WWAI. Towards a massively-parallel-wetware-oriented artificial intelligence distributed worldwide

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While the World Wide Web could become the nerve center for a social super-organism, it remains frustratingly rudimentary. Documents lack uniformity and integration; linking is unintelligent and unstable; interaction is limited, controlled by authors and browsers. However, things are changing. Advances in artificial intelligence could be applied to the WWW, transforming it to a globally distributed, massively parallel, wetware-oriented universe. Panelists from all areas of web development discuss this and other possibilities for the future of the web.

We would like to present the following:

1. **To set visibly main problems encountered by users of WWW and immanent limits of WWW structure**

2. **To discuss existing and potential solutions of relevant problems by using AI methods:**

3. **To specify these AI-tools that may be most useful and applied universally in the future**

4. **To debate social consequences of WWAI existence. Will WWAI actually function as a nerve centre for the social superorganism, an emergent system formed by both humans and AI systems, joined together by the Internet and other cutting-edge communication technologies**

1. Criticism of World Wide Web

2. Roads to Artificial Intelligence
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1. General criticism of World wide Web

The WWW is one of the most popular forms of hypertext, but at the same time one of the worst.

What do I hate about WWW?

1.1 Lack of uniformity and integration:
Incorrect and non-uniform base structure, badly designed from the beginning. Documents are treated separately, isolated from each other. Programs also arise from various sources, created as separate applications independent of each other. Effect: users are forced to operate a whole multitude of increasingly complex programs (trash, crash-prone Tower of Babel). Every so-called update, intended to add new functions, unnecessarily adds to the confusion.

1.2 One-way, unstable and unintelligent linking:
Fixed, one-way connections. Links fail when pages are moved. Linking is a system of external tags, excluding the possibility of creating internal inference mechanisms.

1.3 Lack of creative possibilities
There is no possibility of adding your own comments and notes to the material you are accessing.
As things stand, alternative versions of documents are inaccessible. There is no possibility of adding one's own commentary to an existing document. You can jump between documents, but their structural order remains the same, without any possibility of organizing the documents to suit your own needs. Thus you have no influence over a static presentation.

1.4 Intrusiveness:
Web presentations are totally controlled by their authors and by browsers. Access to a site is generally controlled on an all or nothing basis.

1.5 Lack of ownership laws and micropayment:
There is no copyright, and responsibilities are unclear. Because there is no mechanism of micropayment, a best part of our knowledge is not to be found on the web.

Let’s notice that the development of WWW operates as a process of the accumulation of information, from small bits of text in a pre-www stage, to the phase where a whole multitude of texts, images and animations is published on the web. The effect of this is a “stupid”, dead, global book-encyclopedia-trash, serving only for collecting information.

The situation is indeed changing, thanks to the attempts of implementing some results from the domain called AI that creates a real heady mix.

2. Roads to AI

In consideration of the theoretic constructions, we can distinguish the following approaches:

2.0. symbolic, logic rules based systems, logical programming,
symbolic level – intelligence conceptually understood.
2.1. connectionist, Neural Nets - models inspired by the working of the brain , simulations – measurable intelligence.
2.2. mixed

2.0. Symbolic methods consist of a manipulation of knowledge, presented in a symbolic way, by using logic rules imposed a priori. In this case their strength depends on the state of modern logic.
At the present time, the most influential theory for the logic part of reasoning systems is mathematical logic, especially, **first-order predicate logic**.
First order predicate logic: Mathematical model of the part of language built up from the propositional connectives and the quantifiers. Propositional connectives: The linguistic constructs “and”, “not”, “or” an “implies”. Quantifiers: The linguistic constructs “there exists” and “for all”.

Though these theories have been very successful in many domains, their application in cognitive science and artificial intelligence shows fundamental differences from human reasoning in similar situations.

