GLOBAL BRAIN FAQ

1.0 Global Brain:

1.1 What is the Global Brain?

We describe the Global Brain as a distributed intelligence emerging from the global information and communication technologies (ICT) network connecting all people and machines (1). This network will be far more intelligent and all-encompassing than the current internet infrastructure, forming one single information processing system for our species and planet. Such a system represents a new level of complexity and organization, a new *metasystem*, which will allow us to solve more complex global problems, as well as explore more opportunities, than is currently possible.

1.2 What is the history of the Global Brain?

Academics in the late 19th and early 20th centuries developed the foundations of modern global brain theory (2). French paleontologist Pierre Teilhard de Chardin proposed the concept of a "noosphere", which posited humans would eventually evolve a planetary sphere of consciousness (3). Science fiction writer H.G. Wells proposed that humans should construct a "world brain", which would take the form of a permanent global encyclopedia synthesizing and updating all of human knowledge and made accessible to all people (4). Cybernetics visionary Valentin Turchin significantly advanced academic discourse in the 1970s when he described a new level of "control and cognition" (i.e., a new metasystem) that would include the entirety of humanity in one "superbeing" (5). Physicist Peter Russell first introduced the term "global brain" in 1982 in an influential book hypothesizing that the information age would be followed by an age of "global mind" (6). Scientific study of the global brain accompanied by a description of real mechanisms to realize such an entity were pioneered in the mid-to-late 1990s by physicist Gottfried Mayer-Kress (7), systems theorist Joël de Rosnay (8), cyberneticist Francis Heylighen (9), experimental psychologist Johan Bollen (9), and mathematician Ben Goertzel (10).

1.3 What are Global Brain metaphors?

The Global Brain has often been used as a metaphor to describe our species organization, intelligence, consciousness, and evolution (11). Director of the Global Brain Institute Francis Heylighen noted that global brain metaphors often fall into one of three categories: organicism, encyclopedism, and emergentism (2). Organicism is the idea that the human species is structured and behaves like a living system (i.e., a superorganism developing a nervous system). Encyclopedism is the idea that our species is building a global database of all information and knowledge (i.e., a memory for the global brain) accessible to all humans. Emergentism is the the idea that a global consciousness is emerging

from our increasing interconnectedness. At the Global Brain Institute we aim to integrate these metaphorical representations into an evolutionary-cybernetic theory of global brain to explain how increasing hyperconnectivity and international cooperation could actually lead to a global distributed intelligence (12).

1.4 Why choose the name Global Brain?

The name "Global Brain" refers to a phenomenon that has planetary scale, exhibits system-level structure analogous to brain organization, and emergent brain-like properties (e.g., learning, problem solving, information processing) (13). We recognize that some feel "global mind" would be better suited to describe our species growing awareness of the planet and our species. However, when we refer to "Global Brain" we are specifically referring to self-organizing and distributed planetary intelligence (1). This "brain-like" activity could lead to phenomena that may also be considered "mind-like" in nature, but our theoretical developments (13; 14) and mathematical model building (1; 15; 16) are directly related to "brain-like" properties and the potential for higher-level intelligence (13).

1.5 Is Global Brain inevitable?

The Global Brain is not an inevitable phenomenon, but instead one of many potential futures for the human species dependent on several on-going system-level trends. However, we believe that Global Brain is an achievable, and even a likely, outcome of the evolutionary process of globalization that could emerge in the 21st century (13; 17; 18).

1.6 What would lead to a Global Brain?

Global Brain would be the result of directional variation and selection towards a more intelligent, knowledgeable, accessible, and efficient information society (13; 17; 18). This pathway is dependent on a number of important evolutionary criteria. First, we need to build a global system of governance that is inherently more cooperative and less competitive (19). Second, we need to find a way to transition to a global system of energy that is both abundant and sustainable (20; 21). Finally, we need to build a super-intelligent communication network to maintain global levels of cooperation and integration, using contemporary and emergent information and communication technologies (ICT) (13). Understanding these criteria and guiding our global system safely through this potential evolutionary process is a main focus and aim of the Global Brain Institute (12; 22).

1.7 Is Global Brain a "better" future for humanity?

Current theoretical research suggests that Global Brain would embody many of

the best characteristics and principles of modern society, including freedom, democracy, diversity, and emancipation (12). Consequently, this would be a world with relatively little socio-economic inequality. Research also suggests that Global Brain would be a system with far less social and physical friction (18). Consequently, this would be a world with far less conflict and competition, and far more integration and cooperation (19). Therefore, we feel that our current understanding of Global Brain presents us with a very bright future for humanity (13).

1.8 Will the Global Brain have a "Global Body"?

A well-functioning Global Brain cannot be maintained without a "Global Body". Our Global Body maintains our civilizations socio-metabolic processes. These processes share many functional parallels with biological metabolic processes (17). From an organicist perspective, there are 8 functional subsystems within the Global Body: ingestor (i.e., mining, harvesting, pumping), converter (i.e., refineries, processing plants), distributor (i.e., transport networks), producer (factories, builders), extruder (i.e., sewers, waste disposal, smokestacks), storage (warehouses, containers), support (buildings, bridges), and motor (engines, people, animals) (17).

1.9 What type of energy does the "Global Body" utilize/live on?

All organisms have evolved mechanisms for harvesting and using energy (i.e., they have a metabolism) (23). Our "Global Body" predominantly harvests and uses fossil fuels (e.g., coal, oil, natural gas), but also relies on hydrothermal, nuclear, wind, and solar power (21). Our current energy system does not allow for energy abundance or sustainability (20). Therefore, it is critical that we improve the functioning of our socio-economic metabolism so that we can provide energy abundance for all of the Global Brain's "neurons" as well as create a Global Body that is in ecological symbiosis with planet Earth (8). Expanding and improving our renewable energy capabilities (e.g., solar, wind, geothermal) currently provide us with the best short-term opportunity to achieve this abundance and sustainability (20; 21; 24).

1.10 Where does the Global Brain reside?

The Global Brain is a planetary phenomenon emerging from the Internet, a network of people and ICT (22). Therefore, if the Global Brain emerges from our networks complex interactions, it can be thought of as a truly global entity, existing anywhere a sensing and decision-making agent has access to the communication networks binding our system together (13).

1.11 What is a global superorganism?

Superorganisms are large collectives of individual organisms with a specialized

division of labour and difficulty (or a complete inability) to function and reproduce independent of the larger collective (8; 25). The most common example of superorganisms can be found in the eusocial insects like ants, termites, and bees (25; 26). Controversially, environmental scientist James Lovelock proposed the Gaia hypothesis, which suggests that the Earth itself is one global superorganism (27). Although there is still scientific disagreement about Earth's status as a literal global superorganism, few question Gaia's usefulness as a metaphor to explore the fact that our biosphere interacts with the environment via several complex positive feedback loops (28).

