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Fields of Being: On Morphic Resonance

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In this paper Rupert Sheldrake elucidates his controversial hypothesis of morphic fields and morphic resonance, a revolutionary expansion of the idea of Darwinian evolution that accounts for how living organisms assume their different shapes and develop their unique traits. The implications are far reaching and help account for phenomena of interconnectedness (like telepathy) overlooked by mainstream science.

Pictured above: the intricate form of Darlingtonia californica resembles a striking cobra with bared fangs. How does the "cobra lily" take on its bizarre, distinctive shape? (Photo Credit: David Berry)

Morphic fields underlie the organization of animals, plants, cells, proteins, crystals, brains and minds. They help to explain habits, memories, instincts, telepathy and the sense of direction. They have an inherent memory. They imply that many of the so-called laws of nature are more like habits.

This is, of course, a controversial hypothesis.

The fields of morphogenesis

My interest in these new kind of fields first developed while I was doing research on the development of plants at Cambridge University. To start with, I was concerned only with one particular kind of morphic field, namely morphogenetic fields.

How do plants grow from spores or seeds into the characteristic form of their species? How do the leaves of ferns, oaks and bamboos take up their shapes? These are questions to do with what biologists call *morphogenesis*, the coming-into-being of form (Greek: *morphe* = form; *genesis* = coming into being), one of the great unsolved problems of biology.

In ancient Greece, philosophies of form fell into two main categories. Following Plato, the forms of living organisms were seen as imperfect copies of transcendent archetypes, or ideal Forms. Plato's student Aristotle thought that the Forms of animals and plants were shaped by their souls, which contained the form of the body and attracted the developing organism towards the characteristic form of its species. A similar idea continued in Europe in the Vitalist tradition in biology. But by the late nineteenth century the mechanistic school of thought predominated, seeing all morphogenesis as a mechanistic process determined by inherited chemicals, which are now identified with DNA.

The naive approach is simply to say that morphogenesis is genetically programmed. Different species just follow the instructions in their genes. But a few moments' reflection shows that this reply won't do. All the cells of the body contain the same genes. In your body the same genetic program is present in your eyes, kidneys and fingers. If they are all programmed identically, then how do they develop so differently?

Thanks to the great triumphs of molecular biology, we know what genes actually do. Some code for the sequence of amino acids in proteins; others are involved in the control of protein synthesis. They enable organisms to make particular proteins. But these alone cannot account for form. Your arms and your legs are chemically identical. If ground up and analyzed biochemically, they would be indistinguishable. But they have different shapes. Something other than the genes and the proteins they code for is needed to explain their form.

Biologists who study the development of form in plants and animals have long been aware of these problems, and since the 1920s many have adopted the idea that developing organisms are shaped by fields called *morphogenetic fields*. These are rather like invisible blueprints that underlie the form of the growing organism. But they are not, of course, designed by an architect, any more than a "genetic program" is supposed to be designed by a computer programmer. They are fields: self-organizing regions of influence, analogous to magnetic fields and other recognized fields of nature.

But no one knows what these fields are or how they work. Most biologists assume that they will at some time in the future be explained in terms of regular physics and chemistry. This is no more than an act of faith.

After ten years of research in developmental biology, I came to the conclusion that these fields were not just a way of talking about standard mechanistic processes, but something really new.

The idea of morphogenetic fields was first put forward by Alexander Gurwitsch in 1920. The idea of morphogenetic fields was proposed independently by Gurwitsch in Russian in 1922, Hans Spemann in Germany in 1924 and Paul Weiss in Vienna in 1926. All were leading developmental biologists, and Spemann received the Nobel Prize in 1935 for his work on embryology. These field theories were widely influential at the time, but with the rise of genetics and molecular biology were eclipsed as the fashion shifted towards a bottom-up explanation of morphogenesis in terms of molecular mechanisms,

Alexander Gurwitsch (1874-1954)

rather than the top-down holistic approach that was intrinsic to the field concept.

