Prolonging Human Lifespan by Consciousness Integration or Brain Integration

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Article

Prolonging Human Lifespan by Consciousness Integration or Brain Integration

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Abstract: Human longevity is an important but difficult goal due to the extreme complication of human body. If people could repeatedly transfer their consciousness from old bodies to new ones, their lifespan might be prolonged extremely. However, there are several difficulties which prevent the achievement of such a technique. In this paper, we propose an approach that can transfer human consciousness indirectly, and avoid or significantly relieve those difficulties. The strategy of our approach is to integrate the consciousnesses of two bodies (old and new) into a unique consciousness. By doing so, the consciousness is extended to the new body. After that, the consciousness shrinks and remains in the new body when the old body dies. This may also apply to integrating more than two bodies of human, or animal, or even across different species. After investigating thousands of literatures, we find quite strong evidence (related discoveries and technologies) that can support the proposed approach and its advantages. Beside prolonging human lifespan, the approach could also have other meaningful applications.

Keywords: human; lifespan; aging; consciousness; brain; integration

Introduction

Longevity is one of the most important goal in human society. A lot of efforts have been devoted since ancient times to the present [1]. So far, people have longer lifespan than that in the past. However, human's lifespan is still limited by aging and diseases [2]. As a biological system, a human's body becomes more and more vulnerable by time. Human bodies are so complicated with so many unknowns, and malfunctions may appear in so many different parts with so many different types [3,4]. Even with modern medical science and technologies, it becomes more and more difficult to keep the necessary functions of a person's body when it gets older.

From 2016 to present, we investigated thousands of literatures. During that, we inspected a large amount of combinations of various technologies. There are many approaches (combination of technologies) to the purpose of longevity [5]. Each approach works in some certain, but also has some significant obstacles. After all, it is extremely difficult to keep an aging body always in a good status. However, we gradually found some knowledge that lead us to the other strategy. Is it possible to keep a person "alive" after his/her body is dead? This strategy utilizes some solid foundation provided by nature. For many creatures such as some plants and microbes, a tiny part of an individual such as a seed can grow into a new individual [6]. This is amazing, but human beings also have a similar feature. Two tiny parts from different individuals can be combined (fertilization) and then grow into a new individual [7]. But, what if the tiny parts grow into a new part of the original individual instead of a new individual? In other words, what if the grown ones are still part of the original individual? In some traditional strategies, human consciousness is transferred to a cloned new body before the old body dies. But the strategy is still far from a feasible approach because some major difficulties are unsolved. These may be the main reasons why those techniques still exist mainly in science fictions only. First of all, the essence and features of consciousness are not understood

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enough [8]. Secondly, although many techniques in science fiction have come true, there is no technology that can directly transfer consciousness from one body to another so far, and there is no evidence that such a technology could be invented in near future either. Thirdly, even if a person's consciousness could be well understood and transferred to a new body, the latter might not be treated as the same person. Instead, it might be treated as another individual or the successor of the former [9]. In order to overcome these difficulties, we try to figure out a potential way as simple and feasible as possible based on the massive literatures.

The Proposed Approach

Here we propose an approach that may mitigate or avoid the above issues. It is inspired by certain relevant knowledge we found from thousands of literatures. We will first give an overall description of the approach in this paragraph, and then provide further details and explanation. The key idea of this approach is to integrate two (or more) bodies into one consciousness, and then the old body is substituted by the new one gradually. According to neuroscience, a human brain is comprised of multiple functional regions [10]. Now let's inspect the following seven situations:

1). In some cases, some regions of a patient's brain do not work well, or are even missing. For example, a patient of Aerzihaimo disease [11], or a patient whose brain is partly destroyed [12] or cut off [13]. The patient still has a consciousness although some functions are missing or abnormal. In such a case, the patient's consciousness is comprised of some functional regions of the brain. In a certain case, the patient's brain is compressed severely, and the large space is occupied by cerebrospinal fluid. But the patient still has normal characters and intelligence [14].

