

SCIENCE IN THE DARK

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Introduction

This article is adapted from a talk given at a tribute event to Brian Goodwin which I organised at Schumacher College. I spoke in a panel alongside Martha Blassnigg and Christopher Moore, on the theme of language (see for their contributions elsewhere in this issue).

In order to understand the coherent action of past pointing time, it is necessary we look for examples where existence begins in the dark of the incoherent. The article takes examples from two scientific domains of dark matter and genetics.

Dark matter

Dark matter is one of the unsolved mysteries of modern physics. Hossenfelder of the Perimeter Institute assesses the commonly accepted challenge to physics as follows:

'Today's research in cosmology is accompanied by the group of cosmological problems, which strongly indicate that our knowledge about the universe is incomplete. Most importantly, it is microscopic explanations for dark matter and dark energy that we are lacking.'

The general theory of relativity developed by Einstein a hundred years ago, gives a clear derivation of gravity as the bending of space according to the presence of matter. The bending of space - or more accurately space and time - is what causes bodies to move in deviated orbits towards the heaviness of nearby objects.

Nowadays, there are sophisticated ways of seeing how planets in distant galaxies move, and these do not tally with the amount of matter that is directly visible. There is a mismatch. Sometimes the universe seems to be in need of an expansive pull and other times a restraining rein. To explain this, physicists in the 1930's dreamed up dark matter and dark energy to inject the necessary impulse for the movements of galaxies and the universe with respect to its visible mass.

But evidence as to the nature of dark matter and dark energy is inevitably (being dark) lacking. A recent experiment testing for dark matter notably discovered nothing at all. It is still seen worth the effort to continue to test for the constitution of dark matter as another type of matter previously unknown.

However before we try to imagine an answer, have we really understood the question? Various other physicists, such as Ripalda and Hossenfelder are using what is called the bi-metric approach to relativity. If Einstein could theorise a relation between space bending and matter, then why not juggle with these equations to include dark matter? Space and matter realise their relation in ordinary matter that behaves according to causal laws of interaction. But could one toggle the equations to reveal another type of exotic matter in a different relation to space and time?

Experience and reality

It is worthwhile looking at what such a recasting of the equations would actually mean to Einstein's initial understanding of gravity. Einstein was very insistent that his equations stemmed from the appreciation of experience. His equations were explicitly about the experience of an observer. The observer was implicitly included in the laws. Einstein's arguments were based on the experience of the world, relative to different observers and their motions.

For instance, consider this quote below from Einstein's book *Relativity*, where the quality of gravity is understood by experiential analogy.

'We imagine a large portion of empty space, far removed from stars and other appreciable masses. As reference-body let us imagine a spacious chest resembling a room with an observer inside who is equipped with apparatus. Gravitation naturally does not exist for this observer. He must fasten himself with strings to the floor, otherwise the slightest impact against the floor will cause him to rise slowly towards the ceiling of the room.'

To the middle of the lid of the chest is fixed externally a hook with rope attached, and now a "being" (what kind of a being is immaterial to us) begins pulling at this with constant force. The chest together with the observer

then begin to move "upwards" with a uniformly accelerated motion. In course of time their velocity will reach unheard of value-provided that we are viewing all this from another reference body that is not being pulled with a rope.

But how does the man in the chest regard the process? The acceleration of the chest will be transmitted to him by the reaction of the floor of the chest. He must therefore take up the pressure by means of the legs if he does not wish to be laid full length on the floor. He is then standing in the chest in exactly the same way as anyone stands in a room of a house on our earth. If he releases a body which he previously had in his hand, the acceleration of the chest will no longer be transmitted to this body, and for this reason the body will approach the floor of the chest with an accelerated relative motion. The observer will further convince himself that the acceleration of the body towards the floor of the chest is always of the same magnitude, whatever kind of body he may happen to use for the experiment.

Relying on his knowledge of the gravitational field, the man in the chest will thus come to the conclusion that he and the chest are in a gravitational field which is constant with regard to time.' (Einstein, p.66-67)

Einstein is very specific that what physics, especially relativity, needs to consider is the experience of reality. Through understanding our experience, we find the unlikely equivalences of inertial and gravitational motion, that is key to Einstein's theory of general relativity. A body falls in relation to space and time, according to a distortion brought about by the presence of other masses.

So if we are to change Einstein's equation that gives an exact definition of the geometry of space and time capable of describing the falling of bodies due to gravitational influence, we have to be very clear what is the experiential counterpart of this reinterpretation.

The way Einstein argues the existence of gravity is as follows: let us take away the ground of space, a chest floating in emptiness, and then imagine the necessary interactions, of masses tugging at each other to reinstate the impression of order. Let us do something similar with time. Let us first begin not with a man in a floating chest, but a paradoxical relation that does not in the first instance admit of any precise physical description and thus with no sense of an order to happening as a sequential process. Then order can be given if the process of individuation, by which each existence comes to resolution from its paradoxical origin, communicates relative to the universe, a matter of actualisation that directs change to establishing a common structure. That is each existence, instead of weighing its influence within a common initial order, aligns itself along its own possibility for individuation from a paradoxical origin to embed its own process within a future coherence of resolutions.

