Transcending the Rational Symbol System:
how ICT integrates science, art, philosophy and spirituality
into a global brain

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Abstract:
Symbols support the uniquely human capabilities of language, culture and thinking. Therefore, cognitive science has tried to explain intelligence as founded on rational symbol systems (RSS): collections of symbols together with logical and grammatical rules for combining these symbols into expressions. The main shortcoming of this RSS mechanism is that it reduces the continuous experience of reality to a combination of static, discrete, and to some degree arbitrary, elements. To fully support intelligence, such symbols need to be grounded in subsymbolic networks and situated interactions that capture the subjective, transient and intuitive aspects of experience. Historically, different approaches have tried to overcome the shortcomings of rational symbol systems, albeit as yet with limited success: science, by formalizing and operationalizing symbols; philosophy, by seeking for the reality behind symbols while analyzing the shortcomings of symbolic representations; art, by evoking intuitive insights and experiences; and spirituality, by expanding consciousness beyond rational symbol systems. The on-going explosion in information and communication technology now makes it possible to extend and integrate their results, through techniques such as computer simulation, artificial intelligence, neural networks, multimedia, virtual and augmented reality, and brain-computer interfaces. Thus, the subsymbolic level of cognition, like the symbolic level before it, becomes externalized and controllable, supporting and automating creativity and intuition. It is proposed that this will produce an evolutionary transition to a supra-human level of knowledge, intelligence and consciousness, envisioned as a Global Brain for humanity.
Introduction

A symbol is a token, such as a word, picture or gesture, that conventionally stands for or represents something else: the symbol’s meaning, reference or denotation. The use of symbols is arguably what made humans different from the animals out of which they evolved. Symbols gave us the language we use to not only communicate, but reason. Symbols enabled us to transmit and accumulate knowledge and culture—not just across populations, but across generations. The resulting growth of knowledge culminated in the extremely sophisticated science, technology and culture of the 21st century, which made humans into the dominant force on the planet.

Symbols enabled this by externalizing patterns in our mind, such as concepts, thoughts or feelings, in the form of a physical token. Such tokens represent the mental content while being imprinted as patterns onto a manipulable, physical carrier. For speech, the carrier is sound; for pictures, it is a light-reflecting surface; for text it is paper or silicon memory circuits. This externalization helped us to preserve the otherwise fleeting content of our consciousness. Thus, we could register an accurate and enduring memory of potentially important information. It also allowed us to transmit that information to others, so that they too could benefit from it—and potentially improve it by adding their own information. It finally helped us to manipulate or process that information, by combining different symbols into novel configurations, thus producing as yet unseen content.

This was probably the essential step in the emergence of our typically human form of intelligence. What really made human cognition so powerful compared to animal cognition is our ability to conceive of situations that we have never experienced in reality. That is because we can represent such as yet unknown situations by novel combinations of known symbols. In the simplest case, we receive such a representation as a communication from someone else, across space or time. For example, we can get an idea of how a tool we never saw functions by listening to someone's explanation, reading a description, or studying a diagram. But symbols also enable creative thinking: they allow us to conceive of a tool that does not exist yet, to imagine what we would do in a hypothetical situation, or to design a building that will take years to construct.

How symbols enable endless creativity was perhaps explained most clearly by the linguist Chomsky’s concept of generative grammar (Horrocks, 2014). This is a system of rules that allows you to produce grammatically correct (i.e. understandable) expressions by combining words (i.e. symbols) from a lexicon. The fundamental insight is that both the lexicon and the collection of rules are finite, but the set of expressions that can be generated from them is infinite. Thus, language allows us to recursively produce an infinite number of sentences and sequences of sentences, potentially describing an infinite number of situations. The generative rules of grammar are complemented by the constraining rules of logic, which tell us which of the generated expressions represent logically possible situations, and how we can infer from them further propositions about these situations.

This mechanism of generating abstract representations and then reasoning about them—even in the absence of the phenomena being represented—allows us to reflect, plan, and solve problems. Thus, it appears like the essence of intelligence. Therefore, the pioneers of cognitive science and
artificial intelligence concluded that a collection of symbols together with a collection of rules for manipulating them is all you need to produce intelligent behavior. Newell and Simon formulated this assumption about cognition as the “physical symbol system hypothesis” (Newell and Simon, 1976; Newell, 1980; Nilsson, 2007).

This idea supported a further step in the externalization of mental content: thanks to computers, we no longer need people to manipulate symbols. If we program a computer to apply the rules of grammar and logic, then this program can do the work for us, and reason intelligently about whatever situation can be described by a combination of symbols. This gave rise to the notion of information processing: represent the information you need to reason about as a combination of symbols (words, letters, numbers, or ultimately 1s and 0s), enter it into a suitably programmed machine, and then you can delegate the desired further manipulation of that information to the machine. This was the birth of what we now call Information and Communication Technology (ICT). The main components of ICT are memories to store the combinations of symbols, communication links to transmit these combinations to other memories, and processors (hardware) and programs (software) to transform the combinations into new, potentially more informative combinations.

This externalization and automation of memory, communication, and processing spectacularly enhanced the emergence of distributed intelligence or distributed cognition (Hutchins, 2000; Fischer, 2006; Dror and Harnad, 2008). Previously, processes like memorizing, remembering, and thinking largely happened inside an individual's brain, supported at most by external documents or verbal communications. Nowadays, the Internet allows individuals, external memories and computer programs to interact so intimately that they are starting to behave like a single cognitive system at the planetary scale—a “Global Brain” (Mayer-Kress and Barczys, 1995; Goertzel, 2002; Heylighen, 2011a). This leads us to envisage a distributed intelligence that surpasses human intelligence as radically as human intelligence surpasses animal intelligence. The present article will explore the benefits and limitations of different types of symbol systems in supporting such a superhuman intelligence.

We will in particular examine the shortcomings of the traditional, “rational” or “verbal” form of symbolization, which reduces an infinitely complex and changing reality to a finite collection of discrete and static symbols (“words”) and rules (“grammar” and “logic”) (Shands, 1971). We will call such a collection a rational symbol system (RSS). (Note that this replaces my previous term “conceptual-symbolic code” (Heylighen, 1984)). The RSS term seems to better capture the abstract, rule-based reasoning mode of this form of representation than Newell and Simon's (1976) term “physical symbol system”.