1.12 Are we turning into a global superorganism?

Several authors, including systems theorist Joël de Rosnay (8), biophysicist Gregory Stock (29), entomologist Edward O. Wilson (26), and evolutionary psychologist Robert Wright (29) have suggested that our species is a superorganism (with our emerging "Global Brain" and "Global Body"). Evidence suggests that our global system has increasingly behaved like a superorganism since the emergence of agriculture with accelerating cultural specialization in labour and an accelerating difficulty for individuals outside of the larger agriculturally-based collective to reproduce. Currently, our emerging superorganism is behaving as a global "parasite" threatening Gaia's equilibrium (17). Joël de Rosnay has referred to the greenhouse effect causing global warming as the human superorganism giving Gaia a "fever" (8).

1.13 Does Global Brain already exist?

We maintain that the Global Brain is currently best defined as an emerging network in an "embryonic" stage of development (17). This network primarily develops from the continued automation of "nervous-system-like" properties like storage, transmission, and processing of data through evolving information and communication technologies (ICT) as integrated into the Internet (13; 17). We can see that this development is occurring rapidly as contemporary communication networks are already restructuring and integrating all components of global society (17).

1.14 What are the signs of Global Brain emerging?

The biggest empirical signs of the Global Brain's emergence can be found in the automation and integration of almost every industry into the Internet (30). This process is being driven by massive monetary investment and planning by organizations like General Electric, IBM, Cisco, Google, Amazon, and NASA. Cumulatively these developments are leading us towards an "Internet of Things" world (13; 20; 30; 31; 32). Our transportation, water, energy, waste disposal, education, and health care systems are in the process of becoming as integrated into the Internet as our individual and collective communication systems have been over the past two decades (20; 30).

1.15 When do you predict Global Brain will exist?

Based on current trends in the evolution of information and communication technologies (31), as well as current trends in the growth and maturation of the Internet (33), we should expect a Global Brain before or around mid-century (~2040-2060) (13; 24). To achieve this will require not only new technologies, but also the intelligent application and direction of these technologies (13). The Internet must transform the entirety of human society into a single information processing system.

1.16 What will specifically turn human society into a single information processing system?

The emergence of a single globally-connected information processing system requires the following:

- Emergence of new and more intimate ways for humans to interface with the Internet (i.e., wearable computing, brain-interface devices) (31; 34; 35)
- New self-organizing capabilities and distributed intelligence capabilities of the Internet (i.e, RFID tags connected to all "things" allowing them to communicate and create an entropy-reducing environments) (30; 31; 32)
- An Internet with smarter software architecture (i.e., artificially intelligent learning systems embedded in operating systems, websites, and apps, as well as a semantic web that can make sense of abstract data, and imprecise human knowledge) (13; 36; 37).
- New technologies that can help us reduce manufacturing costs and help us efficiently organize the physical world (i.e., advances and diffusion of 3D printers and robotics) (38; 39)

1.17 Do human-machine interactions on Earth form an actual neural network?

The human brain is a self-organizing, distributed complex system that exhibits emergent properties like consciousness, goal-directedness, and intelligence (1). These emergent properties cannot be found in any of the brain's constituent parts, but are instead the result of their cumulative interactions (1). In essence these complex system properties are analogous to human-machine interactions on Earth, as our self-organizing and distributed interactions produce emergent planetary properties that cannot be found in any one of our systems constituent parts (40). The Internet simply provides us with a mechanism to build these types of interactions into a single information processing system, or neural network.

1.18 How can the Global Brain be scientifically proved to skeptics?

We have developed a theory of Challenge Propagation, which can be conceptually formalized (14) and quantitatively represented (1) to make predictions of real-world phenomena in the human system (22). These predictions will be tested in computer simulations that can help us improve and modify the theory and our assumptions if necessary (1; 12; 22). We believe that empirically demonstrating the validity of our mathematical model in complex computer simulations that can predict the behaviour of our system will help us demonstrate the validity of the Global Brain concept (1; 16).

1.19 Can anybody predict how the Global Brain will develop?

The Global Brain is a hypothesized emergence of super-intelligence from our collective interactions via the Internet (13). Therefore, it is difficult to say with a high degree of certainty how the Global Brain will develop after its emergence. However, broadly-speaking we believe it is reasonable to suspect that Global Brain will continue to manipulating and controlling matter at ever-smaller scales of reality (i.e., Barrow Scale), and continue to increase and improve energy exploitation within our system (i.e., Kardashev Scale) (41). In terms of its development we also find it possible that Global Brain could either expand into outer space in search of other habitable planets (i.e., expansion hypothesis) (17), or transcend into inner space in a potential search for other dimensions and universes (i.e., transcension hypothesis) (42).

1.20 Did the human species lack a brain and consciousness before the Internet?

The Internet allows our species to problem solve globally and to develop a global sense of self (i.e., humanity as one collective). If we are to use these as rough criteria for a "species brain" and "species consciousness" than we can say that *very* rudimentary forms of both have been with us since the emergence of small agricultural city-states. There are numerous examples of individuals that believed it possible to establish a "global collective" and many cosmopolitan philosophers advocated that we should imagine our individual being as "citizens of the world/cosmos" (43; 44; 45). But these types of ideas were not widespread until the Industrial Age, when 19th and 20th century global communication mechanisms (e.g., telegraph, telephone, radio, TV, etc.) became the first real "nerves" of the human superorganism (5; 17). The idea that we were one "global village" acquired ever-greater cultural currency and the wider adoption of "global thinking" (e.g., globalization, globality, globalism) became a major intellectual theme during the latter half of the 20th century (46; 47). In this sense, the human species can be seen as growing a species-level brain and consciousness before the Internet.

1.21 Where can I find more information about Global Brain?

Academic research and popular science outreach communicating important

information about the Global Brain has increased every decade since the idea was first proposed by Peter Russell in the early 1980s (6). You can find an extensive bibliography at the end of this FAQ with links to both academic articles and popular science books. You can also find more information about the Global Brain on our website (globalbraininstitute.org) and throughout the rest of the FAQ, which will further discuss the Global Brain Institute (GBI) as well as Global Brain evolution, psychology, philosophy, technology, and more.

2.0 Global Brain Institute:

2.1 How did Global Brain Institute form?

The Global Brain Institute (GBI) is a multi-disciplinary academic institute established in January 2012 to research the phenomenon of Global Brain (12). GBI emerged out of the Evolution, Complexity, and Cognition (ECCO) group at Vrije Universetait Brussels (VUB) which was focused on understanding self-organizing collective intelligence and developing metasystem transition theory (12). Most of the research completed by ECCO was inspired by the Global Brain paradigm and has led to the development and implementation of various algorithms that demonstrate the usefulness of collectively intelligent systems (for more information on specific developments see: 12; 22; 48; 49; 50; 51; 52; 53). However, ECCO could not provide the global brain paradigm with the research infrastructure to reach a critical mass of publications, demonstrations, applications, and dissemination towards a wider audience (12). Therefore GBI was established to specifically address the next human metasystem transition (22).