(1) Uncertainty
Traditional theories of reasoning are certain in several aspects, whereas actual human reasoning is often uncertain in these aspects.
• The meaning of a term in mathematical logic is determined according to an interpretation, therefore it does not change as the system runs. On the contrary, the meaning of a term in human mind often changes according to experience and context.
• In mathematical logic, the meaning of a compound term is completely determined by its “definition”, which reduces its meaning into the meaning of its components and the operator (connector) that joins the components.
On the contrary, the meaning of a compound term in human mind often cannot be fully reduced to that of its components, though is still related to them.
• In mathematical logic, a statement is either true or false, but people often take truth values of certain statements as between true and false.
• In mathematical logic, the truth value of a statement does not change over time. However, people often revise their beliefs after getting new information.
• In mathematical logic, a contradiction leads to the “proof” of any arbitrary conclusion. However, the existence of a contradiction in a human mind will **not** make the person to do so.
• In traditional reasoning systems, inference processes follow algorithms,therefore are predictable. On the other hand, human reasoning processes are often unpredictable, and very often an inference process “jumps” in an unanticipated direction.
• In traditional reasoning systems, how a conclusion is obtained can be accurately explained and repeated. On the contrary, the human mind often generates conclusions whose sources and paths cannot be backtracked.
• In traditional reasoning systems, every inference process has a prespecified goal, and the process stops whenever its goal is achieved. However, though
human reasoning processes are also guided by various goals, they often cannot be completely achieved

(2) Non-deductive inference
All the inference rules of traditional logic are deduction rules, where the truth of the premises guarantees the truth of the conclusion. In a sense, in deduction the information in a conclusion is already in the

premises, and the inference rule just reveals what is previously implicit.
In everyday reasoning, however, there are other inference rules, where the conclusions seem to contain information not available in the premises:
Induction produces generalizations from special cases.
Abduction produces explanations for given cases.
Analogy produces similarity-based results.
None of the above inference rules guarantees the truth of the conclusion even when the premises are true. Therefore, they are not valid rules in traditional logic. On the other hand, these kinds of inference seem to play important roles in learning and creative thinking. If they are not valid according to traditional theories, then in what sense they are better than arbitrary guesses?

(3) Paradoxes
Traditional logic often generates conclusions that are different from what people usually do.
Sorites paradox: No one grain of wheat can be identified as making the difference between being a heap and not being a heap. Given then that one grain of wheat does not make a heap, it would seem to follow that two do not, thus three do not, and so on. In the end it would appear that noamount of wheat can make a heap.
Implication paradox: Traditional logic uses "P > Q" to represent "If P, then Q". By definition the implication proposition is true if P is false or if Q is true, but "If 1+1 = 3, then the Moon is made of cheese" and "If life exists on Mars, then robins have feather" don't sound right.
Confirmation paradox: Black ravens are usually taken as positive evidence for "Ravens are black." For the same reason, non-black non-ravens should
be taken as positive evidence for "Non-black things are not ravens." Since the two statements are equivalent in traditional logic, white sacks are also
positive evidence for "Ravens are black," which is counter-intuitive.
Wason's selection task: Suppose that I show you four cards displaying A, B, 4, and 7, respectively, and give you the following rule to test: "If a card
has a vowel on one side, then it has an even number on the other side."
Which cards should you turn over in order to decide the truth value of the
rule? According to traditional logic, the answer is A and 7, but people often pick A and 4.

Generally the development of logic performs
• from binary logic to multi-valued,
• from extensional to both extensional and intensional,
• from monotonic to reversible,
• from deduction only to multiple types of inference.

By the elimination or addition of some laws from classical logic, new logics arise.
We should mention here for example
• intuitionist logic (without the law of excluded middle, p or ¬ p),
• multi-valued logics (L_3-Lukasiewicz's 3-valued logic, L_n - Post's n-valued logic or Kleene's 3-valued logic),
• fuzzy logic, which is a superset of conventional (Boolean) logic that has been extended to handle the concept of partial truth - truth values between "completely true" and "completely false",
• paraconsistent logic (without the explosive law, p->¬ p->q),
where the presence of some contradictions doesn't break the deduction.

The semantic interpretation is based on studying the Kripke structures or appropriate algebras (i.e. PB-algebras). The Kripke structure for (e.g.) the intuitionist logic are very natural objects called partially ordered sets.
Nevertheless, with regard to effectiveness, an important role is played by logic of combinators, which is a logic using special operators, in which the type of function is not differentiated from the type of argument. Theoretically, a statement about a fixed point is the same as a statement about recurrence in a computability theory, i.e. study of computable functions on the natural numbers, a theory concerned with recurring functions. Recurring functions have been separated from general functions (being natural numbers used in

discussions) as those functions which are effectively calculable.

