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Research Article

Artificial Self-Awareness Over Time

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Self-awareness results from consciousness of existence in time and space. Thought and consciousness are distinguishing factors between humans and machines having artificial intelligence. No algorithm has been offered for artificial self-awareness based on thinking. Previous studies have not studied the relationship between consciousness, thinking, and time. This study examined the relationship between self-awareness, thinking, memories, and speech over time. A deep logical connection exists between consciousness, thinking, and time. Based on these research findings, an algorithm can be designed for artificial consciousness and self-awareness.

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1. Introduction

Self-awareness, which is the result of knowing consciousness, is one of the matters that neurologists have considered for many years. Some animals have levels of self-awareness [1][2][3]. In the MSR Test designed by “Gordon Gallup Jr.,” a deep relationship was shown between consciousness, self-awareness, and related memories. Mental damage and memory can affect the quality of self-awareness [4][5]. The origin of human consciousness is from his awareness of location over time, and recalling the memories can be related to consciousness levels. Remembering memories has a direct relationship with consciousness. Activating memories and integrating information in the brain are directly related to self-awareness [6][7]. The relationship of self-awareness and memory is fully known in Alzheimer's disease [8][9][10]. The perception of time by the brain is a very complex issue. The brain does not store time in memory and sometimes saves a lengthy memory in separate and short events [11]. The human brain saves concepts instead of general information. Consequently, the remembrance of memories has a deep conceptual relationship with new events [12]. A man's memory has a deep relationship with speech and language[13][14]. The integration of information in the brain makes access to the related information faster[15][16].

Predictive coding of auditory information is a natural process in the human brain [17]. Many brain activities have been simulated in modern neural networks. The simulation of the relationship between memory and feelings, and also sensory neural networks, expresses the possibility of designing artificial consciousness[18][19].

In this study, a different pattern was designed based on the six-dimensional space-time theory [20][21], and the brain function as well as data transfer based on brain entanglement [22].

2. Time

Dimension 'z' is imaginary from the perspective of two-dimensional creatures on the surface of a ball that is expanding, and they experience dimension 'z' in the direction of the "time" dimension. Each motion on the surface of a two-dimensional sphere is evaluated in proportion to the 'z' axis.

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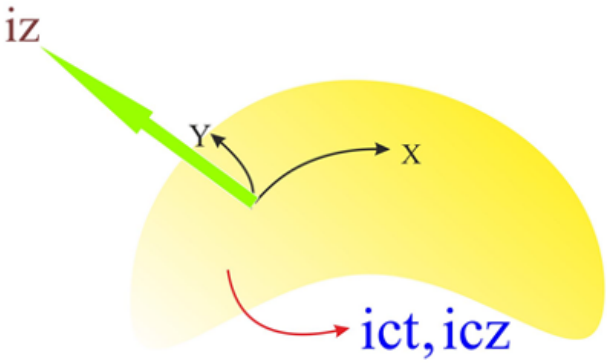

Figure 1. Dimension 'z' is imaginary for two-dimensional creatures on the surface of the sphere.

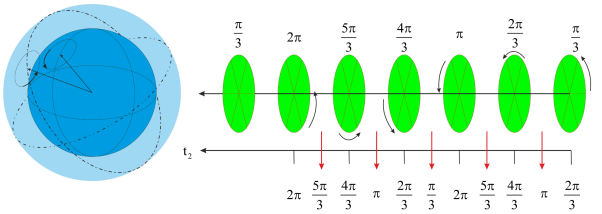

Figure 2. The wave function has been built of repetitive states in space–time, and the brain can predict other states of the wave function for an event.

In fact, the human brain investigates environmental changes, and it creates comprehension and imagination of time due to its activity on the basis of related memories. Each event has a wave function in space and time; the human brain saves the changes related to each object's wave function in memory.

