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Vibrations:

communication through a morphic field

by

Ralph H. Abraham, abraham@vismath.org
Visual Math Institute, http://www.vismath.org
POB 7920, Santa Cruz, CA, USA-95061-7920

Abstract. This is a progress report on the computer simulation of a mathematical model for a morphic field. The model is a two-dimensional lattice of oscillators derived from the d'Alembertian wave equation by spatial discretization. The communication is between two clamped objects inserted into the field. A change of shape in one of them sets off a transient wave which perturbs the boundary field of the other one after a brief delay. Unlike radio propagation, this is a static monopole transmission.

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1. Introduction. Morphogenesis is a branch of mathematics, of chaos theory actually, inspired by the problem of biological morphogenesis, the mystery of pattern formation in biological nature. For example, how did the leopard get its spots? How does an egg become a chicken? Today most biologists believe that a leopard gets its spots from its mother leopard, and a chicken gets its internal organs through the information of DNA alone, in the process of embryogenesis.

But only a few decades ago, vitalists and organicists considered the idea that there are immaterial fields of intelligence which collaborate with DNA: *morphogenetic fields*. Around 1954, this idea was revived by the late theoretical biologist, Conrad Waddington. The renowned French mathematician Rene Thom, inspired by Waddington, provided mathematical models for Waddington's field theory of embryogenesis around 1966.[1] In the process, he introduced Waddington's teleological notion of *attractor* into the history of mathematics, a crucial contribution to dynamical systems theory (also known as *chaos theory*) and its applications.[2]

And more recently, it has been revised and extended by Rupert Sheldrake in a sequence of books.[3] *Morphic field* is the name given by Sheldrake, generically, to morphogenetic, mental, and social fields.[4] Lately he proposed this field as the medium for telepathic communications observed between animals, for example, between people and their pets.[5] More importantly, one goal of his work is the depolarization of the conflict between the sciences and the major world religions which necessary results from the mechanistic and materialistic paradigm rampant in the scientific community of today.[6]

In this paper we report on our recent computer simulation of a mathematical model for this kind of communication.

2. Vibrations and morphogenesis. In 1972, while visiting Rene Thom in France, I discovered the work of Hans Jenny of Basel. Under the influence of the esoteric Christian mystic Rudolph Steiner, Jenny had continued the research of Ernst Chladni, the founder of acoustics, upon the forms created in a field of acoustic vibration. Later that year, while staying at the ashram of Neem Karoli Baba at Kainchi, in the Himalayan foothills of North India, I abstracted the work of Chladni and Jenny into a mathematical model for morphogenesis, and applied it to neurobiology, that is, brain waves. This work was published on my return from India to the University of California, in 1975, as the paper, *Vibrations and the realization of form*. During this same period of time, Rupert Sheldrake was writing his first book on morphogenesis in the ashram of Dom Bede Griffiths, in Tamil Nadu, South India. Both of us were undoubtedly influenced by the Hindu theories of the *akasha*, that is, an infinite, vibrational field of intelligence. Naturally, when we met in

1. The main source is (Thom, 1972).
2. A basic text is (Abraham, 1992).
3. Especially (Sheldrake, 1981) and (Sheldrake, 1988).
4. See p. 112 in (Sheldrake, 1988).
5. See (Sheldrake, 1994), especially pp. 88-89.
6. See the interview with Sheldrake in (Webber, 1986), as well as Ch. 9 in (Sheldrake, 1991).