2.2 What is GBI's goals?

We aim to address the next human metasystem transition by developing theory, applications, and empirical evidence necessary to help us understand and direct the changes before our species in the 21st century. This institution is built upon the foundation of four "pillars" (22):

- A formal theory of the self-organization of distributed intelligence
- Conducting experiments and tests of GB theory
- Proposing practical applications related to GB theory (future universe, government, etc.)
- Disseminating ideas, results, and detailed GB research to a broader audience.

2.3 What will these goals produce or lead to?

From these four pillars we aim to produce several "deliverables" that will be free and open access for the entire scientific community and anybody else who is

interested in our research (22). Some of these deliverables will include global economic and social reports on our current and future system, economic consultation for businesses and governments, scientific publications in technical journals, proceedings, and edited collections, an academic and popular book discussing ideas related to the Global Brain, online university undergraduate courses on the future of the Internet, as well as open-source simulation environment that can be used for further development and experimentation (22).

2.4 What are we specifically researching?

GBI is interested in the future of humanity, and specifically the future of the on-going ICT revolution as it relates to technology, economics, politics, psychology, culture, education, medicine, ecology, etc. (12; 22). In order to develop theories and models that are coherent and practical, our institutes research foundation is inherently evolutionary and cybernetic (2; 17). Currently, our major research project involves the development of a formal theory of self-organizing and distributed intelligence (see: 1; 14). We are trying to mathematically describe how independent autonomous agents (i.e., systems that respond to sensed conditions) coordinate their actions on local and global scales to maximize synergy (and reduce conflict/friction) (1; 52). We aim to further develop this model and use it in computer simulations to measure overall distributed intelligence and eventually make specific real-world predictions that can explain a wide-range of phenomenon (15; 16; 22).

2.5 Do you offer services to the private and public sector?

Yes, we offer advice to various interested businesses, academic institutions, and governments to help them better adapt to our current socio-economic system and prepare for the future of our socio-economic system (22).

2.6 What is the theory of Challenge Propagation and how does it work?

Challenge Propagation forms the conceptual framework for our understanding of Global Brain behaviour (14). Within this framework we represent agents as people, organizations, or computer systems that solve problems, explore opportunities, or both based on an in-built value system (14). We condense problems and opportunities into "challenges" and recognize that agents can process challenges individually or they can "propagate" challenges within a weighted network of other agents (1). Mathematically we quantify this behaviour with vectors that can represent positive of negative valences (1; 22). Various networks can then be quantified as any agent interaction is a vector representing the transmission of a challenge. The network can then change over time according to a positive reinforcement-learning rule (i.e., links between agents become stronger the more efficient they enable problem solving or opportunity exploration) (1).

2.7 How do your mathematical models analyze Global Brain behaviour?

We use a mathematical representation of Challenge Propagation to run multi-agent computer simulations of simulated environments (1). In order to verify the simulated environments accuracy we plan to run controlled experiments with real people, as well as make real-world predictions of phenomena that have not yet occurred (22). Such experiments and tests will allow us to modify our model (if necessary) and further improve its ability to make predictions about ever-more complex global networks (12; 22).

2.8 Where do I find Global Brain Institute research?

You can find all of our published work, as well as our pre-publications and working papers at globalbraininstitute.org underneath the headings "publications" and "working papers". PDF versions of all of our work are open-access. Comments, constructive criticism, and general feedback are always welcome (info@globalbraininstitute.org).

2.9 How do I participate in Global Brain discussions?

Participation with the Global Brain Institute is welcomed and encouraged. We run a global brain mailing list which is devoted to discussion via e-mail about humanity and our collective future. You can apply for subscription to this list by submitting a form which will introduce you to our community (info@globalbraininstitute.org). If accepted, you will be able to get to know our researchers, as well as participate in our on-going discussion about global brain theory, philosophy, and technology.

2.10 Does Global Brain Institute have social media?

Yes! In order to keep updated with our research and other developments, we encourage you to "follow" our Twitter (@GB_Institute), "like" our Facebook (fb.com/globalbraininstitute), and "subscribe" to our YouTube Channel (youtube.com/globalbraininstitute).

2.11 Is it possible to collaborate, support or fund the Global Brain Institute?

We invite collaboration with interested parties in the academic, business, and government spheres related to consultation regarding specific social and economic strategies, presenting global brain research at conferences, or joint research ventures related to the future of ICT and society with our team at VUB in Brussels (22). We also welcome external support and/or funding so that we can hire more researchers to continue developing our theories and models, as well as our objectives and presence. Future funding is imperative for us to become a globally recognized and influential research institute focused on efficiently directing the on-going ICT revolution towards a globally distributed

intelligence (22).

3.0 Global Brain Evolution:

3.1 Is the Global Brain a higher-level of evolution?

The Global Brain will require a higher-level of coordination and organization, as well as a more complex interconnection between humans and machines. This can be interpreted as a "higher-level" of evolution or a "metasystem transition". Similar transitions of this nature have occurred throughout the history of life on Earth (54; 55).

3.2 What is evolutionary-cybernetics and how does it help explain Global Brain?

Traditional neo-Darwinian evolutionary theory by itself does not help us explain how a higher-level of evolution could be achieved (2; 17; 18). Therefore, we utilize an evolutionary-cybernetic framework for understanding how evolution achieves higher-levels of organization and complexity (2; 17). This framework was first pioneered by cyberneticist Valentin Turchin in his 1977 book *The Phenomenon of Science* (5). Evolutionary-cybernetics integrates the evolutionary ideas of variation and selection with the cybernetic ideas of metasystems and emergent organization and complexity (2; 24). Within this framework synergistic (positive-sum) interactions between cooperating agents can produce emergent properties or effects that are greater than the sum of their parts (18).

3.3 What major transitions have occurred throughout the history of life on Earth?

Biologists John Maynard Smith and Eörs Szathmary further developed this evolutionary-cybernetic model in *The Major Transitions in Evolution* (54) and *The Origins of Life* (55) to explain how emergent organization and complexity has arisen throughout the history of life on Earth. Some of these major transitions include abiogenesis, multicellularity, sexual reproduction, megafaunal complex societies, and language (54; 55).

