

# Life, the Universe and Everything

How Complexity can Emerge from Simple Causes  
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## 1. The deepest mysteries

The three greatest mysteries of all:

1. How the Universe came to be
2. How life came from lifeless parts
3. How consciousness came from non-conscious parts

These questions may be misconceived. They may not even be solely philosophical questions. But they all have philosophical aspects and two in particular seem to concern emergence.

Perhaps consciousness did not emerge from non-conscious parts. Panpsychism is the view that mind is in everything, including neurons but also table and chairs, grains of sand and molecules.

Whether or not that's true, I argue there is no good motivation for pansychism in the thought that consciousness could not have emerged from non-conscious parts. And nor need we fear the idea that life could have emerged from lifeless parts.

This talk will explore some issues of emergence and holism with particular reference to causation and the role of powers.

## 2. Power and Potentiality

There is an initial plausibility in the idea that powers are the worldly grounds of potentialities. There are many potentialities but not all of them are realised. And there is not a potential for everything.

A sperm has a power to fertilize an egg, for instance, and a fertilized egg has the power to grow into a human being, which then has the power to learn language. But the human just does not have the power to jump to the moon or to give birth to a donkey. And most sperms do not exercise their power to fertilize an egg, which explains why many potentialities remain unactualised.

Powers are purportedly a part of the natural world. They are to be found in the empirically accessible properties of things. The powers account may thus be capable of naturalising potentiality, which would be an advantage over modal realist accounts of possibility.

What things could have had the power to create life where there previously was none or to create consciousness from bits of grey matter? How do we stop the account being a *deus ex machina*?

## 3. The mutual manifestation model

How do powers produce new phenomena? How do they give rise to new particulars or to new properties within particulars? How are we to understand the basic framework of production for powers?

There are two main models for how powers produce: the stimulus-response (S-R) model and the mutual manifestation (M-M) model. The S-R model is the most widely accepted. But I argue that it is mistaken and instead advocate an amended M-M model.

The S-R model suggests that the stimulus and disposition are unequal partners in the production of the manifestation. The stimulus is active and powerful, the disposition is passive and, unless forced externally, impotent.

The (M-M) model takes powers to form more or less equal partnerships. When they are brought together, they produce something jointly that they could not have produced alone. E.g. don't ask which of the sperm or egg is active or passive; take them as equal partners in the production of an embryo. Each makes a contribution to the outcome.

You should not think of disposition partners jointly *causing* the manifestation. Instead, the coming together of the disposition partners *is* the mutual manifestation: the partnering and the manifestation are identical. This partnering-manifestation identity is seen most clearly with cases such as the following. You have two triangle-shaped slips of paper that, when placed together appropriately, form a square. It is not that the partnering of the triangles *causes* the manifestation of the square, but rather that the partnering *is* the manifestation. (Martin 2008: 51)

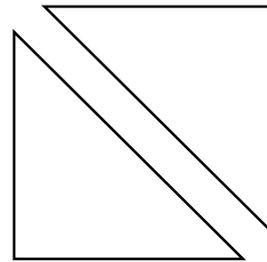


Figure 1: Martin's two triangles

There is much to recommend the M-M model. It shows that the partnered powers are more or less equal partners. They do not differ qualitatively: one being passive and another being active.

It shows that manifestations are produced when the partners are together; when sperm meets egg, when sugar meets liquid, when rock meets the window, and so on.

Martin is right that we do not need anything further once the partners are together. We do not need a stimulus or catalyst to get things going. The stimulus would just be a further power and thus, if needed, would only show that our initial partnership was incomplete with respect to the manifestation in question.

Nevertheless, there are ways in which the M-M model as presented by Martin is inadequate. And the ways in which it is wrong show that it does not take holism and emergence seriously.

## 4. Inadequacies of Martin's model

There are three respects in which Martin's model is inadequate.

- A. The model suggests that the manifest effect is produced instantly. The two triangles, once they are pushed together, form a square immediately. In reality, when partners are together, the effect they are able to produce may take time to occur. Even if the effect *starts* to occur immediately (a claim Mumford and Anjum 2011: ch. 5 support), it will typically be the start of a *process* that takes time to unfold and run its course. Kant (1781: A203) saw this:

The great majority of efficient natural causes are simultaneous with their effects, and the sequence in time of the latter is due only to the fact that the cause cannot achieve its complete effect in one moment. But in the very moment in which the effect first comes to be, it is invariably simultaneous with the causality of its cause.