Science, philosophy, art, and spirituality all have to some degree attempted to transcend the limitations of rational symbol systems in expressing meanings for which no adequate symbols or language exist (Heylighen, 1984). ICT is now lending them a helping hand, by proposing forms of representation, such as neural networks, multi-agent simulations, virtual reality and augmented reality, that are much richer, more dynamic and adaptive than verbal or logical descriptions. We will here not go into the technical details that characterize these novel tools, but focus on how they may help us to transcend the limitations of human intelligence, and thus prepare the grounds for a supra-human form of cognition. In that way, we may extrapolate human symbolic evolution to the next
“major evolutionary transition” (Maynard Smith and Szathmáry, 1997) or “metasystem transition” (Turchin, 1977, 1995; Heylighen, 1995) that would lead to a higher level of intelligent organization.

The Shortcomings of Symbolic Cognition

The understanding of cognition as the rule-governed manipulation of discrete symbols was initially very promising. Rational symbol systems (RSS) not only seemed able to explain the production and understanding of language, logical reasoning, and problem solving in humans; they also allowed us to simulate these processes in computer programs (Newell and Simon, 1976). Thus, in the 1950’s they initiated the domain of Artificial Intelligence (AI). AI researchers quickly produced a number of programs that could perform apparently intelligent activities, such as playing chess, proving theorems, or diagnosing diseases from lists of symptoms. However, after these early successes, by the late 1980’s progress in AI seemed to stall. It turned out that the computer simulation of human intelligence in more concrete, real-world domains was much more difficult than expected. For example, symbolic AI programs were hopelessly unreliable in performing apparently simple tasks like translating between natural languages, recognizing objects in visual scenes, or directing the actions of an autonomous robot. This resulted in increasingly stringent critiques of the symbolic paradigm for understanding cognition (Bickhard and Terveen, 1995).

Perhaps the most fundamental shortcoming pointed out was the “symbol grounding problem” (Harnad, 1990, 2002). This refers to the fact that a symbol is not just a free-floating token, ready to be manipulated according to abstract rules, but a token with a meaning, i.e. a token that stands for some phenomenon or situation outside the symbol system. An RSS or language cannot specify its own interpretation, i.e. the processes through which its symbols are to be connected to things that are not symbols themselves. This fundamental limitation has been called the “linguistic complementarity principle” (Löfgren, 1992). A dictionary may explain one word in terms of other words, e.g. “darkness is the absence of light”. Yet, in the end there will always be words, such as “light”, “bitter”, or “dog”, that can only be really understood by seeing light, experiencing a bitter taste, or interacting with an actual dog (Massé et al., 2008). The process that connects the symbol to its non-symbolic meaning is called “grounding the symbol”. However, it is everything but obvious how this process precisely takes place.

Previously, logicians had tried to evade the problem by using formal semantics, in which a correspondence is established between a symbolic representation and some “model” representing a possible world in which the symbolic expressions are supposed to be true (Copeland, 2002). But the model is of course just another abstract system of symbols. Thus, semantics, understood as a mapping from a formal symbol to a formal “object” that the symbol is supposed to denote, fails to solve the symbol-grounding problem. The real world does not consist of clearly delineated, persistent objects that exist in an objective, one-to-one correspondence with clearly delineated, persistent symbols. As demonstrated both by our subjective experience and by the failed experiments with robots programmed according to purely symbolic schemes, the real world is intrinsically complex, changing, ambiguous and subjective. Therefore, RSS always fall short in fully capturing its behavior.
The solution proposed to the symbol grounding problem is that true cognition is always situated and embodied (Steels and Brooks, 1995; Clark, 1998). That means that we cannot understand the world just by reasoning about symbolic representations. We also need a material body equipped with sensors, such as eyes and ears, that can perceive the external situation, and actuators or effectors, such as muscles and vocal chords, that can act and thus affect that situation. Perceptions and actions are connected by a feedback loop that runs through the outside world: actions change the situation; their effect is influenced by other processes and dynamics in the environment; the combined result of actions and outside events is then again perceived and interpreted, ready to trigger another action. Each perception is compared with the expectations derived from previous perceptions and our knowledge of the world. If perception and expectation diverge, as typically happens in a non-trivial environment, a correction is to be made in the knowledge and/or in the action. Thus, the cognitive system constantly adapts its knowledge to experience, i.e. to its actual interactions with the world. These interactions, which “enact” our cognitive processes (Stewart, Gapenne and Paolo, 2014), ground the cognitive system into the real world.

This system never settles into an objective representation of the world, in which each important object or aspect of the world would be accurately and permanently reflected by a corresponding symbol. The components of this cognitive system therefore cannot be conceptualized as discrete, independent symbols. They are rather fluid networks of associations between different perceptions, interpretations and actions.

The most successful approach for modelling such associations can be found in so-called “connectionist” or “neural” networks (McLeod, Plunkett and Rolls, 1998), which are inspired by the activity of our brain’s neurons and their connecting synapses. These networks learn and refine their knowledge by reinforcing connections that contributed to successful predictions or actions, while weakening the less successful connections. Therefore, their knowledge is not localized in any specific elements, concepts or symbols; it is distributed across a network of connections. Such networks interpret perceptions, infer implications, and decide which actions to perform by using a process of spreading activation. The neurons directly connected to sensors are “activated” by the incoming stimuli, such as light falling onto nerve cells in the retina. Each neuron passes on its activation to a variety of connected neurons in proportion to the strength of the connections, while filtering out too weak signals. As this process is repeated, the pattern of activation is propagated across the network while changing with every step in the process. The recently successful AI method of “deep learning” uses hierarchical neural networks consisting of many layers in which the activation coming from perceptual input is processed into increasingly abstract patterns as it reaches subsequent layers (Schmidhuber, 2015). Eventually, the activation may reach effectors, which convert it into action. The action affects the situation, which in turn activates the sensors in a new feedback round, so that activation continues circulating through brain, body and world.

This neural mechanism of cognitive processing, which appears to be the dominant one in the brain, has been called “subsymbolic” (Bechtel and Abrahamsen, 1991). That means that the RSS-based cognition we know so well, with its grammatical and logical rules for manipulating symbols, is merely a superstructure grafted on top of this immensely complex and dynamic network of mostly subconscious processes. From this perspective, rational thinking based on symbols is merely the tip
of the iceberg—the visible shoot of a plant whose underground network of roots “grounds” these few leaves in a dark and rich soil without which they would not be able to survive and grow.

The Origin of Rational Symbol Systems

But where do those apparently simple and logical RSS come from? The emergence of symbol systems has been elucidated with the help of computer simulations of the origin of language (Steels, 1998, 2005). In these simulations robotic or software agents collectively develop a common vocabulary and system of rules to designate the phenomena they perceive through their sensors. The broad dynamics of these simulations has been confirmed by experiments with people, in which groups of individuals are stimulated to develop conventional labels and schemes in order to collaboratively tackle a problem for which they have no vocabulary available as yet (Garrod and Doherty, 1994; Fay et al., 2010; Fusaroli and Tylén, 2012).

