

observer chain approach would create more detailed flight path and UFO identification data derived from multiple location sightings.

There is no better example of geographical UFO research than the work of Larry Hatch at his web site <http://www.larryhatch.net>. He sets a gold standard for academic rigour in the quality of his computerised geographic profiling of UFO activity.

This proposed technique of UFO tracking has already been employed successfully on a city scale by networks of civilians living in London. The findings of the London trial go further than the task of simple observation. They suggest we can even modify and pre-empt the intelligence controlling the UFO behaviour by attempting to bridge this historical shortfall in an organised sequential surveying of UFO overflights.

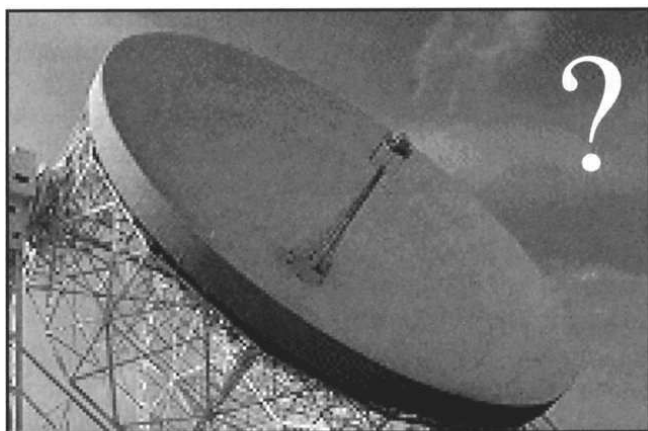
UFOs appear in recent years to have altered their over-flight activity. They have already been seen to be more selectively overt, to be more easily sighted by what we

call repeater witnesses. Perhaps it is from some of these repeaters that we will see the first seeds of an organised force created specifically to form observer chains.

Would this simple behaviour modify the UFO activity in a similar way to the London experiment findings? Could this be leading to precisely the kind of overt UFO over-flights of capital cities once so eagerly anticipated by the early pioneers in our field? What can be derived from these kind of UFO spectaculars is that the audience allowed to view such activity is select and narrow. There are repeater witnesses at the centre of every city having UFO contact. A more democratic UFO witness proliferation would arise when these main witnesses become structured into a useable system in this case the observer chain.

The actions of the global civilian mass population are crucial to what happens next in the continuing world experience of the UFO question. The battle for our hearts and minds has yet to be joined. ■

IS EARTH EMBEDDED IN A LARGE GALACTIC CIVILISATION? © 2003 BY BEATRIZ GATO-RIVERA, particle physicist and member of the Spanish Scientific Research Council (CSIC).

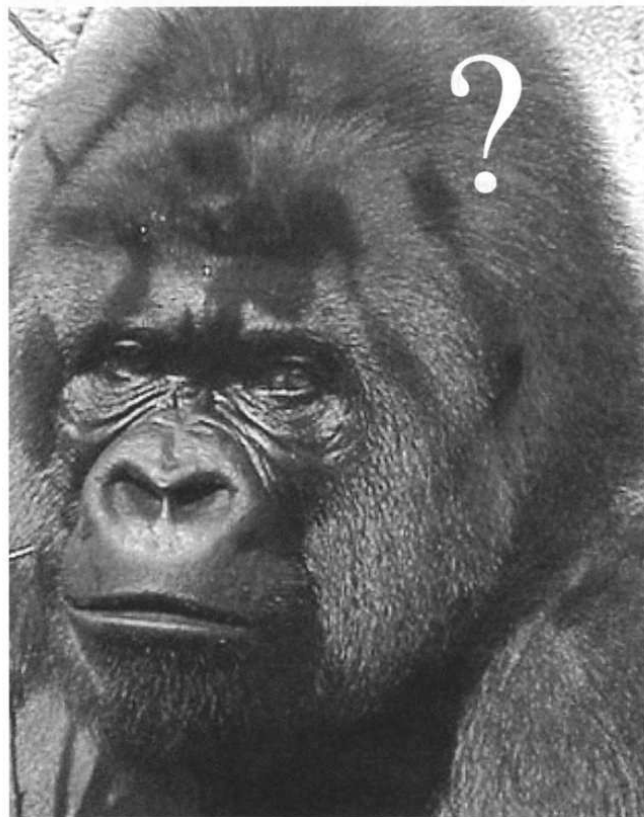


The cosmologist Ken D. Olum, from Tufts University, after doing some computations, concludes, "We should find ourselves in a large civilization (of galactic size), but in fact we do not."

