Seeking Eco Action: the Myth of Data Science and the Art of Resilience

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Abstract

Potentially, representing two different cultures and systems of belief, Data Science and Eco Action may at first seem to be opposing forms of knowledge and practice. However, given the realities of Climate Change and other world crises, we may find that such opposites need to be resolved to address indeterminate futures. Such resolution may give way to emergent forms of knowledge and intrinsic values. But first, we must consider what is 'Data Science' and 'Eco Action'?

Keywords

Resilience, Ecology, Dynamic Quality, Eco Action, Data Science, Indeterminacy, Myth

Introduction

Assuming that they represent, different activities of knowing and doing, how might we resolve the difference between 'Data Science and Eco Action'? How valid is that assumption, and are there any differences to be resolved? The term 'data science' typically denotes interdisciplinary processes and systems to extract knowledge from data. As a form of analysis, it includes statistics, data mining and the development of big data. While the term, 'eco-action', seems more vague and refers to a broad spectrum of initiatives and activities that are intended to benefit the environment and society. They can range from local campaigns for waste management to sustainable commercial and industrial international trading. To open up the comparability between these two terms, and in particular to seek meaning for Eco Action, let us consider a quote from environmental activist, author, and scholar of Buddhism, general systems theory, and deep ecology, Joanna Macy: 'The most radical thing any of us can do at this time is to be fully present to what is happening in the world." [1] Macy's call to active awareness might be predicated on the need for accurate data, but her expression, 'fully present', suggests a nuanced form of knowing beyond quantitative information. Perhaps this is 'Eco Action'?

The myth of Data Science

Meanwhile, there is a myth that data are facts. Even dictionary definitions support this myth: facts that can be analyzed or used in an effort to gain knowledge or make decisions. But the myth extends to the belief that data and facts are the truth, and that data leads to information and information leads to knowledge and knowledge leads to wisdom. Wickipedia tells us that:

> The presentation of the relationships among data, information, knowledge, and sometimes wisdom in a hierarchical arrangement has been part of the language of information science for many years. Although it is uncertain when and by whom those relationships were first presented, the ubiquity of the notion of a hierarchy is embedded in the use of the acronym DIKW as a shorthand representation for the data-to-information-to-knowledge-to-wisdom transformation. [2]

By association, in the 21st Century, data is also defined as information to be used and produced by computers: statistics or other information represented in a form suitable for processing by computer. So, the information that we access from computers is regarded as the truth. How often do we resort to Google, or Wickipedia to gain knowledge of something? But what if the original data is wrong, or the way in which it was generated was faulty? Data, like information and knowledge carry power – both the power that is accessible and the power that is withheld. Indeed, the lack of it can be even more dangerous, as United States Secretary of Defense, Donald Rumsfeld stated on February 12, 2002 in response to a question about the lack of evidence linking the government of Iraq with the supply of weapons of mass destruction to terrorist groups.

> Reports that say that something hasn't happened are always interesting to me, because as we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – the ones we don't know we don't know. And if one looks throughout the history of our country and other free countries, it is the latter category that tend to be the difficult ones. [3]

The data of reality

I now offer you the following text that I received in August 2015 from the London School of Economics:

> The pledges to reduce greenhouse gas emissions that have been made so far by countries ahead of the COP 21 climate change summit are not sufficient to avoid dangerous global warming of more than 2 degrees centigrade, according to an analysis published by the Grantham Research Institute on Climate Change and the Environment,

> and the ESRC Centre for Climate Change Economics and Policy at London School of Economics and Political Science.
>
> A paper describing the analysis concludes that the intended national determined contributions that had been submitted by 20 July 2015 by 46 countries to the secretariat of the United Nations Framework Convention on Climate Change, would lead to annual global emissions in 2030 of 56.9 to 59.1 billion tonnes of carbon dioxide equivalent.
>
> While this total is much less than a 'business as usual' pathway that would mean emissions reach 68 billion tonnes of carbon dioxide equivalent by 2030, it is much higher than the 36 billion tonnes that the United Nations Environment Programme has indicated would be consistent with having a 50 to 66 per cent chance of avoiding a rise in global average temperature of more than 2 degrees centigrade above its pre-industrial level. [4]

Perhaps this data from science is a form of 'Eco Action'?

What if we are not asking the right questions? How will we know? The Data, Information, Knowledge, Wisdom hierarchy becomes more complex when we expand the concept to include symbols or signs signifying stimuli or signals. In themselves these data are of no use, unless applied in a relevant useable form. The essence of Data Science, therefore, resides in its interpretation.

