

Layers of Reality

Foundations of our Space-Time Existence

Hi, this is Grahame Blackwell, here to talk to you about ‘Layers of Reality’. Notice that I don’t say ‘Layers of Material Reality’ – the ‘material’ bit only applies to the topmost one or few layers. We’ll hear more about that later.

This talk is subtitled ‘Foundations of our Space-Time Existence’. We’re all used to the idea of foundations, they’re things that you don’t normally see or even think about, but they’re absolutely crucial to the existence and stability of any structure. In this talk we’re going to be looking down into the structure of reality itself, getting a glimpse of elements of that reality that maybe we’re not even aware of – but without which our day-to-day material reality would have nothing to stand on.

We’re all pretty familiar with the idea of layering, too. In a house, for instance, the walls are usually made of concrete or brick (or maybe wood) – but inside the house we’re very unlikely to experience that concrete or brick directly. There’s likely to be an insulating layer of some sort, then probably an inner lining such as plasterboard, often supported by a wooden frame. Then there’s a finishing layer of plaster skim, a layer of sealant of some sort, then paint or wallpaper to finish it off. Living inside the house, all that most of us experience of those walls is that top layer of paint or wallpaper – but none of us is foolish enough to imagine that the paint or wallpaper stands up all by itself. If we accidentally knock our elbow, for example, against a wall and we didn’t know any better, we might think that paint, that paper, is pretty tough stuff. But of course we know all about the layers behind it, so we know what actually caused the bruise we end up with.

If we want to work with the wall in a deeper way, for example, if we want to put up a shelf strong enough to hold books or crockery, we need to know a bit more about the deeper layers of that wall. If the layer behind the surface coating is plasterboard, then we can’t expect it to support weight like a concrete wall would – we’d have to locate the timbers holding up the plasterboard to fix our shelf supports into. And if the base layer is granite, then we’d better go for a free-standing bookcase instead.

In other words, when we need to deal with the fundamental fabric of our living space we have to know what’s going on under the surface.

To take quite a different example, most of us know how to drive an automobile. You turn on the ignition, turn the key a bit further to activate the starter. Then you use the steering wheel to point the vehicle in the direction you want to go and the various pedals and levers (depending on whether or not it’s an automatic) to make it go, stop, and go faster or slower.

Apart from details like lights and windscreen wipers (and filling the tank occasionally) that’s generally all you need to know, all you need to experience. But of course that’s far from being the whole story. The story starts, at the lowest level, inside the engine with chemical bonds that can be broken by application of a spark, leading to an explosion – which is basically the rapid release of a relatively large amount of gas. Some bright spark (if you’ll excuse the pun) has added the next layer, a piston that’s forced along a cylinder by that gas. Just as clever is the conversion of that linear motion into a rotation which then drives the gears in the gearbox. The gearbox is yet another layer of complexity, passing that rotation out to the wheels in a controlled way so that the engine doesn’t race or stall.

Even this is a vast over-simplification – we haven’t even talked about the ignition cycle, the fuel injection and mixing process, or the inlet and exhaust valve sequence. But it gives an idea of how just driving an automobile is supported by a number of layers that (on a good day, at least) we don’t need to know anything about.

Perhaps the best example of ‘layered reality’ is on your home computer, surfing the internet. In fact there’s a formal structure to computer communications, known as the ‘[OSI 7-Layer Model](#)’. [* Update: the simplified 4-layer [TCP/IP model](#) is now widely used for everyday applications – but the principles still apply.] The top layer is the ‘Application Layer’ - the application you’re dealing with – let’s take internet shopping. You’ll have a screen with pictures of products, text to tell you about those products, buttons you

can click on to ‘add an item’ to your ‘shopping basket’ or to choose a size or colour. This is the ‘Application Layer’. [Notice in passing that the ‘shopping basket’ doesn’t actually exist except as a concept – but its effect is very real.]

Below this application layer is the ‘Presentation Layer’, the information and coding that ensures that your ‘virtual shopping’ experience (‘virtual’ because you don’t go anywhere near an actual shop) is correctly and tidily laid out for you on your computer screen and responds sensibly to your actions. You can actually take a look at that presentation layer any time you like. When you’re looking at a web page on your computer, right-click your mouse with the pointer on the web page. On the menu that pops up, choose ‘View Source’. You’ll be shown the HTML – the HyperText Mark-up Language – that corresponds to the web page you were just looking at. This is the same information as you saw on that web page, but in quite a different form and with bits that effectively say things like “put this there”, “lay that out like that” and “respond to a mouse click here with this action”. HTML, and the browser that handles it, is the layer that formats the screen layout exactly as required for any particular application.