The hypothesis of morphic fields

This was the starting point for my own development of the hypothesis of morphic fields first proposed in my book *A New Science of Life*[1] and further developed in *The Presence of the Past.*[2]

All self-organizing systems are wholes made up of parts, which are themselves wholes at a lower level, such as atoms in molecules and molecules in crystals. The same is true of organelles in cells, cells in tissues, tissues in organs, organs in organisms, organisms in social groups. At each level, the morphic field gives each whole its characteristic properties, and interconnects and coordinates the constituent parts.

The fields responsible for the development and maintenance of bodily form in plants and animals are called morphogenetic fields. In animals, the organization of behaviour and mental activity depends on behavioural and mental fields. The organization of societies and cultures depends on social and cultural fields.[3] All these kinds of organizing fields are morphic fields.[4]

Morphic fields are located within and around the systems they organize. Like quantum fields, they work probabilistically. They restrict, or impose order upon, the inherent indeterminism of the systems under their influence. Thus, for example, a protein field organizes the way in which the chain of amino acids (the “primary structure,” determined by the genes) coils and folds up to give the characteristic three-dimensional form of the protein, “choosing” from among many possible structures, all equally possible from an energetic point of view. Social fields coordinate the behaviour of individuals within social groups, for example the behaviour of fish in schools, or birds in flocks.[5]

The mathematician René Thom has created mathematical models of morphogenetic fields in which the end-points that systems develop towards are defined as *attractors*.[6] In the branch of mathematics known as dynamics, attractors represent the limits towards which dynamical systems are drawn. They provide a scientific way of thinking about ends, purposes, goals or intentions. All morphic fields contain attractors.

The most controversial feature of this hypothesis is that the structure of morphic fields depends on what has happened before. They contain a kind of memory. Through repetition the patterns they organize become increasingly probable, increasingly habitual. The force these fields exert is the force of habit.

Whatever the explanation of its origin, once a new morphic field, a new pattern of organization, has come into being, through repetition the field becomes stronger. The same pattern becomes more likely to happen again. The more often patterns are repeated, the more probable they become. The fields contain a kind of cumulative memory and become increasingly habitual. Fields evolve in time and form the basis of habits. From this point of view nature is essentially habitual. Even the so-called "laws of nature" may be more like habits.

The means by which information or an activity-pattern is transferred from a previous to a subsequent system of the same kind is called morphic resonance. Morphic resonance involves the influence of like upon like, the influence of patterns of activity on subsequent similar patterns of activity, an influence that passes through or across space and time from past to present. These influences do not fall off with distance in space or time. The greater the degree of similarity, the greater the influence of morphic resonance.

Morphic resonance gives an inherent memory in fields at all levels of complexity. Any given morphic system, say that of a squirrel, *tunes in* to previous similar systems, in this case previous squirrels of its species. Through this process each individual squirrel draws upon, and in turn contributes to, a collective or pooled memory of its kind. In the human realm, this kind of collective memory corresponds to what the psychologist C.G. Jung called the "collective unconscious."

One example of the spread of a new pattern of behaviour suggestive of morphic resonance is the

stealing of cream by blue tits (called chickadees in North America) in Britain starting in the 1920s, when fresh supplies of milk were delivered to the doorsteps of houses every morning except Sunday. At the time blue tits and several related species began to steal cream by removing the caps and drinking the cream from the tops of the bottles. The first record of this habit was in 1921 from Southampton and it spread throughout Britain as monitored by amateur birdwatchers between 1930 and 1947. Once cream-stealing had been discovered in a particular place, it spread locally by imitation. A detailed analysis of the records by scientists at Cambridge University showed that cream-stealing was probably discovered independently at least 89 times in the British Isles. The spread of the habit accelerated as time went on. This habit also spread to continental Europe. The Dutch records are particularly interesting. Milk deliveries stopped during the Second World War and began again in 1947. Blue tits live only a few years, and probably none that had learnt this habit before the war would have survived until this date. Nevertheless attacks on milk bottles began again rapidly.[7]

Morphic resonance should be detectable in the realms of physics, chemistry, biology, animal behaviour, psychology and the social sciences. But long established systems, such as zinc atoms, quartz crystals and insulin molecules are governed by such strong morphic fields, with such deep grooves of habit, that little change can be observed. They behave *as if* they are governed by fixed laws.