The general dynamics in these experiments and simulations is the following. Agents start out with some individual association between, on the one hand, a meaningful category of phenomena they can sense, on the other hand, a symbol or “name” to designate that category. When two agents meet, the one points to a phenomenon that belongs to such a category and names it. When both agents agree about the designation, the association between name and category is reinforced in their mind. When they disagree, the association is weakened for the one that used it, and reinforced for the one that heard it. Thus, after such an encounter, their associations become a little more similar. Many such encounters take place between different agents using different names and pointing at different phenomena. Each time, initially different associations become more similar, while similar ones are strengthened. Eventually all associations become “aligned” between all agents: they have developed a consensual scheme for subdividing the reality they experience into a number of categories denoted by conventional symbols. Thus, an RSS has self-organized out of distributed communications between initially independent agents (Heylighen, 2013).

The underlying dynamics is characterized by positive feedback: because more common associations are more often reinforced, they become even more common, while weakening and eventually outcompeting less common associations. Thus, minimal differences in initial “popularity” are non-linearly amplified, leading to a “winner-takes-all” outcome in which a single symbol-category association erases all rival symbolizations. Yet, such amplification means that another group of individuals, where by chance the initial distribution of associations would have been slightly different, is likely to settle on a wholly different symbolic system, language, or culture (Axelrod, 1997; Henrich and Boyd, 1998).

The idiosyncrasy of such self-organized RSS is not limited to the “names” or symbolic tokens used to designate categories. The categories too undergo random shifts and consolidations during the alignment process. Because there is no objective way to subdivide a continuous field of experience into distinct categories, different agent are likely to include different phenomena in a given category. For example, suppose that initially the agents have a somewhat different understanding of which category of colors the symbol “A” refers to. “A” may represent orangey red for the one, yellowish
orange for another, and pale reddish brown for a third one. Whenever two agents encounter a color about which they agree on how to name it, that color becomes more firmly established in their mind as representative of the category denoted by the symbol. When they disagree, the association between that color and the category is weakened. As illustrated by the study of Steels and Belpaeme (2005), this mutual alignment eventually settles on a category about which all agents now agree, e.g. “A” stands for orange. Thus, the evolution of a RSS not only specifies the symbolic tokens, but also their standard meanings, i.e. the category of phenomena that a token stands for. This is a crucial step in the emergence of the typically human form of symbolic cognition.

At the subsymbolic level, the meanings of perceived patterns are essentially subjective, context-dependent and transient. They only make sense in a particular situation for a particular individual, who uses particular associations, learned through a lifetime of particular experiences, to interpret that situation. The same phenomenon experienced by a different individual, at a different moment, or in a different context, is likely to be granted a different meaning (Heylighen, 1999). For example, the same insect-like creature may be perceived as an elegant appearance by one person, a disgusting bug by another, or a rare specimen by a third person. An RSS largely eliminates these idiosyncratic associations and interpretations, and replaces them by an invariant, conventional scheme for categorizing and labeling phenomena. For example, the insect-like creature may be categorized as a praying mantis of the species *Archimantis latistyla*. This eliminates any ambiguity as to which type of creature was observed.

The emergence of a shared RSS simplifies and reduces the cognized phenomena to a relatively small set of invariant categories. This is because the process of communication that created the symbolic system needs to achieve a consensus among a large and disparate group of individuals. It can only do so by restricting itself to the relatively coarse and salient distinctions that everyone in the group is capable of making, while neglecting more subtle differences that certain more sensitive individuals are likely to perceive. The collection of symbols also needs to be small and simple enough so that most people in the group can understand and memorize them, and so that there are sufficient on-going communications using these symbols to regularly reinforce the association between symbol and meaning. Symbols that do not fulfill these conditions will sooner or later be forgotten or misinterpreted so that they lose their original meaning—a common event in the evolution of language. The advantage of such selective retention is that the symbols most likely to survive the process are those that represent the most stable, useful and clearly delimited categories—such as biological species or common types of household objects. Learning those through education into the RSS provides the mind with ready-made tools that can be used in a wide variety of circumstances.

This creation of shared categories through communication has been called the *social construction of reality* (Berger & Luckmann 1966): each social system will develop its own system of symbols, categories and rules to represent reality. In the terminology of AI and ICT, such a consensual system of symbolic distinctions is called an *ontology* (Steels, 1998; Livet, 2012)—originally a philosophical term for the study of the basic elements of reality. Thus, a RSS, by reducing the continuous and ever-changing field of experience to a finite set of discrete and persistent categories, imposes a particular view of what reality consists of. Because there is no
objective way to capture the whole of reality, this restricted view is always to an important degree (inter)subjective, i.e. dependent on the local culture. Therefore, different communities that have settled on different categorizations will not really be able to communicate about their differences.

Translation is only possible if the symbols of the one system can be mapped onto those of the other system while keeping the same interpretation. However, that assumes that the two RSS make the same distinctions, which is in general not the case. For example, the meaning of the French verb “aimer” roughly covers the same meaning as the two distinct English verbs “to love” and “to like”. Therefore, the expression “j’aime” can be translated as either “I love” or “I like”, and only a deeper understanding of the context may indicate which translation is the right one. Such intrinsic ambiguities in part explain why symbolic AI failed to achieve automatic translation. AI researchers initially assumed that the words of all languages could be mapped onto universal semantic categories—an underlying “language of thought”. However, they failed to uncover such a fundamental ontology, and therefore their attempts at translation eventually had to switch to more practical “subsymbolic” methods. Here, the meaning or a word or phrase is typically inferred from the other words in the context and the statistically derived associations between these words (Heylighen, 2001).

More generally, aspects of reality for which there are no corresponding symbols or categories in the given RSS simply cannot be described, communicated, stored or even rationally reflected about. Thus, while the use of rational symbol systems has given humanity the power to represent, register and reason, it has done so only in a highly limited, idiosyncratic manner.

Transcending RSS limitations: different approaches

Given the intrinsic limitations of rational symbol systems, the question is whether we can overcome them. Science, art, philosophy and spirituality all have approached that problem, proposing different methods and tools to go beyond these limits. In the following subsections, we will briefly review the solutions that these different cultural movements have proposed. These solutions evolved roughly in two stages (Heylighen, 1984), a first, “classical” one in which a shortcoming was noted and one or more apparent solutions were proposed, and a second, “revolutionary” one, typically starting in the first half of the 20th century, in which the remaining limitations of any such solutions became clear and a more radical exploration and experimentation was initiated that questioned the RSS to its core. In the last section, we will explore in how far 21st century ICT may provide the medium that allows these “post-RSS” developments to become coordinated and integrated into an emerging “Global Brain” that would provide a truly higher level of cognition.

