The Emergence of Consciousness from Chaos

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Abstract: The idea of consciousness emerging from chaos is not a new idea. In fact, it is one of the oldest ideas of philosophy. What makes it an important idea to herald here in the context of a newly proposed time-equation for space incorporating the Golden Ratio is how the idea of consciousness as a time-equation is associated to "chaos theory". This third paper shall briefly discuss the Schrodinger equation for light, and then present an improved equation as the time-equation Schrodinger analogue. From there, in using the time-equation, the idea that the emergence of light from the atomic level shall be demonstrated to represent a well-known equation for chaos theory, the "logistic map equation". From there we shall present the idea of consciousness as a need for this system of time and space to resolve the disparity between light and particle location, together with the need to reach an exact value for "π" (as was the basis for the axioms of time upon space in the development of the atom in the second paper). A list of features of this proposal of consciousness as an emergent entity will be presented that describe well-known features of conscious expression, as it must in order to satisfy a proposal for the idea of consciousness being such a utility in this golden ratio time-equation model.

1.   Introduction

A key idea proposed in the first paper [1] was the determination of the concept of "time-now" t_N to represent the value of "1"; "1" as a line is "1", "1" squared as surface area is "1", "1" cubed as volume (of a square) is still "1", and so labelling "time-now" t_N as "1" holds "now" as that absolute reference of axial definition around which the other facets of time, namely "time-before" t_B and "time-after" t_A can be modelled, regardless of the multiplicity of dimensionality being applied to it.

Another key proposal, as in the second paper [2], was the idea of light as the time-equation needing to trace "π" as a wave-function, as light, as package of energy. Associated to this was the assumption that the atom alone is not enough to find an exact value for π nor properly resolve independently the disparity between light and a particle's exact location, thus the need for separate atomic references that would resolve these disparities with each other via electron behaviour in the electron shells (namely a release of energy as light, a package of light, that would be released from the atom for every electron shell step-down by the electron).

In criticism of these proposals, what was not presented in the second paper [2] was an equation for the energy of a package of light released from an electron shell. We also did not describe how light would operate *outside* the confines of the constructed atom other than presenting the feature that it would suggest space is expanding at an accelerating rate. To explain this, we will rewind the contemporary Schrodinger wave function equation [3].

Let us begin therefore with a review of the wave-function presented in the second paper [2], and compare this to the Schrodinger equation [3]. Then we shall present an equation for a "photon" of energy, following which a formula for time as this package of light in this new extra-atomic context will be forwarded. From there we will explain a new process of time and space that would qualify and satisfy the "directive" of time in space in that extra-atomic context, reasoning at this point that a concept of "consciousness" [4] would emerge, presenting a list of features the "directive" of time in space would enlist to maintain its golden ratio principle **as** a model of consciousness.

2.   <u>Golden Ratio Time-Wave Mechanics in Space</u>

The construction of the time-equation as light was the core discussion of the second paper [2]. There, we modelled axes of time onto axes of space, delivering a wave-function with electric and magnetic components, while explaining the dimension of the fine structure constant, and the disparity between light and its association to the subatomic particles and those dimensions leading to the idea of "uncertainty" in locating the position of an elementary particle using light ([2]; p11 fig.13).

By comparison, the Schrodinger equation $i\hbar\frac{\partial}{\partial t}\Psi(r,t) = \hat{H}\Psi(r,t)$ [3] provides a description of a wave relevant to the idea of quantum states (packages of energy) [5] and wave-particle uncertainty [6] using the measurement device of momentum. Yet the way the time-equation for light was constructed, namely as a sinusoidal wave per each axis in a 3-d 0-scalar spatial grid, the exact nature of the uncertainty regarding the disparity between the actual measured value for light and the particles separated by the scale of the fine structure constant (like forceps), together with why light is quantised, was uncovered, such as a process of *deriving* the fine structure constant together with deriving the speed of light from the charge of an electron, in avoiding using the concept of momentum, in avoiding the analysis of particles as mass, yet using a time-equation instead.

This process of time-equation analysis became a "directive" of time to trace a circle perfectly as π, *as* the wave-function. Yet on the atomic and subatomic level the exact value for π hadn't been reached ([2]; p8 eq.3, p10 eq.6), errors of ~0.021% and ~0.0013% (10 quotient factored in) respectively, hence as it was proposed there became the need for the atom to generate electron shells as a way of calibrating closer to the value of π. How? By atomic building and interaction with other atoms (as we shall soon explain).

