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Abstract

The Global Brain is a leading hypothesis explaining the current evolution of the human system. Recent multidisciplinary research at the Global Brain Institute has laid a potential framework for thinking about the future of human society within the context of the emergence of a global brain this century. In this article, I outline the theory of challenge propagation and explain how this theory can help us formulate an empirical understanding of the future of individual and collective human experience with a global brain. This includes a prescriptive and predictive analysis of the future of governance and religion. The article invites discussion as well as critical and constructive feedback as its sole purpose is to stimulate a decentralized discussion that will help us all better understand the future of human organization in the twenty-first century.

Keywords

future, evolution, anthropology, global brain, technology

Global Brain

The Global Brain is a leading hypothesis explaining the current evolution of the human system. This hypothesis is meant to describe a distributed self-organizing planetary intelligence emerging from all people and information and communication technologies (ICT) connected via the Internet (Heylighen 2013). The hypothesis of the global brain was first inspired from thinking in the biological and evolutionary sciences, which likened collective human interaction to the collective interaction of neurons within the brain. The brain is a wonderful example of how distributed self-organizing constituents can produce emergent properties such as intelligence, goal-directedness, and even consciousness. Using this metaphor, many thinkers including physicist Peter Russell (1982), cyberneticist Valentin Turchin (1977), and biologist Howard Bloom (2000) have envisioned different versions of humanity as in the process of building a global brain. Cyberneticist Francis Heylighen (2011) recently summarized the three main metaphorical conceptions of a global brain:

- **Encyclopedism**—an entity with all world knowledge organized and accessible to all humans
- **Organicism**—humanity as a super-organism in the process of building a technological nervous system
- **Emergentism**—globalization as in the process of producing an emerging global consciousness

However, researchers are now interested in going beyond metaphor and proposing actual mechanisms and theoretical models that can help us describe the emergence and potential existence of a global brain. Functionally speaking, brains help organisms solve problems just as the global brain would help the human super-organism solve problems too complex for any lower level of intelligent organization.

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Structurally speaking, neurons within neural networks process information in a parallel and distributed fashion transmitting information to connected neurons, that is, in the same basic structural pattern used by humans to transmit information via the Internet. But is this just a metaphor?

Challenge Propagation

To find out if the global brain is more than a metaphor, Global Brain Institute (GBI) have been focusing their attention toward mathematically understanding the nature of human distributed and self-organizing intelligence. This has led to the formulation of a conceptual and mathematical model for the global brain known as “challenge propagation” (or ChallProp) (Heylighen 2012; Heylighen et al. 2012).

Challenge propagation acknowledges that an integral component of intelligence can be expressed as a problem-solving computation (Heylighen 2012). For an intelligent agent (whether that be a neuron, eusocial insect, or human), a problem is something that makes the “initial state” (i.e., the present situation) different from the “goal state” (i.e., an ideal situation). An agent will seek to change its initial state if it receives information that will deteriorate or even threaten its existence. The information will essentially be perceived as a problem. The agent must process this information and solve the problem by drawing on information it already possesses (i.e., this is a problem that has been encountered and overcome before) or the agent must draw on information by cooperating with another agent *or* they can create the information. Both of these last two options are dependent on the ability of the agent in question, which is in turn dependent on the agent’s evolutionary history. If the problem cannot be overcome, the agent will not reach the goal state, and as a result, it could experience deterioration (or in many cases die).

Intelligence expressed as computation:

- Input information: initial state/problem/question
- Output information: goal state/solution/answer

Challenge propagation also acknowledges that agents exhibit the highest degree of intelligence when they solve problems in a distributed collective fashion (Heylighen et al. 2012). For an example, think about a collective human species problem: the problem of global warming. So we have our initial state and we have our goal state of stabilizing the climate. The information we need to stabilize our climate is distributed (i.e., one person does not have the information to stop global warming). We need to draw on the collective intelligence of the entire system. That is why we train ecologists, biologists, engineers, and a whole range of other professionals. With their collective self-organizing intelligence, the problem of global warming can, in principle, be solved. We can reach the “goal state.” And by reaching the goal state, we can get objectively more intelligent because we strengthen the links between important agents, in the process realizing that building a global energy economy on a finite resource supply with negative ecological side effects was a bad idea.