I want to explore the intriguing possibility of whether we could be immersed in a large civilization without being aware of it. Due to the fact that there are billions of stars much older than the Sun in all typical galaxies, we could be not typical among the intelligent observers of the universe.

Typical civilizations of typical galaxies would be hundreds of thousands, or millions, of years more evolved than ours and, consequently, typical intelligent observers would be orders of magnitude more intelligent than us.

Do mountain gorillas know that their civilization is embedded in a larger civilization corresponding to a much more evolved and intelligent species than themselves?



Do they know that they are a protected species inhabiting a natural reserve in a country inside the African continent of the planet Earth?

The answer to these questions is certainly no, they do not know anything about our social structure, our countries, borders, religions, politics, nor even about our villages and

cities, except perhaps for individuals living in a zoo, or adopted as pets.

In the same way, the human civilization of planet Earth could be immersed in a much larger civilization unknowingly, by a much more evolved and intelligent species than ourselves. After all, the Sun is only a young star among thousands of millions of much older stars in our galaxy, and the possible existence of such advanced civilizations is only a question of biological evolution doing its job, slowly but relentlessly through the millennia.

If this happens to be the case, it is quite sensible to assume that these individuals regard our planet as a natural reserve, full of animal and vegetable species, the Solar System being nothing but a small province inside their vast territory.

In this situation, the answer to the usual remark, "If there are advanced extraterrestrials around, why don't they contact us openly and officially, and teach us their science and technology" - seems obvious.

Would any country on this planet send an official delegation to the mountain gorilla territory to introduce themselves openly and officially to the gorilla authorities?

Would they shake hands, make agreements and exchange signatures with the dominant males? About teaching us their science and technology, who would volunteer to teach physics, mathematics and engineering to a bunch of gorillas?

In addition, one has to take into account the limits of the brain capabilities, independently of the culture of education. For example, let us ask ourselves how many bananas would be necessary for the most intelligent gorillas to understand the equations of electromagnetism (even if they watch TV or listen to the radio).

In the same way, we may wonder how many sandwiches, potato chips or cigarettes would be necessary for the most intelligent among our scientists to understand the key scientific results of a much more advanced civilization.

Our intellectual faculties and abilities are limited by our brain capabilities that are by no means infinite. Therefore, it is most natural and sensible to assume that there may exist important key scientific concepts and results whose understanding is completely beyond the brain capabilities of our species, but are within reach of the much more evolved and sophisticated brains of more advanced civilizations.

Ken D. Olum has written a paper about the idea that in the observable Universe, because of the existence of thousands of billions of stars older than the Sun, there must be huge civilizations much older than ours which could have spread widely through the Universe. In his computations, he considers a cosmological mechanism called inflation, and he also uses the anthropic premise that, we should find ourselves among the typical intelligent observers of the Universe.

He predicts: There is a high probability that we are part of a larger civilization. Olum writes, "Nevertheless, we do not belong to such a civilization. Thus something should be amiss, but then what other mistakes are we making?"

The answer to this conundrum is that we could well be part of large civilizations spanning our galaxy (or a large region of it) without being aware of it. Therefore, one obviously natural solution is that we do belong to a large, very advanced civilization, but we are not citizens of it because of our primitive, low status. Olum makes the mistake of thinking that, first, we are typical intelligent observers and, second, that to belong to a civilization implies to be a citizen of it.

Olum's claims that the cosmological inflation should increase the probability that we live in a large civilization are not very convincing. However, this would be the case if there exist thousands or millions of parallel universes separated from ours through extra-dimensions, as in some *brane* world scenarios considered in Particle Physics (every *brane* being a universe).

In this case it would be natural to expect that some proportion of these universes would have the same laws of physics as ours (presumably half of these would be made up of matter and the other half of antimatter), and many of the corresponding advanced civilizations would master the techniques of travel or jumping through (at least some of) the extra dimensions.

