

## LETTERS

Editor:

We are currently working on a project that attempts to integrate artificial intelligence and legal reasoning for the purpose of simulating judicial decision making. The project has defined legal reasoning and legal analysis—the former taking place before the latter begins. Using a historical approach with our legal system's basis founded in English common law, we attempted to examine the role of *stare decisis* in decision making. More extensively we examined the role of reasoning in legal analysis, relying on Wittgenstein and to some extent Hofstadter, for an explanation of the foundation of the thought behind man's reasoning process. Legal reasoning is a specialized thought process, but reasoning is generic to all processes that attempt to incorporate artificial intelligence. Our research now lies in the area of examining normative values and the part they play in legal analysis. Apart from the technical question—can a computer solve legal problems—we are looking at the ability of artificial intelligence and knowledge engineering to determine whether or not computers can differentiate between subjective meaning and objective representations of that meaning. The question now is, can the “intuitive” basis of value choices be programmed into an artificial intelligence data base? How does the fact that value judgements are choices, not calculations, affect the normative propositions necessary to any program designed to simulate legal reasoning? Law is replete with value judgements—is this the “right” line of reasoning to follow for this defendant? Is the line of reasoning “good” for this defendant? Each time a judge or lawyer employs a form of legal reasoning, the different perspectives involved in the value selections made will be done so intuitively, innately, (subliminally?). Can this normative, value-oriented thought process be categorized and enhanced through the use of artificial intelligence? Or will it be destroyed by the very knowledge needed to engineer it into a computer program? We would appreciate your comments.

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Editor:

I have recently been named to the Editorial Panel of *Communications of the ACM (CACM)* with responsibility for artificial intelligence. *CACM* is by far the widest-read computing publication with a current circulation of over 75,000. I would like to encourage submissions to *CACM* in one of several forms: articles of general interest (surveys, tutorials, reviews), research contributions (original, previously-unpublished reports on significant research), and reports on

conferences or committee meetings. Since most of the readers of *CACM* are not specialists in AI, the content and style of the articles would likely differ from those found in the *AI Magazine*. In particular, manuscripts which act to bridge the gap between artificial intelligence research and traditional computing methodologies are welcome. All contributions will be fully reviewed with authors normally notified of acceptance or rejection within 3 months of receipt.

In addition, *CACM* intends to devote substantial amounts of space to special collections of related articles. For examples, see the September 1985 issue on “Architectures for Knowledge-Based Systems” or the November 1985 issue on “Frontiers of Computing in Science and Engineering.” These special sections are usually composed of invited papers selected by a guest editor from the community, with the major focus being the explanation of AI concepts and applications to a broad community of computer scientists. Professional editors at ACM headquarters devote substantial effort in developing graphics and helping to make the articles readable by a wide cross-section of the computing community. I welcome suggestions (and volunteers) from anybody in the AI community for such special sections.

Articles and research contributions should be submitted directly to: Janet Benton, Executive Editor, *CACM*, 11 West 42nd St., New York, NY 10036.

Ideas for articles or special sections, and volunteers for helping in the review process to insure the highest quality of AI publication in *CACM* should be sent to me: friedland@sumex (or call 415-723-3728).

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Editor:

With reference to the article by Michael R. LaChat entitled “Artificial Intelligence and Ethics: An Exercise in the Moral Imagination” which appeared in Volume VII, Number 2 (Summer 1986) of *AI Magazine*, I should like to make several comments.

Physical chemistry has been described “as anything of interest to science,” and I believe that a study of the article from this viewpoint is instructive, and would be of great interest to AI researchers as well as physical scientists.

A system capable of exhibiting “personhood” as defined by LaChat (L) would in reality represent a quasi-living state or system and the Turing Test would be trivial from a thermodynamic standpoint. “Personhood” can only be achieved by a thermodynamic entity and as such is subject first to the laws of thermodynamics.

A thermodynamic entity would have a built-in pain capacity, in that pain would be equivalent to a constraint, and under these conditions Le Chatelier's principle would be operative. In other words, the system would make an attempt to modify itself in such a way so as to minimize the constraint.

With reference to thought taking place without the brain, this is the very basis of the single biological cell, in that the mystery of life resides in controlled transport through membranes.

With reference to emergent properties such as mind at a certain level of organization, Thom (Catastrophe Theory) would argue that from a preliving state (primeval soup) the synthesis of living matter demands a truly anabolic catastrophe which, starting from a static state or field, will lead to a metabolic field. These are based on topological arguments.

The emergence of patterns in space and time from an initially homogeneous mass of matter early attracted the attention of Alan M. Turing (iodine clock reaction and Liesegang rings) culminating in 1952 in his epoch-making paper "The Chemical Basis of Morphogenesis." This work was continued by the Brussels School under Ilya Prigogine resulting in the Nobel Prize winning theory of dissipative structures. The phenomena of chemical oscillations, for example, the Belousov-Zhabotinsky reaction, has attracted extraordinary interest.

