

The Mechanics of God, I: Why Would a Techie Believe in God?

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A Baptist preacher, visiting Vermont, approached a Yankee farmer leaning on a fence post by the side of the road.

“Brother,” he asked the farmer, “do you believe in Baptism by Immersion?”

The Yankee farmer chewed on a blade of grass, then spit it out.

“Believe in it?” he replied. “Dang it, I’ve seen it!”

I’m like that Vermont farmer. I’m an empiricist. I believe what I see.

Yet I also believe in things I can’t see: electrons, or black holes, for instance. They are theoretical constructs that allow me to explain the things I do see.

So, does God fit into that category?

Even an atheist has to believe that the concept, at least, of “God” does exist, whether or not that concept is true, or useful, or the best way to approach things. Like the Yankee farmer, he merely needs to observe what we all have witnessed: some people do believe in God.

And some of those believers are hard-nosed, rational, died-in-the-wool Techies.

What’s a Techie? Someone who makes his or her living as an engineer or a scientist, yes; but it’s broader than that. It’s someone who’s orientation towards the world is extremely pragmatic, logical, and — most of all — *functional*. Where an artist might ask “is it beautiful?” or a philosopher would ask “is it true?”, the question behind a Techie’s world view is, “how does it work?” Techies see the world in terms of processes to be understood, and jobs to be done... problems to be solved. And not only do we want to know where to find the gears and levers, and why they are arranged that way; we also ask: does this do the job it was designed to do?

I’m a Techie; I know my tribe. I spent seven years at MIT. I have worked with scientists and engineers all my adult life. When I became a Jesuit, I had been a scientist for fifteen years, yet — as is typical of Techies, who value our privacy — most of my friends and colleagues had no idea I practiced a religion. Once they found out I was a Jesuit, however, a surprising number came up and started telling me about the churches *they* attended. Religious belief appears to be just as prevalent among people working in technical fields as it is in the general community from which

those people come. I recall a memorable dinner with half a dozen MIT professors where, over coffee, every one of them chipped in with complaints about the organists at each of their churches — some things are universal in all religions!

(For what it's worth, astronomers seem to be more likely to be believers than biologists. But several surveys, more scientific than my anecdotal experiences, have confirmed that in academic settings the real atheists are to be found in English Literature departments!)

Given that observation, that atheist (or anyone else) might want to ask... why do these people find belief, believable?

The answers that an outsider might come up with, like the answers I talk about here, may not any of them be the real answer to the question of why any particular Techie believer does believe. Heck, I don't even say the reasons I'll come up with here are the reasons that I actually use myself.

Choosing to believe, or not to believe, is wrapped up in so many things. Family background. What the "religious people" we grew up around were like. Our preconceptions and prejudices about one religion or another. The sort of self-image we want to project to the world.

A lot of our religion, or lack of it, is simple posturing: "Look at me, I'm a rebel" ... "I'm a good girl" ... "I'm too smart for that stuff" ... "I'm too humble to deny any possibilities." And a lot of it is sincere angst, an honest attempt to deal with — or avoid — the scary questions of life. The point is, within every individual the good motives and bad motives are so intimately mixed together that it's impossible to separate them out. That's what it means to be human.

But even if you're the most skeptical of atheists, I hope that I can convince you that good motives for believing do exist; that belief in at least some sort of God is a possible, reasonable choice; that some reasonable people can and do believe in God; and that, to them, positing the existence of some sort of God is not wholly illogical.

This is probably the only really "proselytizing" part of these talks. If I can't convince you that theism is a not-unreasonable assumption for someone to adopt, then the rest of these talks will make no sense. But you can accept that, without personally adopting any sort of theism yourself.

And most assuredly I am not trying to come up with yet another "proof" for the existence of God. Such proofs are useless. A "God hypothesis" cannot be subjected to "scientific" or rational *proof*.

For one thing, a supernatural God is bigger than any natural, logical system — that's what "supernatural" means. The *supernatural* is by definition above, outside of, bigger than the natural.

So trying to pin down or limit, to prove or disprove, the supernatural in terms of what's natural, is a ridiculous exercise.

For another, we know that every logical proof must start with some assumed axioms. Change your axioms, and you can prove whatever you want. In practice, it's the "whatever you want" that comes first, that determines the axioms you decide to adopt. In essence, it is not God that you find at the end of your logic; rather, your God is the unshakable axiom that you used when you started your chain of logic. Belief comes before the explanations.

For instance, the Newtonian universe does lead to a mechanistic, deterministic view of life; but that shouldn't be surprising, because determinism is the essential assumption we start with in the Newtonian version of the universe. Likewise, start with the assumption that everything is chance, and you have no problem "proving" that life is random and meaningless. All you're doing is recovering the assumption you started with.