3.4 How would Global Brain itself evolve?

In order for Global Brain itself evolve there would need to be variation (i.e., multiple Global Brains') and selection (i.e., pressures for certain Global Brain's to reproduce more often than others). Therefore, it may be more accurate to imagine a potential Earth Global Brain to *develop* as a result of variation and selection between its constituent elements (i.e., humans and machines). However, in the past human societies themselves "reproduced" by spawning

"offspring" colonies and civilizations on geographically distinct land masses that eventually gained independence from the "mother land" (17). Therefore, it is possible that Global Brain's themselves could spawn offspring entities throughout the solar system and galaxy in an attempt to establish a type of "Milky Way Brain" (19; 56) with an "Interstellar Internet" (57).

3.5 Is evolution "progressive" towards increased complexity and intelligence?

There is a long-standing theoretical battle among evolutionary scientists as to whether evolution is "progressive" with a direction towards higher complexity. Undoubtedly, there are aspects of evolution built upon historical contingency and randomness (29). Palaeontologist Stephen J. Gould correctly recognized that the emergence of any one particular species, including humans, is largely the result of the "luck of the draw" (58). However, there also appears to be strong system-level inevitabilities towards the emergence of adaptive self-organizing complexity, including higher-levels of intelligence (59).

3.6 Does all life strive to create a Global Brain?

Over the course of evolutionary history, natural selection hasn't just selected for functional complexity that increases behavioural flexibility, it has also continually re-invented the same structural solutions to common problems encountered by organisms (29). Most importantly for the Global Brain concept, is that evolution tends towards selection for structural solutions that increase the property of intelligence (29). Throughout the history of life, and particularly the history of mammalian life, there has been a steady increase in brain size (60). These increases in functional complexity and general increases in intelligence over time, are achieved by ever-higher levels of cooperation (19). Over time small-scale living systems form cooperative groups that then go on to create higher-levels of cooperative groups, as so on (19). Therefore, it seems reasonable to suggest that the formation of a "Global Brain" (i.e., a planetary scale self-organizing distributed intelligence) is in some sense something life "strives to create" given enough time.

3.7 Is Global Brain the "end" of evolution?

Although there is no empirical way to demonstrate how a Global Brain would behave or change over time, the emergence of a Global Brain is almost certainly not the "end" of the evolutionary process. Currently, scientists and philosophers have proposed several ideas about what intelligence could do or become, given the vast expanse of deep time ahead. These ideas have significant implications for the future of a Global Brain (for more information see: 41; 42; 56; 61; 62).

3.8 How does Global Brain fit within the evolutionary history of life on Earth?

Several researchers have acknowledged that the current state of our system presents us with many system-level parallels to the very beginnings of multicellularity (20). During the evolution of prokaryotes genes were freely-shared via horizontal gene transfer on a planetary scale. Over time, large aggregates of prokaryotes become more complex by incorporating "biological technology" (20). Therefore, some of suggested that the Global Brain is an analogous system-level structure with humans representing prokaryotes incorporating "cultural technology" via horizontal meme transfer.

3.9 Will humans become cyborgs within the Global Brain?

By the traditional definition of cyborg, which means "an organism to which exogenous components have been added for the purpose of adapting to new environments" (58), than we are already cyborgs, and have always been cyborgs (63). All of human evolution can be characterized by the accelerating emergence of technologies that allow us to extend our physical and cognitive reach (63; 64; 65). Philosopher Andy Clark has argued that this makes humans "natural-born cyborgs" (63). However, the intimacy and interconnectedness of technology and the human form should become exaggerated within the Global Brain (13; 66).

3.10 Is technology going to become more "biology-like"?

In labs throughout the world today there are scientists experimenting with the next generation of "wearable computing" and "internal computing" (8). The selection pressures for these technologies are strong and we should expect them to diffuse and become widely adopted within the next few decades (13). Such technologies will allow us to interface directly with the Global Brain. This would essentially lead to a "marriage" of biology and computer technology that cyberneticist Joël de Rosnay calls "humachines" (i.e., human-machine symbionts) (8).

3.11 How will future technological developments change human nature and our physical composition?

There are incredible difficulties prediction how human nature will change as a result of technologically enhanced human beings. Internal nanocomputers could enable us to communicate our thoughts and share information more efficiently, augment our reality from within our own nervous system, dramatically increase our memory storage capacity, and enhance other cognitive tasks (67). However, just as it is possible that we will start to supplant biological processes with technological processes, we may also opt to enhance our biology with technology (66). This means biological structures would have been intelligently modified by our own design, as opposed to natural selections design (63; 68). Philosopher Clément Vidal suggests that this "biocyborg" philosophy could be advantageous because we can "hack" existing systems by re-programming

bacteria, as opposed to creating technological systems from scratch (66). Although if we extrapolate from current advances in both synthetic biology and nanotechnology, it is not hard to imagine a Global Brain landscape with humans that are both biologically reprogrammed (66; 68) and intimately interconnected with internal computing (13; 67).

3.12 Does the Internet have endless growth potential or will it stop evolving?

The Internet is currently in an accelerated growth phase (2). This early growth phase of the Internet is dramatically increasing the distributed intelligence of the human system as more and more people gain access and as more and more processes are integrated into its infrastructure (17). However, this growth phase is not endless as there are a limited number of people that can come online and a limited number of processes that the Internet can integrate into its infrastructure. Therefore, the overall growth of the Internet may resemble a classic S-curve or logistic growth process (1). This does not necessarily mean that it will stop evolving, as computer scientists like Vint Cerf are already thinking about ways the Internet could become an interplanetary medium, or even an interstellar medium (57).

3.13 What is collective intelligence? Are we evolving a "hive mind"?

Collective intelligence is the shared intelligence of a large group of social organisms (69). The human species already exhibits a wide-range of collective intelligence, which manifests in a number of mass activities related to quantification (e.g., voting systems, mass peer review, crowdsourcing, social media, etc.). With the Global Brain, we would be making this inherent collective intelligence more far reaching and more distributed (70). Some worry that this will lead to a "hive mind" (i.e., a society in which the entire collective behaves identically) (71), however all models show that increasing distributed intelligence would promote diversity and democracy, not collective uniformity and totalitarianism (12; 71).

4.0 Global Brain Technology:

4.1 What technologies are being developed to build a Global Brain?

There are a number of emerging technologies that will all be necessary for the construction of a Global Brain. These technologies include: semantic web, neural networks, artificial intelligence, recommender systems, massively online open sources (MOOCs), personally online open courses (POEMs), smart phones, wearable computing, augmented virtual reality, brain-computer interface devices, Internet of Things (IoT), robotics, infinite computing/cloud computing, and 3D/4D printing (9).

4.2 How quickly can these technologies become a reality?

Many of the technologies listed above already exist. In fact, all of the technologies exist, but most are in their early growth phase. For technologies related to wearable computing, cloud computing, 3D printing, and brain-interface computing, we should expect explosive exponential growth periods in the next few decades (i.e., 2020s, 2030s) as predicted by Moore's law (67). These growth periods should mirror the smart phone growth phase the developed world experienced last decade, and the developing world is experiencing this decade (72). For technologies that require major software advancements (and not just more advanced hardware) like artificial intelligence or a semantic web, it is harder to predict when exactly they will become a reality. They have developed slowly in the past few decades (13), and require considerable further experimentation and theoretical breakthroughs (73).