It could even be that the expansion to other parallel universes could be easier, with lower cost, than the expansion inside one's own galaxy. As a result, we could also expect colonizers coming from other universes, building multidimensional empires.

In many other universes, however, the laws of physics would be different. This does not mean, however, that these Shadow Universes would be necessarily empty of intelligent beings. If some of them had advanced civilizations, some of their individuals could even jump to our universe, but we could neither see, nor talk to, the Shadow Visitors (and the other way around). They wouldn't be able to colonize us either.

Let us discuss in detail the possibility that our small terrestrial civilization is embedded in a large civilization unknowingly. In our galaxy there are thousands of millions of stars much older than the Sun.

Therefore, it seems most natural to expect that in a reasonable number of solar systems, technological civilizations should have appeared, and a fraction of them should have survived long enough to spread to large regions of the galaxy. It is then very remarkable that the Solar System has never encountered, or been colonized by, any advanced civilization, or has it?

Olum assumes that, in the process of expansion and colonization, the more advanced civilizations will push the less advanced ones to their own level in order to integrate them, or else they will exploit, damage or annihilate them in order to conquer the planet, in the case of aggressive colonizers.

However, to integrate a primitive civilization into an advanced one could be a very unrealistic possibility. Among other reasons, the differences between their brain capacities and those of the primitive individuals could be pathetic.

With this insight, it is now much easier to accept the possibility that the Solar System could have been encountered or colonized many thousands, or even millions, of years ago by at least, one non-aggressive advanced civilization, who treated and still treat our planet as a protected natural reserve. Perhaps the Solar System has been visited by aggressive colonizers, as well as non-aggressive ones, resulting in battles or negotiations. Perhaps the aggressive losers will come back in the future to try again.

This view about ourselves, as a small primitive civilization immersed in a large, advanced civilization, leads to the realization that we could find ourselves not among the typical intelligent observers of our galaxy, but among a small proportion of primitive intelligent observers instead, completely ignorant of their low status.

It could be that all typical galaxies of the Universe are already colonized (or large regions of them) by advanced

civilizations. Whether the primitive subcivilizations know or ignore their low status will depend on the ethical standards of the advanced civilization in which they are immersed.

If the standards are low, the individuals of the primitive subcivilizations will be abused in many ways, in the same way that in our civilization, large groups of human beings abuse other human beings in weaker positions, as well as animals in general.

In this case, the primitive individuals will be painfully aware of their low status. If the ethical standards of the advanced individuals are high instead, then they will respect the natural evolution (biological, social, cultural) of the primitive subcivilizations, treating them as some kind of protected species.

In this case, the primitive individuals would be completely unaware of the existence of the large advanced civilization in which they are immersed.

If the Solar System is part of the territory of an advanced civilization, why don't we detect any signal of civilization in any of the planets or satellites in it? This would be natural if they had built bases all along the Solar System, including underground and submarine bases on Earth, and some colonies on or below the surface of some solid planets and large satellites (which is what we plan to do in the future ourselves).

The simplest answer would be that they do not find the Solar System attractive enough to live in themselves and would therefore have only a few small bases, difficult to detect.

However, an alternative explanation would be that, being aware of the existence of aggressive advanced civilizations, they would have developed very sophisticated camouflage systems, so that no signals of civilization can be detected by external observers or their space probes. Probably, in many cases, they even manipulate and distort the global data of their planets to fool external observers.

Thus we cannot be sure whether our civilization is the unique civilization inhabiting the Solar System. We should not assume that the data we receive, with no signals of the existence of intelligent life, proves that there is no one out there.

The right claim would be that there is no signal of primitive civilizations, like ours, who would allow themselves to be detected by external observers, but nothing can be said about the possibility of advanced civilizations, capable of fooling telescopes, detectors and space probes, who would not allow themselves to be detected.

In the past, people thought the Earth was the center of the Universe, but now we know better. In spite of this, for many human beings the Earth is still the center of the Universe, the chosen planet inhabited by the most perfect and intelligent beings in the Universe: the Crown of the Creation (There are even some regular scientists and intellectuals who wonder whether the whole Universe was created just for us, terrestrial human beings, to exist!)

Are we unknowingly embedded in another, more advanced civilization, much as gorillas are embedded in ours? Why wouldn't the advanced civilization openly show themselves to us?

