

CLOCKS **ON A TRAIN**

Relativity – The Pamphlet

by Chongo

www.chongonation.org

Ignorance and liberty are mutually exclusive.

This work is dedicated to Giordano Bruno, among the greatest of men, murdered by the church for wanting to share science. They may still murder great men, but they can't burn all the books anymore. Giordano's dream has now finally come true.

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The content of this pamphlet is the description of a single relativity experiment demonstrating that both past and future are as physically existent as the present moment is. Although the content amounts to a total of only about an hour's reading, it is nonetheless recommended that the reader limit their reading to only a single section per day.

Five sections make this a weeklong learning experience, at less than fifteen minutes per day. The final section is even optional. In this way, the reader has adequate time to contemplate each step of the description and thus more easily grasp in an accurate way the new idea that is being explained in each new section. A hard copy, staple bound version of this pamphlet can be purchased at or is otherwise available for open and free, anonymous, on-line viewing at:

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Part One

MOTION AND INTITION

Look around, what do you see? You see ‘things’. These things occupy space, and with its passage, occupy time as well. Reality seems to be made of things occupying space, and in the process, occupying time. An additional feature of our immediate vicinity is that, regardless of wherever we may find ourselves, all these things that constitute reality seem, including ourselves and notwithstanding a couple of rare exceptions, to be always being “pulled” downward, relentlessly. Wherever we find ourselves, gravity seems as relentless and inescapable as time. As is readily obvious, with gravity providing the force to pull things downward, and something “else” that we call time, allowing things the liberty to move as a result of this force, or as the result of any other force. With time, comes the capacity for things to change their position in space, for them to move. This is what we call, motion: things changing their position as a result of their being pulled or pushed. We ‘know’ motion, intuitively.

There is another almost universal feature of motion that we might overlook because we live in such a modern world where if, for no other reason, common, widespread understanding of the motion of the planets around the sun would perhaps unknowingly mislead us to ignore this obvious feature, even though this feature is almost universal to all of our notions of movement. That obvious, universal feature of all motion is that wherever we observe movement, it is universally of something moving, with respect to something else, like all of the local surroundings, that is *not* moving. Motion always

seems to occur against a backdrop of everything else that is not moving, but instead, is stationary. If we did not know that the earth itself is constantly moving, as humans did not, throughout most of their history, then all motion it would seem, is with certainty, always with respect to a stationary Earth below. In other words, things always unambiguously either change position, or do not change position, that is, either they are in a state of motion, or they are stationary. From the perspective of the limited extent of the local environment we perpetually find ourselves within, the distinction between what is moving and what is not moving is absolute and universal. According to that perspective, nothing whatsoever can be in a state of motion and stationary, both together, at once, in the same moment.

This is the intuitive way that we see motion, things move amidst a stationary world that itself, does not seem to be doing so. It is clearly how we humans evolved to envision motion, for the very simple reason that throughout the course of nearly all of human history, this simple picture has served human needs so effectively that it has brought humankind to the point of being able to question the validity of our very intuition itself. It is in this exact way that the great thinker, Albert Einstein, discovered relativity. He assumed something much more certain than common, human intuition, because he knew something about nature that humans had never known before that time, or had been capable of knowing or even understanding, an incredibly important detail about the world that is wholly unimportant to common intuition, that detail being that the speed of light never changes; and because it never does, our

intuition's conclusion that moving and stationary are mutually exclusive states *is a completely incorrect one*. Not only can anything be *both* moving and stationary, together. Everything that is anything cannot avoid doing both things together, ever.

We, and everything else existent, are always in motion while being stationary, unless we, or whatever else, are being pushed or pulled. The rotation and orbit of the earth with which we are always in motion, while being perfectly stationary, prove this. To be perfectly clear, unless we are being pushed or pulled, we are *always* doing both together, moving, and standing still, as it is impossible not to, when not being pushed or pulled! But again, this is not how our intuition ordinarily works. It **MUST** assume that one is *not* the other, meaning that moving things are not, nor can they ever be, stationary, according to it. If our intuition did not work as it does by means of the distinctions (meanings) that it makes, then our ability to interact with our local world would most likely not be as effective as it is, either, and we would not be here in the first place. But, our world has grown colossally. Our intuitive picture of the world includes the whole of the universe now.