Other layers below that include: the Transport Layer, which ensures that information about available products, and about your purchases, passes seamlessly between your computer and the server that provides the shopping website service; the Network Layer that oversees the various logical connections in the communications network that links your computer to the server; and the Physical Layer, which takes care of the actual cables, switches and satellite links that make up the internet itself. All of these layers, and the rest I haven’t mentioned, are invisible to the internet shopper (unless, of course, something goes wrong and technical support has to be called in). Each of these layers is absolutely essential, providing the mechanisms that are used by the layer above it – right up to the layer you’re actually experiencing, the Application Layer – the internet shopping scenario.

When it comes to material reality, the ‘Application Layer’ is day-to-day living. Just as we’ve learned to use mouse-clicks, drag-and-drop and copy-and-paste in our computer applications, we’ve become pretty familiar with the scientific principles of everyday living at the space-time level – things like gravity and water flow, how things grow and how it’s not a good idea to bump into things at high speed. And just as web pages can be tweaked at the HTML level to alter the user’s experience at the application level, so we – at least, some scientists – have begun to learn how to tweak reality at the quantum level to achieve such effects as quantum tunnelling, superconductivity, superfluids and antimatter particle production. These first forays down into the level below our everyday reality – the quantum level – have already given us benefits in fields such as microelectronics, ultra-sensitive instrumentation, and powerful imaging tools for seeing inside living organisms – notably the human body.

And that’s without even really understanding what’s going on at that quantum level, where particles morph into waves and back again at the drop of a hat, where something can apparently have happened and not happened both at the same time, where two closely-linked particles can be separated by many kilometres and still one reacts instantaneously – faster than the speed of light – if the other is messed about with in some way. If we could seriously get our heads round what these quantum clues are telling us, who knows what we might be able to do that could look like magic from the top-level space-time perspective.

Because the quantum level is just a way-station, an interface to a yet deeper level. At the quantum level particles can be waves, and vice versa, information can travel vast distances in no time at all, something can be one thing and another completely different thing both at the same time. Everything is fluid, shifting constantly between different states according to statistical rules tied together by things called wave equations, that tell us how likely it is that something is actually something else – or might be.

But get down another level, below that layer of quantum fluidity, and all those uncertainties disappear. Because at that next level down there are no particles, there are no vast distances, there are no ‘this thing’ and ‘that thing’. Concepts such as matter, time, space, separateness cease to have meaning, so they can’t lead to confusion or contradictions. The quantum reality that gives shape and form to our own day-to-day experience is itself built on a deeper reality which can best be described as a vastly complex multi-dimensional energy system – where none of those dimensions are time or space, but concepts beyond our present understanding.

I hear you saying “Ok – but time and space, distance and separateness are real. My life could depend on me recognising them as real – for instance if I don’t have a bit of space between where I am and where that express train is about to be, I could be in big trouble. And if I need to give myself a scratch where I’m itching, I could be arrested (or worse) if I don’t know the difference between ‘me’ and ‘her’ (or ‘him’).”

Fair enough. But we’re not actually talking about the level at which you make those sort of decisions, we’re talking about that deeper level. It’s all about context. Situations that give rise to dualities at one level may well not at another level. That’s why those apparent paradoxes pop up at the quantum interface between those levels. For example, when we think of things as particles, we’re working on the day-to-day physical level; when we think of them as waves, we’re working on the deeper energy-based level. We’ve switched between the two without even realising it. And different sets of rules apply at those different levels, just as the rules for how you do your internet shopping are quite different from the rules for how you manipulate HTML code. It’s a totally different ball game.

Let’s take one of the most obvious dualities as an example: up and down. Now those two opposites have been ingrained into the psyche of every creature on this planet for millions of years. They are both unquestionably real, and they are opposites. Not knowing that could kill you.

So now – let’s ask an astronaut in deep space about that particular duality – up versus down. For him or her, far from the gravitational pull of any planet or star, those two opposing concepts have no meaning. That duality doesn’t exist in that context. [By the way, this doesn’t mean that deep space is a deeper level of reality, but it does show how our perception of opposites is shaped by the environment that we ourselves are shaped by.]