Applications: The construction of intelligent systems based on logical rules are mainly used for:

- Solving problems: logical games and problems, board games, symbol counting (chess has a combination level of 10^{120}, whereas Go has 10^{761}) In this field computers are better than humans: in 1997 Deeper Blue beat Gary Kasparow.
- The main methods are the seeking and reduction of problems. Splendid results for draughts, chess, etc., but Go, for example, requires more refined techniques. Symbol counting with the help of algebraic computer programs.
- logic reasoning, theorem prooving : for example: program Logic theorist – Newell, Shaw's program for prooving theorems from Principia Mathematica
  - program EQP – proof of Robisons hipothesis (RH: every Boolan algebra is Robinsons algebra), convers doesn't work, the problem didn't have the solution since 1940
- Natural language: language understanding, machine translation, speech understanding.
- Construction of text databases, contextual knowledge
- Automatic programs / autoprograming
  Description of algorithms with the help of natural language, automatic writing of programs, modification of the program itself, programing accesss to databases for managers.
- Expertise, consultant systems, knowledge engineering.
  Knowledge representation, dialog system, explanation of understanding, acquisition of frequently unconscious knowledge
- Robotics and vision, recognition of images, shapes and characteristics, motion control.

Most Important Proof systems:

ACL2 (University of Texas) www.cli.com/software/acl2
Coq, Proof Assistant www.pauillac.inria.fr/coq
EVES , ORA (Canada) www.ora.on.ca/eves.html
NuPrl , Cornell www.cs.cornell.edu/Info/Projects/NuPrl/nuprl.html
ProofPower www.trireme.demon.co.uk/index.html
PVS (Prototype Verification System), SRI International www.cls.sri.com/sri-cls-pvs.html
TPS, Carnegie Mellon University www.gtps.math.cmu.edu/tps.html
Bliksem www.mpi-sb.mpg.de/~nivelle/bliksem/index.html
LeanTaP, a tableau-based theorem proover www.emmy.ira.uka.de/~possega/leantap/
Gandalf (winner of the mixed division at CASC-14) www.chalmers.se/~tammet/gandalf/
METEOR model elimination pr, Duke University
www.cs.duke.edu/~ola/meteor.html
OSHL, university of North Carolina www.cs.duke.edu/~zhu/prover.htnl
Otter (winner of the equational division at CASC-13) www.mcs.anl.gov/AR/otter/index.html
SETHEO www.jessen.informatic.tu-muenchen.de/~setheo
SPASS, MPI Saarbrucken www.spass.mpi-sb.mpg.de/
Geometry Expert, Wichita State University www.cs.twsu.edu/~chou/ge.html
ILF (Integration of Logical Functions), Humboldt University, Berlin www.irm.mathematic.hu-berlin.de/~ilf/
ARP, Australian National University www.arp.anu.edu.au/
ATP, University of Texas at Austin www.ma.utexas.edu/users/bshult/ATP/
DreaM, Edinburgh Dept of AI www.dream.dai.ed.ac.uk/
ICOT, Institute for New Generation Computer Technology www.icot.or.jp
Automated Reasoning, The University of Iowa www.cs.uiowa.edu/ar/arui.html
Mechanized Reasoning Groups at DIST , Genova www.mrg.dist.unig

MIZAR, Warsaw University www.web.cs.ualberta.ca/~piotr/Mizar/
2. 1. **Connectionism** is simply a method of modeling calculating processes with the help of artificial networks, using neuron structures whose fundamental asset is the similarity to the natural ability of the brain to process parallel information (PDP - parallel distribution processing). In this case, the learning process consists in a proper selection of links' weight between neurons, in conformity with one of the versions of the Hebbian rule. The original Hebbian learning rule works on symmetric links (similarity, not inheritance), the weight of a link is decreased when one end is activated and the other isn't.
Another approach that traces out a learning model is the **probabilistic approach**, in which the probabilistic inference mechanism is based on the Bayesian rule.