Humanity's picture of reality has expanded vastly, to encompass magnitudes more than the flat extent of local terrain that ordinarily surrounds us in every lateral direction and upon which we map our world. It is now common knowledge that earth is a planet itself, *moving*, by rotating and by orbiting, around a star called the sun, along with a variety of other planets that are doing the identically same thing. The 'world' includes more, far, far more, than what we evolved to contemplate. Yet we can hardly escape being

forced to do so, anyway. So our mind constructs a mental picture of all this celestial motion that we represent by the image of a set of smaller spherical bodies orbiting a larger one, these smaller systems all orbiting around the largest, central stellar body. This collection is formalized by the scientific term, solar system. The solar system, in turn, spins with the motion of the wheel of the entire Milky Way Galaxy. We imagine the motion of this set of 'floating' bodies in our mind, in the same way that we imagine any other kind of weightless motion here on the surface of Earth. Naturally, this mental image makes perfect sense, *because it is our very 'reason' itself that creates it*, along with the firm belief in the certainty of reason's validity, owing that it is our very reason itself that determines its own validity, and with great bias. But, this mental image has a failing flaw, it persists with the notion of this collective motion happening upon a *stationary* stage, and *no such stage exists*; hence, it is flatly wrong. It is but one, among many other intuitive simplicities, that we wholeheartedly believe, yet are utterly wrong too!

Now we must know more in order to understand our world and to operate even better in it, because the future of humankind and of human liberty flatly depend upon accurate understanding of nature being widespread, instead of how it is now. Widespread *accurate* understanding of nature is achievable only when recognition of inaccurate understanding of nature and the fallacy of our intuition become simple, open, common knowledge.

Part Two

THE THEORY OF ABSOLUTE AND UNIVERSAL, SPACE AND TIME MEASURES

Space seems absolute and universal, everywhere always, at any distance, anywhere. That is, no measurement of any distance ever seems to change or distort, under any circumstance. Regardless of the units that are used to measure the distance, once this number of units is determined, it does not seem to ever change, regardless of anything, and presumably, for the sake of the present explanation, irrespective of any motion whatsoever involved. Likewise, so seem any measurements involving a combination of distances, such as those for surface areas or spatial volumes, for example. And, correspondingly, the angles that are established by these distances seem never to change or distort, either, because no distances affecting these angles ever do.

In stating that measures of distances and the angles that these distances establish seem absolute, what is really being stated is that space itself seems absolute. And, just as seems the case for distances and angles, temporal intervals, that is to say, time, seems also to pass at the same seemingly absolute rate, always, everywhere, under any circumstance whatsoever, regardless

altogether of anything. No clock ever runs faster or slower, under any circumstances, ever, does it not? Any accurate clock seems to run at the same rate as any other, regardless of anything or any motion; a minute is a minute anywhere, always, under any circumstance. Is all this not true, again, always?

Another seemingly obvious fact is that although each clearly seems universal and absolute, time and space clearly seem also wholly “unlike,” meaning that each is physically distinct from the other. Given the liberty to move, space can be navigated at will, locally, in any direction, while time cannot, in any way. Time has only a single direction alone: forward, into the future. Time’s march is utterly unstoppable and moreover, absolutely inescapable. This means that in time’s endless march, we simply cannot help but be continually removed from the past: it *always* lies behind our present moment; and, in like fashion, continually removed from the future: it *always* lies *ahead* of the present moment. Both past and future lie beyond our reach, with the present moment confining the temporal extent of our existence to a perpetual progression of fleeting present moments that, in series, constitute our lives. Reality is accessible in no way other than our immediate moment-by-moment recollections and contemplations of it (even with respect to our recording of events).

All this is clearly obvious to anyone, and an indisputable certainty about the fundamental nature of reality, is it not? Furthermore, what is true for us here now must be true, at any time, anywhere, must it not? Naturally, it seems obvious that the past and future that correspond to the earth correspond also to the moon and

sun, just as this seemingly absolute distinction applies identically to the planets of the solar system, and likewise to the stars in the night sky. Extending this idea further, we realize that this seems true for the entire universe, at any distance, no matter how far. That is to say, that it must be the same time *everywhere*, because what exactly would it mean for it not to be? How? It *not* being the same time everywhere seems unimaginable. Not knowing, we might mistakenly think that so imagining lies outside of our intellectual reach, without realizing that *we would be wholly incorrect in thinking so*. Such a view would be mistaken, because, in fact, it flatly is not in the least, beyond the reach of anyone capable of reading the content, and imagining a moving train, with three clocks on board. With these, one can accurately ‘imagine’ relativity (its local effects upon geometry), albeit in vague terms, in nonetheless completely accurate ones.