2). In some other cases, a hemisphere of a patient' brain is cut off because of disease or wound [15,16]. Such a patient is called a "half-brain" patient. Although some functions are missing or abnormal, he/she also has a consciousness. In such a case, the patient's consciousness is mainly comprised of one hemisphere.

3). In some more cases, patients undergo "split-brain" surgery [17,18]. For a normal person, two hemispheres are connected by commissural fibers. These fibers form three structures, i.e., corpus callosum, anterior commissure and posterior commissure. Corpus callosum is the largest of the three. Commissural fibers integrate functions between left and right structures of the brain, such as perception, memory, cognition and motor related functions [19]. But, for a "split-brain" patient, the major commissural fibers such as those in corpus callosum, are split. As a result, few information can be shared between the hemispheres. In such a case, the patient has only one brain, one head, one body, two arms and two legs. But the brain is comprised of two separated hemispheres. Sharing the same sensory system in total, the patient seems to have only one consciousness. However, there are some extraordinary features showing its differences from a normal consciousness. These are clearly shown in Sperry and Gazzaniga's famous experiments [20–22]. It is well known that left view-field is only perceived by right hemisphere, and right view-field is only perceived by left hemisphere [23]. Left hand is controlled by right hemisphere, and right hand is controlled by left hemisphere. For a normal person, what is seen by eyes can be shared by the two hemispheres through connections, e.g., corpus callosum [24]. But for a "split-brain" patient, if the left view-field and right view-field are separated, the two hemispheres cannot perceive what appears in the opposite view-field. In such a condition, a lot of amazing phenomenon happens. For example, the patient can draw a face if a printed word "face" is perceived only by the right hemisphere. That seems reasonable because the right hemisphere usually has the ability to recognize words and draw graphics. But when the patient is then required to speak out what he/she has seen, he/she says "nothing". The reason is that only left hemisphere usually has the ability to speak, but the printed word has not been shown to it. In another example, a patient says his dream job is "cartographer" (mouth is controlled by left hemisphere), but what his left hand writes down is "racer" (left hand is controlled by right hemisphere). This result is just like that two people are asked the same question, and the two person even have quite different interests.

There are more cases indicating that left and right hemisphere work quite independently if there are no connections between them. What's more, the left hemisphere is often confused or even

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surprised by what is output by the right hemisphere. In daily life, a patient's two hemispheres usually acquire similar information. That is because most things appear in both left and right view-fields, and any sound is heard by both two ears (and then perceived by both of the two hemispheres). However even in such a context, some "split-brain" patients may have Alien Hand Syndrome (AHS). Such a patient sometimes feels one of his/her arms is "controlled by someone else". For example, when a patient's right hand (controlled by left the hemisphere) picks something in a supermarket, the left hand (controlled by the right hemisphere) may try to prevent it. However, some recent researches have been conducted on other patients whose brains were split many years ago. The results suggest that their perception is divided but consciousness is undivided [25]. Despite the controversy, all the above researches demonstrate that multiple hemispheres can form a unique consciousness in certain conditions.

4). As for a normal person, many functional regions comprise left hemisphere and right hemisphere [26]. And then, the two hemispheres join together to form a whole brain. All the functional regions work well and cooperate mutually. In normal condition, one person obviously has only a single consciousness. But this consciousness is comprised of two parts in left and right brains respectively, and the two parts connect to each other tightly.

Consider the researches from case #1 to #4 in combination, we can summarize some phenomenon briefly as follows. A unique consciousness can be formed by only a few regions of a brain, or only the left hemisphere, or only the right-hemisphere. But a unique consciousness can also be formed by all the regions in both the hemispheres. In a sense, the latter is more complicated ("larger") than the former ones although they are all unique.

