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Is Time a creation of Life in response to Gravity?

This hypothesis suggests new ways for looking at extraterrestrial life.

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Abstract

From his personal experience during a space flight (Challenger 1985) onward, the author has been struck repeatedly by the remarkable influence of Earth's environment on life, in particular by its most inevitable elements: time and gravity. Our life might be peculiar to the local Earth conditions, and not cosmic per se.
In this article the hypothesis is postulated that our 'speed' of life, in relation to the speed of information (in this case the speed of light), is specific to humankind. Life is the process that 'makes' time. In this approach the constancy of the speed of light is not so much a property of the external world, but rather a consequence of our getting older at a fixed 'time-speed'. *We are sitting in a 'time train' and all the information that we observe from the outside world is travelling relative to us at the same speed as our train. The train speed is, in a sense, the speed of light*.
If that is the case, then the expanding universe is an illusion. The remnants of the 'big bang' are standing 'still' while we move away and see all distances increasing.
It is also shown in this article that there is a relationship between this time-speed and gravity, and that it can be the result of a process in the brain. By interpreting gravity as the result of a rotating motion, rather than a linear upward acceleration, time is introduced.
In today's science we consider all universal processes in respect to our present (= now). In fact, we believe that the universe started 13.6 billion years ago. This approach to science is set against the history of centralism: from the geocentrism of Ptolemy to the heliocentrism of Galilei, extrapolated to the 'chronocentrism' of today.
An intriguing consequence of this theory is that extraterrestrial life would have a different speed of light. To couch this in a metaphor: *we are living in a green world and see only green, while the others live in a red world and see only red. Each of these worlds can be part of one system, but we cannot see each other*. Ideas are presented on how one might be able to communicate with these extraterrestrial living systems. Based on the assumption that different time propagations are still made up from the same time quanta, but with different lengths of empty time in between, one can imagine that those time speeds could be transferred by a 'replay' at our speed, like the frames in a film. Following the same assumption, a Lorentz transformation could connect both worlds, implying that the signals from another world would, for us, be split into two signals, each with a different time speed and distance speed not corresponding to our speed of light. Detecting those two signals simultaneously could lead to an intriguing experiment.

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I. Introduction

Time is an intriguing feature of our world. Augustine once said: “I know what time is, but when asked I cannot explain”. Time has a different degree of freedom, and is a different type of parameter, from distance, for example. Distance is measured in metres and time in seconds. But with time, these seconds continuously add up; time gets ‘bigger’. A distance, however, can stay the same, at least for us. A light pulse will have no choice of expanding in distance as well as in time. What is it that makes time go on as an inevitable process for us, even if we physically stay in the same position? How can we understand time? I would like to expand my thoughts on this question.

This paper presents a hypothesis that relates the speed of light to the speed of getting older (the ‘speed of life’), which in turn is seen as the speed of time. Rather than taking the speed of light as a universal constant of nature, I propose to see this speed as the consequence of the speed of life. We grow older, live and move towards the future. The speed with which we get older is the same for everyone and is therefore in fact a constant. The hypothesis is that it is this ‘speed of life’ which causes us to perceive light as travelling at a constant and universal speed. The constancy of the speed of light is not a feature of the external world; it is a consequence of life.

When we measure the speed of light, i.e. when we measure light passing one point at one time and then passing a second point at a set distance and at a later time, we cannot avoid having aged by exactly the same amount of time that the measurement took. The resulting question is: which is more fundamental? The clock that indicates the duration or the fact of our getting older? I postulate that it is our getting older. It is as if we are sitting in a ‘time train’ that determines the speed of life, i.e. getting older year by year. It is no wonder then that everywhere we look, everything we see, under all conditions (i.e. mass-less properties) ‘moves’ at our speed, the speed of light.

The idea of ‘life-speed’ is thus introduced, a notion corresponding to our ‘speed of time’. Our speed of time is then defined as an essential element of life, the result of going through time, becoming one day older when one day passes. By a process of reasoning we can further conclude that our ‘life-speed’ must be (directly related to) the speed of light, or rather: causes the speed of light to be what we detect. Since we do not overtake tomorrow and do not end up in yesterday, this ‘life-speed’ corresponds to the speed of information, which is in fact the speed of light. Rather than finding that the constancy of the speed of light is a feature of nature, we posit that it is merely a result of the speed of the observer. We simply live that fast… It should be noted that I am discussing a kind of ‘time-speed’ [s/s] and a ‘space-speed‘ [m/s] here. The relationship can be expressed by ‘the moving clock calibration’ and Lorentz transformation, discussed below (4).

A hundred years ago Albert Michelson received the Nobel Prize for demonstrating in his experiments that the speed of light is constant, regardless of the speed and direction of the observer. Einstein took the constancy of the speed of light as a given property of nature and, using the Lorentz transformation of energy, showed that one of the consequences is the famous equation $E=mc^2$. In the hypothesis proposed here, these

facts do not change. The hypothesis could however prompt a new way of looking at things, offer additional insights and subsequently create new features of life.