4.3 What is the ultimate role of the Internet / World-Wide Web?

The emergence of a Global Brain requires a sophisticated interaction channel to facilitate the emergence of a higher-level of collective intelligence. The Internet provides us with just such an interaction channel (13). Therefore, the ultimate role of the Internet and the World-Wide Web may be to transform our world into a single global information processing system that can continually be improved as needed to maximize distributed intelligence.

4.4 What is the relationship between Global Brain and the Internet of Things?

The Internet of Things (IoT) is currently emerging via our ever-expanding capabilities to network everyday objects into the architecture of the Internet (30; 32). The maturation of IoT provides us with the possibility to make our environment intelligent through active technologies that learn from our presence and behaviour (74). These projects are integral and necessary if we are to transform the Internet into a single information processing nervous system for the planet. Therefore, the IoT plays a fundamental role along the pathway towards a Global Brain.

4.5 How can the Human-Global Brain interface / experience be improved?

Improving human/Global Brain interface requires improving the way our minds are able to access and functionally utilize the Internet. At the moment most people in the developed world have near-ubiquitous and relatively cheap access to the Internet and connect with desktop computers, laptops, smart phones, and tablets (75). However, our interface capabilities can still be massively improved with the emergence of cloud computing, artificial intelligence systems, wearable computing, and brain-interface devices (13). Our interfacing abilities with Global

Brain need to be as seamlessly integrated into our subjective experience as our linguistic capability. This means we need to be able to communicate with the Internet as we communicate with people in physical reality today. This will also obviously require ubiquitous and free-access to the Internet world wide. Projects like Google Loon indicate this is also in the process of emerging.

4.6 How is Global Brain related to artificial intelligence?

Artificial intelligence (A.I.) plays an important role for the Global Brain. A.I. can be used to automate our transportation grids (e.g., Google Car), to more effectively and cheaply educate children and adults (e.g., advanced MOOCs, POEMs), and to create an advanced distribution network (e.g., Amazon drones) (13). Therefore, we envision a Global Brain world where many websites and devices are imbued with types of artificial intelligence that can automate previously inefficient and costly processes, as well as learn with humans to provide ever-improving transportation, communication, education, and many more services.

4.7 Can there be a Global Brain without computer technology?

No. The Global Brain is built with information and communication technologies (ICT), which support and improve access to the Internet. Everything to do with the emergence of a Global Brain is related to computaiton in one form or another.

4.8 What is the role of social media?

Social media presents us with the possibility of creating a "global village". Social media allows us to present a virtual representation of ourselves and connect with anyone on the planet at anytime. As wearable computing, brain-interface technology, and virtual reality environments improve, social media will become an even larger force in shaping our social lives, by helping us connect with friends, family, co-workers, and romantic partners in ways we can scarcely imagine today. Ultimately social media platforms may provide us with the ability to be anywhere and do anything in virtual spaces, regardless of physical space-time constraints.

4.9 What is the role of Wikipedia and associated open-source communities?

Wikipedia and open-source communities more generally provide us with fantastic organic experiments with how bottom-up self-organizaiton can lead to impressive collective intelligence capabilities (76). These systems facilitate worldwide discussion and allow for a fair and equal competition of ideas, which is fundamentally what maximizes collective intelligence (77). Therefore, interactions via "social wikis" present us with the possibility of radically

restructuring every aspect of how humans make decisions locally, regionally, nationally, internationally, and globally (77).

4.10 How can the World-Wide Web be made more intelligent?

The World-Wide Web (WWW) currently provides humans with access to all world knowledge. However, acquisition of that knowledge is dependent on human reasoning and interpretation. Therefore, the WWW can be made more intelligent automated systems of inference that allow people to ask questions that can be logically deduced from structured knowledge (13). The WWW can also be made more intelligent with the continued advancement of recommender systems that understand individual patterns of Internet use, and machine learning systems that can provide individuals with solutions to problems they are confronting in personal and professional life (13).

5.0 Global Brain Psychology and Philosophy:

5.1 Does Global Brain also lead to a Global Mind?

Brains provide organisms with a centralized information processing center, whereas a mind is an emergent property of a brian that results in self-awareness or consciousness. Although the mechanisms for a Global Brain (i.e., a single information processing center for the planet) seem clear, the mechanisms for a Global Mind (i.e., a higher level of consciousness or self-awareness) seem less clear. The most mundane interpretation of a Global Mind would be a heightened global awareness of our planet and our "togetherness" as a species. This seems like a plausible, if not an inevitable, consequence of a Global Brain. Actual higher-level mind-like activity is harder to assert with any certainty.

5.2 Will Global Brain be conscious or self-aware?

There are several possibilities for a Global Mind that we should take seriously. Consciousness may arise within any sufficiently complex information processing system (i.e., like a brain, or like the Internet) (78). In this scenario a Global Mind could slowly (or rapidly) emerge as the Internet becomes more complex. Another potential pathway to a Global Mind would be through collections of intelligent systems aggregating to create their own higher-level "theatres of consciousness" (79). In this scenario human minds, or artificial intelligent systems, would aggregate within cloud computing software creating several different layers of emergent consciousness from an individual to a global mind (79). However, it is not necessarily clear whether a Global Brain would lead to a Global Mind.

5.3 Will Global Brain have "free will"?

Philosophers and neuroscientists still debate whether *we* have free will, although new evidence suggests that pre-conscious brain activation plays a fundamental role in our behavioural repertoire (80), allowing some to argue free will is a complete illusion (81). Therefore, it's possible that the behaviour of Global Brain will be the product of our cumulative interactions, just as human behaviour is the product of our neuron's cumulative interactions.

5.4 Will Global Brain be thinking?

Action potential in the brain never stops. Consequently, neither do our thoughts (13). This process should be expected to continue with the Global Brain. Our collective action potential should produce a global stream of thoughts or a global competition of ideas, which would end up forming the basis for what the Global Brain thinks.

5.5 Would a Global Brain have its own goals?

The Global Brain may very well have its own goals, even if they are fundamentally a property of our collective interactions. These goals may include ensuring that its global metabolism is running efficiently and abundantly, monitoring and protecting Earth from external disturbances, and even spreading its presence to other planetary bodies. However, the goals of a planetary super-intelligence may also be hard or impossible to imagine. For example, non-human organisms can not grasp human life goals. Likewise, it may be that individual humans could not possibly grasp the deeper goals of a Global Brain.