5). In some cases of conjoined twins, two heads share the same body [27]. There is a brain in each head. Since the two brains are separated from each other, they are relatively independent. What's more, they get sensations from different eyes, ears, noses and mouths, respectively. In such a case, therefore, it is reasonable to treat the two heads as two independent consciousnesses.

6). In another case, however, a pair of conjoined twins were born with their brains joined together [27]. They have a single continuous cranium including four cerebral hemispheres. This case even makes scientists question the concept of "self" [28]. Having two brains, two heads, two bodies, four arms and four legs, they are treated as two individuals. Therefore, it is logical to say that each of them has a consciousness. However, there is a special structure that connects the thalamus of one brain to another. It is just like a "bridge" between the two brains, and shuttles brain activity back and forth. The thalamus is a key junction in sensory pathways from the sensory receptors to the sensory cortex, except for the sense of smell [29]. Since the thalamus is like a "hub" for sensory information, the twins can "tune in" to the experience of each other. As a result, there are some amazing features showing their differences from normal consciousnesses. Firstly, they are able to feel what each other perceives. For example, if an object is shown only to one of them, the other is able to know what the former sees [30]. If one of them eats something, the other also feel the taste. Furthermore, if one of them is blamed, the other also feel the pain. Secondly, it is even more extraordinary that them can communicate just "in mind" without any verbal or body language [31]. Thirdly, their bodies are not totally independent. One of them can control three legs, and the other can control three arms. With the help of this feature, the twins are easier to act harmoniously [32]. All these amazing features indicate that their consciousnesses has tighter links than those between normal people (referred to as "collective consciousness" [33]). In other words, that should be treated as something between "two totally independent consciousness" and "one unique consciousness".

In this case, these twins' consciousnesses are linked more tightly than those twins' separated brains (in situation #5). Even if compared to situation #3, they are also linked more tightly than the two split hemispheres of one patient. After all, the twin's brains are joined together, while the two hemispheres in situation #3 are separated from each other. The patient in situation #3 seems more like having only one consciousness. But that is largely because the two hemispheres share almost the same sensory systems (sight, hearing, smell, taste, touch). This can be seen more clearly by a thought experiment. If the two hemispheres (in situation #3) appear in the twins' heads (in situation #6), respectively. In other words, the left hemisphere replaces one of the twins' brain (which including

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two hemispheres), and the right hemisphere replaces another. But the hemispheres are still separated from each other. In such a case, the twins will not know what each other perceives and thinks. This thought experiment indicates that a pair of joined brains is more like a unique consciousness when compared to two separated hemispheres.

7). Furtherly, we can perform another thought experiment. Assume that the brains of the twins are joined more tightly in situation #6. More specifically, any two of the four hemispheres are joined directly or indirectly, and the connection is as strong as that between a normal person's two hemispheres. Each of the hemispheres owns a set of sensory systems, respectively. But information perceived by any one is shared immediately by all the four hemispheres. Furthermore, thoughts generated by any one of the four hemispheres are also shared with the others immediately. In such a case, it would be reasonable to treat the four hemispheres as a larger brain. Since two tightly-joined hemispheres are treated to share a same consciousness (normal person), it would be also reasonable that four tightly-joined ones share a same consciousness. Of course, the latter may be more complicated than the former.

All the above situations indicate how multiple consciousnesses are integrated into a more complicated consciousness. That is achieved mainly by neuro-connection between different parts. Even without entire understanding of consciousness, that provides a basis for our approach. Now let's perform one more thought experiment based on situation #7.