NN are employed everywhere where classic (algorithmic and heuristic) methods are used, but also in:
• specialist programs, e.g. ACORN in medicine
• modeling and simulation programs, e.g. neuropsychological disorders in mental illnesses
• expert programs
• inference programs
• consulting/decision-making programs, e.g. predicting currency fluctuations.
• programs for image analysis and handwriting recognition
• Data Mining programs for recovering knowledge from data and the intelligent processing of data, a transformation data into knowledge, Knowledge Discovery or Data Mining is the partially automated process of extracting patterns, usually from large data sets.

2.2. MIXED. At present, systems have been created which join both symbolic and connectionist approaches.

The dichotomy of the connectionist versus symbolic seems to be false.

Beginning from W. Pitts and W. McCulloch to B. Goertzel, the main problem is **how logic-like processes might emerge from neuron-like processes,** or more exactly - the topic is: **how to construct a neural network, so that symbolic logical inference will emerge from its dynamics?**

The aim of projects such as Goertzel's *Novamente* is "not to build a hybrid system that is part symbolic and part connectionist, but to build a unified system which is similar to symbolic AI in certain aspects, and similar to NN in some other aspects".

To build AI is of course an expensive and long-term process, in which we have to resolve many problems, amongst others the construction of modules that carry out
reasoning, natural language processing, numerical data analysis, financial prediction, learning, short-term memory, and so forth.

Fundamental Problems:

Incompleteness theorem: G¨odel's discovery, that sufficiently strong axiomatic theories cannot decide all propositions which they can express.

Church-Turing Thesis: Claim that every computable function can be computed by a Turing machine (TM: mathematical model of computing device with unbounded memory).

We still don't have a better test than Turing's.
In the course of competition for the Loebner Prize (a limited Turing test) some of the judges, on the basis of conversations through the terminal, regarded certain programs to be more "human" than the people conversing with them.

Can man create AI?
Yes – in some spheres intelligence (understanding as an ability to use gathered knowledge) is already better than human intelligence!

Can an artificial brain create conscience?
There is no evidence to show that conscience is requisite in the solution of problems by intelligence. For AI, conscience is a secondary problem. Conscience is only the ability to interpret the state of the brain, results appears in working memory.

There are no fundamental reasons why artificial systems with a brain-like organization shouldn't be convinced that they have feelings, there is no reason to reject this thesis, philosophical experiments don't provide answers.

Could AI evolve and outgrow human intelligence?
This is already happening in many spheres, and the field is ever widening.
Nevertheless AI will not be precisely equal to human intelligence – artificial systems have other limitations, and exact simulation of the operation of the human brain is very difficult.

Could the uncontrolled development of AI lead to ethical problems?
Absolutely. The dangers: military uses, the increasing rate of social change, the prospect of the complete automation of many trades.
A robot rebellion is unlikely – the virtual space of artificial systems would be more interesting for them than any physical space.

Most ambitious Artificial Intelligence projects:

I can honestly say that I don't think there are here present many serious contenders in the race to build the first viable artificial intelligence.

• Artificial Intelligence Enterprises (www.a-i.com), a small Israeli group led by Jason Hutchens, working towards the creation of an AI conversation system of the Webmind Conversational Engine type, based on language comprehension, semantic and so forth

• CAM Brain project - started at ATR in Japan and continued at StarLab in Brussels -
led by Hugo de Garis, a kind of cellular automata implementation. It's co-author is a Pole - Andrzej Buller (Gdansk Artificial Brain Initiative). According to Buller, the Japanese decided to alter the premise of the project and to keep a significant part of it secret.
Hardware is based on CAM8 (MIT), with the following software:
CA automatic cellular module, Genotype Phenotype Memory module for the storing
of chromosones, Fitnes Evaluator Unit, used in evaluating nerve structures, Genetic Algorytm Unit, Interconnection Memory Module.

• CYC – a project which is actually a large database containing the descriptions of thousands of concepts, on which are based Commonsense knowledge trials in first-order predicate logic. Logically, this demands millions of rules! Is this realistic?
The first million rules concern general classifications, limitations, such concepts as time, space and substance – a basic ontology enabling several CYC systems to communicate.

