

Cambridge University Press
978-0-521-63992-7 - The New World of Mr Tompkins
George Gamow's and Russell Stannard
Excerpt
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I City Speed Limit



It was a public holiday, and Mr Tompkins, a little clerk of a big city bank, slept late and had a leisurely breakfast. Trying to plan his day, he first thought about going to an afternoon movie. Opening the local newspaper, he turned to the entertainment page. But none of the films appealed to him. He detested the current obsession with sex and violence. As for the rest, it was the usual holiday fare aimed at children. If only there were at least one film with some real adventure, with something unusual and maybe challenging about it. But there was none.

Unexpectedly, his eye fell on a little notice in the corner of the page. The town's university was announcing a series of lectures on the problems of modern physics. This afternoon's lecture was to be about Einstein's Theory of Relativity. Well, that might be something! He had often heard the statement that only a dozen people in the world really understood Einstein's theory. Maybe he could become the thirteenth! He decided to go to the lecture; it might be just what he needed.

Arriving at the big university auditorium, he found the lecture had already begun. The room was full of young students. But there was a sprinkling of older people there as well, presumably members of the public like himself. They were listening with keen attention to a tall, white-bearded man standing alongside an overhead projector. He was explaining to his audience the basic ideas of the Theory of Relativity.

Mr Tompkins got as far as understanding that the whole point of Einstein's theory is that there is a maximum velocity, the velocity of

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light, which cannot be exceeded by any moving material object. This fact leads to very strange and unusual consequences. For example, when moving close to the velocity of light, measuring rulers contract and clocks slow down. The professor stated, however, that as the velocity of light is 300,000 kilometres per second (i.e. 186,000 miles per second), these relativistic effects could hardly be observed for events of ordinary life.

It seemed to Mr Tompkins that this was all contradictory to common sense. He was trying to imagine what these effects would look like, when his head slowly dropped on his chest ...

When he opened his eyes again, he found himself sitting, not on a lecture room bench, but on one of the benches provided by the city for the convenience of passengers waiting for a bus. It was a beautiful old city with medieval college buildings lining the street. He suspected that he must be dreaming, but there was nothing unusual about the scene. The hands of the big clock on the college tower opposite were pointing to five o'clock.

The street was nearly empty – except for a single cyclist coming slowly towards him. As he approached, Mr Tompkins's eyes opened wide with astonishment. The bicycle and the young man on it were unbelievably shortened in the direction of their motion, as if seen through a cylindrical lens. The clock on the tower struck five, and the cyclist, evidently in a hurry, stepped harder on the pedals. Mr Tompkins did not notice that he gained much in speed, but, as a result of his effort, he shortened still further and went down the street looking rather like a flat picture cut out of cardboard. Immediately Mr Tompkins understood what was happening to the cyclist – it was the contraction of moving bodies, about which he had just heard. He felt very pleased with himself. 'Nature's speed limit must be lower here,' he concluded. 'I reckon it can't be much more than 20 m.p.h. They'll not be needing speed cameras in this town.' In fact, a speeding ambulance going past at that moment could not do much better than the cyclist; with lights flashing and siren sounding, it was really just crawling along.