**B.** Martin's model suffices only for the linear composition of causes.

Many cases of causation will be nonlinear.

Martin's model suggests that the effect is simply the mereological sum of its component parts. This means that the area of the resultant square is exactly equal to the sum areas of the individual component triangles. Not all causes compose in this way. Some forces might; but for others we need to accept nonlinear composition

Health is a function of exposure to sunlight but not a linear function.

The health benefits of sunlight reduce beyond a certain level.

Nonlinearity could be explained: the component powers interact, e.g. noise levels produced at a party. There is also an antipathetic variety of nonlinearity, where some partnered powers dispose in the opposite direction from that to which they would individually dispose before being partnered.

To amend Martin's model, it seems we should allow the possibility that the resultant square has an area larger or smaller than the areas of the component triangles combined.

**C.** Martin's model involves no genuine transformation or novelty.

Powers simply add. But there are many cases where a produced power is not simply the sum of the producing powers:

Sodium is a soft, bright, silvery metal. It can float on water and, when doing so, decomposes with the production of hydrogen and the formation of hydroxide. Sodium may ignite spontaneously on water, depending on the amount of oxide and metal exposed to the water. It normally does not ignite in air at temperatures below 115°C. Chlorine is a greenish-yellowish gas that is a respiratory irritant. As little as 3.5 p.p.m. (parts per million) can be detected as an odour, and 1000 p.p.m is likely to be fatal after only a few deep breaths. Chlorine is so toxic it was used in gas warfare in 1915. From this information it is impossible to predict that sodium chloride should be the benign compound that makes the oceans salty and is an essential compound for life, not to mention potato chips and margaritas. It is possible that a knowledgeable chemist could make this prediction – not today, but perhaps sometime in the future – but at this point 'salt' appears as an emergent property of sodium and chloride. (Rothschild 2006: 153)

If we are to amend Martin's model, it seems we need to allow for the production of novelty – call it emergence if you will. His two triangles might come together to form, for instance, a circle: something that is not simply the parts struck together.

**D.** Martin's model neglects the issue of organisation of parts. Powers cannot compose according to the principles of standard mereology, which state:

i. For any collection of parts, there is only one whole they compose.

ii. If a collection of parts exists, so does the whole composed of them.

ii. is false for powers. The fully functioning parts of an aeroplane do not automatically have the power of flight, if they are scattered on the hangar floor for instance.

i. is also false. The same component powers could be re-arranged for different overall powers, e.g. if the components of a vacuum cleaner were rearranged to make an electric scooter.

*Causation does not work merely by the addition of constituent powers. It often involves a process at the end of which we can find genuine novelty and transformation.*

Martin was exactly wrong about this. The powers are not jointly their manifestation. They are indeed *causes* of the manifestation where causation is more than mereological composition of components.

## 5. Holism

We now have a model in which the powers of a whole can be greater than (more, different from, the powers of the parts). This naturally dictates that it would be a mistake to consider only the parts. The whole can do things that the parts cannot.

... the basis of this position is the idea that many or all such entities have causal powers that are not simply consequences of the way their physical components are fitted together. This perspective gives biology, in particular, autonomy from the physical sciences. (Dupré: Spinoza Lectures: 12)

Biology is a case in point. The parts of organisms are often not themselves organisms (even if they are organic). The parts are unable to survive apart from the whole. And they seem to be *for* and used by the whole.

Here we see how a holistic approach is likely to be vital in explaining the origin of life from lifeless parts. We note, for instance, a vital *interdependence* of parts: the components of life need each other to function and survive:

For example, proteins are needed to make catalysts, yet catalysts are needed to make proteins. Nucleic acids are needed to make proteins, yet proteins are needed to make nucleic acids. Proteins and lipids are needed to make membranes, yet membranes are needed to provide protection for all the chemical processes going on in a cell... again and again *this* has to be made before *that* can be made – but *that* had to be there already (Cairns-Smith: 39).

This creates a puzzle. How could any one of these ingredients come first, given their interdependence? Answer: holistic and simultaneous solutions during the evolutionary process.



How could there be such a solution? Other interdependent structures exist, which could not have been assembled as a sequence parts without being built upon a whole.