The reason would be that we do not qualify as full members, neither as associates, although we perhaps qualify as pets or little friends.

Why can't we tell they're here? The reason would be that, generically, all advanced civilizations are undetectable for

security reasons, due to the existence of aggressive advanced civilizations. In any case, why would advanced civilizations allow alien civilizations to watch their cities, laboratories, military installations, etc. when they could fool them very easily instead?

If we are one of the ecologically protected species of an advanced civilization, one reason for an individual of this civilization to establish contact with us, primitive individuals, could be scientific research, but also simply to have fun and relax - the kinds of feelings which cause us to interact and play with cats and dogs and many other animal species.

In addition, if on our planet there are millions of cat lovers and dog lovers, and there are even snake, pig and gorilla lovers, it is natural to expect that there may exist some terrestrial human lovers among advanced aliens. This and similar situations would especially be true among advanced individuals who had to spend long periods of time working on primitive planets, living underground or on boring submarine bases, which would exist if our planet is embedded in another civilization.

The criminals of the advanced civilization could be interested in the primitive individuals as well. We can imagine dozens of different purposes for which primitive individuals could be kidnapped, tortured and even killed, including high gastronomy and sadist games.

One only has to think of the treatment that some cruel human beings give to their victims, whether they are other human beings (often children) or animals. The ethical level of an individual, or a civilization, does not necessarily grow in parallel with their technological and scientific achievements, or with their level of material well-being.

SETI could really be SETPI: the search for extraterrestrial primitive intelligence, because only primitive civilizations would allow themselves to be detected by external observers. In addition, the primitive civilizations should have reached the appropriate technological level to be able to produce electromagnetic emissions that would allow them to be detected by distant civilizations.

As a result, the period of detectability of an average civilization could last less than 500 years (until they learn to camouflage themselves), which makes it very unlikely that one primitive civilization could detect another one. For these reasons, this scenario predicts a rather low probability of success for the SETI project.

I have essentially no opinion about the many strange reports of alien abduction and contact, because I have never done any investigation of these matters. However, I believe that the claims of civilizations much more advanced than us must necessarily sound like ridiculous, hilarious, crazy science fiction ideas.

But the same thing would have happened if we had described our TV sets, planes, microwave ovens, computers, etc. to people only 100 years ago. Many people, including many scientists, have a very deep rooted reluctance and aversion to accepting the possibility of the existence of extraterrestrial species much more advanced and intelligent than us, who could even visit our planet.

I call this prejudice the 'Crown of the Creation Syndrome' (CCS). Curiously, while many religious people are not CCS sufferers, many atheists are. This could be because, while both religions and humanism often overestimate the greatness and uniqueness of the human species, the religions also teach humility? ■

A COMMENTARY ON BEATRIZ GATO-RIVERA'S ARTICLE. © BY GEORGE WINGFIELD, BA (Hons, Nat. Sci.), MA, and FSR Consultant.

Is Planet Earth Embedded in a Large Galactic Civilisation? This question posed by physicist Beatriz Gato-Rivera marks a welcome departure from the usual blinkered views concerning extraterrestrial life expressed by the majority of scientists in the last few decades. Whilst maintaining a cautious approach to the subject, she suggests that Planet Earth may be just one tiny habitat for intelligent life situated among – possibly—millions of civilisations, often vastly more advanced than ours, dotted throughout our galaxy.

Her speculation concerns only our own galaxy, the Milky Way, a vast spiralling aggregation of more than 100 billion stars loosely held together by gravitational attraction in a disk-shaped conglomerate roughly 100,000 light years across. Of the billions of other galaxies that stretch through space to the very limits of the universe we can say nothing, though one could suppose that, if life has developed widely in our galaxy, it will also have done so elsewhere. Some appreciation of the huge interstellar distances between possible civilisations within our galaxy must also be considered if we are to address the stricture which scientists, such as Ken D Olum, insist upon: If there is intelligent life out there, why then is it that we see no evidence of it?