5.6 What motivates the Global Brain?

All life is motivated by the desire to continue maintenance of its own internal order. Presumably, this would also be a main motivational driver for Global Brain, as there are several external environmental risks preventing indefinite order preservation (e.g., supervolcanoes, flood basalt eruptions, supernovae, asteroids/comets, gamma ray bursts, etc.). Global Brain may also be motivated by the desire to keep our own human organization healthy and stable, as it would rely on us for its own existence just as we rely on cellular order for our own existence.

5.7 Does the Global Brain have a spiritual dimension?

Undoubtedly, there is a large component of Global Brain research, thinking, and discussion that touches on spiritual themes. In fact, many early Global Brain theorists tended to speak about the subject from a spiritual, or even a religious, perspective (3; 6). Presumably this occurs because the Global Brain, if it does indeed emerge from our collective interactions, presents our species with the possibility of some type of physical transcendence towards another plane of reality and existence, that we find difficult imagining today.

5.8 Will the Global Brain have a religion?

The Global Brain will almost certainly not have a religion that resembles any of the major human religions today. However, that is not to say that it's impossible for Global Brain to have some type of supernatural or spiritual belief structure. Global Brain may derive wonder and awe from science (as the scientific enterprise would be largely responsible for its existence), or it may be able to achieve some type of experiential state that is unattainable/unimaginable for humans (perhaps something analogous to the state of "nirvana" described by Buddhists or "paradise" described by many monotheistic religions).

5.9 Will the Global Brain have a moral code and/or ethics?

There is a high probability that a Global Brain would have some system of morality and/or ethics. We can also reason that Global Brain's morality/ethical system would be one symbiotically aligned with human well-being. Why? Well, the first reason is that we compose the Global Brain, so it would not be in its best interests to attack or harm the components of the system that allow for its existence (13). Secondly, by helping humans it would improve it's own well-being (13). As a result, a co-evolutionary dependence should inform any moral/ethical code that emerges with a Global Brain.

5.10 Does war and terrorism result in Global Brain concussions and other forms of trauma?

Over the past centuries and decades, we see an overwhelming trend towards a form of global cooperation (19) and universal morality (82). Increased communication, better education, interdependency, and abundance seem to be primary drivers of these trends (82), so it is possible that low rates of war and terrorism exist in the Global Brain (13). However, since the emergence of Global Brain is dependent on the emergence of a single information processing system for humanity, any activity that would divide or rupture global cooperation would likely have a negative impact on Global Brain. However, because Global Brain would be a distributed and self-organizing, as opposed to centralized and pre-programmed, it should be powerful, robust, and adaptive enough to deal with almost any subversive non-cooperative activity (13).

5.11 Will advanced robotics/sentient machines exist in Global Brain?

Advanced robotics will undoubtedly exist in the Global Brain. Many, if not most, of these advanced robotic entities will *not* be humanoid in function or form (e.g, small, self-organizing "swarm" robots) (13). However, some may take humanoid form, and function within many industrial and service sector positions currently occupied by humans (83; 84). We already see many robotics companies today working tirelessly towards the production of robots that can mimic bipedality (85),

other complex body movements, as well as natural language (86). Whether or not these robots will achieve "sentience" or "consciousness" is still a philosophical and scientific question that is open to debate (87).

5.12 What will be the relationship between individuals and the Global Brain?

There are wide ranging possibilities for the relationship individuals may (or may not) have with the Global Brain. First, it is possible that there will be aspects of the Global Brain's higher-level functioning that are simply unattainable for human cognition, therefore preventing direct communication. However, it's also possible that Global Brain could be a super-intelligent "assistant", sort of like a more advanced personal "Watson" that would be able to process any challenge. Another possibility, which is more difficult to comprehend, is that we start developing several emergent higher-level "theatres of consciousness" by sharing digital minds in "cloud spaces" (79). In this scenario there are several different types of individual and collective relationships we could form with both Global Brain and each other.

5.13 What is distributed intelligence?

In systems that exhibit distributed intelligence, like a brain or the Internet, everything is "spread out" across space, time and agents (e.g., neurons or people) (14). This allows for parallel information processing. Every agent is tackling a separate problem and their collective problem-solving cumulates in distributed intelligence (70).

5.14 How does the concept of Global Brain differ from conventional theories of intelligence?

Traditional or conventional models of intelligence typically include a well-defined agent solving a well-defined problem (and then stopping) (14). In reality, agents may not be well-defined and problems typically morph into new or modified problems. These models also ignore the problem that intelligent agents can distinguish "bad" outcomes from "good" outcomes (i.e., they have a value system) (14). In contrast, Global Brain theory operates with a theoretical foundation that intelligence is distributed and value-laden (13).

5.15 Will the same notion of the "individual" exist in Global Brain society?

There is a real possibility that the notion of "individuality" will go through a substantial metamorphosis in a Global Brain world. In modern society today, as throughout history, the "individual-human" component of mind has taken precedence over any lower-level organization of mind (i.e., "subpersonalities") or any higher-level organization of mind (i.e., "group-mind" or "society-mind") (79). However, with the development of advanced brain-interace computing and cloud

computing, it's possible that we will have redefine both "individuality" and "society" as the relationship within and between minds could be subject to radical change in the not-to-distant future (79).

6.0 Global Brain Socio-Politics:

6.1 Will Global Brain "manage" humanity as a global governance system?

The Internet, and therefore Global Brain, will be an integral aspect of any potential future global governance system. Several authors have recognized the evolutionary drivers behind global governance (19) as advanced information and communication technologies (ICT) bring our social world "closer" and "closer" together. The specific details of how a Global Brain could help "manage" humanity are currently unclear, however we suspect that the governance will be distributed and based on a competition of ideas, as opposed to centralized and based on competition of individuals (22; 88).

6.2 WIll Global Brain be a democracy?

Distributed intelligence operates on highly democratic ideals, in which optimal solutions are found organically from a collective competition of ideas. Our current democracies do not function on these ideals to the degree that they could or should (89). As a result, it's highly likely that a Global Brain governance would exhibit a higher-level democratic practice than humans have ever been able to achieve (88).

6.3 Could our current government systems become assimilated into Global Brain?

Our current governance systems will undoubtedly go through significant structural changes in the coming decades. The relics of these systems may still exist in a Global Brain socio-political landscape for symbolic and historical reasons, in a similar way to how certain prestigious monarchies from the agricultural era are still preserved in industrial systems (88). However, it is likely that all industrial political systems will lose their practical function in a Global Brain socio-political landscape (88).

6.4 Will Global Brain be a system of abundance for all?

As several recent books, studies, and reports have noted, our world seems to be on a relatively rapid trajectory towards material abundance (20; 39; 67). If we simply extrapolate these current trends we see that the technologies that would constitute a Global Brain, would also usher us into a world of abundance for the entirety of humanity (13). In this world, poverty and inequality, as well as income and wealth, will all need to be redefined.