By contrast, new systems should show an increasing tendency to come into being the more often they are repeated. They should become increasingly probable; they should happen more easily as time goes on. For example, when a new chemical compound is synthesized by research chemists and crystallized, it may take a long time for the crystal to form for the first time. There is no pre-existing morphic field for the lattice structure. But when the first crystals form, they will make it easier for similar crystals to appear anywhere in the world. The more often the compound is crystallized, the easier it should be to crystallize.

In fact new compounds do indeed tend to crystallize more easily the more often they are made. Chemists usually explain this effect in terms of crystal “seeds” from the new crystals spreading around the world as invisible dust particles in the air, or chemists learning from others how to do it. But the hypothesis of morphic fields predicts that this should happen anyway under standardized conditions, even if dust particles are filtered out of the air.

Xylitol crystals

Turanose, a kind of sugar, was considered to be a liquid for decades, but after it first crystallised in the 1920s it formed crystals all over the world. Even more striking are cases in which one kind of crystal appears and is then replaced by another. For example, xylitol, a sugar alcohol used as a sweetener in chewing gum, was first prepared in 1891 and was considered to be a liquid until 1942, when a form melting at 61 degrees centigrade crystallised out. Several years later another form appeared, with a melting point of 94 degrees centigrade and thereafter the first form could not be made again. Crystals of the same compound that exist in different forms are called polymorphs. The replacement of one polymorph by another is a recurrent problem in the pharmaceutical industry. For example, the antibiotic ampicillin was first crystallised as a monohydrate, with one molecule of water of crystallisation per ampicillin molecule. In the 1960s it started to crystallise as a trihydrate, with a different crystal form, and despite persistent efforts, the monohydrate could not be made again.[8]

Connections with quantum physics

Experiments to test for the spatial aspects of morphic fields imply a kind of non-locality that is not at present recognized by institutional science. Nevertheless, it may turn out to be related to the non-locality or non-separability that is an integral part of quantum theory, implying connections or correlations at a distance undreamt of by classical physics. Albert Einstein found the idea of "spooky action at a distance" implied by quantum theory deeply distasteful; but his worst fears have come true.[9] Recent experimental evidence shows that these connections lie at the heart of physics.

Several physicists have been intrigued by the possible connections between morphic fields and quantum theory, including John Bell (of Bell's theorem) and David Bohm, whose theory of the implicate order, based on the non-separability of quantum systems, turned out to be extraordinarily compatible with my own proposals.[10] These connections have also been explored by the American quantum physicist Amit Goswami[11] and by the German quantum physicist Hans-Peter Dürr.[12] But it is still not clear exactly how morphic fields might fit in with quantum physics, if only because the implications of quantum theory for complex systems like cells and brains are still obscure.

Experiments on morphic fields

The hypothesis of morphic fields is a scientific hypothesis, and as such is experimentally testable. There are several possible ways in which it can be, and has been, investigated by experiment. Some of these tests attempt to detect the fields as they link together different parts of a system in space; other tests look for the effects of morphic resonance over time.

The easiest way to test for morphic fields directly is to work with societies of organisms. Individual animals can be separated in such a way that they cannot communicate with each other by normal sensory means. If information still travels between them, this would imply the existence of interconnections of the kind provided by morphic fields. The transfer of information through morphic fields could help provide an explanation for telepathy, which typically takes place between members of groups who share social or emotional bonds.