Science: formalizing and operationalizing concepts and models

Science can be characterized as an attempt to develop knowledge without the simplifications, subjectivity and ambiguity that characterizes everyday knowledge as expressed in natural language.
Science in principle strives towards an as accurate, objective and complete as possible representation of reality. To achieve this, science relies on the methods of **formalization** and **operationalization** (Heylighen, 1999). Formalization means that symbols, rules and expressions are defined explicitly and unambiguously, like in mathematics or programming languages, so that their interpretation does not depend on the person, context or situation. For example, the symbols “0” (zero) and “+” (addition) are defined by the axioms characterizing the system of numbers. Therefore, they are understood by everyone in exactly the same way. Another advantage of formalization is that you can make symbols have any meaning you like while maintaining a logically coherent system, simply by formulating appropriate axioms and definitions. This allows mathematicians to imagine and reason about hyperdimensional geometries that do not seem to have any counterpart in physical reality (though one may be found eventually).

Still, formalization can only define symbols in terms of other symbols. It thus lacks a way to ground symbols in external reality. The latter method is provided by operationalization, which is the definition of a scientific property or category by means of the physical operation needed to establish whether some phenomenon belongs to that category. For example, to determine what an object’s weight is you can put it on a scale and read off the value. Similarly, you can operationalize the property of “introversion” by developing a psychological test that dependably discriminates the more introverted people from the more extroverted ones.

Formalization and operationalization make it possible to reliably establish the correctness of hypotheses. In a completely formal theory, the truth of a proposition can in principle be established by means of a mathematical proof, or a calculation. In a theory with operationally defined properties, the truth of a proposition involving such properties can be established by performing the right operations and checking whether they produce the predicted results. Thus, the great power of science is that it provides a method to systematically test hypotheses, so that it can eliminate the bad ones and keep the better ones. This provides it with a remarkably effective engine of progress.

Up until the end of the 19th century, it was assumed that, using these methods, science would eventually be able to develop a perfectly accurate, objective and complete representation of reality, where everything would be fully determined by mathematically formulated symbols and rules. However, in the first half of the 20th century an array of “limitation principles” was discovered (Barrow, 1998; Yanofsky, 2013) that shattered this dream. The limits of formalization were established by the **theorem of Gödel**, which shows that even in a completely formal RSS we will never be able to derive the truth or falsity of certain propositions from the axioms of the system. A similar limitation was formulated as the **halting problem**: in general we cannot determine whether a formally specified computer program will come to some result or continue to run without end. The limits of operationalization were made clear by the **Heisenberg uncertainty principle** in quantum mechanics, the **observer effect** in the social sciences, and the **butterfly effect** in complex systems. These principles show that we will never be able to accurately establish the state of some external phenomenon because the operation of observation necessarily perturbs the phenomenon in some unpredictable manner, and that even the tiniest perturbations can have huge effects that invalidate any prediction derived from the initial observation.
The conclusion is that science cannot hope for any complete, observer-independent description of reality. Formal and operational representations are intrinsically limited (Heylighen, 1999), and the linguistic complementarity principle—which can be seen as a generalization of these limitations (Löfgren, 1992)—cannot be evaded. While scientific methods allow scientists to overcome many sources of subjectivity and inaccuracy, they must accept that their models at best reflect only limited aspects of an infinitely complex reality, and that different problems require different types of models—without any one of them being the “true” model of reality. Therefore, in practice models are chosen by convention, because working scientists agree that they happen to work well for a given type of problem.

This more pragmatic attitude, which was called “conventionalism” by the mathematician Poincaré (Folina, 2010), has slowly diffused throughout most scientific disciplines. It is perhaps developed most explicitly in the sciences studying complex systems—such as societies, organisms, or the brain—whose subject is so complex and dynamic that any attempt at building a complete representation is anyway doomed to failure. These sciences have developed a variety of broad-purpose modeling techniques, including systems analysis, systems dynamics, network analysis, dynamic systems and multi-agent simulations. Depending on the needs of the situation and the available computing capacities, such models are easily adjusted, incorporating more or fewer features.

For practical purposes of prediction, these methods are often combined with methods developed in statistics, AI and ICT for machine learning, knowledge discovery or data mining, i.e. for the extraction of recurrent patterns from huge amounts of data. The difference is that the modeling methods are proposed by the scientists and then adjusted to the empirical data, while the machine learning methods start from the data, while trying to fit these into common models. Machine learning methods include neural networks and deep learning, genetic algorithms, statistical analysis, and probabilistic induction and abduction. Rather than using the categories and rules of a universal RSS to build the one correct representation of a phenomenon, such scientific modeling and data mining techniques help us to find new (fuzzy) categories and rules tailored to the specific problem domain.

In that way, they externalize our ability of inducing concepts and rules from experience. The human brain has an in-built capability to recognize regularities in myriads of scattered observations, and thus infer higher-level, abstract categories and rules. However, this capability functions almost exclusively at the subsymbolic level, where it was hitherto inaccessible for communication, registration, reflection or manipulation. Contemporary science and ICT are learning to externalize this capability in mathematical models and computer programs, thus making it accessible for practical problem solving and continuing improvement. But to achieve this, they had to give up the assumption that there is a permanent and objective one-to-one correspondence between the symbols of a representation and the objects in the real world. Instead, the (mostly mathematical) symbolizations they use represent the ever-changing connections, processes and interactions between nodes of activity. In that way, their dynamics and organization increasingly resemble the one of the neural networks in our brain.
Philosophy: from answering questions to questioning answers

Philosophy, like science, can be seen as an attempt to go beyond the superficiality, ambiguity and subjectivity of RSS in trying to understand reality. Instead of formalization and operationalization, its main tool is reflection. Initially, this reflection was directed at filling the gaps in the RSS: answering fundamental questions suggested, but left unanswered, by conventional accounts. For example, in the standard account, everything must be produced by a prior cause. But that leaves open the question of what produced the universe, leading Aristotle to postulate a “Prime Mover” who created that universe. As philosophy became separate from science, the questions it focused on were those that did not allow any formal or operational approach, i.e. that could not be resolved through observation, calculation or demonstration. These were initially mostly problems of metaphysics or ontology, which considered the ultimate categories and causes behind the phenomena we observe. For example, a long-standing division in philosophy exists between materialists, for whom all phenomena are ultimately reducible to material particles, and idealists, for whom all phenomena are constituted by abstract ideas.