(The same is true, by the way, of the Argument from Design. Only when you assume a Designer God in the first place, does the evidence of design that "proves" His existence leap out at you. Yes, the order in the universe can be seen as consistent with the assumption of an Intelligent Designer; it's a fine "consistency" argument, but that proves nothing — and you don't have to be an atheist to come up with a different, self-consistent explanation with no place for some meddling Designer.)

Most fundamentally science just doesn't do "proofs" the way that mathematics or philosophy does. No assertion or conclusion of science is ever held to be unassailable; it's always subject to further review. Even our experimental data can be found to be biased by unsuspected error, and its interpretation can be distorted by our theoretical preconceptions. Science is successful only as a way of approaching the truth, asymptotically as it were; it's constantly self-correcting, because it continually recognizes its need to correct itself. That only works if you admit from the beginning that you don't already have the truth, whole and completely understood, and that you'll never have the truth in that way. This humility in the face of the Universe is an essential element of a properly functioning Techie mindset.

It's important to remember that belief in and of itself is no stranger to the scientist. We believe our yardsticks are actually a yard long. We believe in the authority of the CRC Handbook when we look up physical constants or standard formulae. We believe that the laws of physics that worked yesterday, will still work the same way tomorrow. Sometimes, we even believe our data.

More subtly, we start every new project with a belief that a solution does exist. We believe that there is an objective reality, and that in at least some limited way we can make progress in understanding the truth about that objective reality. That's a huge assumption to swallow, and many nontechnical people (the New Age types, for instance) are just as happy thinking that "everything is illusion" or "reality is what you make of it yourself."

Actually, when you think about it, most all of our work is shot through with non-rational behavior. I say non-rational; I don't mean "irrational." Our non-rationality is in fact very reasonable. It's necessary. Because our very rationality itself relies on insight.

We Techies usually start our problem solving with a *hunch*... about where we should look to find that solution, what the answer is going to look like, how this problem will parallel problems we've solved before. Without those hunches, we have no idea where to start. Without knowing ahead of time what the solution is going to look like, we would have no way of recognizing it once we found it; we'd have no idea when to stop.

If you don't think this is the case, just remember back to your first years in college — or try for yourself to teach physics to freshmen. You can have a classroom full of incredibly bright kids, but until they have developed their own set of intuitions they find physics to be utterly mysterious. That's why freshman physics and engineering classes concentrate so much on going over worked-out examples of problems: the point is to force-feed some "canned" experience into the students, by cramming down many examples of solutions that we know will work, in the hope that these students will become more able to recognize a given sort of problem (and how to solve it) when they see one. What we are teaching isn't a collection of facts or formulae; I'd let my students bring equation sheets to the exams, and they'd still manage to flunk. No, what is being presented in physics class is the habit of *intuition*.

Reason itself is based on intuition. "All men are mortal; Socrates is a man; therefore, Socrates is mortal." But how do you know that all men are mortal? Or that Socrates is a man? And what spark inside you allows you to deduce that this demands Socrates must be mortal? Each of these steps involves a non-rational intuition.

"Cats are small and black and furry; this animal is small and black and furry; therefore, this animal is a cat." It takes a bit of education to be able to name all the flaws in that syllogism. But if you don't learn to do so, you're likely to find yourself cuddling up to a skunk.

We know that in practice our logic alone is untrustworthy; our habits of intuition are not

perfect, our premises incomplete, and sometimes we misstep. That's why we also demand experimental evidence.

Notice how we handle the things we believe. First of all, we always recognize that we could be wrong. Logic can be flawed. Tables have been known to have misprints. Hunches sometimes turn out to be mistaken. And secondly, we allow our beliefs to be tested by results. If we get an answer that works, it confirms our trust in the data, and it strengthens our preconceptions the next time we're looking for a hunch. In both cases, we allow our beliefs to be confirmed by our experience.

And finally, we pay attention to everyone else in the community of science and engineering. We check our results against what others have done. Sure, sometimes the lone outcast is the only one to get it right; but face it, that doesn't happen very often. If everyone else's calculations come up with "seven", and you get "seven hundred," everyone — including you — will agree on where to start looking for the mistake.

In our everyday technical work, we Techies have developed some very useful skills at playing off our insights into what we observe with logical reasoning about those insights, using each to test and advance the other. We can make bulbs that light up, bridges that don't fall down, theories that not only explain what we see but also successfully predict what we will see — and where to look next. Techie works. So why can't we apply the same techniques to our understanding of what God is, or might be, to developing and evaluating our philosophical or religious beliefs?

Well... it turns out, philosophy is just as hard to do as physics, and it has just as many traps for the unwary. As with physics, to do philosophy well takes years of experience, not only to learn the literature, and the language, but also to develop all those useful habits and intuitions.