This mistaken image of universal absoluteness (along with any presumed limits upon our ability to imagine more) is best expressed as “the theory of absolute space and absolute time (measures).” It is a solitary set of measures for both space and time, together, a single, absolute standard against which any “variation” from this absoluteness can be established. It is a model that is indeed, foundational to our very way of thinking, and yet we surely cannot even remember having acquired it, much less how, or why; and, unless we learn differently (one way to start: by reading the content), it is a model that we retain for our entire lives, mistakenly believing that it accurately embodies the way that nature really works. This is because we were probably never presented with any

other *different* model (a different model like relativity, for example) that made more sense (like relativity's model does) and that does accurately describe how nature really does work, or never presented with an explanation making far better sense than this naive model of universal absoluteness. Common belief in the indisputable certainty of this model of simplistic absoluteness leads to widespread, grossly incorrect, and undeniably dangerous (e.g. creationism) misunderstandings about nature in general.

Grasping the fundamental idea underlying relativity's remarkable conclusions can correct such misunderstanding, by replacing it with an understanding that corresponds perfectly to how nature, in actual, physical fact, truly *does* work; one *not* based upon common consensus and/or intuitive emotion. The remainder of the short text stands wholly dedicated to bringing the reader who is willing enough to take the time and make the brief intellectual effort necessary for taking the first step toward gaining this stunning understanding that grasping relativity is, to a breathtaking vista that allows viewing what will be its outcome, after it is achieved, and demonstrate just how easily that understanding can be acquired *by anyone*; especially anyone who has taken the initiative to read to the end of this opening, as the current reader must now have done to be reading these lines. Again, **anyone who can read can learn what space and time being relative actually means**, and even more importantly, **learn exactly why relativity is, indeed learn why relativity logically MUST be, a physically true fact.**

Part Three

CLOCKS ON A TRAIN

Imagine a train, a very short train, a train consisting of only a single rail car, with a separate caboose behind it, and an engine that pulls this short, one car long train along the rails. On each of the three different vehicles, there sits a single clock: one on the engine, one on the rail car, and one on the caboose. Each is set to exactly the same time, and with absolutely the greatest precision achievable, physically. Additionally, each of the three clocks keeps absolutely perfect time. So, we set them to be synchronous, so that each displays the identical time as either other. These clocks are set so exactly that we can readily and positively identify what time it is on each with enormous precision and thereby unambiguously identify any difference whatsoever, again, regardless altogether of how slight that difference might be, between the time registered on any one clock and that registered on any another. And again, the clocks can be easily seen and the times that they display clearly read, by anyone positioned along the side of the tracks looking at the train as it passes.

We begin by having the train, serve the purpose for which any train was intended, that of moving over a pair of rails. Our train, with its three clocks set to the exact same time, begins by finding itself moving very, very, very, fast, along the straightest set of rail tracks that there could ever be, stretching over the flattest surface

that there could ever be, the tracks eventually disappearing at the horizon, in either straight direction, across this perfectly flat and endless landscape of uninterrupted desolation that we are imagining.

Now that we have imagined a very short moving train, with clocks evenly spaced along its length that can be seen by anyone positioned along the side of the tracks, with each different clock, set to precisely the exact same time (as the conductor's watch), we now next imagine an observer, standing just next to the rails, just as the train passes by that point, who can see all three clocks. We ask: what time is it on each now?

According to the aptly named, common and intuitive Theory of *Absolute and Universal*, Space and Time Measures (as described in the opening), the three clocks on the train should all show identical times. According to this, the common theory, the clocks would all read the same, irrespective of whether the train is moving, or not moving, because for it, time is absolute and so does not change with motion. Not knowing about relativity, this is what most would presume. But, this is exactly what a body of ideas that embodies scientific purpose, designated formally by the name, Theory of *Universally Relative* Space and Time Measures, says will definitely NOT happen. *It predicts instead, **distinctly different times for each clock***, NOT the same.