The reversal in thinking – “it is not light that moves, but us” - originated from my personal experience of a space flight. Once in space one gets used to the sensation of weightlessness and as a result one develops a sense of the direct relationship between force, acceleration and, consequently, motion. Upon returning to Earth I was overwhelmed by the striking difference between space and Earth. I was very impressed by the significance of the exposure on Earth to the acceleration of gravity. For those on Earth this gravity acceleration is not interpreted as causing motion. But when I stood up after the space shuttle's landing, I felt as if I were standing in an elevator being accelerated upwards at a rate of 10 m/s^2. This acceleration is enormous: 36 km/h in one second, twice the speed of sound per minute, 130,000 km per hour per hour. I therefore cannot help thinking that gravity has always had and will continue to have a major influence on the human race and its culture, including its science.

An obvious question then arises: ”Is our conceptual understanding of the cosmos universal, or does it, unknowingly, depend on local features, in particular our gravity and time?” I am adding time to gravity here as one of the givens of our life on Earth. The sense of time is different when one is in space. Without the effect of gravity one perceives no rhythms, no urge to move or tense the muscles. Somehow the speed of life, of getting older, and the overwhelming effect of gravity seemed to fit together. I started to form a hypothesis and explored the consequences.

The origin of this paper is a presentation at the symposium ‘Conquest of Space’ in 1987[2]; see chapter III. Chapter II starts with a discussion of ‘chronocentrism’. A potential physiological relationship between gravity and time is described in chapter IV. In chapter VI an attempt is made to derive some formulas resulting from the hypothesis, and chapter VII discusses some potential consequences, including a suggested way to observe extraterrestrial life.

The thoughts presented below are purely hypothetical. I do not however know of any similar hypothesis; the thoughts seem novel. Therein might lie the main interest of this article.

II. The consideration of localism

I was fortunate to have been extraterrestrial for one week during my flight on the US Space Shuttle Challenger at the end of 1985. The experience of the difference between Space and Earth was so overwhelming that I now believe sincerely that our views, our culture, our science and our understanding must depend on the Earth's environment, and in particular two aspects of that environment, namely gravity and time.

We humans obtain our information from our location in space and time; this holds in general terms, but also in a more specific sense. Our knowledge and our science are built upon that information. it could be said that our personal perception and

[2] Proceedings of the symposium ‘Conquest of Space’, Paris 13-16 January 1987; and see J. Schneider and M. Leger-Orine (1988), *Frontiers and Space Conquest* (p. 229-231). Kluwer Academic Publishers.

understanding of the world around us is adjusted to fit the information we receive. We could call this adjustment intelligence. We construct a logical and consistent model.

We are obviously somewhat localised, both in space and in time. How does our understanding depend on this localisation? Equally, does the character of our understanding basically express the manner in which we are localised?

Based on this relationship between understanding and location, let us imagine going back in history and asking the question as to how we perceived our location then:

What answer would we have received from Ptolemy to the question: “Is there another Earth?”

Two thousand years ago Ptolemy placed the Earth at the centre of everything. This view explained most of the observations made from the Earth (i.e. the sky) as being directly linked to the Earth. The Earth was seen as the basis, the centre, and of course there can only be one centre. So Ptolemy’s answer to our question would probably have been something like: “The Earth is the Earth; the plural of Earth does not make sense”.

What if we had asked Galileo: “Is there another planetary system?” It is only 500 years since Galileo placed the sun at the centre of the universe, a view based on his understanding of satellites orbiting a heavy body (derived from his observations of the moons of Jupiter). Galileo saw our Earth as being similar to those orbiting satellites, and developed the understanding that all the planets were circling around the Sun. His answer to our question would probably have been something like: “We see Jupiter, but that is a planet like ours; and we see only one sun!”

So how can we extrapolate this reasoning to the question of life? How can we expand on or extrapolate the fundamental question, like the meaning of the Earth for Ptolemy and the significance of the sun for Galileo? I believe the fundamental question today is about time. We accept the notion of time unquestioningly, just as Ptolemy would not question the concept of the Earth and Galileo would not question his beliefs about the sun.

Nowadays we think of ourselves as cosmic beings. We believe that the laws of physics as we understand them apply everywhere. We do not question the potential limitations of our views caused by the fact that we live on the Earth. This seems to me a rather arrogant attitude.

From a geometric or spatial point of view, we have become rather humble in our views, and have come to see the Earth as a planet orbiting a fairly minor and common star near the edge of a rather ordinary galaxy. However, we seem less humble about our position in time. We exist in the present and we go so far as to make convincing statements about when the universe started and how it all relates to *our* time and *our* existence. The ‘big bang’ took place 13.6 billion years before…NOW. After the geocentric and heliocentric world, it could be said that we now live in a ‘chronocentric’ world.