• Think Machines – Dany Hillis, a project concentrating mainly in seeking a suitable hardware platform on which to build real AI.

• SOAR – a project being developed by Allan Newell based on his own theory of the working of the mind, an important aspect of which is higher rules in the course of solving problems.The process of creating a

piece of knowledge is continuous, using the results of lower-level realizations to enable the creation of new knowledge on higher levels.
e.g. R1-Soar, a professional system for the configuration of computer systems Befor learning, 1731 decision cycles, 232 rules After learning: 7 decision cycles, 291 rules
Used, among other things, in the creation of agents teaching the operation of complicated technical equipment in a virtual environment, war games, and robot operation.

• ACT-R, is a cognition architecture, looks like a programming language; however, its constructs reflect assumptions about human cognition, Like a programming language, ACT-R is a framework: for different tasks (e.g., Tower of Hanoi, memory for text or for list of words, language comprehension, communication, aircraft controlling), researchers create models (aka programs) that are written in ACT-R and that, beside incorporating the ACT-R's view of cognition, add their own assumptions about the particular task.
Act* used for: explaining the ownership of memory, the order of answers and the learning of new words, the learning of program elements, and geometric understanding in theorem proving.

Act* as a base for intelligent teaching programs, so-called tutorials: LISP, Prolog, Pascal,

• PSYCHE- European Brain Project, The building of a brain simulator for neuro-psychic purposes – seven European centres.

•SHRUTI based on the relational structures (frames, schemas) which are represented by focal clusters of cells, and inference in SHRUTI corresponds to a transient propagation of rhythmic activity over such cell-clusters. Dynamic bindings between roles and entities are represented within such a rhythmic activity by the synchronous firing of appropriate role and entity cells. Rules correspond to high-efficacy links between cell-clusters, and long-term facts correspond to coincidence and coincidence-failure detector circuits. In particular, SHRUTI demonstrates that temporal synchrony in conjunction with structured neural representations suffices to support rather complex forms of relational information processing in the brain.

• NOVAMENTE (AGIRI) project of Artificial General Intelligence Research Institute
conception Artificial General Inteligence. (SMEPH). The goal of AGI research is the creation of broad human-like and transhuman intelligence, rather than simply "smart" systems that can operate only as tools for human operators in narrowly-defined domains. AGI conception is based on the Self-Modifying, Evolving Probabilistic Hypergraph (SMEPH) intended to identify general structures and dynamics hypothetically applicable to the mind of any sort of intelligent system. In the SMEPH approach, the knowledge in an intelligent system is modeled as a probabilistically-weighted hypergraph (a special mathematical data structure composed of very general nodes and links, including links that point to links or multiple nodes/links), with specific semantics for the nodes and links in the hypergraph. The hypergraph may completely self-modify over time, using the knowledge contained in itself to guide its transformation into something completely different. Nodes are manipulated by two core cognitive algorithms: PTL (Probability Term Logic), used for first-order and higher-order inference, and Combo-BOA (Bayesian Optimization Algorithm operating on combinator-tree objects), used for probabilistically-guided (non-random) GA-type evolution for solution finding and optimization.

• The OSCAR Project . John Pollock directs the OSCAR Project, funded in part by the National Science Foundation. The goal of the OSCAR Project is the formulation of a general theory of rationality and its implementation in an artificial rational agent. The function of artificial agents is to draw conclusions and make decisions on the basis of information supplied to them.

• RKF is the follow-on program. HPKB (DARPA)
High Performance Knowledge Bases (HPKB) is a research program to advance the technology of how computers acquire, represent and manipulate knowledge. HPKB is run by the Defense Advanced Research Projects Agency.

• CRSG – project of this group revolves around the design and implementation of "conscious" software agents.. An autonomous agent senses and acts upon its environment in the service of its own agenda. An autonomous agent with human-like cognitive capabilities is called a cognitive agent. By a "conscious"

software agent, their mean one designed within the constraints of Bernard Baars' Global Workspace Theory of Consciousness.

