observer looks. But there are profound philsophical problems deciding who counts as an observer (see Schrödinger's cat), and there are schools of thought within Quantum Mechanics which suggest all possible pathways are taken at the same time, but in alternate universes (see many-worlds theory). Serious scientists would not propose such counter-intuitive ideas unless they were forced into doing so by the bizarre nature of the sub-atomic world.

The mathematical description of our actual universe has to include vacuum fluctuations (because they have been experimentally verified). In a vacuum (which is not NOTHING, but a potential field) there is no material cause or efficient cause, yet the quantum theory of particles (which is a formal cause) is sufficient reason for virtual pairs of particles to exist momentarily. It is quite conceptually possible that a similar formal theory, applied not to a vacuum but to NOTHING, could be sufficient reason for a tiny, quantum-dominated seed universe to exist, and then following mathematically possible rules, or necessary rules, to grow into the kind of universe we know today.

Arguments about creating something from NOTHING need to carefully distinguish formal from material and efficient causes. Common-sense logic about "you can't create something from nothing" has to be re-tuned to allow for the bizarre yet verifiable reality of quantum mechanics. There is certainly room for the mathematical experts to consider whether a universe is in fact the kind of thing a quantum theory could bring into being given NOTHING, but we no longer have the luxury of being able to deploy classical arguments about cause-and-effect, which are not always valid in a quantum universe.

It's true that you can't get something from nothing, but small-n nothing includes the absence of formal causes. If there are no formal causes, then there are no mathematical truths and no valid arguments for the existence of God. But I've already stated four irrefutable philosophical axioms, and since these truths exist, we have just disproved the existence of "nothing".

In order to avoid a paradox, a formal description of a universe being created from NOTHING would require that universe to have within it an "earliest time". But Relativity tells us that time is not independent of space, and it is possible for "spacetime" to be curved in such a way that there is an "earliest time" just as there is no point North of the North Pole. For this to happen, the Universe would have to be in the grip of an incredibly strong gravitational field – but that's just what WOULD happen if all the mass in the universe were concentrated at one point!

There is plenty of scope here for essayists to explore the philosophical arguments for the existence of "God" – but each "God" must be carefully defined. If you argue the existence of a Necessary Being, is that the same as an Unmoved Mover? There is also scope to critique the internal consistency and testability of mathematical theories for the existence of a universe starting from NOTHING. Is a mathematical axiom requiring a universe to exist, a worse candidate than an abstract "uncaused cause" for identification with the One Jesus called Father? Either way, it is truth which bootstraps something (God or the Universe) into existence.