Time then draws together our initial hunches towards resolution by aligning the process of individuation of a being, or an idea, with a mass in its relation of unique self-actualisation with respect to the universal context. What happens then also when modifying Einstein's equation to allow in extra terms, is that a future originating significance (provision of order) is as the aha moment, that coordinates all the potential impulses into a moment of discovery of their meaningful relationship. We still have matter as the organising principle, but its order is now realised in the future from an initial incoherent state.

What one understands through this inquiry into relativity, is that one can attribute to existence a negative matter, or a matter of possibility, that the future then resolves by fitting together these potentials into a coherent statement over the whole.

The changing of the equations of relativity to explain dark matter by Ripalda and others, are not to relinquish the understanding of experience on which Einstein based the foundation of the theory. Rather the role of experience is argued from the perspective of how we integrate the incoherent and the novel into new whole meaning of value to context. So the universe is not just materially mechanistic, but sends out guides of integrating novel circumstances optimally into a global account of the cosmos.

Language

When we speak, the creativity, the richness is not in the content of the words themselves. The words in a dictionary do not give any clue to dialogue, poetry or conversation that is born through the words. The dictionary holds a few limp descriptions but they do not give that richness when words are put in time and that play of time allows meaning to come out.

A word is simply a dark shadow on its own, until its use in the context of a text, rounds out its illuminated power in conveying a forceful meaning. But if we did not wrestle with the dark potential of words, we would never be able to construct the path to light of meaning.

What is essential about language is the way, that in speaking, the words are endowed with a potential that equips them to naturally seek their place in alignment with other possibilities, to know themselves in a composite order. We do not think speaking. We endow words with a potential that recognises when their use fulfils the meaning we intend.

Just as with Einstein's astronaut/ living-room-occupant, there is an innate order by which words befit themselves to meaning. However the trick of language is to give to the words the potential of meaning something. The words are weighted in their possibility to come to meaning through a sentence. There is then a lawful ordering that for instance the poet knows, where the miracle of meaning takes place.

Meaning returns to establish the rationale for the behaviours that come together in a whole sense. The world is dark with regard explanation but potent with regard hidden meanings. But the task of individuation to express a personal meaning, is coherent with the universe giving simultaneous order to many such searches in the experience of revelation of significance.

Genetics

For my thesis at Schumacher College in 2006 I looked into a model that explored the configuration of these ways of seeing the world, causality and retro-causality, and asked where do they optimally come together. The model discovered a self-similar fractal power law configuration which identifies this place where ambiguity is optimally integrated into the words without dissipating into mere meaninglessness.

When I finished my thesis I had found out in genetics the expression of RNA was known to obey this power law distribution. For there was a new technique called microarray analysis that measured the intensities of all the genes being expressed. At Bristol University, Charles Hindmarch and David Murphy were working with microarrays, trying to find in the haystack of 15000 gene expressions, which genes were responsible for all the physiological changes that happen through dehydration.

Collaboratively analysing the data, we found we could use the power law to compare data from a dehydrated and normal organism. In comparing two different sets of samples, through all genes expressed in normal and dehydrated states, one could look at the particular slopes of the power law for the two sets of data. What consistently happened was the dehydrated data had a different slope than the control data.

Why did this difference in data show itself? In the dehydrated state the organism shuts down loads of possibilities, it would normally entertain because it is focussing on the job of survival. So because the organism has got to survive it goes to a more fundamental response than a normal state. Before anything happens, before anything particular has been done to respond optimally to this threat of dehydration, there has been some kind of assessment of how it needs to work with its possibilities at an organism level.

The organism is then not just a coherence of actions, waiting to be unravelled by the scientist into an explanation. The organism experiences an incoherent threat that it has to assess to orient its possibilities to make coherent response.

The organism is exploring its possibility space with regard everything that could happen. At this moment of meeting the unforeseen circumstance, in a spirit of play of everything it could do, the organism understands that its optimal strategy is reducing its possibilities and focussing on a more basic response than in its normal behaviour. The organism focuses all its energy on what is going to be beneficial in its response to dehydration. The work has recently been published in the *Brazilian Journal of Biology and Medicine*.

The signs are there, in dark matter and in the rich dialogue of genetic processes that science is facing up to finding place in a meaningful cosmos.

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Nezahualcoyotl, the poet-king of Texcoco (1402-1472)

*I, Nezahualcoyotl, ask this:
Is it true one really lives on the earth?
Not forever on earth, only a little
while here.
Though it be jade it falls apart,
though it be gold it wears away,
Not forever on earth, only a little
while here.*

(Michael D. Coe, *Mexico: From the Olmecs to the Aztecs*, (New York: Thames and Hudson, 2002), fifth edition, p. 223.)



Nezahualcoyotl is best remembered for his poetry, but according to accounts by his descendants and biographers, Fernando de Alva Cortés Ixtlilxochitl and Juan Bautista de Pomar, he had an experience of an "Unknown, Unknowable Lord of Everywhere" to whom he built an entirely empty temple in which no blood sacrifices of any kind were allowed — not even those of animals.

According to the Aztec worldview, the universe consisted of three layers. The middle layer was the earthly one, inhabited by humans. Above that world, the Aztecs imaged thirteen levels or heavens, Omeyocan, the "place of duality," being the uppermost. Below the earthly layer, there were the nine levels of the underworld. The three faces represent the cycle of life.