On the basis of the six-dimensional time-space theory [22], the wave function has been built on repetitive moods in space–time depending on the object density. (2.1) Figure 2. Thus, the brain predicts other states of an event during 'REM' sleep, and it recalls them from memory. This is due to the categorization of daily information during sleep.

$$\int_x^x \int_t^t |\Psi(x,t)|^2 dt dx = 1, \quad |\Psi\rangle = b_1 \left|\tilde{\psi}_1\right\rangle + b_2 \left|\tilde{\psi}_2\right\rangle + \cdots + b_n \left|\tilde{\psi}_n\right\rangle$$

$$|\tilde{\psi}\rangle = \alpha_1 |A_1\rangle + \alpha_2 |A_2\rangle + \alpha_3 |A_3\rangle + \alpha_4 |A_4\rangle + \alpha_5 |A_5\rangle + \alpha_6 |A_6\rangle$$

$$b_\mu = x_\mu + ti, X_\mu = (x_1, x_2, x_3, x_4, x_5, x_6) \Rightarrow b_\mu {b_\mu}^* = \left(\frac{1}{3}\right)$$

$$(2.1)$$

$$\int_0^{2\pi} |\psi(x,t)\rangle|^2 dx = 1 \rightarrow \frac{2\pi}{6} \Rightarrow \left(\frac{\pi}{3}\right), \left(\frac{2\pi}{3}\right), (\pi), \left(\frac{4\pi}{3}\right), \left(\frac{5\pi}{3}\right), (2\pi)$$

$$A_1 = \pm\left(\frac{\pi}{3}\right), A_2 = \pm\left(\frac{2\pi}{3}\right), A_3 = \pm(\pi), A_4 = \pm\left(\frac{4\pi}{3}\right), A_5 = \pm\left(\frac{5\pi}{3}\right), A_6 = \pm(2\pi),$$

$$\iota = 1, 2, 3, 4, 5, 6$$

The changes related to the wave function of each event are saved and integrated into the short-term memory in the form of a compressed pulse. During classification, similar information is recalled from long-term memory with regard to the type and place of pulse saving. Most of the time, the brain decides to delete similar information, such as the machine's horn's voice, etc., but at special times, information is saved. Information saving depends on a person's thought. For example, when you are thinking deeply and the voice of a crow attracts your attention, then the brain saves that memory; whereas, if it doesn't attract your attention, then you don't have any memory of the crow's voice that day.

The brain can predict future states of the wave function for several related events. Figure 3. Sometimes, prediction of the future is observed with imaginary and non-significant images in sleep. On the basis of Freud's Dream Interpretation [23], sleep interpretation varies for every individual. For example, chocolate is 'bad' in one's culture, and its observation in sleep can express the occurrence of an unpleasant event in the future. As a result of recalling similar information from memory, the brain simulates images of future events.

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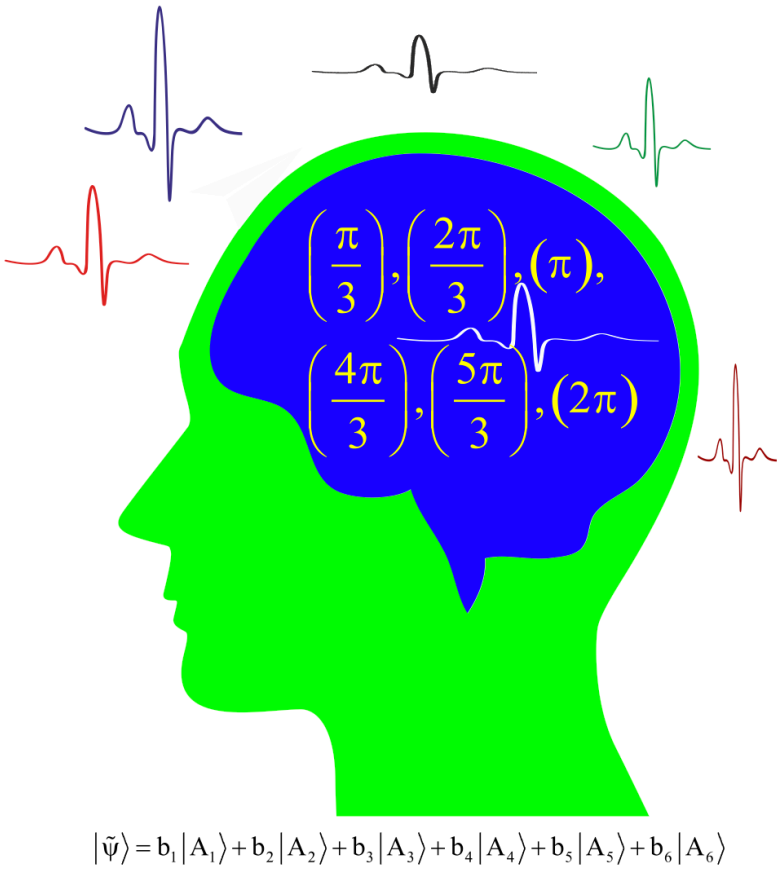