A good philosopher knows that it's harder than it seems for philosophical beliefs to be confirmed by experience. What look like perfectly reasonable extrapolations from the known to the unknown, the sort of way that science progresses, can lead to ludicrous results in philosophy. Just because we got a workable answer, in no way proves that our starting assumptions were necessarily correct.

And so just because we happen to get by, ourselves, with what seems like a perfectly workable way of viewing the universe, doesn't mean that we're qualified to do philosophy on it. Just because we can drive a car, doesn't necessarily mean we could design a new engine for it.

But even a philosopher can detect when an engine is knocking. And any human being can at

least appreciate to some degree what the philosophical issues are, and where the sticking points occur. We can use our technical intuition to ask — always aware that these judgments are never final — if a given philosophical system seems reasonable: Does it “work”?

We Techies are pragmatic people, and we must have pragmatic reasons to believe in anything. When we judge a theory, we ask: What data does this theory try to explain? And how well does it do the job? So ... how would this approach evaluate the theory that there really exists something that we call God?

The fact that there is a word for “God” in almost every culture on Earth ought to raise some questions. Why was that word invented? What is it supposed to do? What things do I see, that the concept “God” helps to explain? To believe in God must resolve some issues, fit some data, solve some problems, answer some questions.

Sure, in some cultures “gods” were invoked to explain phenomena of nature that we now can explain in scientific terms. But science only barely does away with that sort of Theism; to most people, invoking “conservation of energy” is every bit as abstract, arbitrary, and alien as any nature god. And even those rare few of us whose life and work allows us to actually understand what conservation of energy is really saying, also recognize the limits of that explanation. After all, science only explains *how* the universe works; it can’t explain *why* it works that way.

But more importantly, even in the most primitive of religions, “God” is invoked for reasons that have nothing to do with earthquakes and lightning. “God” suggests itself as an answer to the sorts of deep, personal questions that every human being confronts at some time in life.

What are some of those questions? What does believing in God answer? What problems does it solve?

I can think of many questions to which some sort of “God” is a reasonable answer. I’ll give three of them here. (The questions are none of them original to me, of course; similar issues were explicitly raised by Immanuel Kant back in the 1700s. If I say anything original here, I apologize.) I don’t say “God” is the only possible answer to these questions. I merely claim that it is a reasonable answer, one that works for some people, sometimes. Your mileage may vary.

The first question is a “cosmic” question. Why does existence exist?

Why is there time? Why is there space? And how is it that we exist, to be aware of the existence of time and space, and to be able to wonder why they exist?

It’s essentially the same question asked by Aquinas (God as the Prime Mover) and

Descartes (“I think, therefore I am”). This question does not insist that there is a *point* to existence, which is an assumption of a later question, and in any event something that I cannot prove. Rather, it merely notes the fact of existence, and asks, why did this happen?

Any natural cause that I can find or imagine for the existence of the universe (and my own personal existence), that fits within the universe, begs the question:

If you say we’re the creations of some super-being from Alpha Centauri, perhaps figments of his bored imagination, you still have to ask where that super-being came from.

If we’re accidents of the universe, you still have the universe to explain. If ours is but one in an infinite set of possible universes, we still need to explain why any of those universes should be. Even if you say the universe just is, and always was, you still have to deal with the fact that it *is*.

If you say we resulted from a quantum fluctuation within a primordial vacuum, you still have to ask why the primordial vacuum existed. Why did the dimensionalities of space arise so that there could be a place for the vacuum to be, and where did the time come from, within which it could fluctuate and change? And how were the laws of quantum physics defined such that these fluctuations eventually resulted in *me*, in all my glory?

Nothing exists in the universe itself to explain the fact that it exists.

So how does this lead to a suggestion of a God? By definition. We’ll simply define God as the answer (which we otherwise can’t fathom) for why there’s something instead of nothing... the Prime Cause, the First Mover.

The interesting thing about such a definition, such a God, is that by necessity this God is somehow outside of, greater than, and independent of the Universe. It’s nothing contained in this universe. So one might still happily be an atheist, if by that you mean that you don’t believe in any God within this universe; because there’s nothing about our answer that, by itself, demands that such a God has any existence within this universe except to cause it to be.

Of course, pure atheism in itself doesn’t make much sense. You can never rule out unimagined Gods, while on the other hand there is no intellectual contradiction in recognizing the possible existence of an otherwise unknown God. But to believe with surety that there is no God, you have to have a pretty clear picture of the God who it is that you don’t believe in.