To be perfectly clear, the Theory of *Universally Relative* Space and Time Measures says that, among the three, no clock will read the same time as either of the other two. Relativity says that, while the train is in motion, according to the measures of any 'stationary' perspective that is 'not moving', and if the exact time read

on each clock is measured with adequate precision, then the three different clocks on the moving train always display three distinctively different times, even though this result clearly contradicts any ordinary intuitive notions that we would probably have, as it is in direct contradiction to the Absolute and Universal Theory of Space and Time Measures, which predicts instead, that each clock will show an identical reading to the other, no differently from what would be the case if the train were stationary instead of moving. What this common and intuitive idea says *will* be true, relativity says *must* be and *will* be false instead, yet no experiment in the history of humankind has ever shown that relativity is; not a single, solitary one, anytime, ever.

This is a single, clear, easily obvious difference, between what the common and intuitive Theory of Absolute and Universal, Space and Time Measures (again, see opening) says, and what the Theory of Relative Space and Time Measures says instead. According to the common and intuitive Theory of Absolute and Universal, Space and Time Measures, time is absolute, so it passes no differently for anything moving from anything that is not moving, regardless of anything else whatsoever. But, the Theory of Relative Space and Time Measures says times *do* vary, physically, with motion. Yes, according to the Theory of Relativity, times do vary physically with motion, because they absolutely **MUST**. They absolutely must physically vary, *or the laws of physics would have to change with motion instead*. And again, the fact that moving clocks do vary has been demonstrated repeatedly (millions upon millions of times) for the past century with not a single failure once.

That is to say, that what relativity predicts will happen, will, in actual fact, flatly happen (as the Theory of Relativity has yet to ever be incorrect). In the case of a moving train, the three different clocks will read three different times, to anyone who is stationary, like the straight rails of the flat track are stationary, by virtue of 'not moving', as the ground under the tracks never seems to move either. This means that what the common and intuitive Theory of Absolute and Universal, Space and Time Measures predicts, that each clock will read the same, identical time*, will *not* be true, and they will not. When tested, in actual, physical fact, it is the Theory of Relativity that proves true, and it is the common and intuitive model, the model that nearly everyone, everywhere outside of physical science is convinced is true, demonstrates itself not to be. Yes, to be very clear, the widespread, common and intuitive notions of time, space, and the universe as a whole, are, without question, false, despite how many times the reader may hear the words, "the universe began**," spoken by those with presumed "authority," without their explaining that such a statement does not mean 'began *with respect to time*', as 'began', without any further specification, subtly implies. Such authorities would best serve all by clarifying their meaning, so that they expose our common and intuitive notions for being what they truly are, FALSE, as relativity's predictions show, and as any physical experiment so testing always faithfully reveals.

* - Misunderstanding relativity, imagining time 'slowing' with motion would not explain each clock having a different time from each other clock.

** - What "began" or any other word like it that is used in its place (a synonym, for example) means is this: the Big Bang is a beginning in the identical sense that the end of a street can likewise be designated as the location 'where' the street "begins," but in no way 'when'

Part Four

HOW CLOCKS ON A MOVING TRAIN DEMONSTRATE THAT WHAT TIME IT IS WHERE, IS RELATIVE TO MOTION

So, we now have a moving train, with three evenly spaced, *synchronous* clocks, but instead of showing the same time, as that is what synchronous means, concurrent, each shows a distinctly different moment in time instead. Again, the Theory of Relativity predicts this, and the common and intuitive Theory of Absolute and Universal, Space and Time Measures as explained in the opening sections of the text would erroneously specify that this is what would *not* happen. But, besides this demonstrating the validity of what the Theory of Relativity says will happen over common, intuitive notions of spatial and temporal absoluteness (again, the Theory of Absolute and Universal, Space and Time Measures), what does each clock exhibiting a wholly different time mean, in real, physical terms?

Understanding what simultaneous clocks exhibiting altogether different times means explains how relativity sees time and space.

To do so, one must do only a single thing: think (rationally).