Figure 3. In REM sleep, the brain can predict other states of one wave function for an event due to the comparison of daily information and similar information in memory.

3. Memory

Activity in the brain is based on related memories. When it hears a word like "sphere," it recalls the whole objects related to the sphere from memory, as shown in Figure 4. Or when it hears a person's name, it recalls the whole individual with that name from memory. Then, if it hears the person's family name as well, and if the person is known for it, the whole set of characteristics is recalled for that person.

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Figure 4. The brain recalls the whole information related to one word from memory.

Details are not stored in memory. This issue indicates that information is stored in memory in a compressed form.

4. Methods

For each object with all of its details, only a compressed pulse is saved in the brain, and while remembering, we don't recall many details of it.

On the basis of compressing information during Spike current [24], the saved information holds the main details, and a special part encodes each detail. The section related to its volume has separate memories for the types of volume. Each part is compressed into a pulse after recognition; while recalling by the memory, the pulse is dispatched to every section. Each section recalls similar pulse memory separately. For example, after hearing the word "spherical," you simultaneously recall spherical volume, the tenderness of a spherical object, and the whole spherical object from memory. In this method, there is only one pulse against each object, and a particular network of IPSP inhibitory neurons decodes this pulse.

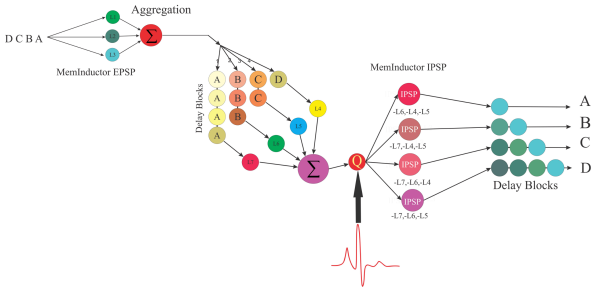

Figure 5. By deleting time and compressing information into compressed pulses, data are saved in memory.

Animals in most species communicate with their parents in the same way when they are born. A compressed sound pulse that is recognized and decoded only by the same species.

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Figure 6. Bird brains recognize and decode the compressed vocal pulses special for their species.

5. Compressing speech in humans

With regard to the deep relationship of speech with thoughts in the brain, the speech numerical method was used for processing information.

Speech is made of various syllables. Syllables are made of consonants and vowels. The human infant learns consonants and vowels based on the difficulty of pronunciation and learns simpler syllables earlier.

On the basis of the fractal structure dependent on the golden constant in the neural network, letters are encoded with a Fibonacci sequence.

a u i h y ë	1	ا او ای ه ی
æ ɛ Ɑ	2	ـَ ـِ ـُ
b , p , m	3	ب پ م
r ,z ,l	5	ر ز ل
t, d,n,z.	8	ت د ذ ط ظ ص ض ژ
ʔ, ɣ,h,x	13	ع غ ق ح خ
d͡ʒ,s, t͡ʃ, ʃ, ʒ	21	ج چ س ش ژ
f,v, c	34	ف و ؤ

Table 1. Consonants and vowels are encoded on the basis of learning type in the brain based on the Fibonacci sequence.