(There’s a story about an Italian atheist philosopher, on his deathbed and as cranky and ornery as ever. A preacher from a New-Age sect came to his bedside to try to convince the freethinker of the wisdom to be found, at last, in his new theosophy. Finally, disgusted by the New-

Age preacher, the atheist leaned up, pointed to the door, and sent him packing, crying, “I don’t believe in the Catholic God, and that’s the real God! Why should I believe in yours?”)

Atheism is not to be confused with agnosticism, which is merely stating that you don’t know what to believe. But agnosticism is no answer to the “why is there something instead of nothing?” question. Of course you don’t know the answer; ultimately, no one knows. But to believe in the God which is the answer to that question, is no more than believing that the question does make sense and thus, in some sort of way, it does have an answer.

Not every question necessarily has an answer. That’s one of the joys of language, it allows for the existence of nonsense. “What’s the difference between a duck?” “Why is a mouse when it spins?” But if you accept that the question, “why is there something instead of nothing?” is not completely nonsense, a Jabberwock or a Purple Cow; if you accept that an answer exists even if you suspect we’ll never know what it is, then you essentially are already believing in some sort of God.

A second question for which “God” is a possible answer, is another classic. What is it that I am looking for out of life? What is it ultimately that I am longing for? What drives me? What is it that gives me the energy to get up in the morning and face another day?

This question starts with the assumption that everyone has at some level an indescribable longing for something, a longing that never seems to be satisfied; and it asks, what is this longing all about, really?

Is that a valid assumption? Are we all beset by unsatisfiable longings for some inexplicable something? You tell me. I can only talk about how my own soul works.

I can, however, point out that other people besides me have talked about such longings. It makes up the plot of three-quarters of all modern literature, from romances to science fiction, but especially in the genre of coming-of-age novels (and 1960’s pop songs). The dream always seems to be to escape from whatever is trapping you in the mundane, to “get outta this place (if it’s the last thing we ever do),” to “break on through to the other side,” to chase after that mysterious something “out there” — preferably with the gorgeous Partner of Our Dreams at our side. Philosophers call this the search for the Transcendent.

There’s another side to the question, by the way. I could equally ask, not only what am I longing for, but where is this longing coming from in the first place?

My question-pair thus identifies God with either the Transcendent that we’re searching for or, more subtly, the reason behind the fact that we’re searching for a Transcendent. This two-

pronged “attack” of the Transcendent into our mundane lives was described by the German theologian Karl Rahner, who used two untranslatable German words to describe it: the thing-we-all-are-aiming-for (*das Wovorher*), and the thing-that’s-the-source-of-why-we’re-searching (*das Woraufhin*).

But rather than spouting German theology at you, I can put it in a much simpler form. God is what turns you on... or at least, that which is behind whatever it is that turns you on. It’s what gets you up in the morning, what you dream about in bed at night.

Everyone has a religion, whether they think they do or not. For some it’s Islam; for others it’s Elvis. But note exactly what I am saying now: if “Elvis” is your religion, that’s different from saying that “Elvis” is your god. Rather, “Elvis” is what you’ve chosen to use, to reach your god; to reach out to that indefinable Something that you do feel closer to, when you’re all alone with the VCR watching *Blue Hawaii* late at night. It’s the “indefinable something” that ultimately you worship; Elvis is just the way you’ve found to get closer to it.

This sort of longing is uniquely human. It’s different from your cat’s longing for tuna, your dog’s longing to be petted. For one thing, tuna satisfies the cat; but at the end of the night, when you turn off the VCR, even those two hours with Elvis leave you feeling a little unsatisfied. Despite his best effort, you still go to bed feeling lonesome tonight.

Of course, most of us are not worshipers at the Church of Elvis. The places where we look for the Transcendent can be much more mundane, much more immediate.

There are the obvious religion substitutes: wealth and power, political causes, football teams, rock stars. Sometimes we madly throw ourselves into sex and drugs and rock and roll as a way to try to drown out this insistent attack of the Transcendent, as if satiating the hungers of the body would still the hunger of the soul. Sometimes, instead of alcohol or cocaine, we overindulge in more socially acceptable “drugs,” like our work, or our families. (And it’s then all the harder to bear when you’re forced into retirement, or your kids rebel against your overbearing presence.)

The philosopher who searches for Truth is caught by this desire. The artist who searches for Beauty, the romantic searching for Love, the mathematician searching for Elegance, all are responding to a need for something bigger than the ordinary.

One of the most clear expressions of this unsatisfied thirst for the Transcendent is our desire for Justice. “If there is a Good God, then why is there Evil in the world?” asks the skeptic; but the very question presupposes not only a God, but an absolute of Right and Wrong. It was this

universal sense of “fairness” that C. S. Lewis uses as the pointer to God in his famous book of popular apologetics, *Mere Christianity*. It can be turned a slightly different way; the presence of Evil in the world — which any day’s newspaper will show you — proves how the Transcendent of Justice is sometimes most acutely felt when it is absent.