The relationship between our perceived localisation and our understanding of the universe seems evident. For me, this statement seems logical. Once accepted, the intriguing consequence is that a different understanding can result from a change in localisation. Given this notion, what might happen if humanity were to occupy outer space? Would the change in environment, in basic forces and in the perception of time alter everyone's understanding? If my experience in space led me to put forward new

theories, would most earthlings believe me? Would I believe them myself on returning to Earth? Well, the next chapter tells the story as I wrote it shortly after my flight:

III. Is Life Earth-like? Space flight, a most unusual experience

"T minus 36 seconds and counting. Automatic sequence start". The Shuttle computers had taken over the countdown. I had already been sitting in the seat for over one and a half hours, lying on my back because the Shuttle stands on its tail. 'So close to launch'. I had spent two years in Houston for the basic astronaut training. Three years' training and preparation as a back-up for the first Spacelab flight. Now, on 30 October 1985, here I was, sitting in the Challenger. Hoping against hope that nothing would come between me and the flight, that nothing would go wrong.

"T minus 6 seconds. Main engine start", I felt the Shuttle coming to life. I counted out loud: "3...2...1..." and then, "Yippee", the solids ignite, and up goes the Shuttle, there goes the D-1 Spacelab, there *I* go - into space. I could feel the increasing speed. Three times the weight on Earth.

After two minutes, at an altitude of 40 km, the two solids are burned out. With a big jerk they separate and then... nothing! As the Shuttle was already on an almost ballistic track, there was no longer any sense of gravity, only the acceleration of the Shuttle. The acceleration was only 1.2 g at this point in time, only slightly more than I felt during the one and a half hours I spent waiting on the pad, without moving. I thought for a fraction of a second that the engines had cut out.

Fortunately, the forces began building again and a smooth six-minute ride brought us into space. The engines stopped; we were weightless. The first thing I did was to take my pen out of my pocket and hold it in front of my nose. It stayed there "I can move my head around it! We are weightless; we are in a no-force environment".

I had often tried to imagine what weightlessness would be like. Now it was real and... different. One key question kept coming back to me: "Will being outside Earth make me think differently about life? Is life Earth-like? I think I found the greatest difference between space and Earth to be gravity, the inevitable gravity.

Life's evolution took place on Earth, man's concept of life was formed on Earth. How general is this concept? The force of gravity to which everybody is exposed throughout their lives is always the same. I was struck by this new sensation of weightlessness, as if I had opened a door and seen a new colour I had never seen before. Yet it was so real; I just didn't have a name for it.

Of course I had to stop this reflection and set to work; we had over 70 experiments to carry out. Many of them had to be done as soon after launch as possible, because they were designed to measure the onset of our adaptation to weightlessness. Some of us got sick, others enjoyed it. It was hard for me not to smile all the time. All of us worked hard and after two days we all felt great.

I had no time to think about gravity and life again until the work was done, 110 orbits around the Earth later. During the course of seven days I got used to the feeling of freedom; no gravitational forces, nothing holding my feet to the floor. When I relaxed and closed my eyes I could even forget my body. It was the purest feeling of rest. The only forces we felt resulted in movement caused by acceleration. I started to think

again about mankind on the surface of Earth. Constantly being pulled downwards by an incredible force; or more accurately, pushed upwards by an enormous acceleration.

Each second, every person on Earth moves 36 km/h faster than in the previous second. That is an acceleration of 100 km/h in 3 seconds, 3 million km/h after one day, almost the speed of light after one year! The brain cannot believe that, of course. As the force of gravity is always constant, we ignore it. When we sit on a chair, for example, we have the sensation that we are sitting still. Horizontal forces, however, are interpreted as changes of speed. When we feel pressure on our back in a car, we go faster. We have therefore developed a different perception of horizontal acceleration compared with the vertical.

How far away is a friend when looking down at him from a 100 metre-high tower? And how close is he when you are on the ground 100 metres away? How striking is the apparent increase in the size of the moon when it is on the horizon, causing us to apply our 'horizontal' view, and how small does the moon seems to be when viewed at the zenith, straight above us? Is our brain fooling us? Of course it is! But how does this influence our concept of life, assuming it does so? How might our view change if we were to perceive gravity not as a static force, but as a real acceleration, going upwards at a faster and faster rate? As I said earlier, I had often thought about this before the flight, but I was never really able to put myself in a place where I felt gravity as acceleration.

The de-orbit burn was completed and the slowing Shuttle re-entered the Earth's atmosphere. Looking through the window, I could see the clouds coming closer and closer, then begin passing us by at incredible speed. Then, at about 200,000 feet, the air drag started to build up. A deep orange glow developed around the Shuttle nose. There was a quite sudden build-up of g-force, to 0.8 g's. My head was pulled downward. It took a major effort to lift my arm. I felt at least four times as heavy as I remembered being before the flight. It was uncomfortable. Strange effects occurred due to my disoriented vestibular system. Whatever I looked at moved when I moved my head. I did not like it! The journey down took 20 minutes.