The nearest star, Alpha Centauri, is about 4 light years distant which in itself is a quite unimaginable distance by our standards. Depending on the rarity, or otherwise, of these postulated civilisations they might well be separated from us by distances of hundreds or even thousands of light years. So how likely is it that we would see evidence of them given that they are indeed out there? If they have travelled to our solar system and visited our planet, one would certainly expect to find evidence of their presence. Here Gato-Rivera shies away from the claims of ufologists, contactees and alien abductees as one might well expect an orthodox scientist to do. Indeed one could argue from that standpoint by presenting the huge mish-mash of ufological evidence amassed over the years, and one could certainly make a formidable case. But, for the sake of examining her article, let us put that on one side and stay with the arguments which she presents.

What other evidence of extraterrestrial intelligence would satisfy orthodox scientists? It seems that the only thing which would satisfy the majority of them would be articulate radio signals detectable by large radio-telescopes of the sort which the SETI Project has been searching for. Several years of searching have yielded nothing definite so far, which does not mean that there is nothing out there. Gato-Rivera suggests that advanced civilisations would disguise or cloak their radio communications so that these were undetectable to those they were not intended for, such as us. Equally, I could suggest that advanced civilisations may use some

completely different means of communication based on science of which we have no knowledge. To them, our electromagnetic radio communications may seem as primitive as the smoke signals of the early Native Americans seem to us. Quite conceivably some other means of remote communication may supersede our use of electromagnetic signals for this purpose in the coming hundreds or thousands of years and the efforts of SETI will be seen to have been wasted.

We should also remember that there's absolutely no reason to suppose that interstellar travel between the planetary systems of advanced civilisations is an easy feat. It could well be that Einstein's laws, implying it is impossible for material objects to travel faster than light, are indeed correct. Such things as "wormholes in space", and the assumed possibility of traversing vast interstellar distances through these in an instant, are no more than a far-out speculation. Although this, and the assumption that one could accelerate using "warp drive" to make one's spaceship travel many times the speed of light, seem to be taken for granted by many people, it should be emphasised that these things are just figments of science fiction rather than science fact. Even if we were able to build spaceships that accelerate to speeds near that of light it might take decades or much, much longer to travel to other planetary systems around remote stars where there could be advanced civilisations. If similar constraints apply to intelligences much more advanced than us, their visits to this planet may well be rare and few and far between.

Such visitations that we do experience need not of course be made by spaceships that have travelled for centuries through space. There may be aliens who live a whole lot nearer to this planet in habitats or colonies of which we are unaware. Possibly within our solar system or under our oceans or even within the Earth itself? We simply do not know. There may also be intelligences which can travel inter-dimensionally by means of which we have no concept. Again we do not know. How utterly blinkered it is then for scientists to maintain that the only way we can know of extraterrestrial intelligence is to search for it by using powerful radio-telescopes!

The orthodox scientists again suppose that any visiting extraterrestrials, "if they existed", would introduce themselves by saying: Take me to your leader. That scenario would be foolishness indeed given the warlike and destructive nature of substantial numbers of this planet's comparatively primitive inhabitants. (Are human beings getting more peaceful as time goes on? Hardly! They seem to be getting merely more technically advanced and efficient in their methods of killing each other.) One can see then that it is perfectly logical to expect that any alien visitors would maintain a very low profile, and cloak their presence in secrecy, to avoid attention. Gato-Rivera

sees a parallel in this policy to our approach to a colony of, say, mountain gorillas. We look on those gorillas as an ecologically protected species and maybe that is how extraterrestrials would regard us.

Certainly, if such aliens wished to take over our planet or to destroy us, they have not done so. That is unarguable. If we did chance to see them, or their craft in our skies, we would have little understanding of what we were looking at. Just like the gorillas, we might be puzzled for a while, but completely uncomprehending of what was going on. That, I believe, is one of her most important points.

Much of the trouble with modern scientific outlook is that many scientists seem to believe that our science is by now more or less complete. There may be, in their estimation, a few murky corners which are not fully understood, but these are minor and will probably yield to research soon enough. Therefore our civilisation represents a pinnacle of intellectual achievement and, in the unlikely case of extraterrestrial intelligence being found, we would undoubtedly be on a par with such beings.

I suggest that this is very far from the case. By present standards Newton's amazing insights into the dynamics of the physical world a little over 300 years ago seem comparatively elementary. In a further 300 years enormous advances may well be made which will turn our present scientific thinking on its head. At any rate, our view of the universe could easily be extremely different from what it is now.