But it takes time to learn to develop a taste, to appreciate these Transcendentals; ask the parent of any child. Or the parent of any teen-ager. So we can never be certain that what we are experiencing isn’t merely a set of learned, social conventions. The fact that virtually every human society has held a number of these conventions in common is, if not highly suggestive, at least consistent with the claim that they are more than just conventions. But that still is no proof. Indeed, a sense of Beauty, or Elegance, or Justice, may simply provide some sort of biological evolutionary advantage, resulting in it being programmed into our genes. (Certainly guys with no sense of Beauty or Truth have a harder time getting dates... or at least they would, if there were any Justice in this world!)

My third question is the final classic: Who am I? Where am I? And what am I supposed to be doing here? Given this cosmos, and these Transcendent urges I feel within it, what am I supposed to be doing about it all? Who am I, and who am I supposed to be? Is there something I was supposed to be doing, and a Someone who knows what it is, even if maybe that Someone neglected to tell me about it?

The classic experience of the “identity crisis” is a standby of college sophomore angst and Woody Allen films. We see the chubby middle-aged executive trying to squeeze himself into a fire-engine-red sports car, and knowingly smile to ourselves. We can laugh, because we’ve all been there. But that desire to know who we are, and what is expected of us, is a powerful human urge. It’s the basis of our fascination with astrology and self-help books. “Know your place,” sneers the villain who wants to crush the plucky young hero of the melodrama; but the Hero is resisting the Evil Overlord precisely because he does know his place, and he’s confident that it doesn’t happen to be where the villain would put him. To give us a confident knowledge of our place and our purpose in this world, is one of the strengths of Tradition (as *Fiddler on the Roof* reminds us). And we get understandably upset when, like Dylan’s Mr. Jones, we find ourselves someplace where we don’t belong, where we know something’s happening but we don’t know what it is.

So where does God fit into this question?

Believing in a God allows one to make intelligent sense of this yearning for place. We can

identify God as the external standard against which we can measure not only where we are, in a metaphysical sense, but also where we're going (and at what speed). God becomes our metaphysical frame of reference. We can use "God" as the source of the order in a universe that has a place for us. Perhaps someone has assigned us our identity and purpose, and that is who we'll call God. Or at the very least, we can postulate a God who observes the choices we make and applauds (or cringes) at the way we make our own places for ourselves.

Or we can recognize that sense of alienation that every human being feels at times, and conclude that wherever it is we really belong, it isn't here. And then we can define God as the Presence in the place where we will finally fit in.

Now notice, even more than the other questions, this argument has absolutely nothing to do with a "proof" of God's existence. Using God as an answer to the question "how do I orient myself in this universe?" only makes sense if you already hypothesize the existence of a God. But as I cannot emphasize often enough, I am not in the least bit interested in trying to "prove" the existence of God. I am trying, instead, to explain the utility of such a belief to a believer. And one of the greatest utilities of a theism is that it provides precisely this sense of logic and order and purpose.

That sense of purpose is useful precisely because the universe can otherwise seem terribly purposeless. And that's a feeling that most people just don't like to live with.

"Deal with it," the agnostic can say, with all justice. "It's a meaningless universe, and if there is any meaning at all, it's what we make for ourselves." That is a possible response to the question. But it's not the only possible answer. A belief in God is another possible, possibly valid, answer. We don't have the external data to prove absolutely one of these answers over the other. We have to make our choice. Given what we know, either choice could be true. But both choices have consequences.

Notice what is missing in all the arguments above. In none of these three questions do we hypothesize a pie-in-the-sky God. In no case do I suggest that you should believe in God as a way of insuring some sort of personal salvation, an eternal life of happiness after death. (That comes later.) Nor do I suggest that believing in God is a way to satisfy your longing for revenge on your enemies, or to provide hope that we will be reunited with the departed loved ones.

You don't have to believe in life after death, to believe in God. The Sadducees, a large party of devoutly believing Jewish religious leaders at the time of Christ, did not believe in life after death.

Jesus of course disagreed with this view, but that's a different issue...

Even without an afterlife or a Judgment Day, the fact of our existence and the nature of our human longings are enough to suggest the possible existence of some sort of external Deity. And a God who was the source of our existence and our longings and our meaning, is one whom we would by definition rank as the most important thing in our lives: the object of worship.

None of these classic questions have conclusive or unique answers. Merely postulating some entity we'll call "God" is not by itself even close to completely satisfactory. But I never said I could answer those questions. I merely point out that these are the sorts of questions that can suggest to someone that the hypothesis of a God might be a possible, useful way to proceed.