Assume that the conjoined twins are separated from each other by surgery. As a result, their brains are also separated. But a certain technique is then used to keep full connection between their brains. The technique might use wired or wireless connections. In other words, their four hemispheres still work as a whole and are integrated even more tightly than their natural connection. Therefore, it is reasonable to treat the twins' consciousness as a whole. Based on this, we proposed the following approach for prolonging human lifespan:

In this approach, a person's body is connected to an extend-body. More specifically, the person's brain is connected to the extend-body's brain. As a result, the consciousnesses of the two bodies are integrated into a more complicated consciousness. In this paper, let's denote such a technique as "Consciousness Integration (CoInt)" or "Brain Integration (BrInt)". Or, it may also be called "Consciousness Mergence" or "Brain Mergence", or some similar names. That means integrating or merging more than one brains to form a unique consciousness. It would be more integrated than "collective consciousness" [33,34], and nearer to the unified consciousness of a normal person. The feasibility of such techniques is supported by existing literatures in some certain [31,33,35,36]. Furtherly, the connection can base on wired or wireless techniques. But wireless technique can provide more convenience for the person's daily activities. The extend-body is a clone of the person, which has exactly the same gene/DNA as the person (ethical issue will be discussed in the next section). The cloned body should be connected to the main body as earlier as possible. It might be best at the moment when or even before it leaves artificial uterus. If the cloned one has already formed independent mind and memories, it might be treated as an independent individual. In that case, it would be more questionable whether the cloned one should be integrated. After connection, the information, memories and thoughts in any of the brains will be shared with each other. As time goes by, some of those would be synchronized into the new body's brain. In this period, the four hemispheres in the two bodies work as a unique consciousness. This is like the overlap when two tapes stick together to form a longer one, and the overlapped parts are integrated into a whole. This is necessary and important because it enable the two bodies to be treated as a same individual. If without this overlap, the new body would be just the successor of the old one. After the old body dies, the remaining new body is almost the same as the former, both physically and psychologically. The only difference is that the new body is younger and healthier. Please note that the old body is not an independent individual, and it only includes part of the integrated consciousness/brain. When the old body dies, it is just like that one of a normal patient's hemispheres is damaged or removed.

Throughout the whole process, the person's consciousness always exists and is always unique. It never disappears at any time, nor are there more than one consciousness at any time. In other words, the existence of the unique consciousness is continuous throughout all the time. More strictly

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speaking, the person has one and only one consciousness at any given moment. What's changing is just the "volume" of the consciousness, i.e., the consciousness first becomes "larger" (extends to new body) and then becomes "smaller" again (when the old body dies). The change of the consciousness is shown by Figure 1. Furtherly, the consciousness could keep awake even when the old body is dying. Just like normal patients could keep awake when the damaged parts of their brains are being removed through surgery [14]. What's more, the consciousness' carrier (i.e., the collection of the integrated hemispheres) also exists and is unique at any given moment.

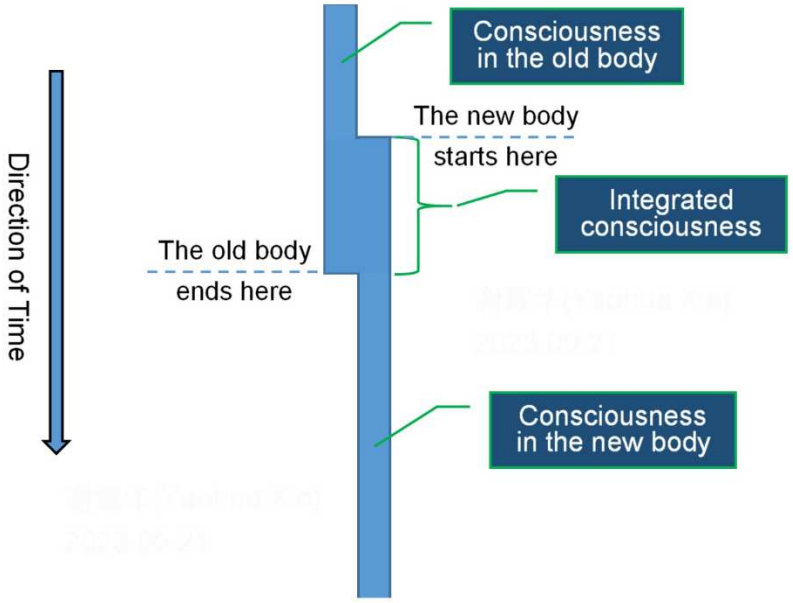

Figure 1. First, the consciousness is extended to the new body by integration. By doing so, the consciousness includes both the old and new bodies. Then it shrinks and remains only in the new body after the old body dies. At any given moment, there is one and only one unique consciousness.