One example of this occurred in 1997 when the author, Haley, was conducting research into the biodiversity of Northern England at the UK Institute for Terrestrial Ecology (now Centre for Ecology and Hydrology). Confusion arose when using the Institute's Countryside Information System (CIS), a database that combined satellite imaging with field studies and remote data gathering equipment. When the figures didn't add up, the Head of the Land Use Section explained that the black shapes on the CIS map were 'Urban' and these were excluded from the 'Countryside' data. Haley asserted that some parts of the City of Manchester had higher biodiversity than rural Yorkshire, and if this data was excluded, it would misrepresent what was actually on the ground. From this exchange 'Urban' was included in the 2000 update of the CIS. Consequently, as one of the defining criteria for this new category was 'Humans', the Institute had to introduce humans as a criterion to define all other landscape categories. And so, humans finally entered the landscape of British ecological research.[5]

Since the advent of Information Technology, of the electronic type, the generation and processing of data has become the driving factor in forming the way society thinks and in the way questions are framed. This shift in perception might be considered as profound as the shift from iconic space to Renaissance perspective, for as the British artist, David Hockney, staes: 'The way we depict space determines what we do with it.' [6] Given the predisposition to express biodiversity and natural phenomena in metric and fiscal terms (i.e. 'Ecosystem Services' and 'Natural Capital'), there does indeed seem to be a cultural shift away from the intrinsic values of 'nature'. Perhaps, this represents a call for Eco Action?

Data becomes chaos

During the 1950s, Edward Lorenz, the father of chaos theory and the butterfly effect became sceptical of the appropriateness of the linear statistical models in meteorology, as most atmospheric phenomena involved in weather forecasting are non-linear. His work on the topic culminated in the publication of his 1963 paper *Deterministic Nonperiodic Flow* in the Journal of Atmospheric Sciences. In that paper, he writes:

> Two states differing by imperceptible amounts may eventually evolve into two considerably different states ... If, then, there is any error whatever in observing the present state — and in any real system such errors seem inevitable — an acceptable prediction of an instantaneous state in the distant future may well be impossible....In view of the inevitable inaccuracy and incompleteness of weather observations, precise very-long-range forecasting would seem to be nonexistent. [7]

In the science of complex systems, a dynamic form of equilibrium is called a Strange Attractor. The difference between an Attractor and a Strange Attractor is that an Attractor represents a state to which a system finally settles, while a Strange Attractor represents some kind of trajectory upon which a system runs from situation to situation without ever settling down. This may, also, be understood as the pattern of evolution in natural and social systems. Perhaps this is 'Eco Action'?

So, despite the assertion of Data, or Information Science that data is the truth, we find that the truth itself is subject to the 'Law of Unpredictable Consequences', or indeterminacy – a paradox, simultaneously representing both remedy and poison, or what French philosopher, Edgar Morin, refers to as 'ecology of action' – every act is subject to its own ecology, and is therefore beyond our control. [8] Perhaps, this is the same as 'Eco Action'?

Values, truths and realities

So, where does this leave Data Science? Let us consider the implications of the myth in our everyday lives. For instance, what sort of data is necessary to know and respond to '*Harmony, spirituality and the balance of all (human and non-human)*? Of course, these concepts are not truths, but realities. They are a few of the many subjective, qualitative, and even experiential realities upon which most human beings base most of their judgments and decisions.

Perhaps, these qualities are related to 'Eco Action?

To deny these intangible values and ethics is to have insufficient, relevant data to develop appropriate policies and strategies for our futures. And yet, as mentioned above, this is precisely the case of the United Nations initiative on Ecosystem Services that has further developed Natural Capital as a means of assessing the viability of natural resources. It is no surprise that economics has the same etymological route as ecology, in the Ancient Greek word, '*oikos*', meaning home, or dwelling. However, to attribute proper worth and value to our environment, of which we are an integral part, it is necessary to develop more nuanced forms of data, data collection and data interpretation based on deeper questions and cognoscente knowledge of complex multiple realities existing simultaneously. Indeed, *oikos* referred to the correct order of family relationships within the home. Perhaps, such complexity is related to 'Eco Action'?