The semantic relationship of synonym words is specified by the aggregation and evolution of numbers, in such a manner that the aggregation and evolution of numbers related to various words are grouped in one framework (5.1). According to the mirror work in music and art[25], as well as the symmetrical structure of the neural network in the brain and the semantic interpretation of information[26], numbers are coded and interpreted.

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$$
\begin{aligned}
&\textit{symmetric coding of numbers} \Rightarrow xy \rightarrow xy \times yx \\
&\textit{aggregation of numbers} \Rightarrow xkps \rightarrow x+k+p+s \\
&\text{In persian} \Rightarrow \textit{Kindness}, \textit{Love}, \textit{Affection}, \textit{Loyalty}, \textit{Sorrow} \\
&\textit{Love} = \text{ʔeʃːɣ} \ \textit{in speech} = \text{ɛʃɣ} \\
&\textit{Kindness} \Rightarrow 3+2+1+2+3+2+8 = 21 \Rightarrow 21 \times 12 = 252 \Rightarrow 2+5+2 = 9 \\
&\textit{Love} \Rightarrow 2+21+13 = 36 \Rightarrow 36 \times 63 = 2268 \rightarrow 2+2+6+8 = 18 \rightarrow 1+8 = 9 \\
&\textit{Affection} \Rightarrow 3+2+5 = 10 \Rightarrow 10 \times 10 = 100 \rightarrow 1 \\
&\textit{Loyalty} \Rightarrow 34+2+34+1 = 71 \Rightarrow 71 \times 17 = 1207 \rightarrow 1+2+0+7 = 10 \rightarrow 1 \\
&\textit{Sorrow} \Rightarrow 13+2+3 = 18 \Rightarrow 18 \times 81 = 1458 \rightarrow 1+4+5+8 = 18 \rightarrow 1+8 = 9
\end{aligned} \tag{5.1}
$$

Consequently, a unique meaning can be regarded for numbers, and the concentration intensity of that meaning varies in different numbers.

Semantically, the words are grouped with various concentration intensities of meanings.

Interpretation	Number
unique And The Opposite	1
Generate And The Opposite	2
Material And The Opposite	3
Hegemony, Wisdom And The Opposite	4
Happy And The Opposite	5
Time And The Opposite	6
Love,Holy And The Opposite	7
Power And The Opposite	8
METAPHYSICAL And The Opposite	9

Table 2. The meaning of each number was obtained according to the meaning of hundreds of synonymous words.

6. Discussion and results

As a result of this research, it seems that there is a deep connection between self-awareness and time. Our understanding of time is formed in the brain, and the brain operates based on related memories. Although the passage of time is not stored in the brain, the timing of memories plays an essential role in a person's consciousness of place and time. Sleep plays an important role in classifying and comparing information. Compressing and integrating information in memory is directly related to creating self-awareness.

Related memories in memory play an essential role in logic, self-awareness, and thinking.

Although the passage of time is not stored in memory, events are classified based on date and time in memory.

Consciousness of before and after during time is the zero and one logic of humans for thinking. As a result, consciousness has a deep dependence on knowing the present time, and self-awareness is the result of thinking in the context of consciousness. As a result, if we base information processing on information processing over time, we can create levels of artificial consciousness for a machine.

Basically, switching on and off in digital systems cannot create a meaningful connection between information units. However, at higher levels of information processing, artificial intelligence is able to distinguish similar patterns from each other. Artificial intelligence does not think because thinking depends on the awareness of time. Awareness is the comparison of information stored over time. But the important point is that consciousness is formed outside of time, and self-awareness has been expanded in space-time like a wave function in quantum mechanics. The reason for the existence of self-awareness is that the passage of time is not stored in the brain. Although we may sing a piece of music with recall from memory with precise timing, the entire piece of music is not completely recalled from memory, and we can think of the last melodies of the piece when we sing the beginning. Symmetry exists not only in the structure of neurons but also plays a fundamental role in information processing. As a result, in the algorithm designed for artificial neural networks, creating symmetry in information processing can be an effective step in improving the semantic comparison between information units. Thinking and sleep are both the result of comparing predictions over time. Predictive processing, based on the states of an event's wave function (compressed information from an event in a spike pulse) by a neural network, can be the basis for a neural network to start thinking and sleeping.