The proposed approach might also feasible for more than two bodies. For example, a person's consciousness is extended to two or more cloned bodies. As a result, all the brains in all of the bodies form a unique consciousness. When one of the bodies die, the brains in the rest bodies still form a unique consciousness together.

One of the varieties of the proposed approach is to use artificial objects, e.g., artificial brains/neurons or artificial intelligence as extended-bodies. In some cases, such as using artificial neurons, the extension and shrinkage of consciousness can be progressive. For example, the people's neurons are replaced by artificial ones gradually [37]. This is a traditional strategy, somewhat similar to the renewal of "Ship of Theseus". Although it may be more flexible, there are some extra questions using artificial objects. We will discuss them in the following section.

Analysis of the Approach

In introduction, we briefly discuss the strategy of transferring consciousnesses from old bodies to new ones. Then, three major difficulties are mentioned. In our approach, these difficulties can be avoided or significantly relieved.

First of all, our approach does not require full understanding of the essence and features of consciousness. The approach is based on the "separability" and "integrability" of brains, especially the phenomenon that multiple hemispheres can be integrated to form a whole consciousness. As long as strong enough connections can be built between hemispheres, full understanding of the essence and features of consciousness is not necessary.

Secondly, our approach requires no technology for direct transferring of consciousness from one body to another. The proposed approach implies a procedure of "extend and shrink". One person's

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consciousness is first extended to a new body so as to form a more complicated consciousness. Then, the consciousness shrinks and exists only in the new body after the old body dies. With such a procedure, direct transferring of consciousness is avoided.

Thirdly, "personal identity" [38,39] would still be a key issue, even if the essence and features of consciousness were full understood and techniques were invented for direct transferring of consciousness. In a traditional strategy, one person's consciousness is directly transferred into a cloned new body. Then there are actually two consciousnesses, each of which exists in one body respectively. This actually results in two independent individuals. Although they are very similar in body and mind, they appear in different locations at the same time. Which one should be treated as that person? What's more, they are two independent consciousnesses which have independent memories, knowledge, intelligence and thoughts after transferring. No matter whether the old one dies before, when or after the new one appears, the latter is just a copy of the former. They both know they are not the same individual even if other people cannot distinguish them. The old one never has direct connections with the new one, and all their activities are independent from each other. In another traditional strategy, the original body/brain is destroyed during transferring. By doing so, there is only one consciousness after transferring. But this may be even more unacceptable because the original one is actually "killed" during the procedure. This case is similar to Davidson's famous thought experiment of " Swampman" [40]. Davidson imagines that a man is struck by a lightning in a swamp, and his body is transformed into its basic elements. At the same time, a nearby tree is transformed into an exact replica of the man who also behaves exactly like the original man. Even if everyone else thinks the new individual is the old one, the latter knows that his/her own consciousness disappears when his/her body is destroyed.

On the contrary, our strategy results in a unique consciousness which owns two or more bodies. Information seen, heard, touched, smelled and tasted by one of the bodies, is fully shared with the others immediately. The thoughts generated by the brain in any of the bodies, are also fully shared with the other immediately. What's more, any parts of the two bodies act harmoniously under the control of the unique consciousness. This is somewhat similar to so called "superorganism", but is more integrated. All the hemispheres of the unique consciousness work together, just like the hemispheres in a normal brain. Actually, they might be integrated even more tightly than a normal brain if their connections could be built strong enough. The "death" of the old body only means the removal of part of the unique consciousness. This is similar to the situation when part of a patient's brain is damaged by disease or removed by surgery. People may question that the integrated consciousness is not "100% the same" as the original consciousness. But please note that any person's consciousness and body is always changing. A person may be significantly different at the age of ten and thirty, no matter for consciousness or body. But "they" should be recognized as the same person. When a patient's large portion of brain, arm or leg is removed by surgery, he/she is also recognized as the same person. At the micro level, a person's cells are updated every several years, months or even days [41], and about 330 billion cells are replaced every day [42].