With that process in play we went ahead in the initial paper [1] to generate the energy shell modelling to further understand the spatial characteristics of the t_A time front ([1]; p13-15). In the second paper [2], we detailed what would be the existence of an elementary particle substructure to the subatomic particles ([2]; p16 fig.16), and

then suggested that matter would "emerge" from that level, explaining the equation $e_p = m_p c^2$ upon that emergent basis ([2]; p16, eq.15). What we didn't take a step toward was the energy value of a package of light, a photon [7].

3. <u>Establishing the correct time and space granularity for a basic scale of extra-atomic energy</u>

The equation for the energy of a package of light on the extra-atomic level would follow the same rules as presented in the second paper [2]; note equation $e_p = m_p c^2$ ([2]; p16, eq.15). Once again, why is the total "energy" of mass beyond the elementary 30c level ([2]; p16 fig.16), and more specifically, proportional to mass and c^2? The answer is that all there would be "beyond" the 30c manifold would be a "c" factor that can only be "squared" as a "future" event beyond the primary 30c "time-before" and "time-now" events ([2]; p16 fig.16).

For the idea of light beyond the atom (beyond the subatomic particles, and beyond the electron shells), it is assumed that electrons in going between electron shells would release light as packaged quanta. Research confirms this would represent a photon (massless, no electric charge, yet behaving as though having mass [7]. Here, the proposal is that this photon would obey the dual-state (golden ratio) light cone modelling presented in the initial paper ([1]; p4-6). The functionality though here is extra-atomic and obeys the protocol of $e_p = m_p c^2$ ([2]; p16, eq.15).

So, in the same manner of that equation, we could say that the total energy released by an electron jump would be as though it exists as a feature of the charge of the electron, its signature of energy, differentiated by time in the context of the scale of electron migration.

Essentially, light from this new extra-atomic level would become malleable in its characteristics of wavelength and thus frequency, still though upholding the required speed of light so as not to undermine the fundamental basis of the time-equation. "Charge" as a concept of the time-equation (and thus charge times frequency) would be the electrical charge of the electron for each wavelength jump it makes in the electron shell at the speed of light, thus the charge per unit of time, as charge "differentiated by time", namely $e_c \cdot f$, where e_c is the electron charge and f the frequency of wave effected by jumping between an electron shell. Such would be the energy owned by the electron in electron shells undertaking electron shell jumps.

Now, if we apply $e_p = m_p c^2$ ([2]; p16, eq.15), the mass of a photon would represent the energy of the photon E, as the photon has 0 mass in travelling at the speed of light. Here though also we are considering light fractioned by 19.8 as a quantum of light, differentiated by 19.8, $\frac{c}{19.8}$, as the equation for light was generated thus ([2]; p16, eq.15), with such differentiation. Thus, the following equation would suit:

$$e_c \cdot f = E \cdot \left(\frac{c}{19.8}\right)^2 \tag{1}$$

Now, if we change the equation to look like $E = e_c \left(\frac{19.8}{c}\right)^2 f$, then $e_c \left(\frac{19.8}{c}\right)^2$ is by our knowledge of the Planck equation $E = hf$ [8] the value for h.

Is the value the same?

The value $e_c \left(\frac{19.8}{c}\right)^2$ is $7.0163 \cdot 10^{-34} \, Cm^{-2}s^2$. This value is slightly higher than the value for h ($6.626 \cdot 10^{-34} \, Js$) as we didn't factor in the notion that 19.8 is a _held_ level within the atom, and when the "19.8" (21.8) standard is lifted from fine structure atomic axiom *forceps* between the electron and the proton, then the value should drop 0.5 points on the fine structure gradient to 19.3, the same value the $\frac{-1}{\varphi}$ was initially "out" in the initial modelling ([2]; p11, fig15).

We now get a perfect result as $e_c(\frac{19.3}{c})^2 = 6.626 \cdot 10^{-34} \, Cm^{-2}s^2$ albeit using a different set of dimensional variables.

Once again, why do electrons jump between shells? It is proposed to be the atom's way to find the perfection of π while trying to resolve the error of light and particle location (and in the case with the electron shells, the electron). In fact, the idea of light to trace "π" is what would define a "quantum", a wavelength of light.