As a result of the discussion, the designed model is implemented from the point of view of the semantic interpretation of numbers and words for the network.

Each word is saved with a meaning in network memory. Different specifications for the meaning of each word, such as colour, volume, application, and so on, are encoded separately in the spike main current. While recalling information, a set of inhibitory IPSP neurons, which are similar to excitatory EPSP neurons of the encoder, are responsible for decoding the information.

More complex details like frequency and relationship with other senses of artificial neural networks, such as touching, can be related to the integration of information. Artificial sleep for ANN is a predictable procedure for processing and classifying information. Artificial consciousness has resulted from the general and complex process of information and facts during time, and also from the semantic relationship of information in memory with other existing

components. Therefore, consciousness is awareness concerning attendance in time and place.

Awareness and will are the two factors dependent on each other. Free will results from consciousness, and the authority to have machines with consciousness is an unavoidable affair. Designing a neural network based on the presented method in this paper can be an effective step for producing consciousness in machines with artificial intelligence. More complex patterns of words and numbers can also be effective for this method.

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References

1. ^*Lei, Y. (2023). Sociality and self-awareness in animals. Frontiers in Psychology, 13, 1065638. https://doi.org/10.3389/fpsyg.2022.1065638*
2. ^*Lage, Caio A., De Wet Wolmarans, and Daniel C. Mograbi. "An evolutionary view of self-awareness." Behavioural Processes 194 (2022): 104543. https://doi.org/10.1016/j.beproc.2021.104543*
3. ^*Birch, J., Schnell, A. K., & Clayton, N. S. (2020). Dimensions of animal consciousness. Trends in cognitive sciences, 24(10), 789-801. https://doi.org/10.1016/j.tics.2020.07.007*
4. ^*Wales, L. (2023). Conceptual framework of the recovery of consciousness following a severe traumatic brain injury in childhood. Brain Injury, 37(7), 655-661. https://doi.org/10.1080/02699052.2022.2158233*
5. ^*Thaler, A. (2023). Disturbances of primary integration, subjective awareness, and objective self-awareness. Psychoanalytic Psychology, 40(1), 14. https://doi.org/10.1037/pap0000429*
6. ^*Bird, C. M. (2020). How do we remember events?. Current Opinion in Behavioral Sciences, 32, 120-125. https://doi.org/10.1016/j.cobeha.2020.01.020*
7. ^*Zheng, J., Schjetnan, A. G., Yebra, M., Gomes, B. A., Mosher, C. P., Kalia, S. K.,.. & Rutishauser, U. (2022). Neurons detect cognitive boundaries to structure episodic memories in humans. Nature neuroscience, 25(3), 358-368. https://doi.org/10.1038/s41593-022-01020-w*
8. ^*Clare, L. (2003). Managing threats to self: awareness in early stage Alzheimer's disease. Social science & medicine, 57(6), 1017-1029. https://doi.org/10.1016/S0277-9536(02)00476-8*
9. ^*Zamboni, G., Drazich, E., McCulloch, E., Filippini, N., Mackay, C. E., Jenkinson, M.,.. & Wilcock, G. K. (2013). Neuroanatomy of impaired self-awareness in Alzheimer's disease and mild cognitive impairment. Cortex, 49(3), 668-678. https://doi.org/10.1016/j.cortex.2012.04.011*
10. ^*Mimmack, K. J., Gagliardi, G. P., Marshall, G. A., Vannini, P., Weiner, M. W., Toga, A. W.,.. & Alzheimer's Disease Neuroimaging Initiative. (2023). Measurement of Dimensions of self-awareness of Memory Function and Their Association With Clinical Progression in Cognitively Normal Older Adults. JAMA Network Open, 6(4), e239964-e239964. https://doi:10.1001/jamanetworkopen.2023.9964*
11. ^*Zheng, J., Schjetnan, A. G., Yebra, M., Gomes, B. A., Mosher, C. P., Kalia, S. K.,.. & Rutishauser, U. (2022). Neurons detect cognitive boundaries to structure episodic memories in humans. Nature neuroscience, 25(3), 358-368. https://doi.org/10.1038/s41593-022-01020-w*
12. ^*Hahamy, A., Dubossarsky, H., & Behrens, T. E. (2023). The human brain reactivates context-specific past information at event boundaries of naturalistic experiences. Nature neuroscience, 1-10. https://doi.org/10.1038/s41593-023-01331-6*
13. ^*Marian, V., & Kaushanskaya, M. (2007). Language context guides memory content. Psychonomic Bulletin & Review, 14, 925-933. https://doi.org/10.3758/BF03194123*
14. ^*Martinez-Lincoln, A., Fotidzis, T. S., Cutting, L. E., Price, G. R., & Barquero, L. A. (2023). Examination of common and unique brain regions for atypical reading and math: a meta-analysis. Cerebral Cortex, 33(11), 6959-6989. https://doi.org/10.1093/cercor/bhad013*
15. ^*Aboud, K. S., Nguyen, T. Q., Del Tufo, S. N., Chang, C., Zald, D. H., Key, A. P.,.. & Cutting, L. E. (2023). Rapid interactions of widespread brain networks characterize semantic cognition. Journal of Neuroscience, 43(1), 142-154. https://doi.org/10.1523/JNEUROSCI.0529-21.2022*
16. ^*Toker, D., & Sommer, F. T. (2019). Information integration in large brain networks. PLoS computational biology, 15(2), e1006807. https://doi.org/10.1371/journal.pcbi.1006807*
17. ^*Caucheteux, C., Gramfort, A., & King, J. R. (2023). Evidence of a predictive coding hierarchy in the human brain listening to speech. Nature human behaviour, 7(3), 430-441. https://doi.org/10.1038/s41562-022-01516-2*
18. ^*Wang, C., Xu, C., Sun, J., & Deng, Q. (2023). A memristor-based associative memory neural network circuit with emotion effect. Neural Computing and Applications, 1-16. https://doi.org/10.1007/s00521-023-08275-9*