• KSL Ontology Server Projects
The Ontology Server is a tool that supports distributed, collaborative editing, browsing and creation of Ontolingua ontologies. The Ontology Server can be used with any recent web-browser. Projects Using the Ontology Server: CommerceNet, The Enterprise Project, The InterMed Project, The Trial Bank, Accounting Information Systems, The SHADE Project, The Genbase Project, Network-based Information Brokers, Bayesian Network to Ontolingua /KIF/frame Transformer

• The Blue Brain Project - was launched by the Brain Mind Institute, EPFL, Switzerland and IBM, USA in May, 2005.

• COG developed in MIT Humanoid Robotics Group. Projects of Behavioural Intelligence
[Coco], [Cog], [Kismet], [Macaco], robots
Based on the assumption that intelligence should be developed gradually, beginning with animal perception of surroundings, and motor senses (co-ordination of movement, sound, object recognition) and moving to symbolic intelligence (speech recognition, thought).
Based on the assumption: human intelligence is the result of development processes, social activity, and the integration of multi-modular sensoral information.
New skills arise on the basis of past experiences.
People do not form complete and faithfull representations.
Many dissimilar representations are used in different contexts.
The brain does not have a CPU – there is no central control unit.
The brain has specific limitations, even in logic.
Irrationality of human behaviour, the role of emotion.
Human intelligence requires a human body; easier to make a robot than to simulate gravity, flexibility, limb co-ordination, etc.
Questions:
How to develop such a system? What should be the stages and strategies of learning?
Which behaviors evoke caring responses in humans?
Which motivations, emotions and forces are necessary for communication?
How to use learned skills in new contexts?
How to achieve a behavioural harmony among a collection of subsystems of different (sometimes opposing) aims, behaviour, activity and stability? How to precisely model the biological characteristics of an organizm?
How to evaluate progress in the creation of such a system?
This approach may be productive, but only after decades.

As can be seen, researchers are concentrating on either one another aspects of the brain.
It seems that nobody is actually attempting to build a complete artificial brain, a computer system - observing and operating in the environment of a kind of WWW which could serve as a ‘body’ – which remembers information, recognizes patterns both in it’s surroundings and within itself, a system which would be capable of creating new structures and finding solutions to hitherto insoluble problems.

3. Towards WWAI

WWW is a natural space to experiment with these constructions and tools.

Today's attempts to create AI have limited scope, but let's imagine that
WWW could be transformed in one **WWAI**:
**a massively-parallel-wetware-oriented intelligence, consisting of structures and dynamics emergent from a community of intelligent software objects,
distributed worldwide.**

This would indeed be a progressive process, in which we supercompile and improve our own cognitive functions.

Today we are at the stage where we've hooked up this AI constructions to a "simulated body" in WWW and started teaching it experimentally.

In the future, WWAI will function as a nerve centre for the social superorganism, an emergent system formed by both humans and AI systems, joined together by the Internet and other cutting-edge communication technologies.

WWAI : World Wide Artificial Intelligence

What is the future of the Web? (speculative)

- Present work is concentrated on replacing analog technology with its digital and network equivalents – e.g. publication becomes ever-faster, and in such fields as science the Web radically altered the way in which information is exchanged, and a similar phenomenon can be seen in the field of business. All of this is interesting, but it is nevertheless only the extension of existing aspects of human society into the digital world (for example, in the opinion of some critics we don't see any expansion in business, but merely the replacing of processing tools by others). There is very little discussion aimed at proposing something fundamentally new.

- The Web in its present form can be compared to the mind of a small child which has not yet learned to think for itself.

- During the next decades we will see a growth in this infantile mind and a progression from this larval phase to the coming of an autonomous, global and intelligent WWAI system

- it will be a fusion of two fields which have been separated:
  Artificial Intelligence and Networking

- the consequences of this progression will have far-reaching effects – the arrival of AI and then WWAI will be a turning-point in the history of our civilization. For the first time in his history, man will stand face-to-face with an intelligent non-human being.