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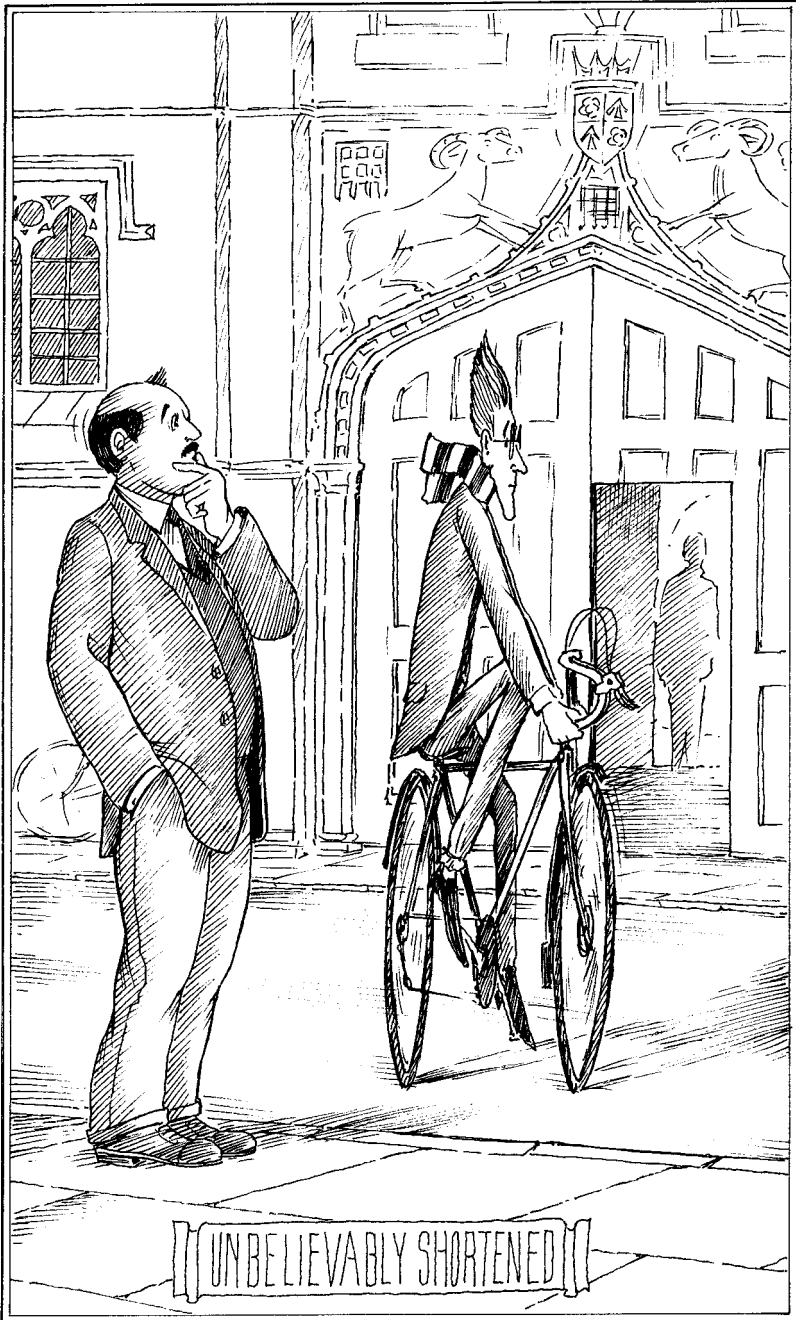
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Mr Tompkins wanted to chase after the cyclist to ask him how he felt about being flattened. But how was he to catch up with him? It was then he spotted another bicycle standing against the wall of the college. Mr Tompkins thought it probably belonged to a student attending lectures who might not miss it if he were to borrow it for a short while. Making sure no-one was looking, he mounted the bike and sped down the street in pursuit of the other cyclist.

He fully expected that his newly acquired motion would immediately shorten him, and looked forward to this as his increasing girth had lately caused him some anxiety. To his surprise, however, nothing happened; both he and his cycle remained the same size and shape. On the other hand, the scene around him completely changed. The streets grew shorter, the windows of the shops became narrow slits, and the pedestrians were the thinnest people he had ever seen.

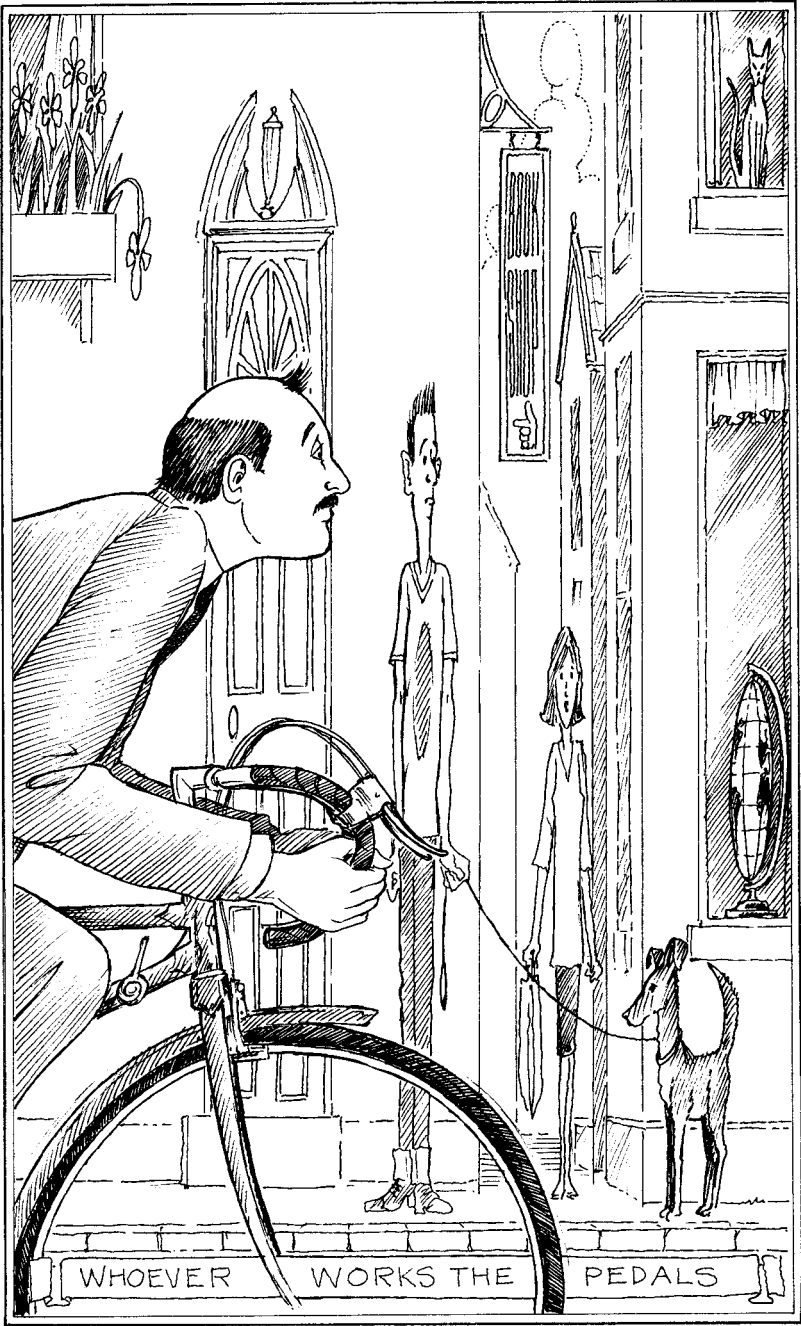
'Ah!' exclaimed Mr Tompkins excitedly. 'I get it now. This is where the word *relativity* comes in. Everything that moves relative to me looks shorter for me – whoever works the pedals!'