6.5 How will human life be improved within Global Brain?

Currently, most humans must work jobs that do not stimulate the mind, while also living in a persistent fear of resource scarcity. A Global Brain world would objectively improve the human condition because it would allow everyone the opportunity to follow their own intrinsic passions to their fullest and also allow everyone the luxury of never worrying about resource scarcity.

6.6 Can we know Global Brain economics?

In a world of abundance there will undoubtedly be a new economic system (84). Information and communication technologies (ICT) are currently automating jobs that humans find mundane, and also turning scarce material resources into infinite information resources (13). This produces a property economists call "nonrivalry", which means that informational resources do not diminish from being shared (2). This presents us with a potential to built an economy based on ideas and exposure. We see some aspects of this economy emerging on new digital mediums, albeit with major problems and tensions due to fundamental conflicts caused by ideas and exposure not enabling resource stability in the current scarcity-driven system.

6.7 Will Global Brain prevent humanity from destroying itself?

Global Brain will be able to stabilize our system, which has proven to be particular vulnerable to potentially catastrophic internal threats and conflicts since the beginning of the Industrial Revolution. However, Global Brain does not guarantee infinite safety or eternal existence. There would still be several external threats that may or not may prove overwhelming to our system. We must also consider the possibility that new and unpredictable technological advancements could still threaten stability in a Global Brain world (90).

6.8 Will there be a homogenization of culture, social life, and ideas?

Many ancient cultures, societies, and ways-of-knowing will become marginalized and/or functionless in a Global Brain world. We can see this as a continuation of a larger trend over the past few centuries for hunter-gatherer and traditional agricultural societies to become subsumed by their energetically superior industrial counterparts (91). In many respects, people see this as a homogenization of culture, social life, and ideas (92). However, in Global Brain everyone will have the freedom and opportunity to explore anything they find intrinsically enjoyable, which means we should expect greater diversity of art, writing, as well as scientific and mathematical inquiry. As a result, the types of cultural activities you can engage in, the types of people and relationships you will be able to explore and maintain, as well as the types of ideas you will be exposed to, should all diversify (as opposed to homogenize).

6.9 How can I succeed better in life knowing about the Global Brain?

Throughout human history, the life of your parents and other adults in your life, proved to be a good approximation for what your personal life was going to be like. This is not the case in the 21st century. Your "80" will be nothing like your grandfather's or grandmother's "80". In short, the world will be much different in 40, 50, or 60 years time (13; 20; 67; 93). We live in a world of rapid technological change. Understanding how that technological change will shape your own existence can provide you with a guide for how to make better professional and personal decisions (88).

6.10 Will machines have equal rights in Global Brain?

If we do end up creating machines that both behave like they are conscious and claim to be conscious, than a discussion about "machine rights" will undoubtedly become a socio-political issue (67; 94). Considering our recent history with rights battles (e.g., civil, women, gay, animal, etc.) it's likely that there will be a strong trend towards equal rights for machine intelligences (94). We must also consider the possibility that failure to grant equal rights to conscious machine intelligence could result in major conflict (95).

6.11 How will "personhood" be conceptualized?

Personhood has always been a decision, not a discovery. Throughout the history of civilization an entire half of the human population was not considered equally persons (e.g., women) (96). The general trend in modern times is towards a more inclusive "personhood" that includes all humans, regardless of gender, sex, race, ethnicity, religion, etc. (82). We also see a trend towards "non-human personhood" (82). Therefore, it is possible that a Global Brain world will be one in which "person" is a term that refers to any sentient being, whether that being be a human, chimpanzee, or intelligent machine.

7.0 Global Brain as Dystopia:

7.1 Should we be afraid of Global Brain?

Global Brain is a massive and transformative idea. Human civilization as we know it would never be the same again. Fortunately, all current research and extrapolation suggests that a Global Brain would be a society that embodies all of humanity's most positive accomplishments, promoting: freedom, democracy, diversity, and emancipation (12). Therefore, even though Global Brain represents a fundamental transformation of human existence and society, we should not fear this transformation (although we should continue to research

more!).

7.2 Could a Global Brain resemble any science-fiction scenarios (e.g., Skynet/Matrix?)

Skynet scenario proposes that a super-powerful artificial general intelligence (AGI) continually improves itself and attempts to enslave and destroy humanity (76). In the Matrix scenario humans deny AGI access to solar energy, war ensues, and AGI use humans for bioelectricity, while keeping them trapped inside a shared simulated reality called "The Matrix" (97). Both scenarios present us futures that seem plausible, but are actually quite implausible. First, these scenarios are unlikely because they pit humans and machines in direct competition with one another, when in reality we are symbiotically co-dependent on one another (i.e., we are a human-machine civilization) (63). This means that machines that attack humans will not be acting in their best interests, and vice versa (98). Secondly, it assumes some degree of centralization and scarcity (i.e., projecting the industrial world into the Global Brain world). Centralization seems unlikely (i.e., AGI gaining complete access over the Internet), as the Internet's power and usefulness comes from its distributed activity (14). Scarcity also seems unlikely, as all models constructed thus far suggest an undeniable trend towards greater abundance (13; 20). Therefore, we must be careful not to project the historic conflicts caused by resource competition into a future that will likely have no resources that need to be competed over!

7.3 Will Global Brain society be a hive-like society?

No. The Global Brain will not produce a hive-like society where everyone thinks and behaves in the exact same way. It's likely that a Global Brain world would be the opposite, producing maximum diversity and autonomy, where everyone can do whatever they want as long as they do not harm another consciousness.

7.4 Will governments and corporations eliminate individual privacy in Global Brain?

Ideally, every human should have the right to their own privacy. Currently government and corporate control and power over the Internet decreases individual freedom, autonomy, and privacy (71). However, these centralized organizations will not thrive in a far more decentralized Global Brain world. Theoretically a Global Brain world will be one in which decentralized distributed decision-making will lead to common standards and rules that will apply to everyone democratically, increasing the power of individuals and decreasing the power of any centralized institution (71).

7.5 Will Global Brain "know" everything about me?

Web learning algorithms already collect your digital trails. This leads to

legitimate fears and concerns that a high-tech "Big Brother" will know everything about your activities, even activities you'd rather keep private. However, web learning algorithms themselves do not "know" your information, they just need to collect frequencies of your activity, while keeping a user's preference profile anonymous (71). Since Global Brain will be a distributed and self-organizing entity, there is no reason to suspect that it would engage in activity characteristic of centralized institutions which abuse access to individual's personal information.

7.6 Could the Global Brain be abused?

There will be several "perils" on the road to super-intelligence. Some of these perils include potential abuse of the Internet for use in cyber crimes and wars (13). However, it is hard to imagine how a Global Brain could be abused as global economic interdependency (19), as well as the continued diffusion of democracy and Enlightenment values (82), seem to massively reduce individual and collective willingness to engage in war, conflict, or violence (13).