When I started looking for evidence of field-like connections between members of social groups, I found that I was moving into realms very little understood by science. For example, no one knows how societies of termites are coordinated in such a way that these small, blind insects can build complex nests with an intricate internal architecture.[13] No one understands how flocks of birds or schools of fish can change direction so quickly without the individuals bumping into each other.[14] Likewise, no one understands the nature of human social bonds.

One particularly promising area for this kind of research concerns telepathy between people and domesticated animals, as discussed in my book *Dogs That Know When Their Owners Are Coming Home*. For example, many dogs and cats seem to know when their owners are coming home, even when they return at non-routine times in unfamiliar vehicles such as taxis, and when no one at home knows when they are coming. The animals seem to be responding telepathically to their owners' intentions.[15]

According to the hypothesis of formative causation, morphic fields extend beyond the brain into the environment, linking us to the objects of our perception, and are capable of affecting them through our intention and attention.[16] This is another aspect of morphic fields that lends itself to experimental testing. Such fields would mean that we can affect things just by looking at them, in ways that cannot be explained in terms of conventional physics. For example, we may be able to affect someone by looking at them from behind, when they have no other way of knowing that we are staring at them.

The sense of being stared at from behind is in fact a common experience. Experiments already indicate that it is a real phenomenon.[17] It does not seem to be explicable in terms of chance coincidence, the known senses, or fields currently recognized by physicists.

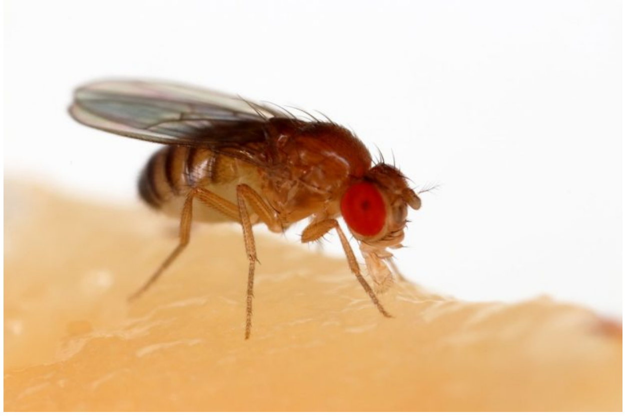
The unsolved problems of animal navigation, migration, and homing may also depend on invisible fields connecting the animals to their destinations.[18] In effect, these could act like invisible elastic bands linking them to their homes. In the language of dynamics, their home can be regarded as an *attractor*.[19]

Morphic resonance in biology

The build-up of habits can be observed experimentally only in the case of new patterns of development and of behaviour.

There is already evidence from observations of fruit flies that morphic resonance effects may be occurring in the realm of morphogenesis. When fruit fly eggs were exposed to a chemical (diethyl ether), some of them developed abnormally, turning into flies with four wings instead of two. When this treatment was repeated generation after generation, more and more flies developed four wings, even if their ancestors had never been exposed to the chemical.[20]

In the 1950s British biologist Conrad Hal Waddington (1905-1975) conducted a series of experiments with fruit flies in his laboratory. In



Drosophila melanogaster

Photo Credit: Sanjay Acharya

one experiment, he exposed fruit fly eggs to ether fumes for twenty-five minutes approximately three hours after they had been laid. Once hatched from their eggs, a statistically significant number of the flies developed four wings instead of the normal two. Waddington then selected these abnormal flies as parents of the next generation, which again he subjected to the ether stimulus. Continuing this experiment for several generations, he discovered that in as few as eight generations, a substantial number of fruit flies were born abnormally with four wings even when they were not exposed to the abnormal stimulus. Then, in the 1980s, geneticist Mae-Wan Ho (1941-2016) and her colleagues repeated Waddington's fruit fly experiments, but this time, instead of selecting only abnormal flies as parents for the next generation, she allowed all the flies to mate at random. Nevertheless, she and her colleagues found that the percentage of abnormal fruit flies "progressively increased from 2% in the first generation to over 30% in the tenth." Part of this effect could have been due to epigenetic inheritance, but when Ho and colleagues repeated the experiment with a fresh batch of fruit flies, instead of 2% showing four wings in the first generation, 10% did so; instead of 6% in the second generation, 20% had four wings. This suggests an effect of morphic resonance.[21]