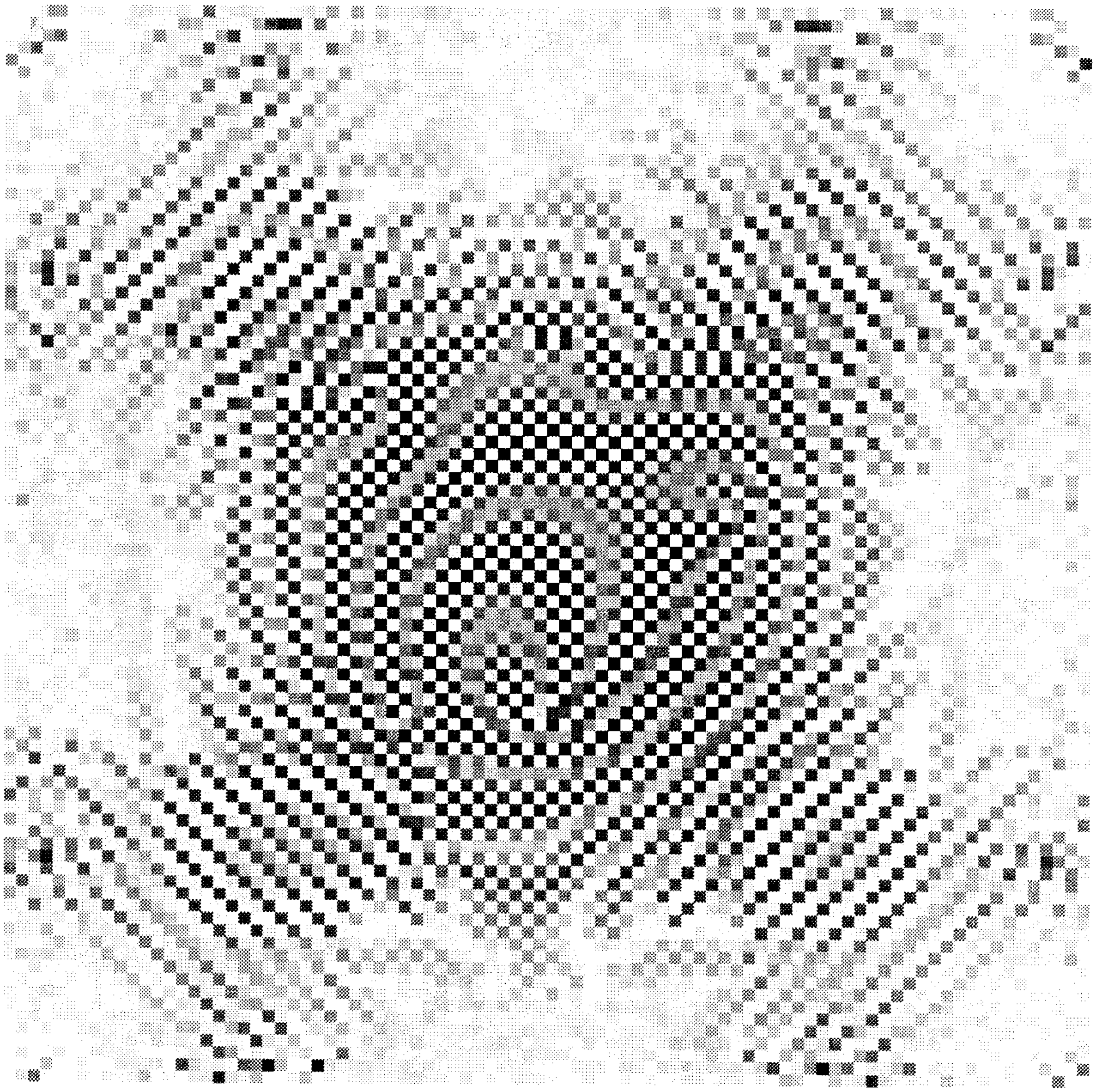
1982, we found we had much in common. Our friendship and discussions over the years are the basis of the work reported here.

3. *Reaction-diffusion models.* The evolution of mathematical models for morphogenesis began in 1924, with the work of Roland Fischer. This was the first example, to my knowledge, of a reaction-diffusion equation. This type of model combines a spatially distributed chemical reaction with a diffusion of the chemical reactants through the spatial substrate. After intuitive and theoretical discussions of this sort of model for embryogenesis (by Rashevsky, the founder of mathematical biology, in the 1930s) and for plant phyllotaxis (by Turing in England in the 1950s) the computer simulations began in the 1970s, in the group of Prigogine in Brussels. These simulations proved conclusively that the reaction-diffusion models were capable of morphogenesis, and many more studies have followed (see the books of Murray and Meinhardt in the Bibliography).