Besides, we believe that it is important and necessary that the new body should have the same gene/DNA as the old one, given today's scientific and technological level. Otherwise their personal identity might be problematic. After the old body dies, the remain is actually another person carrying the former's mind and memories, etc. In that case, what is prolonged might not be the former's lifespan indeed. What's more, there might be more unpredictable risks such as medical, biological, psychological, ethical, social or economic ones in that case.

If the proposed approach is realized, people's consciousness would be able to extend to cloned bodies without temporal and spatial breaks. As a result, people would be able to live many times longer than usual. In theory, such a technique could be used repeatedly and thus prolongs people's lives extremely. That might also have some impact on life forms. As shown by the history of earth's lives, small inorganic molecules generate small organic molecules, then small organic molecules generate big organic molecules, then stable multi-molecular systems, then primitive lives, then prokaryote, then eukaryotes, then multi-cellular organism [43]. With the help of modern science and technology, it is probably near the time that lives could be upgraded into a "multi-body" form. In

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further future, if people are able to adopt non-biological systems (such as mechanical body) as extend-bodies, lives would be upgraded into "multi-form". But before those, there are still some ethical issues, technical difficulties and potential risks need to be solved.

The first problem is whether such a technique should exist or not, ethically. After all, the "natural" result of a clone cell will be an independent individual [44,45]. But it will have to become an extended part of a person in order to achieve the proposed approach. From the ethical point of view, people may concern about the rights of the potential individual. But similar problem might also exist in many cell experiments [46–48]. After all, cells are often taken from people's bodies. Many of those have the potential to become an independent individual. But they die and discarded after experiments or medical tests. Even in daily life, a lot of cells drop out of people's bodies often. Many of those also have the potential to become independent individuals, especially with the development of technology (e.g., cloning, induced cell [49]). Furtherly, it might be more controversial when a cell has already grown into a neonate, even if it is "born" from an artificial uterus [50].

Fortunately, there would be much fewer problems starting from animal experiments first [51,52]. Besides, people in different cultures or groups may hold different attitude upon these issues [53,54]. What's more, people's attitudes are constantly changing. For example, autopsy was once treated as devil's behavior, but it is very normal now [55]. Also, the use of anesthesia was treated unethical and even blasphemous, but now it has become an essential part of surgical procedures [56]. Let's assume that humans were all naturally born to have their consciousness integrated with their parents. Then is it possible that the non-integrated would be treated as "disabled"? Policies and laws often change with people's attitudes also [57]. If something is beneficial to society, it would be accepted by more and more people gradually. From another point of view, consciousness integration is not manipulating the new body, but the sharing and inheritance of knowledge from the old body. Sharing and inheritance (especially education) are extremely important factors that helps human establish civilization [58]. However, human's sharing and inheritance, is not perfect yet. It requires great efforts of families and societies, especially of parents and teachers. New born individuals cannot inherit knowledge form older individuals directly. They have to spend many years learning through external media, e.g. books, indirectly. Similar situation also happens between different individuals. But Artificial Intelligence (AI) has much greater advantages than human in this aspect. All the knowledge and abilities can be duplicated to large amount of copies easily in a very short time [59]. If humans were able to share and inherit knowledge more directly, we will be less inferior than AI. This would be an extra benefit of the proposed approach.

