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The Global Brain as a model of the future information society: An introduction to the special issue

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ABSTRACT

The Global Brain can be defined as the distributed intelligence emerging from all human and technological agents as interacting via the Internet. It plays the role of a nervous system for the social superorganism. A brief history of this idea is sketched, with a focus on the developments leading to the creation of the Global Brain Group, and the Global Brain Institute (GBI) that emerged out of it. As directors of the GBI, the authors of this paper took the initiative of editing a special issue on the topic of "the Global Brain as a model of the future information society". We briefly sketch the contributions from the different papers in this issue. We conclude by reviewing some common dystopian misconceptions associated with the Global Brain paradigm, and by offering an optimistic outlook on how the "offer network" protocol inspired by this paradigm may lay the foundation for a much more synergetic and sustainable society.

1. Introduction

Since it came to the fore in the late 1980s, information and communication technology (ICT) has drastically changed the organization and functioning of society, bringing us into a new regime that has been called *the information society*. The Internet in particular has taken over ever more social, economic and technological functions from other systems of communication and collaboration, and this at an absolutely staggering speed. At the same time, it has been opening up a seemingly infinite variety of new forms of interaction. It is being used for applications as diverse as ordering groceries, organizing political protests, financing new ventures, sharing commodities, discussing global problems, keeping in touch with friends, monitoring factories remotely, guiding traffic, publishing documents, keeping stock in warehouses, distributing calculations across thousands of independent computers, "crowdsourcing" tasks to anonymous workers, and remotely following courses.

This explosion in the number of actual and potential developments of the Internet is overwhelming (Heylighen, 2016a). The resulting confusion makes it very difficult to discern stable trends—except for a general growth in Internet use. Forecasting how these myriad competing advances will shape the future information society seems especially daunting. Still, there exists a paradigm that promises to bring some order to this tangle of volatile, uncertain, complex, and ambiguous (VUCA) developments: the *Global Brain* (Bernstein et al., 2012; Goertzel, 2002; Heylighen, 2011; Mayer-Kress and Barczys, 1995; Russell, 1995)].

The Global Brain can be defined as the self-organizing, adaptive network formed by all people on this planet together with the information and communication technologies that connect them into a cohesive system. The idea is that global interactions have made the people on this planet interdependent to such a degree that together they form a single *superorganism* (Heylighen, 2007; Stock, 1993), i.e. an organism (global society) whose components are organisms themselves (individual people). As the Internet becomes faster, smarter, and more encompassing, it increasingly interconnects people and computers into a single information-processing network, which plays the role of a nervous system for this superorganism (Heylighen, 2011, Heylighen, 2002). The function of a nervous system is to coordinate the different activities taking place inside this organism, thus increasing their efficiency and coherence, while minimizing any friction or conflict. It moreover provides a repository of knowledge, which functions like a world memory (Wells, 1937) or global expert system (Skulimowski, 2013) that would be able to answer any questions. The knowledge function is supported by the emerging Semantic Web, a suite of protocols for representing knowledge in a machine-understandable way (Berners-Lee and Fischetti, 1999; Heylighen, 2016c). The communication with the superorganism's physical body is supported by the Internet of Things, another emerging technology for the integration of physical objects into the ICT network (Atzori et al., 2010; Rifkin, 2014).

While the Global Brain concept was initially formulated merely as a metaphor, globalization together with the explosive development of the Internet are turning it into an increasingly realistic model of the present information society (Heylighen and Bollen, 1996). Indeed, the network

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of social, communication, and economic links make individuals, organizations, machines and even ecosystems across the world ever more dependent on each other, and ever less capable of acting purely on their own without considering potentially faraway consequences. Moreover, the storage, exchange and propagation of information across this network provide it with a level of knowledge and capability for intelligence that far surpasses that of any individual or organization. An extrapolation of these accelerating technological developments suggests that we may be undergoing a "metasystem transition" or "singularity" within the next few decades (Heylighen, 2008, 2012, 2015). This is a radical shift to a level of intelligence that is as yet difficult to imagine, but that is likely to fundamentally alter the human condition.

The intelligence of such a Global Brain is collective or *distributed*: it is not localized in any particular individual, organization or computer system. It rather emerges from the interactions between all these components. Such a distributed intelligence may be able to tackle current and emerging global problems that have eluded more traditional approaches. Yet, at the same time it will create technological and social challenges that are still difficult to imagine, transforming our society in all aspects. The present special issue of the journal *Technological Forecasting and Social Change* is intended to survey some of these challenges to the information society, while using the Global Brain paradigm to better understand both opportunities and dangers.

But let us first review the different conceptual strands that together led to the Global Brain paradigm. (For a more in-depth historical analysis, see (Heylighen, 2011).) We will here focus in particular on the developments that preceded the creation of the *Global Brain Institute*, and the present special issue that grew out of its activities.

2. A brief history of the Global Brain vision.

In the late 19th century, the founding fathers of sociology, Émile Durkheim and Herbert Spencer (1898), observed that society is in many aspects similar to an organism. However, they did not yet find any clear counterpart for a nervous system in this *social organism*. In the 1920s, the French paleontologist Teilhard de Chardin (1959) described the growth of the *noosphere*, the network of ideas and communications that envelops the planet, a concept he developed together with the Russian geologist Vernadsky (1926).