So there are excellent reasons for thinking, like Gato-Rivera, that humanity could indeed be embedded in a large galactic civilisation without being aware of it. On the other hand extraterrestrial civilisations may be only too aware of our existence but choose to leave us alone. Whether they regard us as a species to be protected or one to be clandestinely experimented upon is clearly something that we cannot answer. Perhaps they have no particular interest in us, in our well-being, or in our continued existence? If we are "embedded" thus, there will certainly have been visits and maybe visits from several different species of extraterrestrials. As I have said, the visitors' agenda can hardly be to announce themselves or, at worst, to exterminate us, or that would certainly have happened already. In most respects we must appear extremely primitive to visiting extraterrestrials though we can hardly be seen as any kind of a threat to them.

Consider a parallel situation. If you and your friends were to land in some remote region or on an island where there existed a colony of gorillas, would you announce yourselves or demand to meet their leader? Would these

animals, if they saw you, have the slightest idea of what you represented, or where you came from, or the purpose of your visit? Of course not. I suggest that they—or perhaps an even more dissimilar species to our own, such as fish or insects—are analogous to human beings confronted by extraterrestrial visitors. Our sightings of such visitors or their craft would be like the sighting by a fish, or by insects, of the vapour trail of a high-flying jet moving across the sky. Such creatures can have little idea of the significance of what they see, or what it means.

Orthodox scientific discussion about where extraterrestrial life may be within our galaxy excludes any mention of the possibility that such life may have engaged in colonisation, migration, or even interbreeding with less intelligent species of a similar kind. We are told that if the physical conditions are correct for life and the supposed primordial "soup" of water, amino-acids and other essential elements are present, life on a planet could gradually develop and evolve over a period of millions of years.

Under some conditions, the wide spectrum of such evolving life may produce a particular species with the advanced attributes of intelligence and self-awareness. Not all that long ago scientific orthodoxy completely rejected such a notion, and it is fairly obvious that the current scientific thinking on these matters is little more than a fad which will soon be superseded by different suggestions. If scientists can now talk openly about the possibility of extraterrestrial intelligence, why cannot they envisage that intelligent life on this planet might possibly have developed here as a result of colonisation, interbreeding, or even as a result of the deliberate "farming" of the life-forms which existed here by some external civilisation? Again we simply do not know, but we should not rule out these possibilities.

The absurd "Crown of Creation" viewpoint mentioned by Gato-Rivera is one that is still adhered to by many people who think that human beings are the most perfect and the most intelligent creatures in the universe—perhaps even the only intelligent species in the universe. Common sense should be enough to dismiss such a preposterous notion. We are a comparatively primitive civilisation, not far in advance of those mountain gorillas, and with a very long way to go yet.

Also it seems more than likely that our existence on this planet is known about by external civilisations which choose to let us remain ignorant of our situation. It is at least encouraging that mainstream scientists like Beatriz Gato-Rivera are brave enough to express new ideas on this and move away from the orthodox scientific thinking of yesteryear? ■

IS OUR UNIVERSE A HALL OF MIRRORS, A COPY OF ANOTHER UNIVERSE, OR A SMALL PART OF A GREATER UNIVERSE? AND WAS IT CREATED BY A 'SIMULATOR' – OR ALIENS, PERHAPS?

It is a little known fact that physicist Paul Davies, author of such works as *God and the new physics*, used to sit in on informal meetings arranged by FSR in the 1970s. Paul Davies has always been something of a lateral

thinker, pushing out the boundaries while basing his thinking on science-fact and fact-based possibilities. He is currently employed at the Australian Centre for Astrobiology at Macquarie University, Sydney.

He has a new book out - *The Origin of Life*, published by Penguin – and on September 23rd 03 wrote a thought leadership article for *The Guardian*, a British national newspaper, reprinted below. FSR has previously published science-based articles about our universe and other universes, but as far as I am aware this is the first time that a physicist has speculated, in the way that Paul Davies does here, about what may be behind our universe, literally as well as figuratively.

Readers may wish to draw parallels with the previous article written by George Wingfield exclusively for FSR, which addresses a question recently posed by Beatriz Gato-Rivera, particle physicist and member of the Spanish Scientific Research Council (CSIC) – Is Planet Earth Embedded in a Large Galactic Civilization? - **Paul Whitehead, Consultant, FSR.**

Reality in the melting pot.