Evolution scenario – three phases of the Internet:

1. pre-WWW - the direct exchange of small numbers of bytes of text
2. WWW – the exchange of texts, images and programs via ftp is still delayed and dependent on architecture
3. Web – direct exchange of animation, programs, thanks to languages such as Java

the web has become a real-time software resource, knowbots surfing the net perform specialist operations for their owners.

the third phase is interesting, but I would like to go a step further and out forward the vision of an intelligent network

How can we transform the Web from a global trash-can of books into a massively parallel self-organizing software?

What will happen when the inert collection from the third phase begins to form self-organizing patterns, memory, and thinking structures and dynamics which hadn't previously been programmed?

Problems:
P1. The problem of scale: the problem of computer power (the human brain has 10 000 000 000 neurons, compared to which our computers have the brain of a chicken, but on the other hand a standard neuron network is more than is necessary – a typical workstation can simulate barely hundreds of neurons evolving in a sensible manner)

P2. The problem of architecture: Another need is the creation of a suitable, elastic computer architecture, which could be continually upgraded.

WWW, or part of it, could potentially transformed into a collective computer of great power

Each web page with a suitable Java (or other) code is a potential "neuron" in the WWAI,
And every link between pages can be treated as a "synaptic link" between two neurons. Of course, the neuron-synaps metaphor should not be treated literally. It's more appropriate to think of web pages as clusters of neurons. What's important is that the possibility exists, and that it's possible to transform the Web into a dynamic cognitive system.

To my mind what we need in order to form WWAI is a general theory of the thinking process, which abstracts specific human and computer characteristics, in other words which will explain the structure and dynamics of thought independent of the specific components from which it is composed.

SM – Simple Model (abstract framework), which adapts itself to both human and digital systems

a. a model of the mind as a network of agents continually transforming each other
b. solid mind structures such as memory, perceptive system etc. as the attractors of probabilistic functions which describe dynamic of agents
c. evolving: a new hierarchical network arises out of the original network by means of mutation and crossover,
d. conscience: a completely unnecessary concept could be treated as a quick exchange of information in loops from cognitive centers to perceptual centers

Web pages should be dynamic and not static, links with inferential mechanisms, agents must independently control their own destiny.

Independent creation of links – they must be formed by spontaneous self-organization rather than established algorithms – links are continually created, destroyed and modified, change their importance and form a new page order.

Independent creation of new pages and the modification of old ones by web agents.
Web pages do not have a fixed content, but are arranged by totally dynamic of self-modification. When a new page is added to WWAI the new pattern is immediately recognized, the page "moves" until it finds it's place in the network order, and old pages must also update their position. This order cannot be static like, for example, the categories in the Yahoo search engine.

It also seems to be important to think about the long-term future of Web intelligence.
But that really belongs to ethical or spritual speculation. That which begins with smart search engines and servers (through the stage where WWAI will be independent of human intelligence, to the stage when the border between WWAI and human intelligence will no longer exist: Hive Mind, Supraman.) could finish with something really cosmic and surprising – a new form of intelligence evolution on our planet.
Pessimistic version: it could all end up completely differently – the existence of some kind of total global neurosis (from human neurosis to global; WWAI neurosis) or global brain cancer.

4. Supplement: FLOAT project

FLOAT is an on-line community channel providing „experimental space" and a variety of tools through which users can voice their ideas, both locally and globally, for transmission wordwide.

FLOAT is a multi-user hyperstructure kit - a set of tools or primitives for building, modeling, analysis, and visualization of hyperstructures.

The main problem that we're considering is a problem of ordering (sorting) and visualizing information. The tool should be sufficiently flexible and stiff at the same time. Flexible in the sense that the user must always have the possibility of :
• adding new content,
• re-organizing the information to which he has access,
• presenting the same information in various ways (the means of viewing of his choice, appropriate to the content). Stiff in the sense that the structure in which information is arranged is partially ordered.

We begin with a very simple set of rules for building blocks and their assembly-- one type of unit, one type of connection - and then assemble them into a variety of mechanisms.