Emergence is also associated with synergetics (after H. Haken), phase transitions and cooperative phenomena, self-organization, energy dissipation, the theory of scaling laws, and renormalization groups, symmetry breaking, etc.

LaChat writes that in the history of AI there are two basic approaches viz., the cybernetic model and the information processing model. There is a third approach begun by the author in 1950 and known only to a small group which included Einstein, Schrodinger, and E.J. Opik. See *Cosmic Biology*, Philosophical Library, New York, 1975 and a monograph published under the auspices of the Boeing Airplane Company and the University of Washington in 1961—*Towards the Correspondence Between Chemical Dynamics and the General Cosmological Problem*. This is a unified field approach in which an attempt is made to bring so-called biological phenomena into the mainstream of physical theory. Within the boundaries of Opik's oscillating universe it permits the derivation of mathematical equations for the "living state" and supports the suggestion of the Soviet scientist I.S. Shklovskii that artificial intelligence may be the next phase of organic evolution. The third approach is concerned with the problem of incorporating boundary conditions or topological parameters into algebraic descriptions of chemically reacting systems; certain aspects can be developed by experimentation and tested in the same way.

In the third approach (quasi-thermodynamic) the emergence of consciousness is more the result of a very large number of chemical events taking place within a small area (some form of meta-coupling or chemical resonance) rather than chemistry or substrate design. Further, the conscious or

intelligent entity or state has to be a dissipative structure and serve a cosmological purpose. Although it is not possible to describe the model here, it is of interest to pass along the observation, that if artificial intelligence were the next phase of organic evolution, that due to extraordinary energy or material requirements, such entities or machines would have to be cannibalistic in nature. The cosmological driving force or the ultimate goal is the supreme organization of matter, and which in the present era must reside (short of exobiological entities) in or be represented by the human brain, since no other volume element houses such a large number of events in the normal course of things. It can only be challenged by the human zygote.

The physicist John Tyndall remarked that "structural forces are certainly in the mass, whether or not those forces reach to the extent of forming a plant or an animal. In an amorphous drop of water lie latent all the marvels of crystalline force. . . ." Analogous to molecular communications.

Finally, since Michael R. LaChat has carried the classical, purist, AI speculations to the extreme (and for which he should be commended) viz., assigning it or them such properties as moral thought, pain, emotions, or even the desire to reproduce, or legal rights, he has entered the domain of the nonlinear thermodynamicist and therefore such comments on his article are appropriate. He has gone beyond the supercalculating or thinking machine and if history is any criteria, concerned himself with the quasi-living state. Speculations by the undersigned on Information—its Physicochemical Origins and Nature, have resulted in the new science of Electrotopygraphy (ETG); see pages 89 to 126 in *Proceedings of AI '85* (Tower).

Steel (that wonderful exotic mixture of pure iron and carbon) is the greatgrandfather of artificial intelligence, in that the transistor was discovered by investigations of the electrochemistry of steel corrosion. (steel-transistor-IC-computers-AI). It has been said that all great advances in human civilization have followed an advance in metals technology; Bronze Age, etc. Whether he is aware of it or not, the questions that LaChat is raising must ultimately center upon the most difficult problem, viz., does morality have a thermodynamic basis? The undersigned would be inclined to think so. However, as Max Planck showed us, nature or natural phenomena are most interesting when they exhibit discontinuities, and this is what Turing was looking for in his work on Chemical Morphogenesis.

Respectfully,  
Minas Ensanian  
Chairman  
Electrotopygraph Corporation

Editor,

Michael LaChat's paper, "AI and Ethics: An Exercise in the Moral Imagination," states "we can say that the (Frankenstein) monster is claiming that he was the improper subject of

a poorly-designed nontherapeutic experiment.” This is not the case. The monster was complaining because Frankenstein abandoned him and thrust him out without the necessary knowledge to deal with the world. The monster describes how he was tormented by hunger and thirst, and how he had to learn to see and to communicate all on his own. This is the gist of the quote included by the author, “. . . (Adam) was allowed to convene with, and acquire knowledge from, beings of a superior nature, but I was wretched, helpless, and alone.”

Most readers of Frankenstein would answer the question posed by LaChat “Is the construction of an AI an immoral experiment?” as follows: “yes, it is immoral if it involves the creation of a feeling creature that is made to suffer to no purpose.”

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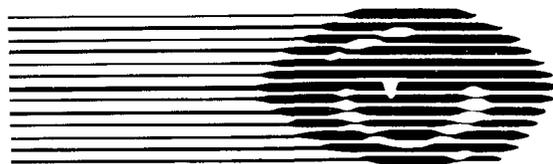
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