However, as philosophy evolved, the number of philosophical concepts and systems proposed to answer such questions merely seemed to multiply. There was not any clear sign of progress, in the sense that newer answers would in some objective way be “better” than older ones, or that philosophers would reach some degree of consensus about the ultimate constituents of reality. Thus, it transpired that philosophical systems, in spite of their ambitions and the deep reflection on which they are based, are just as incomplete, subjective, and ambiguous as any other symbolic systems. This observation was perhaps formulated most forcefully in the early 20th century by Wittgenstein (2010), who noted that all such systems are merely “language games” that are intrinsically limited in what they can express (Black, 1979). This made Wittgenstein conclude that metaphysical discussion is merely a waste of time, as expressed by his famous quote: “Whereof one cannot speak, thereof one must be silent”.

This critical stance was highly influential. As a result, philosophy started to focus almost exclusively on a critical analysis of existing RSS, emphasizing limitations and raising further questions rather than proposing solutions. Thus, the focus moved from ontology to epistemology, i.e. the study of how we can gather knowledge about reality rather than the study of reality itself. This critical examination spread to encompass language, morality, society, science, culture, technology, … i.e. the symbolic systems that cover about all domains of human life. Two major traditions are conventionally distinguished in such philosophical examination: the Anglo-Saxon, “analytic” approach, and the Continental, “hermeneutic” or “deconstructive” approach.

The analytic tradition tries to remain close to the formal and operational methods of science by introducing explicit categories, and using logical reasoning to draw conclusions from “thought experiments” based on such distinctions. However, since the categories these philosophers use fall by definition outside the categories that have been successfully formalized and operationalized in science, the conclusions drawn from such “counter-factual” reasoning rarely reach results that are concrete and consensual enough to make an impact outside of philosophy. At best, they help
scientists to more precisely formulate the questions they are addressing, e.g. in modeling, cognitive science and AI.

The continental tradition has moved farther away from science and logic and closer to literature and art, formulating its insights in often poetic but typically vague and ambiguous narratives. Its emphasis is on “deconstructing” the hidden assumptions and biases behind common ways of thinking and acting. Thus, the recent continental tradition, especially in its “post-modern” guise, has been reminding us of the subjectivity, culture-dependence and implicit biases of common RSS, while inspiring us to go beyond such reductionist approaches by conceiving the world as a dynamic and holistic network of interactions (Heylighen, Cilliers and Gershenson, 2007).

Art: evoking experiences and inspiring insights

I will here consider art broadly to include not just the traditional domains of painting and sculpture, but poetry, literature, music, cinema, performance, theatre, animation and any other “creative” forms of personal expression. Art, like science, can be seen as an attempt to transcend the limitations of symbolic communication as rooted in verbal language. However, while science strives to eliminate the subjective aspects of symbolic representation, art in a way does the opposite: providing access to people’s highly subjective, personal meanings and experiences, which are too subtle and idiosyncratic to express in a system of discrete symbols and rules. The subtle combination of curiosity, beauty, fear and disgust elicited by the sight of a praying mantis cannot be expressed by its scientific name *Archimantis latistyla*. However, a drawing, animation or poetic description of that creature’s threatening but elegant stance might. Art in a sense bypasses the rational, symbolic level of cognition and directly addresses the subsymbolic level of associations, feelings, and experiences, where it elicits the kind of intuitive meanings that cannot really be expressed in words.

To achieve that, art makes use of two methods of signification: icons and metaphors. In semiotics (Merrell, 2001; Hawkes, 2003), an *icon* is defined as a sign that conveys a particular meaning by its resemblance to the phenomenon it refers to. For example, a portrait refers to the person being depicted by its similarity in shape to the person’s facial features. Someone looking at the portrait will be immediately reminded of the person it represents, and therefore of that person’s character, typical expressions, and walk of life—all features that are impossible to fully capture in words. Yet, a portrait is more than just a photograph—even though the latter arguably captures the person’s facial features more accurately and in more detail. Just like in the case of scientific models, the strength of an artistic representation lies in selectivity and simplification, in expressing the features that are most important to convey, without clouding the picture with unnecessary details. What is important in this case is determined by the artist and the subject, without any pretense at objectivity, but rather at expressing the, for the artist, most intuitively or emotionally significant aspects of the subject. These are also the ones that are most likely to move or inspire the viewer of the artwork. Thus, art ideally manages to register and communicate the subjective, emotional, intuitive aspects of some idea or phenomenon—which are ignored by RSS—by evoking the corresponding feelings in the audience.
The subjective selectivity of representation is even more outspoken when using metaphors. Like an icon, a metaphor uses the similarity between a symbol and what it stands for, but this time the similarity is not to be found with the symbolic token (the signifier), but with the phenomenon it refers to (the signified). For example, if you say that a certain person is a “wolf”, you refer to some similarity between the characteristics of that person and the characteristics of the animal conventionally called “wolf”. Like in the case of an icon, this similarity evokes subjective feelings and associations (e.g. hunger, greed, brutality) that are not evoked by the RSS labeling of that person. These feelings are intrinsically ambiguous and context-dependent, however, because a metaphor does not specify which characteristics are shared between the thing being literally referred to (the wolf) and the thing metaphorically referred to (the person). Obviously, that person does not have a grey fur and a long snout with sharp canines, but he might have a large appetite or an aggressive disposition. When used in the context of eating, the metaphor may refer to the appetite; when used in the context of interpersonal relationships, it may refer to being aggressive. Like in the case of iconic art, the skill of the writer or poet describing a phenomenon lies in selecting the combination of metaphorical elements and context-elements that would evoke the most pertinent feelings in the reader.

The use of icons and metaphors allows art to create symbolic representations that reflect our subsymbolic experiences and intuitions better than RSS do. Artistic representations convey not just the category to which a phenomenon belongs, but the connotations and affective meanings associated with that phenomenon. This incites the mind to make further associations, by letting the neural activation spread from the evoked meanings to more indirectly related meanings that put the phenomenon in a broader perspective or that suggest novel aspects. For example, a person who has read a poem, seen a painting or watched a movie may be inspired by this work of art to develop an broader, intuitive understanding of the situation depicted and to see it in a new light. This cognitive processing plays a role similar to the rational, logical inference supported by an RSS representation in extending understanding, but now at the more fluid, felt, “subsymbolic” level. Thus, artistic representation not only communicates felt meanings, it also helps us to process that meaning into novel insights.