But, and most critical for the theory of challenge propagation, it is acknowledged that all intelligent behavior is not necessarily about problem solving (Heylighen 2012). Intelligent agents also follow an “in-built” value system that has evolved based on the improvement of their own system (i.e., for humans, it is good to exercise, play, listen to music, be creative, travel, build social connections, etc.). These are not “problems.” As Francis Heylighen noted, when you go on a walk, you are not solving the problem of being “walkless” (Heylighen 2012). When you go on a walk, you are presumably exploring an “opportunity” to relax and experience nature. Exploring opportunities allows agents to “progress” or “grow.”

Intelligent agents are always on a continuum between problems and opportunities (Heylighen et al. 2012). In the theory of challenge propagation, problems/opportunities are collapsed into “challenges.” We do not like remaining at “zero” (i.e., doing nothing). If we are not solving a problem (challenge relaxing), we are seeking an opportunity (challenge seeking). If an agent cannot solve a problem or

explore an opportunity, they will “propagate” it within their network of agents (“friends”) that can assist their relaxing or seeking. This is why the theory is called “challenge propagation,” as all intelligent agents “propagate” “challenges” in the system they are contained within.

Of course, problems/opportunities are not a strict binary as agents can do both simultaneously (Heylighen et al. 2012). And there are few hard rules about the prioritization of problems/opportunities, as some agents enjoy solving problems more than exploring opportunities (i.e., Elon Musk) and some agents enjoy exploring opportunities more than solving problems (i.e., Paris Hilton). However, one important rule for evolved agents is that challenge relaxing must take priority when it comes to problems related to natural selection, or else they will risk deterioration and eventually death.

The GBI is building and testing this basic mathematical model of challenge propagation in a prototype simulation of the human system to test whether the human system as a global brain would, indeed, be (1) distributed and (2) self-organizing. What would validation of this model mean? It would mean that to achieve a truly global level of organization, the agents within the human system can coordinate over time and space without centralized “top-down” control. Instead they must only coordinate using stigmergic “bottom-up” interactions. This appears to be a basic property of truly complex systems. As a result, our ideal organization for the global brain would generate the same parallel organization observed within biological brains.

This mathematical model can be seen as both prescriptive *and* predictive of the future human organization. The model is prescriptive because we can actually work toward designing the future of human institutions within this basic theoretical framework. As a basic principle, all future institutions must be “stigmergic” (i.e., based on the property of decentralized and distributed bottom-up organization). We can further test the proposed organizations of human institutions within the ChallProp computer simulation software, to see how well

specific designs will enhance human collective intelligence toward achieving the “goal state” of global cooperation and ecological sustainability (Veitas 2014).

Furthermore, the model is predictive because there appears to be strong evolutionary pressures toward more distributed forms of human organization (Heylighen 2013). These pressures emerge from *real physical systems* that largely dictate how humans *can* organize, namely, the Internet and the emerging renewables energy grid. Both grids are inherently distributed, decentralized, and global. Therefore, they are systems that allow for global cooperation and ecological sustainability. Furthermore, cybernetic and evolutionary models suggest social re-organization in our desired “goal state” direction may be in essence an inevitable process that has occurred during previous transitions to new information and energy systems. Both control information theory (Corning 2007) and human metasystem transition theory (Last 2014) suggest that a new information medium eventually uses matter/energy in new “purposive” processes (i.e., the Internet enabling the control of renewables), which leads directly to a new cybernetic organization (i.e., more decentralized and distributed).

Indeed, the hunting revolution, agricultural revolution, and the industrial revolution, led to structural re-organizations of human existence only after a new information technology enabled the stabilization of a new energy source (Last 2014). During the hunting transition the evolution of modern language enabled the coordination of large-scale hunting, which was necessary for the formation of group sizes three times the size of our more primitive human ancestors. During the agricultural revolution recorded symbols (i.e., written language) facilitated the organization of vast bureaucracy for the stabilization of agricultural practices and emergence of civilization. And during the industrial revolution the emergence of the printing press led to the flourishing of scientific and technical knowledge that would allow for the exploitation of fossil fuels, and the emergence of international trade and governance networks (Last 2014). These theories help us reduce the past and future of human organization to a matter of physics, information theory, and evolutionary energetics. If true, the

likely result of the advancing global communications and energy grids should be the gradual re-organization of all major human institutions that increase collective intelligence within the challenge propagation framework: organizations that are decentralized, distributed, and global.