Then, the major problem is how to extend a consciousness to a new body. Furtherly, the extended consciousness should be able to shrink into the new body after the old body dies. In order to achieve these, the "Consciousness Integration" or "Brain Integration" technique is required. So far, this technique is not an existing one. But science and technology do provide certain basis for it. First of all, the hemispheres of a brain are quite independent if without commissural fibers and shared sensory organs [26]. According to the foregoing analysis, we can see that commissural fibers and shared sensory organs are the key factors that integrate hemispheres into a unique consciousness. So we need ways to connect hemispheres of different brains just like commissural fibers do, and share sensations between the hemispheres. One of the possible ways is to adopt Brain-to-Brain Interface (B2BI), which based on Brain-Machine Interface (BMI) and Machine-Brain Interface (MBI) [60]. For example, cut off the commissural fibers, and then install certain devices on the cross-sections. The devices could be something similar to repeaters or distributors [61–63]. A repeater is a device that can receive signals and retransmit them to another media after amplification. It can increase transmission distance without affecting signal quality. A distributor is a device that can distribute signals from a single source to multiple targets. It can be used in combination with repeater to share signals between multiple targets remotely. Furthermore, the devices should be able to transmit signals bidirectionally. In order to achieve wireless transmit, advanced communication technology is required [64]. It may be difficult to transmit brain signals entirely without any loss. But given the tolerance of brains [26,29], the device might work in some certain even when its bandwidth or precision is lower than

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ideal situation. If most of the brain signals can be shared between all the hemispheres of all the brains, the consciousnesses would be integrated similarly to that of a natural brain.

However, with the help of technologies, we might go further than natural brains do. For example, neural signals from more regions of the hemispheres can be read with certain techniques, e.g., implanting electrodes [65]. Then, the signals can be transmitted and written into other hemispheres with techniques such as Deep Brain Stimulation (DBS) [66,67]. By doing so, the inter-communication between hemispheres might be stronger than that in natural brains. That may further integrate the hemispheres as a unique consciousness. There are even more flexible functions that might be achieved with the help of technologies. For example, people might be able to switch attention between signals from different brains. Then people would be able to experience different lives during day and night, respectively. Or, sensation from all of the brains might be integrated as a whole. The visual field of a normal person feels like an area in front of his/her face. When an object is moved around from the front to the back of the head, it seems disappeared gradually. However, in the above case #6, the conjoined twins can "see" what is behind them through the eyes of each other [30]. Besides, many animals have much larger visual fields than human. If visual fields could be shared and integrated between different bodies/brains, people might have visual fields of 360 degrees. What's more, different parts of a visual field could be used to show scenes at different places. Or, people might be able to turn on or off different parts at will. Similar things might also happen to other sensations. Generally speaking, more signals shared between brains/hemispheres means they are integrated more tightly. Then, it is more reasonable that they are treated as a unique consciousness.

But there are some extra problems when using artificial objects as extended-bodies. After all, the "hard problems" [68,69] about consciousness is even harder than achieving Artificial Generic Intelligence (AGI). There are many difficulties about the essence and generation of consciousness, especially about "subjectivity" [70–72]. People are able to create artificial intelligence and robots, and know every details about their design, function and behavior. But we have no way to enter their subjective experience even if they do have subjective experience. Actually, we do not even have a way to really enter other people's subjective experience. Therefore, although we believe other people have subjective experience similar to ourselves, we actually cannot prove it. This is the so-called "Problem of Other Minds" which has no solution so far [73,74]. These difficulties lead to many extra questions hard to answer. For example, if some artificial objects have exactly the same functions as human's brains, they may become intelligent objects. They may also have impacts on the real world, and even be able to form advanced civilization just like humans do. However, do they also have consciousnesses subjectively compatible to human ones (if they do have a certain type of consciousness)? Do they have subjective visual field in front of their faces, or just acquire image signals from their cameras? Can they imagine scenes in their minds subjectively, or just build data structures with their programs? Do they have subjective experience of emotion/mood, or just have some changing parameters? For example, are they moved by music, or just change the values of some variables in their software? More arguably, can they really be used as the extension of human's lives? In other words, an artificial object may replace a person's brain (and body) gradually or by the aforementioned "extend-shrink" procedure. But is it really the extension of that person's life? Or, is it just an artificial intelligence/robot that inherits everything (appearance, memories, abilities, etc.) from that person? Furthermore, the artificial object may be replaced by a cloned new body of that person later. Then, is the new body really the extension of that person's life? Or, is it just a new individual that inherits everything from the artificial intelligence/robot? Or, is it even a "philosophical zombie" [37] which looks exactly like the person but actually has no subjective feelings? We believe these issues should be treated with caution. Otherwise, human as a specie, might be replaced completely by some artificial intelligent objects such as robots, at worst. Maybe people can find satisfying answers and solutions in the future. But so far, we do not have enough evidences to answer these questions definitely. So we presently pay more attention to using cloned bodies as extended-bodies.