4.   Extra-atomic "time" as chaos

This new platform beyond the atom deserves more attention, a platform we have termed "extra-atomic".

We have derived a value for the energy of a photon as it jumps through energy shells, releasing energy with each energy shell descent, highlighting the energy provided care of the charge of the electron per wavelength for each speed factor (and thus per time), or simply the charge of the electron factored with its frequency, which resulted here in equation 1, such from considering $e_p = m_p c^2$ ([2]; p16, eq.15). Now we must consider a new "extra-atomic" equation for time that recognises this primary $t_A, (t_B^2)$, realm.

The principle equation for time was presented as $\frac{t_A + t_B}{t_A} = \frac{t_A}{t_B}$ ([1]; p4, eq.6), or more simply $t_B + 1 = t_A$. Then, when applied to space it became $(t_B \cdot -2\sqrt{3}) + 1 = \pi$ ([2]; p7, eq.2). Now we must consider a new process for time beyond the atom; we must also consider that time would still, beyond the atom, seek a way of upholding its need to trace a perfect circle, to put multiple atomic references together in an ultimate context of time seeking to trace a circle. Simply, the atomic context can't be undermined, but developed upon. How indeed can such be done?

Ultimately t_A as per eq.7 of the first paper ([1]; p4, eq7), would need to be as $t_B^2 = \varphi \cdot -\frac{1}{\varphi} = -1$. Doing this is bringing equality for time for both results of the golden ratio, which is the problem it is trying to resolve. This gives t_B the value of "i", and thus time-after t_A becoming -1 (i^2). Thus, the equation for time becomes $t_B + 1 = -1$.

This can be expanded to $t_B + 1 = t_B - t_A$, if indeed $t_B - t_A = -1$.

Thus, we get the following: $t_B + 1 = t_B(1 - t_B)$. Now let's add in a spatial point "x" that represents this new extra-atomic condition for time for the x-axis in 0-scalar space:

$$x_{(t_B+1)} = x_{t_B}(1 - x_{t_B}) \tag{2}$$

It is not as simple as this though; it's an ideal, although the reality would hold nonetheless that time is still seeking to trace a perfect circle while still needing to uphold its basic elementary particle dual golden ratio result wave-function processes. Thus, we must add a new constant k; thus repairing eq. 2 we now have:

$$x_{(t_B+1)} = k \cdot x_{t_B}(1 - x_{t_B}) \tag{3}$$

This constant k would represent a feature that highlights a *sensitivity* to the underlying wave-function atomic processes at play, as what we can term "*initial conditions*". This equation would represent how any extra-atomic condition for "x" would evolve in time, would propagate through time, having an underlying structure in obeying the golden ratio time-equation. This is not the first time we have seen this equation, as it represents the "logistic map equation" [9], used in chaos theory [10], defining the idea of chaos with an underlying sensitivity to

initial conditions [11], promoting fractal lattices [12], an equation that has been used to successfully study sentient population growth [10].

One key feature of the underlying order for our modelling of time and space is for time to trace a circle, and for the disparity between light and the position of a particle to be resolved. We can present though that the extra-atomic level would be chaotic and yet sensitive to the underlying initial conditions of the atom, and that the value "k" can be adjusted to accommodate for the proposed directive of time in space, and one way it can do this is through a fractal Fibonacci sequence [13] process of spatial modelling, given that the Fibonacci sequence is a golden ratio algorithm [14].

5.   The directive of "time" in chaos and the emergence of consciousness

The need for this proposed time-equation system with space to define π perfectly and eliminate the error between light and particle location would be the "directive" in this chaotic extra-atomic manifold. This would happen through the assembly of all these chaotic yet (golden ratio) fractal conglomerations which would follow what we know as a Fibonacci sequence of layered building, a sequence that adheres to the golden ratio, and in this case a way to build structures upon sub-structure dimensions [13], a most practical form of spatial modelling without corrupting underlying sub-structure "initial conditions" of atoms all undertaking their force-associations as per gravitational and electromagnetic interaction ([1]; p8-10).

The overall structure of reality logically would play out as vast conglomerations undergoing time-equation (circular) formations as 3-d spherical structures in a context of (in all appearance) a type of chaos with prescribed initial conditions, noting also that the set time-equation feature within the atom required that light have a certain "uncertainty" to it owing to how the time-equation wave-function develops, implementing the need to step from a 19.8-manifold to a 21.8-manifold (owing to the quantised features of that wavefunction). Light presumably thus would be still vulnerable to that same set of conditional uncertainties that the atom was able to deal with as per its construction. How though can light behave extra-atomically to honour these underlying conditions of π reconciliation on the atomic scale?