So we need to start building global institutions for the global brain. Here, I hope to give a brief introduction to the power of challenge propagation in explaining societal re-organization. First, I will describe the recommended organization for the future of governance. Second, I will describe the recommended organization for the future of religion. Both of these organizations have played a fundamental role to the organization of human society since the emergence of civilization. What will their nature be in the global brain?

For reasons described above, this overview is meant to be both prescriptive *and* predictive. If governance and religious institutions take the prescriptive organizational recommendations seriously, then this will increase the chances that they will survive and adapt to the next human metasystem (i.e., the global brain). If they ignore the prescriptive organizational recommendations, it will increase the likelihood that these institutions will collapse in the coming decades. I predict that the time these institutions have to re-organize is dependent on the full establishment and maturation of a distributed renewables energy grid. This would be in accordance with both control information theory (Corning 2007) and human metasystem transition theory (Last 2014). If re-organization fails to occur before the establishment of a new energy grid, they will be re-organized externally from current institutions (i.e., in a people's revolution). The primary reasons for this being that "the people" will no longer be energetically dependent on the centralized fossil fuel industry. The fossil fuel and telecommunication magnates will not be able to corrupt political office to the same degree, and, as a consequence, the balance of power will switch from the "old system" of industry and telecommunication (which is strongly centralized and hierarchical) to the "new system" of renewables and the Internet (which will be strongly decentralized and distributed).

Furthermore, challenge propagation extends beyond the domain of governance and religion and may also be applied to other human institutions. This power gives us the potential ability to organize the entirety of human civilization on a global scale. Such an organization is best described as a "global village."

Governance

Human governance institutions characteristic of the agricultural era were largely monarchical. Monarchical governance organizations are highly centralized with the majority of power in the hands of a very small group of individuals, or just one individual. Consequently, these organizations disproportionately benefitted a small elite within society. The transition to modern democratic governance institutions, which began with the American and French Revolutions respectively, was characterized by a significant decentralization and distribution of decision-making. However, in modern democracies, there are growing problems with corruption and inefficiency. These problems are largely the result of individuals within our governance system being co-opted by a small economic elite (a "billionaire class"). Furthermore, our governance systems are national-in-scope, which is an insufficient level of organization in the twenty-first century, given our emerging global communication infrastructure, which allows for global trade and a truly global movement of thought, resources, and peoples. As a result, it is clear that our "present state" is now out of line with the "goal state" of a governance organization for the global brain in the global village.

We need to form a governance organization that globally increases socioeconomic equality and environmental stability. We need to form organizations that eliminate the possibility that our governance institutions can be co-opted by small groups of elites. We need to create governance organizations that allow global participation and open competition of ideas free from ideology, power, and wealth. This is not impossible; in fact, such a system is easily designed within a challenge propagation framework.

There have been significant theoretical and practical advances from projects related to collective intelligence (Klein 2012) and open government (Noveck 2009). These projects lay the very beginning of a theoretical groundwork for a new style of governance organization. By using the principles of challenge propagation, recent societal developments, emerging ICT, and the latest research projects, I have formulated a framework for thinking about the next generation of government (Last 2014). I call this new organization a *Distributed Digital Democracy* (Last 2014). Distributed Digital Democracy can be summarized based on its three main properties:

- **Distributed**—decision-making is distributed throughout the entire system based on trust-networks, expertise, and personal history with proposed ideas and successfully implemented policy.
- **Digital**—all activity is hosted and maintained in a virtual distributed social network that allows for equal participation and the establishment of social connections based on trust and past decision-making.
- **Democracy**—all policies (or ideas) are put through a rigorous process that maximizes ongoing collective democratic activity, namely, (1) input, (2) processing, (3) output, (4) feedback.