But it's a way to proceed that has its own potholes for the unwary. If you do assume that there is a God to help answer those questions, you run smack into some classic philosophical conundrums. The difficulties are well documented, and well worth taking a look at. I'm going to go over just some of them — as with the questions themselves, I could hardly be exhaustive in a chapter this short — and I'm going to take them in reverse order. (The most interesting trap for Techies is the last.)

First... OK, so God gives an orientation to my life. ***But Whose Life Is This, Anyway?***

What about Predestination versus Free Will? Does the existence of a God who determines my "place in the universe" mean that my life has already been determined? Is everything predestined? Or do I get judged on how close I get to guessing God's secret plan for me? If He does have a plan for me, why does He make it so hard for me to figure it out? And what if I don't like it — don't I have anything to say about this?

For one thing, we clearly *are* limited in our choices. We are limited by the laws of physics, and by the constraints of the time and place in which I live. I will never be a basketball all-star. I will never be a courtier to King Louis XV of France. I will never flap my arms and fly to the Moon. Free will is not the ability to choose anything imaginable, but merely the ability to choose among a finite set of limited possibilities.

But clearly, the problem is deeper than that. Just as Newton's deterministic mechanics, when extrapolated to the physics and chemistry of the human brain, has a hard time explaining free will, likewise the postulate of an all-knowing all-powerful God, who defines the purpose in our life, can also make free will hard to understand. Yet, if we don't have free will, then any further argument is pointless (since we would not be free to accept or reject them). Our experience in life gives us

every reason to believe (and no reason to doubt) that we actually are free agents. Indeed our desire for freedom, our repugnance at the idea of being a slave — no matter how happy — is a fundamental data point, telling us that our understanding of this omnipotent life-defining God, like our understanding of Newtonian physics, is missing something essential if it doesn't have room for free will.

We have a conundrum, one that does not have an obvious solution. If we assume a “God” as the answer to who defines our life, we must recognize that this God must be consistent with the observational fact of our freedom to make that definition for ourselves. That's a tricky kind of God to imagine. But then, we never said it would be easy.

OK, God is the source and answer to some deep urges. *But Is Every Urge, an Urge from God?* Obviously not.

The medievals understood this point. They described the different urges that come over one, that seem to come from outside one's own person, as “spirits,” angels and devils. To them, angels and devils were not cartoon concepts (or characters in some fantasy TV show) but descriptions of actual, ordinary, mundane experiences.

A model student takes a gun to school and kills two of his friends. A lover in anger says the one cruel remark she knows is most likely to hurt the one she loves. A dieter deliberately walks into an ice cream shop... One of the characteristics of actions like these is that we know darn well that we shouldn't do them, that they're stupid, that the momentary pleasure of the act — if there is any pleasure to it at all — is nothing compared to the miserable consequences. We know that the hot fudge sundae is never as good as it looks; that the pornographic film will not satisfy our lusts; that the alcohol won't make our hurt go away. What “gets into” us? When we see someone else in some self-destructive act, we ask, “Whatever possessed him to do that?” Does our modern psycho babble tell us anything more than what the ancients meant when they said that such a person was “possessed by a devil”?

Especially when there are other times that these outside impulses are strokes of genius. Some of the greatest acts in history occurred when ordinary people gave themselves over completely to extraordinary ideas: Mother Theresa going to India, Einstein's imagination riding on the crest of a light wave. What made Rosa Parks refuse to give up her seat on the bus?

And what about those ideas that, on the surface, look like good and noble plans, but which underneath serve to do nothing but foster our egoism and paranoia? Sadism that masquerade as

“tough love”? When “protecting the weak” becomes an enervating paternalism?

Where do these impulses come from? And how do you tell the good ones from the bad?

And what’s harder, once you have adopted some standard other than “self-interest” to guide your actions, you can be left with some tricky situations. You’re liable to make mistakes; indeed, mistakes are inevitable. And that opens up the whole realm of sin, of guilt, of the need for forgiveness and redemption... and the need to forgive and redeem others. It’s a can of worms, and there’s no getting away from it.

But from the purely Techie point of view, the nastiest and subtlest trap comes from using the existence of the physical universe to demonstrate the existence of God. If that’s our answer, then can’t we use the evidence of science to determine what this God must be like? ***Are the Laws of Science the same as the Laws of God?*** Is science an experimental theology?

Steven Jay Gould, in his book *Rocks of Ages*, has argued strongly against this; he insists that an impermeable barrier stands between the worlds of science and religion, and that neither can make useful contributions to the other’s realm. But that can’t be entirely true. Our twenty-first century view of the universe must mean we look at God differently than they did in 1000 BC. That shouldn’t be surprising, or disturbing. After all, the picture of God we had when we were five years old wouldn’t be enough to handle our adult understanding of the Universe. (Our picture of science as a five-year-old was pretty skimpy, too.)