The Shuttle touched down smoothly on the runway at Edwards Airforce base. It slowed, rolling to a stop. And then, silence; but heavy, so heavy. After receiving the go-ahead from our commander, we unstrapped and exercised our leg muscles before trying to stand up out of our seats. Now came one of the most impressive moments of my flight. I stood up and... it was frightening, for a few seconds I felt as if I had just stepped into an elevator going upwards at incredible speed. All my thoughts about the perception of gravity came flooding back. I had just perceived it as true acceleration!

What does this gravitational force do to us? We are all so used to it that it must give us a distorted view. We cannot escape it. The first few nights I woke up several times, switched to acceleration, the bed was pushing me upwards, the speed was building up. Then I switched back to the perception of gravity as a force; I felt as if I was tied down by my hands and feet.

Somehow, this inevitable gravity, its incredible speed and the continuous passage of time, suddenly seemed to fit together naturally; time, seen as the need to experience changes, to live.

Time passes at the same speed for all of us time. To reach tomorrow, we all have to wait one day. It is as if we are on the same wave, being carried towards the future..... It makes me think of an analogy:

On the other side of a lake whose surface is as flat as a mirror sits a blind and deaf man. He is fishing using his sensitive fingertips on the rod and sensing any movement of the water's surface. If I want to communicate with him I can throw a stone into the water. The ripples will reach his float. The man will know that I am there.
Now suppose I am on a boat which moves at a speed equal to the speed of the ripples which disturb that flat water surface. I can throw as many stones in the water as I like, but the lake in front of the boat stays flat, undisturbed. I cannot communicate with the other side of the lake. If I want to see that changed, I have to wait until I arrive there. Just as I have to wait for tomorrow to arrive. Yesterday is already disturbed, like the wake of the boat.

If the analogy holds, you might ask yourself: "What causes the boat to move? Where is the engine?".

Is gravity the engine? If so, then gravity is giving us the speed at which information is transmitted, like the ripples in the water. But that is the speed of light, 300.000 km/h. What then is our speed in time? One hour per hour of course; that speed is one. Is it gravity, then? Is it the Earth which pushes us towards the future? Is it Earth which gives us our sense of time? Do we live the way we live because we are on Earth? Is our concept of time and of life universal, or does it depend on Earth? Is life Earth-like?
I believe it is.

IV. Resolving the conflict through physiology

How are we to understand the way we, that is our brains, construct an interpretation of our observations? It is ultimately these interpretations which shape and determine our view of our environment, our cosmos, everything.

There is no question that life is influenced by gravity. That influence is obvious when we look at the various life forms (trees grow upwards, people's legs are about one metre long,…).

The rhythm of our gait when we walk and dance can be represented by

$\omega = \sqrt{\frac{l}{g}}$, where l is the length of our legs.

A so fundamental element of our lives, namely thythm is thus gravity dependent.
Most intriguingly, this gravity influence also plays a major role in how our brain, our central nervous system (CNS) makes sense of the information that comes into our brain as a result of gravitational acceleration and through our eyes. We think of ourselves as standing still, whereas in fact be are being accelerated at 1 g. If we are accelerated in a car, however, we will feel the increase in speed and are impressed by it. This anisotropic handling of acceleration by our brain introduces some apparent illusions, like the well-known lunar illusion: the moon appears much bigger when it is setting,

whereas a photograph would reveal that it is the same size as when it is at its highest point in the sky

How are we able to differentiate between horizontal and vertical acceleration? Experiments show that we create an internal state of awareness of the vertical in our CNS that brings the many observations into harmony[3]. (Conflicts will give rise to nausea…) In this harmony, we treat horizontal observations very differently from vertical information. We have managed to subtract the bias of 1 g in the vertical direction very precisely. How precisely we are able to do this can be demonstrated by turning a hand in a 6 seconds circle. This seems to be not too difficult, until we realise that our hand moves sideways to the right with a 0.01 g sinus wave motion, upwards at 1.01 g, downwards at 0.99 g and to the left with a sinus wave motion of 0.1 g. Needless to say, fine-tuning such as this is not so easy. In fact if we try to move other limbs in different circles and frequencies at the same time, we soon realise the workload this imposes on our CNS!

So what is the CNS doing here? We measure the accelerations with the vestibular organ located in our inner ear, the otolith. We observe the static environment with our eyes. It could be said that the otolith follows Einstein, i.e. making the observation that 'we are accelerating', while the eyes follow Newton: 'we are standing still and are being pulled downwards towards the earth'. Somewhere, deeply embedded in our brain, we make sense of these two inputs. But both inputs have different dimensions and are measured in different units! When writing down the function of the CNS in an engineering block diagram and creating a simulation (for example using Simulink), we will be forced include a calibration of the unit of acceleration versus the unit of expression of the static observation. The static observation corresponds to Newton's 'uniform state of motion', and is therefore expressed in m/s, while gravity is a *rate of change* in speed and is therefore expressed in m/s^2. In order to evaluate these units and meld the two observations into some kind of formulation, it is necessary to perform a comparison. To do this, we need to know the relationship between the units m/s^2 and m/s; that relationship has to do with time, i.e. the unit of the 'second'. It could thus be postulated that embedded in our CNS there is an internal method of defining the notion of a second in such a way that our combination of perceived acceleration and our static view makes sense. The fact that this treatment of gravitational input by our CNS takes place at a very basic and fundamental level has been demonstrated in various experiments in which test subjects are exposed to different levels of gravity. Fundamental changes in reflexes are found to take place when the subject is exposed for several hours to a different rate of acceleration from the 'normal' 1 g[4]. The question could be asked here whether these changes in reflexes during exposure to increased or reduced g result from a different internal time calibration (in the central nervous system). This paper does not address this question; related research is being performed on this elsewhere[5].