Although the specifics of a Distributed Digital Democracy still need to be proposed and tested, I maintain that the basic properties of its architecture would work well for governance in the Internet-age and could possibly succeed at all levels of decision-making from local to global. Therefore, it is a potential candidate system to get us from our “present state” of massive global socioeconomic inequality and environmental instability to the “goal state” of global socioeconomic equality and environmental stability.

I predict that some form of governance similar to a Distributed Digital Democracy will emerge regardless of contemporary institutional resistance *after* the emergence and stabilization of a renewable energy grid. This

prediction is in accordance with both control information theory and human metasystem transition theory as described above. If this prediction is validated, all institutional decision-making will be more inclusive and will have a global scope of the whole of humanity. Recent research suggests that failing to reorganize in this way would put global civilization in serious danger of societal collapse (Motesharrei et al. 2014). Therefore, our future seems to be a choice between two extremes: (1) global re-organization with a new communication medium and energy grid or (2) societal collapse of varying degrees with unknowable consequences for humanity and our future.

Religion

Religious institutions have always been an important component of human society. All of the first human civilizations included religious institutions that were at times more powerful than political institutions and at times symbiotic or completely merged with political institutions (i.e., “divine” or “supernatural” power translated into real-world political power). Of course, this relationship between religious and political institutions was significantly ruptured with the emergence of new democratic political institutions. New democratic political institutions are typically explicitly “secular.” In fact, the defining attribute of modern political and religious institutions is their “separation” from one another. This can be simply explained by challenge propagation. The new democratic governance institutions that emerged during the Industrial Revolution were more decentralized and distributed, which prevented successful unification and partnership with religious institutions that remained inherently centralized and hierarchical.

The failure of religious institutions, particularly the Abrahamic religious institutions, to become more decentralized and distributed has arguably defined their controversial existence throughout the Industrial Era. This organization will ultimately lead to their collapse as the world transitions into the next system that promotes even further decentralization and

distribution. There are a number of modern trends that support the assertion that this collapse is already underway:

- Religious adherence declines with increases in education and standard of living (WIN-Gallup International Poll 2012). Massive increases in educational attainment and standard of living should both continue as we accelerate toward the global brain. There are already many emerging advanced technological solutions to the global education problem (i.e., artificial intelligence systems, massively online open courses, etc.) (Diamandis and Kotler 2011). Also, global standard of living has been steadily improving for decades (Gates and Gates 2014) with major improvements to be expected if/when there is a global governance transition (Glenn et al. 2012).
- Modern social norms are becoming increasingly “secular” or “humanist” (Pew Research Center 2014). This is characterized by all of humanity becoming far more inclusive of all humans, regardless of race, ethnicity, sexual orientation, and so on. In contrast, religious social norms are often based on various types of “exclusion.” Most recently, this problem has intensified in the developed world in specific regard to lesbian, gay, bisexual, and transgender (LGBT) rights. However, throughout the world as a whole, religious social norms are often massively exclusionary against women as well. Statistics show that many young demographic groups are “moving away” from religious institutions as a result (Pew Research Center 2014).
- The qualitative declines in religious belief (i.e., strict and literal adherence to one religion/text) have been overwhelming (Pew Research Center 2014). The growing “secularization” of the developed world has made it practically impossible for individuals who are strict and literal adherents to Abrahamic religions to be taken seriously in modern political, scientific, and medical discussions. This fact is

often overshadowed by the more moderate quantitative declines in religious belief (although quantitative declines are also quite clear) (Smith 2012).

- Non-religious or anti-religious content thrives on many of the collective intelligence platforms available via the Internet today (i.e., *Reddit*, *YouTube*). The overwhelming positive reception of non-religious content can be quantified in several different mediums with distributed voting systems (i.e., *Reddit*’s “upvote/downvote,” *YouTube*’s “like/dislike” bar). More importantly, collective intelligence platforms offer people access to non-religious and alternative media in several different content forms via the Internet. This facilitates the types of discussion and exposure to non-religious ways of thinking, in ways that were practically impossible pre-Internet. Consequently, the generation that has grown up with the Internet (i.e., Millennials) is quantitatively the least-religious generation, perhaps in the entirety of human civilization (Pew Research Center 2014).