But Gould has a point. Though they interact, they don’t interact in the sense that the results of one can immediately be applied to the field of the other.

About the year AD 500 in India a great mathematician and astronomer, Aryabhata, published a breakthrough work of geometry and astronomy. A thousand years before Copernicus, he suggested that the Earth was spinning. He still had the Sun and planets moving about the Earth; but this spinning Earth in a universe of fixed stars was a major departure from Aristotelian physics.

Whether it was this idea of a fixed set of background stars, or some other unspoken motivation (his surviving writings are sketchy, to say the least), the observational data available to him, inherited from the Greeks and Babylonians, and his advanced understanding of geometry led him to calculate the length of time it takes for all the planets to make once complete circuit of the heavens, relative to those fixed stars. And he gives these numbers in his book to a remarkably high accuracy... better than one part in a hundred thousand, in some cases. This is science of a quality that would not be equaled for more than a thousand years.

Yet there is a problem in the way he presents these numbers. The trouble is, he wants to express the period of, say, Mars, in terms of an Earth year; but the period of Mars is not some exact number of Earth years long. It's not one year, or two years, but 1.8807 years, according to our best data to date. We express the fraction of a year by all those numbers past the decimal point; and it's understood that whatever uncertainty remains in that data, lies in the last significant figure.

Now, Aryabhata didn't have the decimal point to use, because mathematicians hadn't invented it yet. So how could he express the period of Mars? He was very clever. He could do it as a ratio. For instance, he could say that in 205 Earth years you'll find Mars making 109 circuits of the heavens. Do the arithmetic and you find that this ratio matches the modern figure to four decimal places.

Of course, it's not correct in the fifth decimal place. It couldn't be, no ratio would be, because no planet orbits the Sun with a period that is a perfect ratio of a round number of Earth years (nor is any period constant to that precision, for that matter). The period of each planet, expressed in terms of an Earth year, is always a slightly varying number whose values beyond the decimal point never occur in a repeating pattern. It is a number that cannot be expressed as a ratio — it's an *irrational* number.

But Aryabhata didn't know all that. He just knew that these ratios — hardly simple numbers in themselves, measured to a sixtieth of a circle — did match a thousand years' worth of data. And given ratios like this for each planet, the next obvious step is to compare all the ratios against a common period. In essence, you multiply all these ratios together to find the common denominator of the ratios for all the planets together. Using numbers going back to the Babylonians, this comes out to be 4.32 billion Earth years.

What does this common denominator mean? It means that, if the planets all did really orbit with periods in perfect ratios to the Earth's period, then this 4.32 billion years would represent the amount of time it would take for the whole system of planetary positions to repeat itself.

Now, put yourself into the ancient Hindu cosmology, one that accepted the astrological idea of human and Earthly events being controlled by the positions of the planets. If the planets repeat their positions every 4.32 billion years, like the best astronomy of those days implied, then this calculation provided "solid scientific proof" that life on Earth was indeed trapped in an endless cycle, relentlessly and inevitably repeating itself. And science even gave us the length of time between cycles of the universe: 4.32 billion years! Later Hindu astronomers speculated about when

exactly the time was when all the planets started out perfectly lined up; and how long it would be (given current planetary positions) before this perfect lineup would occur again; and what this would mean for the future of humanity...

Knowing what we know today, that planetary periods are not perfect ratios, we immediately see the fallacy of this argument. Planetary positions never repeat. There was no moment when all the planets were perfectly aligned, nor will there be in the future. There is no scientific basis for the concept of a repeating universe. Yet this version of Hindu philosophy seemed to be backed up by a science that was not only good for its day, but darn impressive by anyone's standard. The numbers it was based on were good to four or five significant figures! What more could you ask for?

Now consider Johannes Kepler, the man whose laws of planetary motions made the heliocentric system actually work. Copernicus had proposed a system where the Earth moved around the Sun, which was the center of the solar system, but the Copernican system still was a system of circular orbits. And so just like Ptolemy before him, in order to match the actual observed positions of the planets Copernicus had to assume that the planets moved in little circles around their "average" circular orbits. And he had to assume "eccentric" circles, namely circular orbits that were centered not exactly on the center of the solar system, but on some point offset from that center. Even the Sun itself did not sit at the center, but rather did a small circular dance about its average position.

None of this was satisfactory to Kepler. The problem to him wasn't one of inelegance; rather, it was a theological problem. Kepler, you see, had a very peculiar notion of God's place in the universe. Unlike the standard theologies of his day, Catholic or Protestant, Kepler's personal mysticism told him that everything in the physical world exactly mirrored, or paralleled, the spiritual realm. Thus to him the light of the Sun represented in some real way, more than just symbolically, the Holy Spirit itself pouring itself upon the Earth. And the source of this light, the Sun, was to his thinking the physical manifestation of God the Father himself!

