

THE PHYSICAL ENVIRONMENT

Including time, the physical environment has four dimensions, all, as far as our senses can tell, extending out to infinity in each direction.

In the case of space we have become used to mind-bending numbers of light years describing the distance of the more remote bodies, and beyond there we give up, whatever theories mathematicians may produce. We can use a symbol to denote infinity, but we cannot in our minds grasp the idea of endlessness in all directions, nor of curving space; it seems fair enough that light and gravity should be able to curve, but not space.

Much the same difficulty applies to time, although here we have critical dates, which seem in a way less remote than some of the distances - age of the solar system about 4.5×10^9 years; date of the Big Bang about 15×10^9 years. Let us take our space/time ship back through the Big Bang, carefully screening its systems from cataclysmic event. What then? Nobody is going to convince us that time started ticking at some specified instant in the Big Bang. Nor that it is some cloud system analogous to the surface of a sphere. We are so infinity-orientated despite our intellectual problems with infinity that we expect to see time stretching away forever backwards and forwards, possibly occupied by a series of Big Bangs and Anti-Bangs if we care to speculate. We can no more conceive of a margin to space and time than we can grasp the idea of their infinite extent. The intellectual problems remain much the same if one Big Bang, or a succession of them or continuous creation, is the theory in vogue amongst those we hope to be the best able to judge.

As organisms, we live at a particular scale of space and time that suits our biological convenience. Our intelligence has given us the ability to be able to think in terms of much larger and much smaller scales of both, though, and to appreciate that there is no special sanctity to our own or any other scale. With no valid reference point, small and large become relative terms, and the infinitely small and infinitely large pose the same sort of problems to our comprehension as the other

infinities. As we move to larger scales however, matter seems to become much less substantial. The 'ultimate' particle of the atom is made of smaller components and these possibly of smaller ones again, all with a lot of space between them and mostly comprising forces and charges reacting constantly with each other. What would one sense if one was able to enlarge the smallest sub-atomic particle to the size of a football pitch, and then to do the same a thousand-fold again? Would this sub-sub-microscopic world be of any lesser significance than our own?

As we move the other way, to smaller scales, concepts at first appear easier. Small as the scale may need to be, there is perhaps no great problem in envisaging the edge of the matter of our expanding universe. Beyond and around it we see black emptiness; but not entirely empty, because it is still affected by the force fields of our universe, far, far away. However far we move, or however small we make the scale, we cannot encounter total nothingness without a reference point a graspable concept? Would our space/time ship not still sense time and space if it entered a black vacuum?

Then there is the question of what matter is and where it came from. OK, it is made of interacting force fields; matter and energy are the same. OK, there are particles and antiparticles, which add together to make nothing; so its totality may well be zero. There still remains the problem of whence came the positive and negative patterns of the particles. Why did they bother to come into existence in this total nothingness, which we cannot conceive?

All of these problems of the infinite context are beyond the grasp of our intellect, and it seems likely that they will remain so however far our mathematicians are able to probe. There is a satisfying impossibility about the matter that relieves us of any responsibility of trying to pursue it too far, and we have little option but to accept it as the context within which we must operate.

This is the point at which we may feel inclined to refer the matter to some super-intelligence, which for convenience we may call God, hopeful that he may know what he is up to. Unfortunately we may then wonder when and by whom the

existence of God was ordained, and this leads us back again in much the same intellectual problem. We might as well accept that the problem of all the infinities is, excluding the mathematicians and theologians, beyond us all.

What we have done, though, and will continue to do, is to extend our understanding well towards the infinities. Looking outwards in all directions we see certainty merging into hypothesis merging into infinity. The frontiers between these three are constantly shifting outwards. As territorial organisms, which owe their success to their curiosity, these shifting frontiers of our domain deserve our constant attention. Big developments of understanding have occurred and will continue to occur. The order of things appears to be extremely complex, but current thinking moves in the direction of seeking an underlying simplicity, from which all the rest follows automatically.

One thing for sure is that our cosy commuter world, by which we set so many stores, is physically an infinitesimally small corner of total reality. The one grain of hope we may entertain as to its having some sort of significance beyond its size and time-space is that we alone seem to have the ability and opportunity to study and try to understand what goes on. As part of the universe we are specialised as its eyes and ears and brain, looking at and thinking about itself. If the eyes, ears and brain are of greater consequence than the rest of the body, yes, we are important, or at least we have a role, which might be able to make some sort of sense of this curious charade.