The conclusion as far as our present discussion is concerned is that the basis of our internal time reference could well be physiological.

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[3] Larry Young, MIT, PI Spacelab I and Spacelab D-1, private communications

[4] W.J. Ockels, R. Furrer, E. Messerschmid, Simulation of space adaptation syndrome on earth Nature Vol. 340 (1989) p. 681

[5] Nooij SAE, Bos JE, Groen EL, Bles W. (in press) Space sickness on Earth. Accepted for publication in *Microgravity Science and Technology*

Compare the physical and physiological aspects of colour vision: the basis of our perception of the colours green, blue, red is physiological in nature. A common understanding has evolved among humans, based on 1) the fact that our physiology is more or less similar, and 2) the development of communication, i.e. language. The physiological basis lies in the specialised cells on the retina: certain cells have special sensitivity to the colours red, blue and green. This differentiated sensitivity prompted early humans to communicate their specific sensations to each other when they saw different colours. A method of communication - language - evolved which caused humans to think that they were perceiving similar impressions, and as a result the perception of these colours became part of a shared awareness of nature.

Much later, experimental and theoretical research led to an understanding of electromagnetic radiation, and subsequently to the determination of the exact frequencies and wavelengths of the corresponding colours. However, the basis for our perception and recognition of colours remains physiological. It could even be said that we humans define colours.

Just as our foot provides a – rough - calibration of length, so the cells of our retina calibrate colours. In a similar way, it could be said that our brain calibrates time. These calibrations have been made more precise by use of standard meters, prisms and wavelength definitions for colours, and through the use of clocks for measuring time. The calibration of time by our brains might be an integral part of getting older. We congratulate each other on birthdays because we have all become exactly one year older…

We can perhaps be more precise in explaining how our brain defines or calibrates time:

Let us assume that our CNS produces an awareness that must make sense, i.e. is logical. Let us also assume that this logic is also present when the process does not take place at a conscious level, but at a deep and fundamental level, as is the case with our interpretation of vestibular and visual inputs, for example. What are the inputs which our brains have to make sense of? We are moving forwards at the speed of light (the hypothesis of this paper), and we are also being accelerated upwards by the ground. But the ground does not rise! The logical way to explain such a situation is to assume that we are subject to a rotation, a circular motion. I assume that this is what our CNS ‘thinks’ when it ‘combines’ the acceleration input from the otolith in our inner ear and the ‘static’ input from our eyes. The gravitational acceleration is then the result of centripetal acceleration, while the speed is the velocity of the propagation of light (our ‘life-speed’). (this is in fact a description of gravity that is similar to the notion of the curvature of space as introduced by Einstein):

$$g = \frac{c^2}{\rho}$$

Or:

$$\frac{\rho}{c} = \frac{c}{g} \qquad (1)$$

where g is the gravitational acceleration, c is the speed of light and ρ is the radius of curvature.

Equation (1) expresses a fundamental property of circular motion, namely that the ratio of distance measurement (here radius) and speed (here speed of light) is the same as the ratio of speed and acceleration (here gravity)

This ratio, the left-hand side of equation (1), can be interpreted as our characteristic time, i.e. 'life-time' unit, being the ratio of our 'life-speed' c and gravity g:

$$\tau = \frac{c}{g} \qquad (2)$$

Our life-time unit is thus about 3 10^7 seconds, which is approximately one year.

This time unit does not say much about the speed of life itself, but it could be compared to other time units, either from a different gravitational environment or from an environment that has a relative speed with respect to us (Lorentz). This is done in chapter V.

With the parallel I have drawn between the physiological basis of colours and the physiological basis of time, it becomes plausible that a very precise definition of the speed of time, for example as measured using an atomic clock, can indeed result from experimental physics, even though the basis of time is still physiological. (clocks are compared on the basis of consistency)

There is however an apparent difference between colour vision and time perception. We observe a variety of colours, giving rise to our awareness of a spectrum, whereas we are exposed to only one level of gravity, and therefore to only one time. We therefore (as yet) have no means of imagining what kind of extension might exist beyond this single time perception.

This single-point observation of time and gravity could lead directly to the consideration that our understanding of physics might well be limited to (and by) the same single-point observation. In fact, assuming that our time perception is due to or created by our physiology (i.e. sensed by our otoliths and interpreted by our central nervous system), the only possible conclusion can be that our 'speed' in time is just one of many possible speeds. This means that of the most fundamental elements of physics, namely the constancy of the speed of light, now in fact becomes our speed of life, which in turn is simply a (limiting) feature of our physiology and our location on the Earth.