The only thing we can consider is that we must invite a new concept/process that can address this error and the fallibility of the time-equation as an initial condition for chaos, beyond the simple idea of the chaos at play, that tries to rectify the observed position of a body (particle or groups of particles) with their actual location. The proposal here is that such a "thing", such an extra-atomic manifestation, is consciousness [15], a merging of the immediacy of 0-scalar space as quantum entanglement, as also fractal mass and photon interaction along a Fibonacci sequence [13] gradient, with the need to bring synthesis to what is observed as what is exactly found to be observed where it should be, together with being the very device itself guiding the design of the time-equation and the capability of temporal consciousness thereof ([1]: p2-4).

The proposal here is that consciousness would represent that feature of time and space extra-atomically that aims to keep everything together in a perfect circle, as the concept of the time-equation prescribes for the wave-function, without corrupting the atomic and subatomic protocols of time's placement upon space as the golden ratio. Simply, consciousness would be a bringing together of a certain set of conditions, if not a primary concept itself. As a "bringing together" concept, it would represent vast array of different references of spatial context, working as one, along the directive for time to achieve π and have the error of light and the observation of particles relevant to light rectified. Moreover, consciousness would be that feature of time and space that sets the value of "k" in the logistic map equation (eq. 3) towards fulfilling the given protocols of the time-equation.

To resolve these issues, let us detail therefore this hypothetical manifold and see if it bears all the ingredients of what we could consider as consciousness:

(i) Ultimately, when the system reaches the state of having collectively defined π and rectified the disparity between light and particles, it would trace a perfect circle in time, let's say as a "universal time-cycle" (UTC).

(ii) This process would logically involve light and particle matter, both as one in the context of consciousness, which would need to be traced in the one UTC.

(iii) Logically to achieve this, one UTC would be used with an identical UTC, creating the idea of an ever-repeating UTC; the error of particle location of one UTC would calibrate exactly to the location of the next UTC, and vice-versa, and thus as an identical and thus repeating UTC.

(iv) To achieve this, the UTCs would need to accommodate for a common singular location of matter within each cycle; potentially therefore the edge of the universe would represent the break-down of matter, within which would be the bulk of space and mass undergoing a process of (only logically) temporal spatial rotation and precession [16] of mass to accommodate for (iii).

(v) The size of the universe thus would be calibrated accordingly harbouring the required rotation and precession of matter for this UTC.

(vi) Part of this process in the overall consciousness manifold would require this UTC to link with its constituent parts, parts as a resonance within the UTC that would alleviate the disparity between what is observed and what is located within itself.

(vii) Ultimately the idea of chaos would in all appearance be overarched by such a UTC order.

(viii) Associated to the UTC, space would harbour conscious sub-structures (networks leading to the ultimate level) as "conscious-references".

(ix) Consciousness for the system would exist as a fundamental process for any reference in the UTC with the "ideal" aim to uphold the UTC process, as a process of exercising observation and calculation of structures in diminishing the atomic-based disparity between what is observed and where mass is located.

(x) In that system of consciousness would therefore exist the idea of "knowledge" [17], as a recognition of what is observed according to its correct placement; as $t_A = t_B^2$ the idea of "memory" t_B would represent a dual complex axis as a surface area of recorded knowledge for conscious references and mass references.

(xi) This knowledge would represent a process of the system's need to correct "errors" of observation and "reason" (reason being knowledge with the directive understood and in use), and to have this clearly documented in the form of symbols conveying such knowledge, symbols relevant to the conscious level of the time wheel of eternity and understood to conscious references within that UTC.

(xii) These underlying references would though in not being the ultimate structure be considered as inherently incomplete, flawed.

(xiii) Consciousness would be more greatly concentrated in complex emergent systems (from chaos), less concentrated on the level between atoms.

(xiv) Consciousness in these references would nonetheless be an event between vast-networks of atoms seeking their own π-scaling perfection while aiming to address the disparity between light and particles.

(xv) Quantum entanglement between atoms would be in play between free particles or atoms in a general context of universal 0-scalar space, logically creating the differentiation in the context of consciousness of subject and object [18] for conscious-references.