However, this latter function is as yet much less developed than the logical reasoning enabled by rational symbol systems. Initially, art seems to have been content to represent easily recognizable meanings by using traditional formats of expression, such as stories, figurative paintings, or songs. But the beginning of the 20th century witnessed a revolution in which art began to radically experiment with new representations, new meanings, and new ways of communication and interaction with the public. Thus, it put into question everything that had come before. This revolution was exemplified by a wave of “avant-garde” or “experimental” movements and approaches, including cubism, Dadaism, surrealism, abstract expressionism, avant-garde theater, atonal music, electro-acoustic music, video art, performance art, installations, mixed-media and multi-media, computer-generated art, flash-mobbing, and many more.

What these movements have in common is a desire to experiment with novel forms of expression and novel combinations of existing forms, thus transcending the boundaries between different disciplines, genres and media. For example, a contemporary theater piece or performance
may exhibit actors that perform movements and dialogues in a partially scripted, partially improvised manner, a background screen on which video-taped or computer-generated movies or pictures are shown, an audio background of music and electronically generated sounds that accentuate or suppress the actors’ speech, physical objects that are assembled by the actors in different configurations or that are programmed to react in certain ways, and a public that interacts with the events on stage by proposing additional activities via their smartphone.

Such experimental pieces and performances are intended to question the assumptions and expectations of the conventional RSS, just like critical philosophy does. Their bringing together of disparate but evocative representations ideally elicits novel insights—in the artist, the performer, or the audience. By putting together meaningful symbols that are normally never put together, such art incites the creation of new associations and combinations in the brain, thus stimulating imagination, creativity and discovery.

Such unconstrained combination was perhaps explored most systematically by the surrealists (Matthews, 1986), whose painters produced unforgettable images such as melting clocks, bowler-hatted men raining from the sky, or a locomotive steaming out of a chimney. A favorite surrealist game illustrates the method at its simplest. Different people each in turn add some element to an emerging sentence or drawing, however, without seeing what the others have previously contributed. This leads to apparently absurd results, such as “Le cadavre exquis boira le vin nouveau” (“The exquisite corpse shall drink the new wine”), the sentence that gave the game its name of “Cadavre Exquis”. From the surrealist perspective, such juxtaposition of logically unrelated elements provides a window into the subconscious—which is also the realm of dreams—by inciting the mind to find intuitive, non-rational connections between these elements. Thus, surrealism and related art movements that use “impossible” combinations of symbols can be seen as searching for “surrealities” that go beyond the socially constructed reality of the conventional RSS.

More mainstream art—as exemplified perhaps by Hollywood movies, horror stories, and pictures of maidens and unicorns—is not as radical in its exploration of alternate realities and experimentation with formats and symbols. Still, it has assimilated the most successful results of previous experiments, incorporating plenty of surreal fantasies, absurd humor, and complex computer animations. The popularity of genres such as thrillers, science fiction, and fantasy testifies to the fact that an underlying message of even commercial art is that reality is not what it seems, and that the situation may be very different from what the reigning RSS has taught us. Concerts, performances and movies integrate a variety of sophisticated media, technologies and methods that together create an all-encompassing spectacle that speaks to the major senses and emotions. Thus, art has fully embraced ICT and other technologies to more powerfully convey experiences and explore creative processes. The recent approach of ArtScience (Edwards, 2008; Root-Bernstein et al., 2011; Siler, 2011) even attempts to synthesize the more playful, serendipitous artistic methods of experimentation and exploration with the more controlled scientific ones—e.g. by letting computer programs process astronomical data into poetic text (Petrovic, 2018), or trying to recreate the origin of life by subjecting mixtures of molecules in transparent vessels to electrical discharges.
Next to science, philosophy and art, there is a final domain of human culture that has systematically attempted to transcend the limitations of rational, symbolic cognition. This not very clearly defined domain has been called mysticism, spirituality, or consciousness expansion (Glenn, 1989; Deikman, 2000; Harris, 2014). It is exemplified by practices of meditation, mindfulness and the use of psychedelic drugs. Such techniques help people to bypass the rigid distinctions imposed by the RSS, and thus achieve a more direct access to experience and the reality behind it. While such spiritual practices are often associated with religion, as a supposed means to attain communion with God, they are in a sense antithetical to the common understanding of religion as a collection of articles of faith that are to be accepted without questioning (Harris, 2014). Whereas religious faith is supposed to be “blind”, spiritual practice is supposed to make us see more clearly, by opening the “doors of perception” and thus attaining “enlightenment”.

The tradition is ancient, going back to shamans that used hallucinogenic mushrooms, fasting, sweat lodges, and other intense experiences to induce a trance-like state that would bring them into contact with the “spirit world”. Some of these practices and the accompanying philosophies were systematically developed in Eastern spiritual traditions—in particular Buddhism, Hinduism, Taoism and Sufism. Here, the focus is on learning to control one’s desires, thoughts, feelings, and most generally consciousness. This allows practitioners to detach themselves from the conventional “reality” of the RSS, while getting in touch with a wider or deeper reality behind it. The most common method is meditation: unwavering concentration on a single idea or sensation. This is intrinsically very difficult because attention naturally wanders towards ever-new feelings and thoughts. When concentration is maintained sufficiently long, this may result in a “mystical experience”, in which the subject loses the sense of being a separate individual here and now, and instead feels like becoming one with the universe (the so-called “oceanic feeling”).

Deikman (2000; 1966) has interpreted such an experience as a “deautomatization” of the neural processes in our brain. Normally, activation is propagating automatically along the strongest, most frequently used connections between neurons, thus helping us to make sense of the present situation within our standard picture of reality. The continuous refocusing of attention on the same neural region, however, creates an “overload” of these strong connections, so that they stop performing their habitual function. You can demonstrate this effect to yourself by continually repeating the same word. After a while, the word will lose all of its meaning, turning into a mere sound rather than a symbol with a signification. If the brain region that is overloaded includes the neural systems that monitor who, when or where you are, you may even lose your sense of self and instead feel like a timeless emptiness.

The overload of strong, automated connections allows activation to spread along weaker, less common connections that reach more indirectly associated meanings. The result is a “fresh” experience, where the same phenomenon is perceived in a different light—typically more vividly and in more detail, while triggering novel sensations and creative insights. Related mystical experiences may be produced by psychedelic drugs, such as LSD or psilocybin, which appear to facilitate the
flow of activation along more diverse and unusual connections (Schartner et al., 2017), thus alerting people to different aspects of reality.