Now does that invalidate the concept of up-down duality? Of course not, it simply shows that up-down duality is just an interpretation in a particular context of a more general principle – the principle of gravitation. Up and down are clearly very real opposites on the surface of a planet, and it’s vital to understand that – but that’s just because the cosmic principle of gravitation has a particular significance in the neighbourhood of a planet, and for people living on that planet. To regard up-down duality as a fundamental aspect of the universe would be both parochial and wrong – it’s just a feature of where we happen to live, resulting from some deeper truth.

In the same way, other dualities that start causing us problems when we start exploring away from where we live – that is, beyond the space-time layer of reality – can be seen as local features arising from deeper truths, rather than immutable truths in themselves.

We could say that the role of science is to discover – or uncover – ways in which the structure of those deeper levels determines how things behave, and why things behave the way they do, at the level of our daily experience. That’s nothing new, it didn’t just recently arrive with quantum physics, it’s actually been around for hundreds of years. If we look at the material realm that we operate in, there are in fact three levels there before we even hit the quantum layer.

The first thing that’s immediately obvious about the world around us is the animals and plants that are pretty well everywhere you look. Our world is teeming with living organisms, biological structures – including us. It’s fair to say that the world is primarily about living things, about those biological structures. But biological structures are actually complex molecules, complex chemical structures (plus electrical impulses and something called ‘life’ that we can’t really pin down yet). ‘Biology’ is, in a real sense, a layer that rests on a layer below it called ‘chemistry’, a layer we’ve known about for a long time (though we haven’t thought of it like that). And chemistry, the interactions of different atoms and molecules, depends on the physical properties of those atoms and molecules, following rules that were around long before Max Planck’s quantum theory appeared on the scene. The chemistry layers rests firmly on the classical physics layer – which has been known of since well before the time of Newton.

But since biology, chemistry and physics are all very apparent to us – very real, very much ‘in yer face’, so to speak – it’s handy to think of them as one composite layer, the layer of everyday space-time experience. That layer, that level, is supported by the layer we refer to as ‘Quantum Mechanics’ – later extended to ‘Quantum Electrodynamics’ and then ‘Quantum Chromodynamics’ – and that layer is supported by

something even more nebulous (from our perspective, at least, if not from the perspective of ‘Objective Reality’. From that perspective it might well be said that it’s our physical forms and our material reality that are nebulous – an effect of an effect of an effect of an effect ...)

And so it goes on, down through the successive levels of reality. Or perhaps we should say ‘up’ – since each new level takes us to a higher understanding of the nature of this universe and our place in it. In this talk I’ve only scratched the surface; that multidimensional energy system is by no means the final story, there must be a deeper (or higher) level that gives rise to that, and a yet further level that gives rise to that – and so on and so on, beyond imagining.

And of course every level takes us one step nearer to the ultimate source that has brought our reality into being, whatever that might be. Each level is what might be called a ‘meta-frame’ for the level before – the structure of that deeper level defines the rules for the one that’s built upon it (just like that HTML on the computer defines the rules for the display that we experience on our computer screen and how we can interact with it). The physics of one layer is, quite literally, the meta-physics of the layer that it supports. And with each step the issues become more abstract, progressively more refined than the nuts and bolts (figuratively speaking) of our spacetime reality. Those issues move steadily from the purely physical through questions of consciousness that are already being thrown up by the quantum level, to questions that must surely come under the heading of ‘spirituality’. It’s likely that as our progression through those levels continues, as our understanding increases, there may be surprises in store for followers of any and every faith – including the faith of atheism.

But don’t let anyone kid you that this progression from this realm of space and time, of particles and objects, through the levels to concepts that might be labelled ‘spiritual’, is un-scientific. Far from it, there’s nothing more scientific. The word ‘science’ comes from the Latin word ‘sciens’, which means ‘knowing’. The more ‘knowing’ we have about the foundations of our existence and our universe, the better we’re equipped to deal with issues at every level of our reality, from matters of right and wrong to how we tweak our reality to achieve interstellar travel (just as a couple of examples).

Interestingly, this concept of successive of levels of reality links in closely to the sequence of chakras, or energy centres, in the human body as defined in Eastern mysticism and applied practically in various forms of therapy. That’s another aspect of this picture of reality, for another time.