

Preface

What *is* time?

It's a question that I first puzzled over as a young boy. I remember the occasion well - The sunlight poured in through the windscreen of the car, illuminating the interior with a glowing soft light as it bathed us in the warmth of its rays. My father was at the wheel; my mother in the passenger seat; and my brother on the back seat beside me. Out of the window, the world flew by in a blur of green fields and fence-posts, beneath the comforting blanket of a warm and hazy summer sky.

We were in motion, dynamic and fluid, and so was the world. Seconds ticked by, and as they passed, they brought with them change. There was of course nothing out of the ordinary about the situation, but it was the first time it had occurred to me to marvel at how it might happen. How exactly does that change come to be?

It might seem like a strange question to ask - everyone else certainly seemed to think so - but it is one that is fundamental to the world.

Through the glare of the sun, my eyes strained to capture the motion of the hands on my wristwatch, as I squinted to focus on the dial.

Tick. Tock. Tick. Tock.

The radio crackled and fizzed to the sounds of the sports report, and in the front of the car someone was talking, but I remained transfixed upon the motion of the hands - cocooned in my own little bubble, and insulated from everything that was happening around me.

Tick. Tock. Tick. Tock.

Time seems to carry us forwards relentlessly along its never ebbing flow, but what really were these seconds that were ticking by? What was it that the hands were really counting off?

I was held mesmerized by its mystery, and it's a moment that stayed with me.

From the seeds that were planted that day, grew a life-long fascination with what I believe to be one of the deepest of questions that can be asked - what exactly, is this thing we call 'time'?

St. Augustine once mused that he felt he knew, so long as nobody asked him to explain it. For him, like most of us, I suspect the concept was one of his intuitive understanding. It is the idea that the world exists in a present moment; that the past is how it used to be, and that the future is how it might be going forwards.

It is the notion that we (along with everything else) are carried upon the crest of that ever-changing present moment, located at the very bleeding-edge of history as we are swept inextricably along towards the future. It is the idea that time can be represented as a neat line stretching away towards the right-hand side of a piece of paper; that one moment flows into the next; and that we live in a dynamically changing world. It is the belief that events happen at distinct and objectively identifiable moments, against the backdrop of a time that ticks away universally the same for all things in all places. It is the idea that it makes sense to speak of the time at which something happened; that the future is open; and that once it is gone, the past exists only as a memory.

It is this view that was assumed by Sir Isaac Newton when he wrote down his famed laws of motion in the 1600's, and it is the same view that is so deeply engrained into our psyche, that it is almost impossible to conceive of it being any other way.

It is also, entirely wrong.

In 1905, Einstein published his astonishing theory of Special Relativity, and our conception of the nature of reality was transformed. Like a veil had been lifted from our eyes, no longer could we presume to trust that our everyday experience was representative of the true nature of the world, for in its glorious wonder, inescapably, that world is not what it seems...

Einstein's incredible discoveries began a revolution in our understanding

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that is still unfolding to this day. It is the purpose of this book to attempt to explore the remarkable insights of that revolution; to uncover the true nature of time; the character of the reality it implies; and to venture a tentative answer to the deep mystery of how a world so shockingly at odds with the one we perceive, can possibly give rise to the everyday experience of what it is to be human.

It is a journey through the extraordinary implications that flow as a consequence of Relativity, and the deep questions they pose to us with regards to the very foundations of reality. It will explore the challenges they present to our most basic of assumptions about human experience - assumptions about the nature of life and death, consciousness, identity, and free-will - and will reveal the basic dynamism of the world to be but an illusion.

There is, as we shall see, in fact no such thing as the flow of time. How this incredible truth can possibly be reconciled with the reality we suppose to experience, is the central mystery with which we shall be concerned.

The search for answers will lead us through some of the most incredible and profound discoveries of man, as we probe the revelations that lie at the very heart of existence through the remarkable lens of quantum physics, and discover how the universe, and the life that we know, might arise from it.

Sat in the car that day as a child, I had no way of knowing that right there with me were all of the elements of that mystery, which together, would one day form the answers I was seeking - the light; the motion; the space through which we moved; the intricate interplay of trillions of subatomic particles; the miraculous manner through which they relate; conscious experience; observation; and perhaps most astonishing of all - the thunderous silence of the splitting of worlds.

It is only now, after all these years, that I understand that the beauty of that day remains etched not only into my memory, but into the very fabric of reality itself. I'd like to share with you why.

This is the story of time...

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