First and most significantly, synchronous clocks set to an identical simultaneous moment on the moving train showing different moments and thereby demonstrating the predictions of relativity being valid means, obviously, as stated, that the common and intuitive Theory of Absolute and Universal, Space and Time Measures, which predicts otherwise, is categorically incorrect. But, it means further that any conclusions at all that are ever made that are based upon this erroneous body of ideas is likewise just as incorrect as it is. *Failing to recognize this critical fact will prevent grasping or lead to misunderstanding, what relativity truly says.*

Most noteworthy of this incorrect notion is the idea that the absolute time that this model includes was passing eternally and that during the course of its passage, the universe 'happened', as a uniquely "creative" phenomenon that *instead of creating new configurations of existing energy, created the energy itself from a state lacking any.* That is to say, that there was a unique moment, even if there was no other place because there was only the single place where the universe initiated the inception of all that was to follow, in which the state of affairs consisted of a total lack of energy, being instantaneously replaced by a state of affairs that included all the energy existent today, within a single, absolute set of measures for time and space applicable everywhere, physically distinguishing what moving is, from what being stationary is, irrespective altogether of an motion whatsoever. But again, this is, of course, the erroneous and untrue model that relativity *replaces*. So this plainly incorrect picture of universal absoluteness is flatly not the way that nature really works and that the universe does not conform

to a universal time, nor, as we shall see, that the universe does not conform to a universal space either. Both time and space measures physically change with motion.

According to this absolute model of unyielding certainty, the past always ceases to exist, while the future does not, lying perpetually in a realm that is physically yet to exist. According to it, the present moment is all that does exist, reality extending nowhere beyond. Yet, as relativity's accurate prediction that the clocks will show distinctly different times while the common and intuitive theory of universal absoluteness erroneously predicts that they will not, confinement of existence merely to the present moment MUST be as false as the fallacious model (again, the common and intuitive Theory of Universal and Absolute, Space and Time Measures) specifying this simple, confining, and wholly erroneous picture of a logically impossible physical existence is. Absolute space and time measures do not to apply to nature. Such certainty is *demonstrably* wrong. As we shall see clocks on a moving train demonstrate, physical existence extends is not confined to the present.

According to relativity, physical existence is not confined to any unique, single perspective alone, the single one corresponding to our single, individual perspective of our world's space and time measures. Relativity says that physical existence extends beyond the present moment, into both the moments constituting the past and into the moments constituting the future, endlessly, in both directions of time. Synchronous clocks on a moving train registering non-synchronous times prove it. And here is how they do.

Each clock corresponds to an EXISTENT moment in time, irrespective of whether it is past, present, or future, with respect to any other moment. Grasping the physical meaning of this point is absolutely crucial to understanding relativity accurately. Failing to grasp the validity of this as a physical fact, or failing to genuinely understand its meaning or to truly accept it as actual physical fact, or to simply refuse to, means not just failing to understand relativity accurately, but rather, as actual intellectual fact, failing to understand relativity at all, or even worst, being perhaps convinced that one nonetheless understands, however vaguely, where such understanding is conventionally labeled otherwise, or again, worst, where misunderstanding combines with a misplaced certainty that one truly possesses understanding, while retaining old ideas, now “justified.” Yes, that moment on the rail car, caboose, or engine, that registers three, distinctly different moments according to a single simultaneous moment for a stationary observer, are three moments of real, physical space, that physically exist as much as the single, simultaneous moment of a physical space for a stationary observer next to the rail tracks is physically existent, even though they are wholly different, distinct moments, each corresponding to a wholly different and distinct, physically existent space. Each moment, as a three-dimensional space (meaning an unbounded spatial volume), is a physically real moment of existence actually existing, like we do.

Reading different times on the faces of the clocks on a moving train reveals that existence is not limited to a single moment and no others, but spans all moments instead, all that there ever are, ever were and ever will ever, together. This is true because

what is true for a short train is true for a train of *any* length. Given a train of *any* length, equipped with clocks on each rail car added, each clock would correspond to a different, yet nonetheless a *wholly* existent, momentary space, it can cross the entire universe, in *any* direction. And, this is true a moving train at *any* moment whatsoever, from the moment of the Big Bang until ANY other. Hence *the WHOLE, ENTIRE history of the universe, past and future, anywhere, is physically existent now*. Nothing could be more of a contradiction to our intuitive notions than past and future being existent, yet physically, they are.