V. Understanding time

The previous chapters present the hypothesis that life, and thus human life, is locally determined by its (and our) location on the Earth. Rather than taking the speed at which information and massless energy propagates to be a universal phenomenon of nature (i.e. the speed of light), the hypothesis posits that the speed of light is the result of a locally adapted life process that 'moves' at that speed. Clearly, it is difficult to imagine and visualize what the speed of life is, but let us try.

Life certainly coincides with progress in time. Time becomes longer, extends, by one second each second. In this sense, the speed of time is absolute; it is not a relative speed. Although everyone feels that this is true, a thorough analysis is likely to result in

a tautology, in the sense of circular reasoning: comparing one clock with another or with some cyclical natural feature, and measuring the degree of consistency…

The hypothesis presented here enables us to cut through the circular reasoning by proposing to calibrate the speed of our time in a relative sense with respect to another clock, which moves at a 'slower speed' than we do and which therefore also shows a slower time speed. Remember that the hypothesis posits that we 'move' and that it is because of that very motion that our clock shows 'progress'. If we look at another clock, which 'moves' at a 'slower' speed, that clock will have a relative speed with respect to us. If we allow the other clock to slow down to a speed of almost zero, we will observe the progress of time as measured by that clock also nearly standing still. The relative speed has approached the speed of light. The approach in this calibration thus involves comparing the time progress of the other clock, which moves at a relative speed v, with respect to the time progress of our clock. The ratio of these time progressions (or intervals) is given by the well-known Lorenz transformation:

$$\Delta t_v = \frac{\Delta t_0}{\sqrt{1-\frac{v^2}{c^2}}} \qquad (3)$$

Or:

$$\frac{\Delta t_0^2}{\Delta t_v^2} + \frac{v^2}{c^2} = 1$$

Defining the relative 'time-speed' as:

$$\frac{\Delta t_0}{\Delta t_v} = \xi_v$$

And defining a relative 'space-speed'

$$\frac{v}{c} = \gamma_v$$

We have

$$\boxed{\xi_v^2 + \gamma_v^2 = 1} \qquad (4)$$

Which means that the relative time speed versus the relative space speed follows an arc of radius 1. Unity here means the world according to our speed of light c.

In fact we use the characteristic time in equation (3), and the amount of time that we observe the moving clock passing through when our clock passes through one time unit is:

$$\frac{\tau_0}{\tau_v} \cdot \tau_0$$

Where the index 0 indicates our clock and v the moving clock. Using equation (4) and

$$\frac{\tau_0}{\tau_v} = \frac{\Delta t_0}{\Delta t_v} = \xi_v$$

we obtain

$$\tau_{v0} = \tau_0 \sqrt{1-\gamma_v^2} \qquad (5)$$

τ_{v0} is then the time through which the moving clock passes as observed by us and as compared to our time unit.

The more slowly the moving clock moves in the absolute time-speed sense, or the faster it will go relative to us, the smaller will be the amount of time passed indicated by our clock, .

Due to the fact that time is quantized, this process cannot continue indefinitely. When the relative speed is approaching c, the time duration τ_{v0} of the moving clock will approach zero. As the minimum time element is $h_t=5.4.10^{-44}$ seconds, the slowing down process will stop at a speed that, using equation (3), is ½ $c.h_t^2$ away from the speed of light. It is here were we find the absolute calibration.

Suppose there is another living environment somewhere where the 'life speed' is different (2). In that world we can perform the same calibration of time speed. Say the speed there is x.c. where x is not equal to 1.

The limit for the moving clock in that world will be ½ $x.c.h_t^2$ away form c. I am assuming here that the duration of the time quantum is a fixed property of the universe. The time quantum reflects a snapshot, and not a process or progression of life (if we do not make this assumption, there is no more that we can say) The time quanta then connect the two different worlds as indicated in figure 1, at the point where the 'moving' clock would almost stand still, i.e.

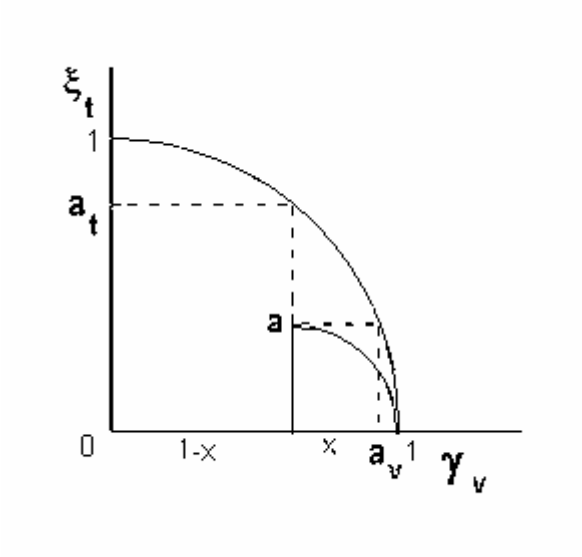

Figure 1.
Graphical representation of the relationship between time and space speed according to the Lorentz transformation. The figures indicates another life speed x.c and the resultant split of time speed and space speed, at point a. The connecting point close to 1 on the horizontal axis is formed by the time quantum.

the point $\gamma_v = 1$.