4. *Wave-diffusion models.* Following the success of reaction-diffusion models for chemical and biological morphogenesis, successive generalizations were reported in various works. The wave-diffusion models were based on the foundational work of mathematical physics, the wave equation for the vibrating string of d'Alembert, published in 1749. An early model of this type was the one-dimensional lattice of oscillators of Fermi, Pasta, and Ulam, in which chaotic behavior was observed in the 1950s. A very general model of this type is the *cellular dynamical system* discussed in the 1970s, and reported in my book, *Complex Dynamical Systems.*

5. *Morphic fields.* The physical fields of modern physics are recent inventions. They are cognitive strategies only: it is impossible to prove they exist. The first one, the gravitational field, was the invention of Isaac Newton, 300 years ago. The second one, the electromagnetic field, was invented about a century ago to represent the observations of Michael Faraday in the 1830s, and later, of Heinrich Hertz with his high voltage coil. Soon, this concept was embedded in a highly successful mathematical model by Clerk Maxwell, now known as the *Maxwell equations.* Just a few years later tensor analysis was developed by mathematicians, and applied to both the gravitational and electromagnetic fields. These two fields are called material fields, although they are not material themselves, because they are created and maintained by physical mass or electromagnetic properties, and they interact with matter. The morphic fields of Rupert Sheldrake are may be called immaterial fields, in that their creation and maintenance may be outside the material universe, like the akasha.They are nevertheless amenable to mathematical models, which may improve our understanding of them.

6. *Our model.* Our model for the tensorial morphic field (in this simple model a scalar field) is derived from an electromagnetic field on a two-dimensional, flat torus, in which are placed two conductors. One, A, will be the receiver of a communication transmitted by the other, B. In imitation of the senses of sight, hearing, and smell, we imagine that B sends the message by a motion or change of shape, like ringing a bell. An oscillatory transient then propagates through the scalar field, a vibration like a sound wave. As the transient arrives at the boundary of the receiver, A, a *perception* occurs.



This is a boundary event, in which the morphic field external to A (which we visualize in our model as a small, hollow square) disturbs the equilibrium state on the square boundary of A (think of an imperfectly grounded conductor in a field of radio waves). This disturbance crosses the boundary, by becoming a changing boundary condition for the tensorial state representing the inner psychological space (psychocosm) of A. This interior effect might also be modeled by a tensorial field, but we have not done so.[1] But if we did, the perception event might be modeled by a tensor field on the boundary of A.[2] Thus, we would have three tensor fields: the external morphic field, the boundary perception field, and the interior mental field.

1. But see Roy, 1996.
2. See Hoffman.

Here, we simulate the perception by conductor A of a transient wave triggered by a sudden change of shape in conductor B in a simpler scheme: we just image the waves arriving at the square boundary of A, as a retina. We visualize the morphic field restricted to the neighborhood of the square boundary. This mode of communication is monopolar. A change of shape is transmitted through the field, without oscillation of either conductor. A transient carries the information, and we regard this is a model for *morphic resonance*, as defined by Sheldrake.[1]

7. *Simulation results.* The simulation was carried out by Peter Broadwell, using the software system MIMI (Mathematically Illuminated Musical Instrument) which we have developed, along with Ami Radunskaya, for our live performances of visual mathematics and music. A toral lattice of about 8,000 oscillators with Laplacean coupling (that is, the 88 x 88 cell discretization of a d'Alembertian wave equation on a two-dimensional rectangle with the opposite edges identified) was imaged by color coding the displacement (that is, the wave amplitude) on the computer screen. The simulation ran on a Silicon Graphics Iris Indigo computer, at about 10 iterations per second. The result is an animated color image on the screen, which is available in a ten-minute videotape, in which the communication potential of this kind of morphic field is clearly demonstrated.

8. *Conclusion.* In this first experiment, we have a convincing demonstration that communication of a semiotic (iconic) nature (analogous to radio broadcasting in the electromagnetic field) may be supported by an immaterial field such as the morphic fields of Rupert Sheldrake, We do not claim to establish the existence of such fields, nor the capacity of the brain to emit or receive them. However, the whole language and cognitive strategy of Sheldrake, involving morphic fields and morphic resonance as the basis for physical, biological, and social morphogenesis, is strongly supported by our results.

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1. See pp. 95-86 in (Sheldrake, 1981).

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