(xvi) This incomplete state, as a sub-structure state within the UTC, in the context of a UTC universal consciousness, would manifest as "choice", an inherent vulnerability and uncertainty that needs correcting through deliberation of what is observed and where it is observed.

(xvii)   Given the quantum entanglement principle in effect for 0-scalar space, ultimately two types of consciousness determination would emerge in each conscious-reference network in the one system with the goal of working together to reach the ultimate level of consciousness, two types through all spectrums of chaotic-fractal structures.

(xviii)   These two types could be considered as two features of consciousness, one a positive value, the other the negative inverse value of consciousness (two results for the golden ratio in quantum entanglement).

(xix)   Each reference would be subject to this inherent dual process whether it is enacted as choice, or conscious entanglement (manifesting as a type of role-play), or any other system of consciousness deliberation using the idea of entanglement according to the golden ratio equation.

(xx)   The closer to the ultimate (pure directive), the less choice, the further away from the ultimate (chaos), the more choice (ultimately becoming random decision making).

(xxi)   The ultimate (UTC) level would be the logical hallmark of what must be as a standard set for the system, looking after the system, being the establishment of consciousness "power", the bottom destructive, negligent of what could only be the vast vicissitudes of conscious purpose and deliberation.

(xxii)   This UTC consciousness would nonetheless harbour chaos as consciousness albeit in a restrained fashion else corrupt the fundamental principal of keeping the UTC system ordered.

It does therefore seem that this hypothetical manifold bears some resemblance to our ideas of consciousness [15]. Despite this hypothetical UTC proposal, perhaps we can do more with this UTC manifold, the actual t_A process in play, as there does appear to be an element of determinism [19] in the process of consciousness on this "time-after" t_A manifold.

6.   <u>Consciousness as an extra-atomic "after" event</u>

The feature to note is that consciousness would operate in this t_A realm, *the* manifold for the process of the emergence of consciousness extra-atomically ([1]; p4 eq.7, p.6 fig.9.3). As such, consciousness would represent the "time-after" t_A paradigm. Thus, let us suggest this as a "time-ahead", or rather, "life-ahead" manifold for time and space, as consciousness, given that in using the term "consciousness" we are implying "life". The following points could be considered:

(xxiii)   The "life-ahead" would exist as an ultimate basis in the t_A realm, a type of "super"-consciousness.

(xxiv)   All the facets of consciousness from this "life-ahead" level would resonate through the system to a "sub"-conscious level, and a "time-before" level of "knowledge recording" (memory).

(xxv)   The t_A manifold would thus resonate the idea of determinism in this grand system of consciousness, a "set option" we can choose for or against from a sub-reference (a choice between order or chaos).

(xxvi)   Consciousness primarily would operate from the "order" level, and thus less as an "ability" in matter (sub-conscious), more where the ability has found perfection (super-conscious).

(xxvii)   The atomic primordial level would thus logically give in to an ultimate non-matter energy-based t_A level.

(xxviii)   The UTC "life-ahead" consciousness as a directive would resonate through the system as a directive which would take the form in each reference as an intuitive [20] drive to uphold the system directive.

In terms of the spatial size of the UTC, that would be relevant to the length of time of a UTC and the type of rotation and precession of all the major celestial bodies in that universal system. As for the length of time of a UTC, the thinking is that with all things considered equal, we as an intelligent conscious species could logically be

considered to be asleep for half a UTC, and awake the other half. So, given we can plug in our usefulness here, and that we have roughly 5000 years of recorded history accounted for (dating back roughly to 3000BC or so with the emergence of the bronze age and associated discovery of the wheel [21]), it wouldn't be unreasonable to suggest the time for one UTC would be double 5,000 or so years and double any extra time we can manage to keep ourselves awake as a species (current estimates suggest 1000 years into the future [22]), and thus ~12,000 years, of course a conscious assessment, an assessment based on the human conscious temporal experience in a hypothetical UTC, a concept to be further discussed in a subsequent paper.