There is also much circumstantial evidence that animal behaviour can evolve rapidly, as if a collective memory is building up through morphic resonance. In particular, large-scale adaptations have occurred in the behaviour of domesticated animals all over the world.

One example concerns cattle guards. Ranchers throughout the American West have found that they can save money on cattle grids by using fake ones instead, consisting of stripes painted across the road. Real cattle guards are made of a series of parallel steel tubes or rails with gaps in between, which make it difficult for cattle to walk across them, and even painful to try. However, present-day cattle do not usually even try to cross them. The illusory grids work just like the real ones. When cattle approach them, they "put on brakes with all four feet," as one rancher expressed it to me.

Is this just because calves learn from older cattle that they should not try to cross? Apparently not. Several ranchers have told me that herds not previously exposed to real cattle grids will avoid the phoney ones. And Ted Friend, of Texas A & M University, has tested the response of several hundred head of cattle to painted grids, and has found that naive animals avoid them just as much as those previously exposed to real grids.[22] Sheep and horses likewise show an aversion to crossing painted grids. This aversion may well depend on morphic resonance from previous members of the species that have learned to avoid cattle grids the hard way.

There are many such examples. There are also data from laboratory experiments on rats and other animals that such effects occur. The best known involves a series of experiments in which subsequent generations of rats learned how to escape from a water maze. As time went on, rats in laboratories all over the world were able to do this quicker and quicker.[23]

Morphic resonance in human learning

Morphic resonance has many implications for the understanding of human learning, including the acquisition of languages. Through the collective memory on which individuals draw, and to which they contribute, it should in general be easier to learn what others have learned before.

This idea fits well with the observations of linguists like Noam Chomsky, who propose that language learning by young children takes place so rapidly and creatively that it cannot be explained simply in terms of imitation. The structure of language seems to be inherited in some way. In his book *The Language Instinct* Steven Pinker gives many examples to support this idea.

One of the few areas in which detailed quantitative data are available over periods of decades is in the scores of IQ (Intelligence Quotient) tests. If morphic resonance occurs, average performance in IQ tests should be rising not because people are becoming more intelligent, but because IQ tests should be getting easier to do as a result of morphic resonance from the millions who have done them before. This effect is now well known, and is called the "Flynn effect," after its discoverer, James Flynn.

Large increases in IQ test scores have occurred in many different countries, including the USA, Japan, Britain, France, Germany and Holland.[24] Many attempts have been made to explain this "Flynn effect," but none have succeeded.[25] Flynn himself describes it as "baffling."[26] But morphic resonance could provide a natural explanation.

Implications

The hypothesis of formative causation has far-reaching implications in all branches of science. For example, morphic fields could revolutionize our understanding of cultural inheritance, and the influence of ancestors. Richard Dawkins has given the name "meme" to "units of cultural transmission,"[27] and such memes can be interpreted as morphic fields. Morphic resonance also sheds new light on many religious practices, including rituals.[28] Even scientific paradigms can be seen as morphic fields, stabilized by morphic resonance, with a tendency to become increasingly habitual and unconscious the more often they are repeated.[29]

But however wide its implications, this hypothesis has a major inherent limitation. It helps explain how patterns of organization are repeated; but it does not explain how they come into being in the first place. It leaves open the question of evolutionary creativity. Formative causation is compatible with several different theories, ranging from the idea that all novelty is ultimately a matter of chance, to explanations in terms of divine creativity.[30]

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