Well, reasoned Kepler, it would hardly be fitting for God the Father to make this eccentric little dance around the center of the universe. God had to be the center, in a literal sense. So Kepler went searching for an astronomical system that allowed the Sun, God, to remain fixed. Eventually he hit upon replacing the circles and epicycles of Copernicus with elliptical orbits, and the rest is history.

Kepler the philosopher also had an interesting axiom of philosophy. He maintained that no

true deduction can be made from false premises. We merely note in passing that his deductions of planetary motions in elliptical orbits have stood the test of time far better than his theological premises. The point is, of course, that Kepler was exactly wrong: it's quite possible to start with false premises and still arrive at a true conclusion.

Back in 1865, Maxwell derived his famous equations uniting electricity and magnetism, (predicting the electromagnetic wave nature of light, and the possibility of radio, and the transmission of AC power, and just about everything else we use in electronics today) by assuming that the "ether" had a "finite compressibility." His theory led to Einstein's theory of relativity, which in turn showed that there was no such thing as an "ether." Yet our electrical appliances still work, regardless.

In 1800, astronomers used "Bode's Law" of planetary positions to look for a planet between Mars and Jupiter, and the asteroid belt was discovered; a hundred years later Clyde Tombaugh was guided by Percival Lowell's calculations to discover the planet Pluto. We now know that in both cases the theories were completely in error (neither the asteroids, nor Pluto, have the properties that those theories demanded). But the coincidences in position did occur; and the asteroids, and Pluto, are still out there long after the theories that led to their discovery have been discarded.

Of course, even in science, not every false assumption will inevitably lead to a true conclusion. But still, I think it is striking to see how differently philosophy and physics behave. Physics seems to be pretty robust; if your starting conditions are not too far away from reality, you have a good chance of getting somewhere close to the truth. Physics converges on the truth. Philosophy, by contrast, exhibits what could be called extreme sensitivity to starting conditions. Like of mathematical chaos, a slight change in your philosophical assumptions can result in a radically diverging outcome.

Now recall, science is only an approximation of the truth. Every data point has error bars. No scientific number is perfect. No measurement is perfect. And every scientific theory, no matter how good or useful, is at best only an approximation of the truth. It can be a phenomenally good approximation; but that is not the same as perfect. If you try to extrapolate too far from your data, sooner or later you're likely to go very wrong. (And that's the way it's supposed to work; when Newton's Laws fail, we get quantum theory, or relativity. Who knows what we'll get, when those laws fail?)

So forging too close a tie between your religious beliefs and the “best science of the day” can lead to real problems. You can’t conclude that just because your philosophy is based on the best science of the day, it must be true; it might look really silly when the best science of tomorrow comes along. You can’t even run the argument the other way, and try to conclude that since your science is based on a certain philosophical viewpoint, the success of that science proves your viewpoint was correct. Hindu astronomy does not prove Hindu cosmology. Kepler’s laws do not prove Kepler’s theology.

We scientists are used to confirming our theories with results; if the right answer comes out, we think that this confirms our starting hypotheses. But while this works in a rough-and-ready way in science, in general that’s not at all a logically valid deduction. And the failure of our assumptions (like quantum behavior) are most likely to occur precisely where we are extrapolating from the everyday world to extreme cases. Now, the philosophical issues of origins, and meaning, and the ultimate longing of the soul, are precisely those sorts of extreme questions. It’s just at the point of the “religious” questions that we should be most cautious in extrapolating from our scientific experience, recognizing that it is precisely here where our assumptions are most likely to fail us.

So are we forced back to Steven Jay Gould’s impermeable wall between science and religion? I don’t think so. After all, every believer is a human being, located at a particular place and time, whose beliefs must coexist with the reality of the physical universe. And, what Gould forgets, every scientist is a human being, driven by desires and ambitions — and assumptions — that in some way are rooted in the Transcendent, rooted in the three questions we outlined above.

So it can’t be that simple, just keeping our worlds of science and religion separate. It is an observational fact that science and religion do interact. They interact in the very yearnings that give rise to the scientific enterprise. Science doesn’t give answers to religious questions; rather, science provokes those questions. Religion doesn’t tell us what to know; rather, it asks us to reflect on why it is we want to know. The religious Techie turns to God to explain why existence exists, to explain why the heart yearns to know why it exists, and to give direction and heart to an enterprise that we know will never be complete.

And it was in organized religion that the medieval Techies first found the model for how to proceed in that enterprise, the model for the enterprise we now know as organized science. That parallel, and the modern Techie view of organized religion, will be the topic of tomorrow’s talk.