I am further assuming that the creatures living in the 'other' world experience a similar relationship between gravity and 'life speed', thus similar to (2):

$$\tau_x = \frac{x \cdot c}{g_x} \qquad (6)$$

We can now discuss the time-speed of our time with respect to the extraterrestrial time-speed, as given by the equation:

$$\xi_x = \frac{\tau}{\tau_x} = \frac{\frac{c}{g}}{\frac{x \cdot c}{g_x}} = \frac{g_x}{x \cdot g} \qquad (6)$$

τ_x is however not the time we can observe, because for us the other world has a relative speed to us. I am assuming here that the speed in time is one-dimensional and absolute. To observe the effects, i.e. information and processes of the other world, we need to apply the Lorentz relationship (4), i.e. we move at a speed equivalent to c, while the other world moves at a speed of x.c, thus at a speed-relative speed (1-x)c away form us. Equation (4) then gives the time-speed observed by us relative to the other world, viz.:

$$\left(\frac{\tau}{\tau_x}\right)^2 + \frac{(1-x)c^2}{c^2} = 1$$

And with (2) and

we obtain:

$$\boxed{\frac{g_x}{g} = x \cdot \sqrt{1-(1-x)^2}} \qquad (7)$$

Equation (5) describes the gravitational field in which life will progress with a life-speed of x c, where x can be different from x=1.

The above derivation contains numerous assumptions and simplifications which might not be correct. It does however seem that without those assumptions, and within the context of the present hypothesis, we cannot relate our world to another.

The important next step is to define an experiment and related observables that can prove the existence of extraterrestrial life and the concept of related life speed. Some ideas on this are presented in chapter VI.

VI. Next step: consequences

Quite where this thinking is leading me, I do not know. Obviously, there is a need to find calculable consequences and potential verifications based on experimental observations. So the question remains: what consequences might we imagine if we assume that the hypothesis that time is a product of our physiology and of our gravitational environment is valid?

A first and fundamental consequence is related to the nature or 'causality' of time. In today's physics, time is treated as an external factor, which allows us to describe processes involving mass and forces, or particle exchanges, rather than as an internal factor that is related to our life. My hypothesis turns that situation around. As stated earlier, instead of considering that the constancy of the speed of light is a property of the universe, it suggests that the constancy of the speed of light could result from within ourselves. In my view we are on a 'time-train', which is travelling (= living) at a certain speed towards the future. The situation is like that when we are travelling on a train and measuring the speeds of objects that we pass: churches, cows, roads, trees. When properly analysed, all the speeds will turn out to be the same, namely the speed of the train - n a similar way to the way in which we always measure the same speed of light…

A second consequence of the hypothesis is that our time is not universal. Rather, our time is one of many different times. Life that originated in a different gravitational field will have a different time. The notion that the universe is 13.6 billion years old is then the result of 'tunnel vision'. In fact the expansion of the universe could well be an illusion. The metaphor used earlier of travelling in a train implies that we are sitting facing backwards, looking only to the side (the present) and backwards (into the past). We will observe that the trees we pass move with increasing speed as time passes, i.e. as they come more and more into line with the path of the train. When they are almost in line with the train itself they have a speed that is equal to the speed of the train. In a similar way, we see stars moving away from us with ever greater speed as their distance from the Earth and thus their age increases. Finally we see the ultimate, the oldest, the big bang, as travelling at almost the speed of light. So if we retain the metaphor, the big bang is not a reality of nature, but is rather the ultimate extrapolation of our human interpretation of time in the direction of the past.

A third consequence ensues from an intriguing thought about the problem of unification of the theories relating to gravity and quantum physics. Time, when seen as resulting from gravity and life, will no longer be a dimension which is independent of gravity. What might the consequence of this be? Let us represent the existing theory of gravity as G(t), where G describes all formulas containing t as a parameter to describe all gravity-related processes. Similarly, we indicate the formulas and theories of quantum physics as Q(t). Many attempts to integrate these two theories in one unified theory have failed. The two theory systems seem difficult to relate to each other. But in the light of the present hypothesis this problem could be understood as resulting from the fact that the system of the two theories is over-defined. In G(t), t is not an independent variable/parameter. In fact one could even consider proposing that the relationship be

inverted to create T(g) and that this subsequently be substituted into Q(T(g)), thus solving the unification problem. At this point in our thinking, we realise that Q (g) does not contain any processes. In fact the theory will simply show (consistent) facts. A process will then result from introducing a particular time with a 'time speed' that creates a string of facts in a process. Our 'time speed' can be seen as an integral part of our life.