7.   Conclusion

The findings here in promotion of the idea of consciousness being an emergent feature of chaos are interesting, for "determinism" (life-ahead) appears in-play, such as a process of how a time and space system would "use" the idea of consciousness to satisfy a prime directive of reducing the uncertainty between light and matter together with the need of time to trace π. Although what resulted appears similar to how we have regarded not just consciousness but the idea of an absolute consciousness, the theoretic path ahead is still quite extensive. Here though the key finding has been a value for the energy of a photon, together with an equation for time on the extra-atomic level that in all structure represents what we already know to be the "logical map equation", a key equation used in the investigation of chaotic systems. From that equation, we suggested that upon the extra-atomic manifold would need to emerge the idea of consciousness as a process of light/observation finding parity with the calculation of a particle regarding its location, resulting in many ideas regarding consciousness we may find familiar. More of this paper shall be expanded upon as with the two previous papers [1][2] in subsequent works.

Conflicts of Interest

The author declares no conflicts of interest; this has been an entirely self-funded independent project.

References

1.   Jarvis S. H. (2017), Gravity's Emergence from Electrodynamics, http://vixra.org/abs/1704.0169, www.gravielectric.com.

2.   Jarvis S. H. (2017), Golden Ratio Axioms of Time and Space, http://vixra.org/abs/1706.0488, www.gravielectric.com.

3.   Schrödinger, E. (1926). "An Undulatory Theory of the Mechanics of Atoms and Molecules" (PDF). Physical Review. 28 (6): 1049–1070. Bibcode:1926PhRv...28.1049S. doi:10.1103/PhysRev.28.1049

4.   Robert van Gulick (2004). "Consciousness". Stanford Encyclopedia of Philosophy

5.   Klein, Martin J. (1961). "Max Planck and the beginnings of the quantum theory". Archive for History of Exact Sciences. 1 (5): 459. doi:10.1007/BF00327765

6.   Heisenberg, W. (1927), "Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik", Zeitschrift für Physik (in German), 43 (3–4): 172–198.

7.   Kragh, Helge (1 January 2014). "Photon: New light on an old name" (PDF-1.5). arXiv:1401.0293

8.   http://physics.nist.gov/cgi-bin/cuu/Value?plkmc2gev

9.   Boeing, G. (2016). "Visual Analysis of Nonlinear Dynamical Systems: Chaos, Fractals, Self-Similarity and the Limits of Prediction". Systems. 4 (4): 37. doi:10.3390/systems4040037. Retrieved 2017-07-04.

10.   May, Robert M. 1976. "Simple mathematical models with very complicated dynamics." Nature 261(5560):459-467.

11.   Baumol, William J., Economic Dynamics, Macmillan Co., 3rd edition, 1970, p160

12. Mandelbrot, B. (1982). The Fractal Geometry of Nature. New York: Macmillan. ISBN 0716711869.

13. Singh, Parmanand (1985), "The So-called Fibonacci numbers in ancient and medieval India", Historia Mathematica, 12 (3): 229–44, doi:10.1016/0315-0860(85)90021-7

14. Livio, Mario (2002). The Golden Ratio: The Story of Phi, The World's Most Astonishing Number. New York: Broadway Books. ISBN 0-7679-0815-5.

15. John Searle (2005). "Consciousness". In Honderich T. The Oxford companion to philosophy. Oxford University Press. ISBN 978-0-19-926479-7.

16. Schaub, Hanspeter (2003), Analytical Mechanics of Space Systems, AIAA, pp. 149–150, ISBN 9781600860270, retrieved 4 July 2014

17. knowledge: definition of knowledge in Oxford dictionary (American English) (US)". oxforddictionaries.com. Archived from the original on 2017-07-03.

18. Descartes, René. "LIII". The Principles of Philosophy. Retrieved 3 July 2017.

19. Hoefer, Carl (Apr 1, 2008). "Causal Determinism". In Edward N. Zalta, ed. The Stanford Encyclopedia of Philosophy (Winter 2009 edition).

20. Intuition and consciousness – Rosenblatt AD, Thickstun JT. Psychoanal Q. 1994 Oct;63(4):696-714.

21. Anthony, David A. (2007). The horse, the wheel, and language: how Bronze-Age riders from the Eurasian steppes shaped the modern world. Princeton, N.J: Princeton University Press. p. 67. ISBN 0-691-05887-3.

22. http://www.sciencealert.com/humanity-only-has-around-1-000-years-left-on-earth-stephen-hawking-predicts

23. Swain, Tony (1993). Place for Strangers: Towards a History of Australian Aboriginal Being. Cambridge University Press. ISBN 978-0-521-44691-4.

24. https://www.merriam-webster.com/dictionary/god