He was a good cyclist and was doing his best to overtake the young man. But he found that it was not at all easy to get up speed on this bicycle. Although he was working on the pedals as hard as he possibly could, the increase in speed was almost negligible. His legs had already begun to ache, but still he could not manage to pass a lamp-post on the corner much faster than when he had just started. It looked as if all his efforts to move faster were leading to nothing. He began to understand now why the ambulance could not do much better than the cyclist. It was then he remembered what the professor had said about the impossibility of exceeding the limiting velocity of light. He noticed, however, that the harder he tried, the shorter the city blocks became. The cyclist riding ahead of him did not now look so far away – and indeed he eventually managed to catch up with him. Riding side by side, he glanced across and was surprised to find that both the cyclist and his bike were now looking quite normal.

'Ah, that must be because we are no longer moving relative to each other,' he concluded.

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'Excuse me,' he called out, 'Don't you find it inconvenient to live in a city with such a low speed limit?'

'Speed limit?' returned the other in surprise, 'we don't have any speed limit here. I can get anywhere as fast as I wish – or at least I could if I had a motor-cycle instead of this old bike!'

'But you were moving very slowly when you passed me a moment ago,' said Mr Tompkins.

'I wouldn't call it slow,' remarked the young man. 'That's the fifth block we've passed since we started talking. Isn't that fast enough for you?'

'Ah yes, but that's only because the blocks and the streets are so short now,' protested Mr Tompkins.

'What difference does it make? We move faster, or the street becomes shorter – it all comes down to the same thing in the end. I have to go ten blocks to get to the post office. If I step harder on the pedals the blocks become shorter and I get there quicker. In fact, here we are,' said the young man stopping and dismounting.

Mr Tompkins stopped too. He looked at the post office clock; it showed half-past five. 'Hah!' he exclaimed triumphantly. 'What did I tell you. You *were* going slow. It took you all of half an hour to go those ten blocks. It was exactly five o'clock by the college clock when you first passed me, and now it's half-past!'

'Did you *notice* this half hour?' asked his companion. 'Did it *seem* like half-an-hour?'

Mr Tompkins had to admit that it hadn't really seemed all that long – no more than a few minutes. Moreover, looking at his wrist watch he saw that it was showing only five minutes past five. 'Oh!' he murmured, 'Are you saying the post office clock is fast?'

'You could say that,' replied the young man. 'Or, of course, it could be your watch running slow. It's been moving relative to those clocks, right? What more do you expect?' He looked at Mr Tompkins with some exasperation. 'What's the matter with you, anyway? You sound like you're from some other planet.' With that, the young man disappeared into the post office.

Mr Tompkins thought what a pity it was the professor was not at hand to explain these strange happenings to him. The young man was evidently a native, and had been accustomed to this state of things even before he had learned to walk. So Mr Tompkins was forced to explore this strange world by himself. He reset his watch by the time shown on the post office clock, and to make sure it was still going all right, he waited for ten minutes. It now kept the same time as the post office clock, so all seemed to be well.

Resuming his journey down the street, he came to the railway station and decided to check his watch once more, this time by the station clock. To his dismay it was again quite a bit slow.