Teilhard's rather abstract and mystical vision was complemented by the more pragmatic approach of the Belgian information scientist Paul Otlet, who envisaged a world-wide web-like interface that would allow accessing the whole of human knowledge as stored in an immense cross-linked repository (Otlet, 1935; Rayward, 1994). At the same time, the British author Wells (1937) proposed the creation of a "World Brain", which he saw as a university-like global institution that would collect, organize and make available all that knowledge. For a concrete implementation of these visions, we had to wait for the concept of hypermedia further developed by the Americans Bush (1945), Engelbart (1988) and Nelson (1983), and the emergence of the Internet in the 1970s. Internet and hypermedia were first integrated by the British computer scientist Tim Berners-Lee, who thus in 1991 created the *World-Wide Web*, an invention that would soon take over the world (Berners-Lee and Fischetti, 1999).

While the web, with its network of associative hyperlinks, was clearly inspired by the organization of the brain, the link with the social organism was still lacking. This link was clarified by a number of authors inspired by Teilhard's vision: the British physicist Russell (1983), who coined the term "global brain" in 1982, the German complexity scientist Gottfried Mayer-Kress (Mayer-Kress and Barczys, 1995), who connected Russell's idea with the Internet, the French futurist Joël de Rosnay, who discussed the "planetary brain" of the "global macro-organism" (De Rosnay, 1986, 2000), and the Russian computer scientist Turchin (1977). As one of the founding fathers of Artificial Intelligence in the Soviet Union in the 1960s, Turchin developed an integrated theory of the evolution of cybernetic organization and intelligence, from primitive cells to the human brain, and beyond, to what he called the social "superbeing". His core innovation was the concept of *metasystem transition* (Heylighen, 1995; Turchin, 1977, 1995): the evolutionary emergence of a higher level of complexity through the integration of subsystems into a metasystem. The implication of his theory was that humanity is at present undergoing a metasystem transition to a level of collective intelligence that we as yet cannot imagine.

After moving to the USA, Turchin came in contact with the American cybernetician Cliff Joslyn, who proposed to collaboratively develop Turchin's ideas via the new tools of hypermedia and the Internet. To do this, in 1989 they founded the *Principia Cybernetica Project* (Heylighen et al., 1991). They were joined one year later by the Belgian cybernetician Francis Heylighen. Heylighen was quick to realize the importance of the newly created world-wide web to realize Joslyn's vision. He therefore created the Principia Cybernetica website in 1993 (Turchin et al., 1993), as one of the first complex, collaborative websites in the world.

While working at the Free University of Brussels (VUB) with his then PhD student, the Belgian psychologist Johan Bollen (now at Indiana University), Heylighen further realized that the world-wide web could become much more intelligent by implementing the mechanisms of Hebbian learning and spreading activation that characterize the brain. Combining these insights with Turchin's theory led him to propose a first concrete model of the future, intelligent web, i.e. the global brain (Heylighen and Bollen, 1996).

After coming into contact with the American artificial intelligence researcher Ben Goertzel, who had developed similar ideas (Goertzel, 2002), the two of them founded the international *Global Brain Group* in 1996. This brought together most of the researchers who had actively reflected about this issue, including Russell, Mayer-Kress, de Rosnay, Turchin, Joslyn, Bollen, and the futurologist Jerome Glenn, who had envisaged a merger between ICT and human consciousness (Glenn, 1989). The group organized a first international workshop on the global brain in 2001 (Heylighen, 2001) at the VUB. It has since maintained an active email discussion forum (GBRAIN-L) on the topic.

After a few years of more limited activity, the community was revived and expanded in 2012 with the foundation of the *Global Brain Institute* (GBI). This was made possible thanks to a grant from the Yuri Milner Foundation intended to stimulate research on the Global Brain. The institute, situated at the VUB, is presently led by the authors of this paper and editors of this special issue: Francis Heylighen, as scientific director, and Marta Lenartowicz, as managing director. Its scientific board includes the still active members of the Global Brain Group, as well as some newer recruits that have worked on related themes: the German sociologist and complexity scientist Dirk Helbing (Helbing, 2015; Helbing et al., 2012), the American computer scientist and collective intelligence researcher Marko Rodriguez (Rodriguez, 2004, 2005; Rodriguez et al., 2007), and the Mexican complexity scientist Gershenson (2004, 2008).

The GBI team consists of nearly a dozen researchers at pre-doc and post-doc levels from a variety of scientific and cultural backgrounds, ranging from the humanities to the social sciences, engineering, computer science and mathematics. It investigates the emergence of a distributed intelligence out of the Internet, by means of conceptual theory, mathematical models, computer simulations, surveys of social and technological developments, and the formulation of forecasts and scenarios.

The Global Brain Institute (GBI) is particularly interested in how developments in ICT will affect the future information society. Our fundamental objective is to better understand these on-going changes. This would help us to anticipate them and to direct them towards the most desirable outcomes—while as much as possible steering clear of dangers and negative side effects. By disseminating our insights, results and recommendations to scientists, decision-makers and the wider public, we hope to effectively influence these developments. In this way, the GBI intends to help the anticipated "Global Brain" organization of the