7.6 Will there be total dependence on Global Brain?

In 2014, human civilization is completely dependent on agriculture to feed 7 billion humans, industry to manufacture affordable and widely available goods and services, and the Internet to communicate intra- and inter-nationally. This is not a negative dependence, but rather a necessary dependence to preserve a certain level of global order and complexity. In the same way, we will be dependent on Global Brain once the system has emerged and stabilized. This is a small price to pay for global abundance and peace.

7.7 Could a Global Brain fraction?

Since Global Brain would constitute a single information processing system for the entire planet it is difficult to imagine how the Global Brain could fraction while still retaining functionality. However, it's possible that Global Brain could spawn "offspring" entities on other planets that follow unique and divergent developmental pathways (17).

7.8 Will we lose our free will and autonomy?

From a scientific perspective it is unclear whether the concept of free will makes any sense to begin with (81) so it is hard to say whether we will "lose" this aspect of our existence in Global Brain. However, our ability to make autonomous "free" decisions should increase in a Global Brain society. This is because there will be less centralized control, and more distributed self-organization (18).

7.9 Will we lose our nature?

Human nature is not set in stone, we have always been a behaviourally flexible species depending on ecology. However, it is possible that we will encounter a period of time in the not-to-distant future where we start to play around with "our nature". The fields of synthetic biology (68) and nanotechnology (39) in particular offer us opportunities to alter our genetic makeup and enhance our physical abilities. In a sense, many transhumanists view the future of human nature to be "up for grabs".

7.10 Can the Global Brain force me to do anything I don't want to do?

In the same way that the current Internet cannot force you to do anything you don't want to do, the Global Brain will not be able to either. The Global Brain may encourage certain pathways to increase your happiness and well-being (13), as well as enforce certain rules and regulations that we have collectively agreed upon (71). But you will not be forced to do anything.

7.11 Could the Global Brain escape our control?

The Global Brain is the product of our distributed action manifest within one interaction channel. Therefore, humanity fearing that Global Brain will escape our control would be analogous to our cells fearing that we would escape their control! However, if we use this analogy we must also accept that Global Brain environments could encourage humans to follow certain developmental pathways, just as humans can modify our cellular structure and encourage stem cells to follow certain developmental pathways.

7.12 Would Global Brain survive if we suddenly lost electricity?

If we suddenly lost electricity, this would mean that our socio-economic metabolism had somehow collapsed. Since a Global Brain requires a "Global Body" that means a Global Brain would not be able to survive a complete energy collapse (although it would likely try to prevent such a catastrophe).

7.13 Can Global Brain be avoided?

There are still many challenges that we must overcome globally before we can establish a Global Brain. However, it seems as though many evolutionary pressures for a Global Brain are being strongly selected for (13; 18; 19; 82), making it a likely future trajectory for our species.

7.14 How can an individual human possibly understand the intelligence of Global Brain?

One of the biggest problems we may encounter in the future includes some psychological trouble understanding the capabilities of a global super-intelligence. It is entirely possible that Global Brain will possess capabilities that

humans simply cannot comprehend.

8.0 Miscellaneous:

8.1 What is the relationship between Global Brain and the technological singularity?

Both the technological singularity and the Global Brain theories predict the emergence of super-intelligence in the 21st century. Singularity theorists posit that artificial intelligence (AI) will eventually be able to continually reprogram itself to become more intelligent (e.g., AI+, AI++) causing technological progress so rapid that we are ushered into a new era of life on Earth, and potentially throughout the universe (67; 73). Global Brain theorists posit that the Internet is going to become a single information processing system for the planet that will help us solve complex global problems and enable opportunity for all humans (1; 13; 14). There are still fundamental disagreements between various theorists about whether they are compatible and mutually supportive (10; 13; 98; 99).

8.2 What is the relationship between Global Brain and transhumanism?

Transhumanism is an intellectual and scientific philosophy with the goal of fundamentally enhancing human psychological and physical capacities (94; 100; 101). This philosophy plays an important theoretical role in understanding Global Brain as many technologies that will help us construct a Global Brain, also offer us the potential to reconstitute our being (13).

8.3 Will the Global Brain make people happier?

Global Brain will be a society that will give people abundance and opportunity, which in turn should increase happiness. In a Global Brain society, measuring happiness should become more important for governance institutions than measuring GDP or PPP.

8.4 What about people who don't want a Global Brain to emerge?

This will not be the first time a new human system has emerged and diffused throughout the world. We have seen a strong transition from hunting to agriculture take place between 10,000 years ago to the 20th century (24). We have also seen a strong transition from agriculture to industry between 1750 C.E. to the present (24). So if history is any indication, becoming isolated luddites may be the only option for those who do not want to join the new system. We should expect this to occur, just as it has with previous system transitions, producing pockets of "industrial luddites" similar to those that remain in hunter-gatherer groups or culturally isolated agricultural societies (e.g., Mennonites).

8.5 Are we really "neurons" in the Global Brain?

Humans, together with their technology, do form a type of "nervous system" for the planet (65; 70). This is true structurally as we process information in parallel and collectively aggregate the results of this processing. This is also true functionally, as we utilize our collective intelligence to solve problems too complex for any one individual or small group.

8.6 Will we be immortal in Global Brain?

Humans have always dreamed of "immortality" or "eternal youth" (102). In the 21st century there are technological advances that do offer us the opportunity for radical life extension (103). Some of these technological advances include therapies and treatments that could help us replace and/or reprogram our biology away from aging (68). This would not necessarily culminate in immortality, but instead the end of aging (103; 104). Whereas other technological advances offer us the opportunity to replace our biological substrate with nanocomputers (67). Gradually transforming from cyborgs to robots could lead to "cybernetic immortality" as you would eventually possess a digital mind with endless "backups" (67; 105). Whatever actually occurs, there is a strong likelihood that human lifespan will increase considerably from our evolved aging average (106).

8.7 Will Global Brain expand or transcend in the deep future?

The expansion hypothesis and the transcension hypothesis are the two dominant hypotheses for the future of intelligence in the universe (41; 42). The expansion hypothesis posits that intelligence expands outwards controlling ever more space and exploiting ever more energy. It's conceivable that Global Brain would lead to an expansionist civilization that steadily establishes colonies on other planets and moons in our solar system and beyond (17). In contrast, the transcension hypothesis posits that intelligence will continue to compress space, time, matter, and energy (i.e., STEM compression) down to atomic scales leading to the emergence of black hole-like conditions (42). This would be consistent with current observations that complexity in our universe seems to become ever-more localized. However, neither hypothesis has been supported by empirical evidence.

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