In this context it makes little difference if there are another million incommunicado world occupied by thinking beings. In that case we are a millionth part of the effort by the universe at self-expression and self-comprehension. In a universe of infinities what is the difference between one and a millionth, amongst friends? There have been quite a few thousands of millions of human beings anyhow.

But then, why the wish to be especially significant? A little humility seems called for, so let us drive the beast of our biological nature back into its kennel and reflect

that for an infinity of time, less only three score years and ten, we have no claim to constitute anything special. True we go back to that interacting body of forces that is all things, but in forms not specially organised for investigation and comprehension in the human sense. This human phase of our being, which we may wish to regard as significant, is certainly not significant in terms of time.

Our real home is in the nuclear furnaces of successive suns and super-nova, in the loneliness of interstellar space and in the hearts of dead stars. We probably need Big Bangs and Big Crunches from time to time to keep us from getting stuck in niches.

We talk of 15,000 million years back to the Big Bang, and of infinite time before that. It makes the present day seem to carry a great weight of responsibility. 'We the heir to all ages'. Perhaps one should be standing perpetually in awe out of respect for all the fussing around which has gone on to bring about this particular minute. All those toiling ancestors to whom we owe everything.

And yet, what minute? The present minute comprises two bits; the bit that is the now part of the millennia which have passed and ceased to be, and another bit which we have yet to reach. The present is a sort of ghost without any width, flitting along with us. If we can perceive a tenth of a second we are more alert than most of our fellows, and yet the whole procession of electromagnetic waves can flash past in a tenth of a second, carrying complex codes. This particular organism that we temporarily constitute has to comprehend that present instant as a chunk of time which in reality is only the present instant in relation to ourselves. For convenience we are obliged to sip time in manageable draughts, and are aided by the occurrence of lengthy periods of quiescence of our perceived environment. All this does not alter the fact that the present instant in any real sense can barely exist since it is infinitely short - we are at the infinity barrier again.

One is used to seeing Brownian motion and being told it is 'random'; then there is random radio noise and random collisions of elementary particles. How random are these things? Every particle that moves, every photon buzzing around, reacts

instantly and precisely to all the forces that surround it. An elementary particle that enters a cloud chamber has no choice about what it is up to, nor does the particle with which it collides, nor do the particles given off in the collision. Nothing could be more precisely automatic. In the given circumstances every juggle in the Brownian movement could be predicted if all the forces involved were known and could be taken into account quickly enough.

All of this jiggling has been going on for a long time and all over the place, but the same conclusion applies. It makes one wonder if there is not some sort of con trick going on. If the forces involved are such that a precisely defined path has to be followed (and what is the evidence of this?), then perhaps one could swallow the idea that time really is circular and the whole thing keeps on happening again and again, punctuated by Big Bangs and so on. A closed loop of time and space is no more difficult to comprehend than infinity, and the idea is much cosier. It's rather tough on those who have an unfortunate life though. It would be annoying for example, to keep on getting run over at the age of three; and positively no way out of the loop.

It has to be admitted all the same that an unchangeable time loop sounds rather unlikely despite the immutability of physical events. For one thing it allows not the slightest jot of free will even in circumstances where an organism has apparent identical advantage in following one of two possible courses. Events are so interwoven that the slightest departure from a per-determined course, say by some amoeba 600 million years ago, would completely wreck the loop. Repetitions of Big Bangs and Anti-Bangs, yes, perhaps, repetitions of individual detail, no.

The possibility of loops, however, is speculation, and it does not solve any problems. When, for example, did the loops start? We know a lot about our context and our position in it, so questions as to whether we are driving through nothingness in a straight line or in circles are not the crucial ones, albeit interesting.

The one crucial question is why all these positive and negative forces ever

bothered to separate out from nothingness in the first place. Put in anthropomorphic terms - why did God ever bother to create himself? Surely not to satisfy an immature curiosity to find out what he was capable of, or worse, just to be admired by bits of himself? Who would be so irreverent as to suggest motivations that appear to point to a creator who requires some sort of psychiatric attention?

We come repeatedly and inescapably back to the infinity barrier. It is the wall that we cannot pass. On this side of it we have so far constantly been able to expand our physical perception by using new methods and perfecting old ones. The universe we now perceive has frontiers immensely further away than those that we were able to perceive 200 years ago and our thinking about it can be immensely more refined. We no longer need, for example, argue about the presence or absence of a navel on Adam's abdomen. Whether or not our knowledge will continue to expand at the same rate remains to be seen. There is no law of nature that all things proceed in the same direction at the same rate of change. There remain, however, physical questions to which we should be able to find the answer, and the nature of life is one of these.