A fourth consequence of the hypothesis is that extraterrestrial life would most probably have a different time speed from ours. The link between such a world and our own could be formed by the assumption that both our time and their time is made up from the same time quanta. One way of communicating with extraterrestrial intelligence might then be to detect signals using a kind of telescope, which are then transferred into information packages of the smallest time elements h_t. These snapshots could then be 'replayed' at a speed that we 'understand' (although written as if it were a simple action, this process could in fact be a very tedious job involving large quantum computers, etc.)

Another possible method might be that suggested by figure 1. In the 'world' of x.c, life moves at the time-speed shown at point **a**. This point **a** corresponds to one relative time-speed ξ_a and relative space-speed γ_a on the curve $\xi_v^2 + \gamma_v^2 = x^2$. With respect to the world with x=1 (i.e. our world) the point **a** corresponds to two separate points $\mathbf{a_t}$ and $\mathbf{a_v}$. So, still assuming that our relatively simple assumption holds, it would be possible, if we know the value of the other gravity g_x, to transfer our observations via this relationship.

Returning to the comparison with colour vision, we can now take the metaphor of having two worlds, one green and one red. The people in the green world only see green and thus cannot see the red world, and vice versa. For the red and green people to communicate, a colour transformer would be needed. In a comparable way, to facilitate communication that bridges the different time speeds, a time-speed transformer would be needed.

VII. Epilogue

I hope that the reader has enjoyed the thoughts expressed in this paper and that these thoughts may contribute to new perspectives. Obviously, the ideas expressed are highly speculative. I have however not found or heard any similar thoughts expressed during the last 20 years, and I therefore assume they are original, and perhaps interesting.

In conclusion, I would place these thoughts in a somewhat philosophical framework in relation to our present existence on the Earth:

In my view, we human beings are approaching the boundaries of our living domain. Many years ago we began imagining travelling through space and propagating our species with settlements throughout the universe – like the L5 society, for example. We saw in the 1930s images of women walking in long dresses on the moon. No more than 46 years ago we looked hopefully to the skies, where the first astronaut Yuri Gagarin was circling the Earth. A surprisingly short time after this, only eight years, Neil

Armstrong became the first man to set foot on the moon. Werner von Braun had already devised detailed plans for an even larger rocket than Saturn V for taking man to the next destination: Mars.

But what happened after those successful days? The more space missions we carried out, the more our desire to travel away from Earth diminished. This decline in enthusiasm might be the result of the fact that space travel is so technically demanding and so costly. For some reason we can no longer undertake space missions at the pace of the Apollo programme. For some reason the average age of employees in the space programmes has steadily increased. It is no longer the cool thing to do. The programmes themselves slowed down and public interest waned. The various space stations, Skylab, Salyut, Mir, sank literally into the atmosphere due to lack of funding. Even today's International Space Station (ISS) has problems. Promises by successive US presidents that man would go to Mars came to be regarded as a sign of weakness rather than a sign of strength, owing to the sad mimicking echoes of John F Kennedy and the lack of results following these announcements. At the same time, we realised that the world beyond the Earth is not habitable. Mars and the moon are the only places where it seems as if it might be possible to live, but even then only with extreme technical support. On Earth we find life everywhere, including in the most extreme conditions. We have so far not found any signs of life anywhere else. The result is that, after 50 years of space exploration, life appears to be firmly restricted to Earth.

At the same time, however, we realise that the Earth is becoming too small for us. We are pushing against the limits to our growth, as the Club of Rome warned us over thirty years ago, and as we have been recently reminded again by Al Gore. We are running short of oil – and a good thing too, otherwise we would pollute the world even more than we are doing already! We are running short of fresh water; we are running short of everything, in fact; there are simply too many people. Nature, including our climate, is calling a halt to humankind's existence.

We thus are in a catch 22 situation: we are stuck here on Earth and the Earth is becoming too small to sustain us. Wouldn't it be nice suddenly to discover an escape route? To suddenly realise that there is a whole new world which we could explore and which would allow us to expand again? I cannot be sure, of course, but somehow such a course of events seems natural to me. (Human) life is too smart to allow itself to be compromised so easily.

The move beyond geocentrism, and subsequently beyond heliocentrism, did not change any data or measurements at that time, but it did make people broaden their view of other planets, and subsequently this view led to new discoveries that otherwise would not have been made. I hope that in the same way the realisation that there is something beyond our chronocentrism will allow for the development of new insights, which will then lead us to new experiments, theories and possibly even a new cosmos, with new opportunities for our life to grow.

VIII Acknowledgement

I have been walking around for the last 20 years with various versions of draft papers describing in some vague manner the thoughts expressed in this paper. I have also given several presentations, but again and again I have hesitated to publish them as I felt that the presentation of the ideas was not sufficiently sound and could not be

readily understood. In particular, understanding the notion of 'time-speed' is difficult. The present paper was written after many hours of discussion of my ideas with a dear and critical friend, to whom I would like to express my gratitude[6].

[6] Frans ter Horst, private communication