But, of course, continued religious decline cannot be expected with absolute certainty. Such a decline can only be expected *if religious institutions fail to re-structure their organizations*. I will try to explain this in simple socio-technological evolutionary terms related to challenge propagation.

Humans have inherent spiritual needs, and these needs can manifest in many different ways (they are not exclusively manifest in religious institutions) (Pew Research Center 2014). But unfortunately, most religious organizations are inherently hierarchical and centralized. This organization prevents a real active dialogue about spirituality and faith between religious leaders and practitioners and further reduces the chances that religious leaders will actually be able to connect to “the people’s” innate and changing spirituality. Therefore, the only religious institutions that can survive the transition toward global brain will be those that have a much more active and open dialogue. This can only be achieved with a decreased emphasis on leaders, authorities,

and denominations. Essentially, religious organization needs to become far more decentralized and distributed in its organization, where ideas can propagate with greater ease (due to reduced hierarchy) and efficiency (due to distribution). This institutional organization is likely to reduce, or completely erode fundamentalism and associated dogmatic ideas. This is because dogmatic ideas require centralized control to survive. Therefore, many traditional unsubstantiated ideas that lack empirical support are destined to become marginalized and eliminated in a Darwinian fashion anyway, as a simple function of our system's information transfer rate increasing over time.

More importantly, a re-organization of religious institutions would allow different religious groups to move past any theological divisions and find a common purpose and goal for the twenty-first century that is more in-line with religion's core purpose of providing the people with an outlet to explore worldviews and their innate spirituality. Some of the core similarities between all religious groups are likely to include:

- A belief in the "golden rule" (also known as the "ethic of reciprocity") (i.e., one should treat others as one would like others to treat oneself)
- All people should have their basic needs met
- Some form of an unknowable "afterlife"
- Superintelligent creation of the universe

I am not a religious expert but encourage discussion along the lines of cooperation, commonality, and unified purpose. My attempt here is simply to encourage and recommend an organization that should allow religious institutions to accomplish a greater spiritual unity and reverse a clear qualitative and quantitative decline, which is likely to lead to greater irrelevance and collapse in the modern world.

Either way, a transition to a more distributed and decentralized form of religious belief will take hold, with or without traditional religious institutional initiative in this direction. Therefore, just like the transition to new governance, I predict that contemporary religious institutions have the option to accept the new organization and

thrive, or reject the new organization and collapse. As stated above, collapse should be ultimately caused by the new advancing information and energy systems, which force re-organization in a distributed and decentralized way. The proximate cause of the collapse will happen for two main reasons. The first reason is related to the fact that a growing number of people are becoming disconnected from religious institutions, as they exist today (WIN-Gallup International Poll 2012). This suggests that religious institutions are losing their function (i.e., failing to connect to people's innate spirituality). The speed at which this is happening is far quicker than most people realize, at least on generational scales of time (WIN-Gallup International Poll 2012). The second reason is that future society will have a distributed digital governance medium. The combination of a people disconnected from religious institutions and a distributed digital governance medium, would likely result in policy imposing land tax requirements and removing tax breaks for religious institutions. In this scenario, it is possible that we would see a flourishing of "new religions," which would be more decentralized and distributed, and consequently focused on spirituality and individual happiness, rather than false explanation and dogma. However, contemporary religious institutions *could still fulfill this function*, if they drastically re-structure, as I recommend above.

Concluding Thoughts

In this article, I tried to introduce the reader to the idea of Global Brain and a potential global brain social landscape related to governance and religion. This landscape will be much different as it will be both decentralized and distributed. Consequently, we can say that the future of governance *and* religion will be far more effective at achieving their goal state. Government will be better at making decisions that actually benefit the entirety of society. Religion will be better at addressing the spiritual needs of the people. The big unknown, and something that may be difficult for challenge propagation to predict, is whether or not these transitions will be peaceful/violent, internal/external. My personal prediction is that there will be tremendous regional variation depending on each sociopolitical

region's experience with previous forms of these institutions. However, I am hopeful that a peaceful and internal transition could proceed in both governance and religion, once all humans have unlimited access to the Internet and a new distributed energy grid has been established. This should make it culturally clear that a global institutional transition of a structural nature is taking place, as a result of new information and energy grids.

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