Korzybski’s (1958) theory of General Semantics explains why we need such consciousness expanding techniques to overcome the limitations of symbolic cognition. General Semantics notes that our understanding of the phenomena we experience is built up in subsequent stages of neurophysiological processing: from the outside phenomenon, via our sensory experience, to an increasingly abstract representation of that experience, concluding with a particular word or symbol that supposedly captures the essence or meaning of that phenomenon. The problem is that we tend to identify that highly simplified and rigidified symbolic representation with the phenomenon itself—a fundamental mistake summarized by Korzybski’s famous aphorism: "the map is not the territory". To counter the “insanity” that arises from this systematically repeated error, Korzybski (1958) proposes a number of psychological techniques that should make us again more conscious of the previous stages in our cognitive processing, when the phenomenon was not yet reduced to its symbolic caricature.

Numerous other psychological, therapeutic, meditative, physical (such as yoga or tai-chi), drug-based and other methods have been proposed to expand consciousness and liberate people from the too rigid thoughts, categories and perceptions induced by their RSS. Perhaps the simplest and presently most popular approach is mindfulness (Bishop et al., 2004). Here people are taught to become aware of all the fleeting sensations and feelings that pass through their body and mind at any moment, focusing on these subsymbolic experiences rather than on the verbal, symbolic reflections and ruminations that most often dominate our consciousness. This practice has been shown to increase mental health and well-being in a wide variety of situations.

Like science and art, consciousness-enhancing techniques can be supported by technology. Researchers are increasingly concluding that consciousness is not just determined by the brain but by the whole of our interactions with the outside world (Noë, 2010). This observation parallels the “situated and embodied” and “enactive” views of cognition (Clark, 2008; Stewart, Gapenne and Paolo, 2014), which note that mental content must be grounded in such interactions to be meaningful. That implies that external tools that support such interaction also enhance cognition and consciousness. The simplest such tools, such as microphones, infrared goggles, or radio telescopes, amplify our powers of perceptions. Others, such as walking sticks, hammers or cars, amplify our powers of action. Research has shown that if such tools immediately and dependably extend our powers of interaction we will start to experience them as part of our own body, and eventually consciousness (Clark, 2008). For example, blind people who have light sensors implanted that stimulate a fine-grained array of nerves in their tongue, eventually learn to associate the stimuli experienced on their tongue with outside patterns in such a direct way that it feels to them as if they are “seeing” these patterns inside their mind—while ignoring the implanted hardware.

Virtual reality (VR) is a technique in which a computer-generated three-dimensional environment is presented directly before the eyes via displays in a special headset. When the person wearing the VR-headset moves, the image in the display moves accordingly, so that it feels as if the person is actually moving inside the virtual world. As a result, the consciousness of the real world vanishes, to be replaced by a felt presence inside the virtual reality. This technique can obviously be
used to create “psychedelic”, “out-of-body” experiences, in which the person e.g. feels as if flying in space and observing the Earth and the Moon. But it can also be used to tackle particular problems of “insanity”, in which inappropriate interpretations have become rigidified. For example, psychotherapists have started to use such virtual experiences to teach traumatized patients to better deal with the objects of their fears (Sanchez-Vives and Slater, 2005; Bohil, Alicea and Biocca, 2011).

Augmented reality is a technology that uses special glasses to superpose a computer-generated representation on top of an image of the physical reality, thus enhancing our unaided perception (Van Krevelen and Poelman, 2010). For example, while watching an ocean-liner from the outside, the superposed image might show you the distribution of the rooms and decks inside the ship, while informing you about its destination, and the year it was built.

The next technological breakthrough is likely to be a direct brain-computer interface, in which our brain waves or other neural signals are registered by sensors and interpreted by a computer program (He et al., 2013). This would allow us to manipulate virtual representations or steer physical processes simply by thinking about them. The futurist Glenn (1989) has extrapolated such ever more intimate connections between brain and world to what he calls “Conscious-Technology” or a merger between technology and spirituality. But this merger is likely to also encompass science, art and philosophy. Let us then examine how ICT may help us to integrate all the different tools and techniques we have surveyed.

**Conclusion: towards a Global Brain**

We have reviewed how symbols form the foundation for the typically human level of intelligence. They allow us to communicate, register and accumulate knowledge; to reason about that knowledge; and to conceive of situations we have never experienced before. This form of cognition is based on rational symbol systems, as exemplified by verbal language. These RSS allow us to combine discrete symbols into meaningful expressions that can be processed into further expressions. Such symbols behave like standard semantic components or building blocks, which can be stored, transmitted, combined and manipulated according to logical rules without losing their meaning. That is because they provide stable externalizations of otherwise fleeting mental content.

However, this strength of RSS is also their weakness: meanings that are fluid, vague, subjective, interconnected, dynamic or context-dependent cannot be expressed by such independent symbols. The failed attempts to build a human-level artificial intelligence based on RSS have reminded us that the bulk of human cognition still resides at the subsymbolic level of intuition and subjective experience. Symbols and rules on their own are not sufficient: they must be grounded in an immensely complex and dynamic network of interactions. These are carried by our body and brain, which rely on billions of neurons, synapses, sensors, effectors, and their extensions into the outside world. Recent advances in science, technology, philosophy, art, and spirituality are giving us an increasingly broad and deep grasp of these subsymbolic networks and processes.

Yet, these approaches are themselves symbolic enterprises: they are intended to produce external representations that can be communicated, stored, and manipulated. The apparent paradox
can be resolved as follows: these representations are actually metarepresentations (Heylighen, 1988, 1990). They represent not existing categories, but the processes that create such symbolic distinctions. For example, the “deep learning” neural networks of contemporary AI (Schmidhuber, 2015) are not reasoning about given symbols or categories: they are inducing new distinctions by searching for recurrent patterns in immense arrays of low-level data collected by various sensors. For example, when such a program is trained with millions of photos of pets harvested from the web, it will eventually learn to classify them in high-level categories, such as cats, dogs, mice, parrots, goldfish, etc. This means that we have succeeded in externalizing some of the subsymbolic capabilities of our brain.

A deep-learning program is still a symbolic representation of some of our neural mechanisms of pattern recognition and sense making. Thus, followers of Newell and Simon (1976) might argue that this new form of AI has vindicated their “physical symbol system hypothesis”, which states that symbols are the necessary and sufficient condition for intelligence (Nilsson, 2007). Nevertheless, the organization of such a connectionist program is completely different from the one of a RSS: its “symbols” are no longer static, independent and governed by formal rules. Instead they are constantly changing, interconnected, and grounded in an ongoing interaction with the real world. Thus, the program is really a metarepresentation: a system that represents the processes that generate specific representations, such as the symbolic category of “cats”, but that could equally learn to generate an infinite number of other representations.