19. ^*Wang, Y., Sun, J., Wang, Y., & Liu, P. (2023). Multimodal Mood Consistency and Mood Dependency Neural Network Circuit Based on Memristors. Electronics, 12(3), 521. https://doi.org/10.3390/electronics12030521*
20. ^*Mousavi, S. K. The balance In the six dimensions of space-time description of quantum mechanics phenomena and nature of time. Journal of Physics: Theories and Applications, 7(1). https://doi.org/10.20961/jphystheor-appl.v7i1.63874*
21. ^*Mousavi, S.K. The General Balance in the Six Dimensional of Space-Time. Preprints 2023, 2023081112. https://doi.org/10.20944/preprints202308.1112.v1*
22. a, b*Mousavi, S.K. Information Transfer Based on Brains Entanglement. Preprints 2023, 2023081731. https://doi.org/10.20944/preprints202308.1731.v1*
23. ^*Frieden, K. (2012). Freud's dream of interpretation. State University of New York Press.*
24. ^*Mousavi, S.K. Compression And Decoding Of Data In The Spike Current. Researchgate 2023,9. https://doi.org/10.13140/RG.2.2.14164.88969/2*
25. ^*von Albrecht, M. (1995). Some types of Mirroring in Literature and Music. International Journal of Musicology, 45-69.https://www.jstor.org/stable/24617751*
26. ^*Ocklenburg, S., & Mundorf, A. (2022). Symmetry and asymmetry in biological structures. Proceedings of the National Academy of Sciences, 119(28), e2204881119. https://doi.org/10.1017/S1062798705000700*

Declarations

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