FLOAT is a platform that
- supports the exploration of the experimental topics as:
Artificial Intelligence, Computer Aided Biotechnology, CyberArt, Tactical Media, Hacktivism
- provokes the discussion about the impact of the new technologies on our culture
- supports knowledge transfer and the exchange of know-how abilities
- provides right access to the flexible, intelligent, electronic network
- builds alternative methods for the collection and distribution data
- transforms closed circle of power systems into the open network

The central concept in F-hyperlink is the concept of ordered set, which is a set equipped with a special type of binary relation. The relations of most interested to us are the order relations.
An ordered set (or partially ordered set or poset) is an ordered pair (P,<=) of set P and binary relation <= contained in PxP, called the order on P, such that <= is reflexive, transitive, and antisymetric.
*P*1. *For all a*, *a* < *a* (*Reflexive*)
*P*2. *I f a* < *b and b* < *a*, *then a* = *b* (*Antisymmetry*)
*P*3. *I f a* < *b and* < *c*, *then a* < *c* (*Transitivity*)

The idea in semantics is p<q if q has “more information” than p or p is “less defined” than q.

Let (P, <=) be a poset, f: P-> P is ordered preserving. An element p in P is a fixed point of f:P-> P iff f(p)=p.
A complete partial order (CPO) is a partial order such that every chain has a lub (lowest upper bound). A poset is pointed iff it contains a least element.

Important Theorem (Abian-Brown, Scott): If P is pointed CPO, then the least fixed point p of a continuous function f:P->P exists and p= lub {F^I(\bot)| I in Nat}.

Fixed points are important because they exactly characterize solutions to recursive definitions. Fixed point operators are essential for recursion, and recursion is central for computation.

General Boolean Algebras

The algebra of logical statements is well-known and is called *Boolean algebra*
There are three operations in this algebra: conjunction °¸, disjunction °˝, and complementation
In terms of the English language, the logical operation of conjunction is implemented by the grammatical conjunction ‘*and*’, the logical operation of disjunction is implemented by the grammatical conjunction ‘*or*’, and the logical complement is denoted by the adverb ‘*not*’. Implication among assertions is defined so that a logical statement *a* implies a logical statement *b*, written *a*=>*b*, when *a*∨*b* = *b* or equivalently when *a*∧*b* = *a*. These are the basic ideas behind Boolean logic.

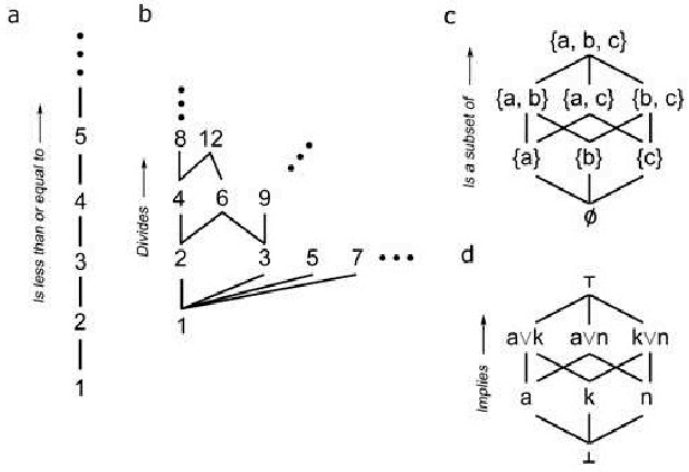

FIGURE 1. Four different posets.
(a) The positive integers ordered by ‘is less than or equal to’.

(b) The positive integers ordered by ‘divides’.
(c) The powerset of {*a*,*b*,*c*} ordered by ‘is a subset of’.
(d) Three mutually exclusive logical statements *a*, *k*, *n* ordered by ‘implies’. Note that the same set can lead to different posets under different ordering relations (a and b), and that different sets under different ordering relations can lead to isomorphic posets (c and d).

The effect of our contribution to probability theory was **to generalize Boolean implication among logical statements to degrees of implication represented by real numbers.**. These real numbers, which represent the degree to which we believe one logical statement implies another logical statement, are now recognized to be equivalent to probabilities.
Our methodology **centered on deriving the rules to manipulate these numbers.** The key idea is that these rules must maintain consistency with the underlying
Boolean algebra.

NAVIGATION AND ENVIRONMENT

The program was used to create a collective, dynamical installation that allows small groups of participants to interact with virtual objects, and with each other, in real time.
New mobile interface of the installation uses 5-fingers wireless keyboard or touch stream.

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