The shift from a symbolic representation to a metarepresentation exemplifies the process that Turchin has called a metasystem transition (Turchin, 1977; Heylighen, 1991; Turchin, 1995; Heylighen, 1995). This is the evolutionary emergence of a system that is capable of manipulating or controlling the organization of the system at the level below and thus extending its capabilities. The origin of human language was such a metasystem transition, as it gave us the ability to manipulate some of the meanings that our brain generated. But it did not give us the ability to control the processes that generated such meaning. Science, art, philosophy and spirituality all have attempted to extend our control over such sense-making processes, with concrete, albeit limited successes. The fundamental reason for the limitations is that these processes are much more complex and fluid than expected, requiring an immense, ever-adapting network of interactions that extends across individual brains, bodies and world.

But this is where the on-going ICT revolution comes to the rescue. Present-day computers, memories, sensors and networks can handle immense flows of data, processes, and communications. They readily represent and thus externalize ideas, knowledge, images, sounds, movements, three-dimensional objects and most other phenomena that enter our consciousness. They can be programmed and manipulated, thus giving us control over these representations and processes. They have incorporated the sophisticated formal and operational modeling and data analysis methods of science and the powerful multimedia evocations of art; they have expanded our consciousness via prosthetic sensors, virtual and augmented reality; all this while being informed by the critical reflections of philosophy as to the nature of cognition and representation. The only thing still lacking to complete the metasystem transition is coordination: these different tools and methods largely
developed independently, addressing different aspects and problems, in an apparently chaotic explosion of competing yet interconnected applications.

The “Global Brain” is the idea that a grand synthesis between all these different ICT applications is evolving, so as to produce the equivalent of an integrated nervous system for humankind (Goertzel 2002; Heylighen 2011; Mayer-Kress & Barczys 1995). The dynamics of this evolution is similar to the one that produced human language: interaction between incompatible applications produces misunderstanding, friction, and thus loss of energy and information. This motivates the agents responsible for these applications to align their functions and standards with those of others, so that the systems become interoperable. Those that fail to do so will become increasingly irrelevant within the larger scheme, eventually losing the competition with those that use more compatible standards. This process of mutual alignment has been taking place since the beginnings of ICT. The Internet (TCP/IP) and World-Wide Web (HTML) standards are some of its great successes (Heylighen, 2017b). However, given the variety of novel applications that are constantly appearing and the complexity and unpredictability of the overall evolution, it is likely to take several more decades before a truly integrated system will take shape.

We need more than technological innovation to achieve such a grand synthesis of RSS-transcending approaches. We also need a deep theoretical or philosophical reflection that would lay the foundations for a new understanding of reality—one that is not biased by the RSS with its predisposition to reduce complex phenomena to static objects and properties that obey predetermined rules. That means that we need a completely new kind of ontology, one whose building blocks are not independent elements but interconnected processes, actions or interactions (Rescher, 1996; Heylighen, 2011b). Here, meaning would not be a priori given like in an RSS, but self-organizing or emergent, so that new meanings can be generated without limit. Such a process ontology may offer a new universal language that would unify all scientific and cultural disciplines, including art, philosophy and spirituality (Heylighen, 1984). This language would also become the standard medium used in ICT for the exchange and processing of knowledge and information across the most diverse types of hardware and software. This function is already to some degree presaged by the Semantic Web standard (Berners-Lee and Fischetti, 1999; Allemang and Hendler, 2011), which functions as a cognitive extension of the present World-Wide Web, and a potential precursor of a Global Brain.

Let us try to conceive some of the likely attributes of the envisaged Global Brain. This superhuman intelligence will be fully collective or distributed (Heylighen, 2017a): no individual, computer or organization will have control over it. As the Internet makes it ever easier for information to flow from one person or machine to another one, that information will not stay in place but propagate across the network, just like activation spreads across the neurons of the human brain. Every source of information or processing, whether human or technological, can potentially contribute to any decision that needs to be made. Therefore, it is advantageous for any system to spread its net as widely as possible, incorporating as many information-producing agents as possible, without anyone having a monopoly.

A derived attribute is what we might call “practical omniscience” (Heylighen, 2015): any information, knowledge or sensor that is available will eventually be integrated into the global
network. More importantly, any knowledge that is not yet available but needed to solve some problem will be generated on the spot, using the mechanisms of machine learning, model-building and creativity stimulation that AI, science and art have been developing. We saw that these mechanisms function by externalizing the sense-making processes of the human brain. But because the scope of the information they use will be planetary, they will far surpass the limits of the human brain. This is not just because of the ever-growing capabilities of ICT hardware, but because the distributed intelligence of the network will mobilize the collective perception, intuition and creativity of billions of human beings. As highly educated people with a great diversity of different experiences get access to all the knowledge, creative tools, metarepresentations, and supports for expanded consciousness, their capabilities for coming up with new concepts and insights, individually and collectively, are likely to explode. Through the planetary communication network, any new idea, generated by anyone or anything, can be immediately combined with any other idea or information to generate ever further insights, in an endless cascade of creative discovery.

This creative process is similar to the scientific, technical and cultural progress that was enabled by human language, which we may see as the first level of symbolic representation. However, thanks to ICT and the other innovations we sketched, this process will have accelerated to such a degree that its results will seem nearly instantaneous. Extrapolations of accelerating progress indeed suggest that in the foreseeable future we would reach an apparently infinite speed of innovation—an event that has been dubbed the “technological Singularity” (Kurzweil, 2005; Goertzel and Goertzel, 2015; Heylighen, 2015). In mathematics, a singularity is a point where a continuous function becomes discontinuous, implying that we cannot extrapolate the curve beyond this singular point. But that also means that it becomes nearly impossible to infer what the consequences of this metasystem transition towards a supra-human intelligence will be…

We have come to the point where our description of the ongoing evolutionary transition towards a higher level of symbolization must stop. While I have tried to survey some of the social, technological and economic implications of this transition elsewhere (Heylighen, 2007, 2015), our focus here is on communication, cognition, and ultimately consciousness. But the complexity and change we are experiencing in this early 21st century is so overwhelming that no scientific model, artistic depiction, philosophical analysis, or individual awareness is as yet able to capture their full impact. We can only hope that the processes I have sketched will indeed self-organize into an integrated system of distributed intelligence, a Global Brain, that will give humankind a vastly broader and deeper insight into reality than it hitherto managed to achieve and thus help it to cope with the immense challenges that our planet has to deal with.

References