According to the Theory of Relativity, it is only the whole of one's (our) uniquely individual future that is perpetually removed from an individual's ability to ever physically observe this individual future directly. Yet, again, based upon relativity's unquestionable demonstrable accuracy, this individually unique future is *wholly, physically existent*, despite one's absolute and inescapable physical removal from this individual future's direct observation, ever. Likewise, so is the individual past that corresponds to one's particular perspective that leads to this existent future just as physically existent as this future is. The distinctly different, non-synchronous times exhibited on the faces of the synchronous clocks openly demonstrates that both past and future physically exist just as much as the present moment we are currently experiencing physically does. Again, all moments, everywhere and anywhere, are physically existent always. It is a demonstrably true and irrefutable, physical fact.

Part Five (Optional)

HOW CLOCKS ON A MOVING TRAIN DEMONSTRATE THAT SPACE DISTANCES, LIKE WHAT TIME IT IS, ARE RELATIVE TO MOTION TOO

Clocks on a moving train, besides demonstrating that the past and future exist as much as the present moment does and are therefore physically real, also demonstrates that the measure of spatial distances is no more absolute than the measure of time is. Clocks on a moving train demonstrate that the measure of spatial distances absolutely do change also, physically, as a consequence of motion. (And it should be noted that correspondingly, so do the angles that these distances define likewise change with motion.) Again, this true physical fact that is demonstrated by relativity is a clear and direct contradiction to the common and intuitive notions that most embrace (believe), like that of time being absolute (as the preceding section explained) instead of relative (which, as the preceding section explained, it unquestionably is). In the second section, we formally codified this common and intuitive set of ideas about time and space as the Theory of *Absolute and Universal, Space and Time Measures*. In the next section we put clocks on a moving train to illustrate the difference between the conclusions drawn by our common and intuitive ideas, and those drawn by relativity. In the next section, the fourth, preceding this, the conceptual difference between a common and intuitive three-dimensional model of space

and time, and the more complex, four-dimensional model that characterizes relativity's description were explained. In this, the fifth and final section, we will see how time is "tied" to space in such a way that spatial distances change with motion also, in correspondence with (as a consequence of) what time it is where, changing with motion. (For many, the revelations of the preceding chapter suffice the needs of the reader, which is why this section was cited as being optional; but, please note that rarely does harm to deepen and enrich one's understanding of nature by better understanding its formal description through science. And what's more, unless the reader has stopped to reread parts along the way, no more than an hour should have elapsed, yet within so few minutes, the reader has been able to acquire an accurate picture, however vague that picture might be, of how relativity structures space and time differently from how common intuition does. If the reader has understood, then they now possess a picture that should last for a lifetime.

No mention has yet been made as to exactly what different times appeared on the faces of the synchronous clocks on the moving train. This is because it does not matter for time. That each clock read a different time from every other is all that matters for demonstrating motion's effects upon time, in the simplest way. But, to see motion's effects upon spatial measures, *what time it is* on each clock *must* be considered.

The clocks on the moving train correspond to three different moments in time, each of which, their selves, corresponds to an unbounded spatial volume corresponding to that particular moment.

Lying in the pattern of a line on the train, the moments reflected in the times registered on the line of clocks has an order. The clock in the engine registers the earliest moment. The clock on the rail car behind it registers a later moment, and the clock in the caboose registers the latest time, later in time than either of the other two. Thus, we have three, evenly-spaced clocks in a row, each showing an earlier time than the clock behind it, along the direction that this line of clocks is moving, with the motion of the speeding train that carries them.

Now, consider this. Each time corresponds to a particular point in the motion of the clock in the direction of the straight tracks. The later the time registering on a clock, the further along the direction of motion that clock has traveled. Therefore, a later clock is further ahead, and thus more advanced along the tracks, than a clock marking an earlier time. Because the clock on the engine is at an earlier time and the clock on the caboose at a later, a more advanced caboose is catching up with a less advanced engine, thereby shortening the train. Like time changing with respect to motion, space distances 'shrink' in the direction of motion, as time 'stretches' out, thereby guaranteeing that the *combined* measure of the two together, along with the laws of physics themselves, never change, but *requires* that past and future exist, which unambiguously **contradicts** time having ever begun or everything existent (all energy) being once created; like religious belief, each is a demonstrably irrefutable, as well as dangerous, lie. 🌐

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