'Oh dear, relativity again,' concluded Mr Tompkins. 'It must happen everytime I move. How inconvenient. Fancy having to reset one's watch whenever you've been anywhere.'

At that moment a well-dressed gentleman emerged from the station exit. He looked to be in his forties. He glanced around and recognised an old lady waiting by the kerb side and went over to greet her. Much to Mr Tompkins's surprise, she addressed the new arrival as 'dear Grandfather'. How was that possible? How could *he* possibly be *her* grandfather?

Overcome with curiosity, Mr Tompkins went up to the pair and diffidently asked, 'Excuse me. Did I hear you rightly? Are you really her grandfather? I'm sorry, but I ...'

'Ah, I see,' said the gentleman, smiling, 'perhaps I should explain. My business requires me to travel a great deal.'

Mr Tompkins still looked perplexed, so the stranger continued. 'I spend most of my life on the train. So, naturally I grow old much more slowly than my relatives living in the city. It's always such a pleasure to come back and see my dear little granddaughter. But I'm sorry, you'll have to excuse me, please ...' He hailed a taxi, leaving Mr Tompkins alone again with his problems.

A couple of sandwiches from the station buffet somewhat revived him. 'Yes, of course,' he mused, sipping his coffee, 'motion slows down time, so that's why he ages less. And all motion is relative

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– that's what the professor said – so that means he will appear younger to his relatives, in the same way as the relatives appear younger to him. Good. That's got that sorted out.'

But then he stopped. He put down the cup. 'Hold on. That's not right,' he thought. 'The granddaughter did *not* seem younger to him; she was older than him. Grey hair is not relative! So what does that mean? All motion is *not* relative?'

He decided to make one last attempt to find out how things really are, and turned to the only other customer in the buffet – a solitary man in railway uniform.

'Excuse me,' he began, 'would you be good enough to tell me who is responsible for the fact that the passengers in the train grow old so much more slowly than the people staying at one place?'

'I am responsible for it,' said the man, very simply.

'Oh!' exclaimed Mr Tompkins. 'How...'

'I'm a train driver,' answered the man, as though that explained everything.

'A train driver?' repeated Mr Tompkins. 'I always wanted to be a train driver – when I was a boy, that is. But ... but what's that got to do with staying young?' he added, looking more and more puzzled.

'Don't know exactly,' said the driver, 'but that's the way it is. Got it from this bloke from the university. Sitting over there we were,' he said nodding at a table by the door. 'Passing the time of day, you know. Told me all about it he did. Way over my head, mind you. Didn't understand a word of it. But he did say it was all down to acceleration and slowing down. I remember that bit. It's not just speed that affects time, he said; it's acceleration too. Every time you get pushed or pulled around on the train – as it comes into stations, or leaves stations – that upsets time for the passengers. Someone who is *not* on the train doesn't feel all those changes. As the train comes into the platform you don't find people standing on the platform having to hold onto rails or what-have-you to stop falling over in the way the passengers on the train do. So that's where the difference comes in. Somehow ...' he shrugged.

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CITY SPEED LIMIT 9

Suddenly a heavy hand shook Mr Tompkins's shoulder. He found himself sitting not in the station café but on the bench of the auditorium in which he had been listening to the professor's lecture. The lights were dimmed and the room was empty. It was the janitor who had awakened him saying: 'Sorry, sir, but we're closing up. If you want to sleep, you'd be better off at home.' Mr Tompkins sheepishly got to his feet and started towards the exit.



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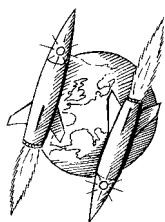
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2 The Professor's Lecture on Relativity which Caused Mr Tompkins's Dream



Ladies and gentlemen:

At a very primitive stage in the development of the human mind there formed definite notions of space and time as the frame in which different events take place. These notions, without essential changes, have been carried forward from generation to generation, and, since the development of the exact sciences, they have been built into the foundations of the mathematical description of the Universe. The great Newton perhaps gave the first clear-cut formulation of the classical notions of space and time, writing in his *Principia*:

‘Absolute space, in its own nature, without relation to anything external, remains always similar and immovable;’ and ‘Absolute, true and mathematical time, of itself, and from its own nature, flows equably without relation to anything external.’

So strong was the belief in the absolute correctness of these *classical* ideas about space and time that they have often been held by philosophers as given a priori, and no scientist even thought about the possibility of doubting them.

However, at the start of the present century it became clear that a number of results, obtained by the most refined methods of experimental physics, led to clear contradictions if interpreted in the classical frame of space and time. This realization brought to one of the greatest twentieth century physicists, Albert Einstein, the revolutionary idea that there are hardly any reasons, except those of tradition, for