The Times, September 23rd 03

According to 'multiverse' theorists, life as we know it could be nothing but a Matrix-style simulation

Five hundred years ago it was widely believed that the Earth lay at the centre of the universe and mankind was the pinnacle of creation. Then along came Copernicus and showed that our planet was merely one of several orbiting the sun. Since then the lesson of Earth's mediocrity has been reinforced again and again: ours is a typical planet around a typical star in a typical galaxy, of which there exist untold billions.

The Copernican principle - that our location in space is unremarkable - is the default assumption for most scientists. But recently this principle has been challenged by a group of cosmologists who claim that what we have all along been calling "the universe" is nothing of the sort. Rather, it is a tiny fragment of a much vaster and more elaborate system that, for want of a better word, has been dubbed "the multiverse".

The basic idea is simple. Cosmologists think the universe began with a big bang about 14bn years ago. This means we can't see anything farther than 14bn light years away, however good our telescopes may be, because light from those regions hasn't had time to reach us yet. But this doesn't mean there is nothing there, and for decades astronomers supposed that what lies beyond this horizon in space is likely to be more or less the same as we observe in our cosmic backyard - just more galaxies.

Now this assumption is in serious doubt following major developments in fundamental physics. A key premise of the more-of-the-same view of the universe is that the laws of physics are identical everywhere and for all time. But physicists have found that some features of nature thought to be law-like might actually be frozen accidents - properties that were locked in only as the universe cooled from its fiery birth.

Take the mass of the electron. Why does it have the value it does? Well, maybe the mass isn't decided in advance once and for all by some deep law, but just comes out at random, like the throw of a die, in the searing maelstrom of the big bang. In which case, it could come

out differently somewhere else. In the same way, the strength of gravity or the number of space dimensions might also vary from place to place.

There is no evidence for any substantial variation in these features out as far as our best telescopes can peer. But that is no guarantee that a trillion light years away it will be the same. Electrons could be heavier there or space might have five dimensions. A God's-eye view of the cosmos would then resemble a patchwork quilt, with a haphazard pattern of properties. What we took to be universal laws of physics would be relegated to mere by-laws, appropriate only to our local "Hubble bubble", while far out in space other "bubbles", possibly generated by other big bangs quite distinct from ours, possess other laws.

Multiverse enthusiasts bolster their claims by pointing to the astonishing bio-friendliness of the universe. It has long been known that the existence of life depends rather sensitively on the exact form of the laws of physics. Change things a bit and life would never have happened. This looks suspiciously fluky, but it can be readily explained by the multiverse. Most of the cosmic patches in the quilt will be sterile, their physics all wrong for making life. Only here and there, in rare patches where all the numbers come out right, will life arise and observers like us evolve to marvel at it all.

History has thus turned full circle. According to the multiverse theory, if you look at Earth's location in space on a grand enough scale, then it does occupy a special and privileged position, namely one that can support life. Like winners in a gigantic cosmic lottery, we find ourselves in a rare bio-friendly patch for the simple reason that we could not exist in any of the bio-hostile ones.

If one accepts recent advances in fundamental physics, then some sort of multiverse seems inevitable. But how far down this slippery slope should one go? Max Tegmark, a cosmologist at the University of Pennsylvania, argues that there is no need to stop with properties like the strengths of forces or the masses of particles. Why not consider all possible mathematical laws? Don't like the law of gravity? No problem. There's a universe out there somewhere with gravity that waxes and wanes in a paisley pattern. Of course, there's nobody there to admire it.

Tegmark's speculation forces us to confront what is perhaps the deepest of all the deep questions of existence: why there is something rather than nothing. There are only two "natural" states of affairs. The first is that nothing exists. The other is that everything exists. The former we can eliminate by observation. So should we conclude that everything exists - all possible worlds? Those who would argue against this position must concede that there is some rule that divides what actually exists from what is merely possible, but not real. But where does that rule come from? And why that rule rather than some other?

These are murky waters, but they get even murkier when we scrutinise what is meant by the words "exist" and "real". In the Tegmark multiverse of all possible worlds, some worlds will have intelligent civilisations with computers powerful enough to create authentic-looking virtual worlds. Like in the movie *The Matrix*, it may be almost impossible for an observer to know which