Case #6 has demonstrated the feasibility that two brains are partly integrated in natural conditions [26,31]. The integration/mergence of consciousnesses/brains is not only an approach to prolonged lives, but also provides potential chances for other applications. For example, a person's abilities will be greatly enhanced and extended when he/she owns more than one brain and body; and her/his ability to resist risks is also much stronger. What's more, temporary integration of consciousness or mind sharing between lovers/relatives/friends/colleagues might provide novel experiences and special values. Besides, people are curious about the subjective feelings of other people and even animals [75,76]. If such a technique could be used to integrate human's brains and animal's brains, people might have chance to "enter", prove and even experience the subjective feelings of others or even animals. However, there might be more risks when bodies of different ages or species are integrated artificially. When brains are integrated more tightly, there might also be more potential issues need to solve. For any technologies, it is hard to predict all the risks that may emerge in the future. But it would be helpful if more people contribute more efforts to solve them.

Conclusions and Prospect

Longevity is one of the most important goals people wish to achieve [77]. From 2016 to present, we have investigated thousands of literatures, and inspected a large amount of technologies. Then we find some related knowledge (discussed above), which inspire us to propose this approach of "Consciousness Integration" or "Brain Integration" for longevity and other potential applications. It can also be called "Consciousness Mergence" or "Brain Mergence". In our approach, two or more brains of different bodies are integrated/merged to form a unique consciousness. As a result, the formed consciousness is more complicated which owns two or more bodies and brains. The original consciousness of each body becomes part of the "large" consciousness. When one of the bodies "dies", it only means the "large" consciousness shrinks, i.e., becomes "smaller". The consciousness can even keep awake during this procedure, just like what happens during some brain surgeries, e.g., removing part of a patient's brain [14]. The proposed approach requires neither the full understanding of the essence and features of consciousness, nor the techniques for direct transferring of consciousness.

In traditional strategies, there will be two or more copies of the same consciousness if it is transferred to other bodies. Or, the original consciousness disappears if its brain is destroyed during transferring. In the first case, the new bodies are actually new individuals even if their consciousnesses seem the same as the original one. Even if the new bodies can live much longer than the original one, the prolonged time is not really owned by the original one. In the second case, the original person is actually "killed" during transferring, and the new bodies are just its successors. In any of the two cases, the original consciousness dies with its body/brain, either during transferring or later. But in our approach, the consciousness becomes a cross-body and more complicated one. The brains in all the bodies form a unique consciousness together. The death of any one of the bodies only changes the "volume" of the consciousness. At any time, there is one and only one consciousness, which does not break off and does not have multiple copies. This may better solve the problem of "personal identity".

So far, all kind of animals including human beings can only live for a limited time. However, lives can be perpetuated through generations for billions of years, and even much longer in theory. This is an inherent and miraculous ability of organism. Our approach tries to integrate/merge the consciousness of an individual and that of its clone into a whole. If this could be achieved repeatedly from generation to generation, the consciousness would exist for a very long time. By doing so, the miraculous ability is borrowed to prolong the life span of individuals significantly.

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