Questions of resilience

Expanding the concept and practice of ecological restoration in the context of Climate Change, we need to consider the potential for resilience as a long-term concept for adaptation, so how is data applied here? From the ecological literature, resilience has been defined in two different ways, each emphasising a different aspect of stability. One reflects efficiency, the other persistence, or the difference between constancy and change, predictability and unpredictability. Efficiency, control, constancy and predictability are core attributes of desires for fail-safe design and optimal performance, and are appropriate for systems where uncertainty is low. However, they can be counterproductive for dynamic, evolving systems where variability and novelty result in high uncertainty. The other definition focuses on persistence, adaptability, variability, and unpredictability – qualities embraced by those with an evolutionary or developmental perspective. The latter attributes are at the heart of designing for sustainability.

The first definition concentrates on stability near an equilibrium steady state, where resistance to disturbance and speed of recovery to equilibrium are used to measure the property. This is termed ***engineering resilience***. Perhaps, this is 'Eco Action'?

The second definition emphasises conditions far from any equilibrium steady state, where instabilities can flip a system into another regime of behaviour, or stability domain. In this case resilience is measured by magnitude of disturbance that can be absorbed before a system changes its structure by changing the variables and processes that control behaviour. This we term ***ecosystem resilience***. Perhaps this is 'Eco Action'?

Despite our compelling myths to the contrary, the world and most things in it are beyond our control, and this includes data and Data Science. We must learn to expect the unexpected, the uncertain, the indeterminate. To do so is to understand the adaptive cycle. And to prepare for such eventualities is to be ecologically resilient.

The adaptive cycle

The model of the adaptive cycle was derived from studying ecosystem dynamics. As a tool for thought, it focuses attention on processes of destruction and reorganization, which are often neglected in favor of growth and conservation. By linking system organization, resilience, and dynamics, we gain a more complete view of these processes. And, as a fundamental unit for understanding complex systems from cells to ecosystems to societies, an adaptive cycle alternates between long periods of aggregation and transformation of resources, and shorter periods that create opportunities for innovation. Adaptive cycles are nested in a hierarchy across time and space. In essence, larger and slower components of the hierarchy provide the memory of the past and of the distant to allow recovery of smaller and faster adaptive cycles.

The editors of '*Panarchy: Understanding Transformations in Human and Natural Systems'*, Gunderson & Holling write:

> That interplay between stabilizing and destabilizing properties is at the heart of present issues of development and the environment – global change, biodiversity loss, ecosystem restoration, and sustainable development.
>
> Exclusive emphasis on … engineering resilience, reinforces the dangerous myth that the variability of natural systems can be effectively controlled, that the consequences are predictable, and that sustained maximum production is an attainable and sustainable goal… The very success of limiting variability of a target leads to the unperceived shrinkage of stability domains. As ecosystem resilience is lost, the system becomes more vulnerable to external shocks that previously could be absorbed. (Holling & Gunderson 2002 P28)
>
> Three priorities shape the pattern of dynamic change in the cycle: ***Potential*** sets limits to what is possible – it determines the number of options for the future. ***Connectedness*** determines the degree to which a system can control its own destiny, as distinct from being caught by the whims of external variability. ***Resilience*** determines how vulnerable a system is to unexpected disturbances and surprises that can exceed or break that control. [9]

While 'engineered resilience' refers to how fast a system returns to equilibrium after a shock or stress, the term 'ecological resilience' is applied to how far a system may be perturbed before it collapses or becomes another state of being. [10] The capacity to withstand disturbance is not just a question of how long the status quo can be maintained, but how we might emerge in a new world.

Of course resilience is both pattern and process. And like ecology and art it is an emergent phenomena. It is not

a purposive, solution-led, problem-based form or object that can be fixed. It's a ***dynamic 'quality'***. Perhaps this is 'Eco Action'?

So, over time, what might be the full economic, social, cultural, and psychological costs of cognitive dissonance, hypocrisy, and mendacity regarding the ontology of 'eco-cide'? Science, governmental policy and legislation offer important strategies based on material rationality, but they have done little to change the status quo of 'the industrial growth society' and its trajectory of destruction and extinction. It's time to change the way we think, towards an eco-culture. Perhaps this is 'Eco Action'?

The art of ecology

Systems theorist, Gregory Bateson referred to ecology as 'the pattern that connects' but we may also consider ecology as a pattern of values. [11]

The beauty of ecology, like resilience, is that it is not an object. It's the relationship between objects or things. It's ***how*** they relate to each other, or dwell together. Bateson talked about the evolution of the human hand, and that most science focuses on the evolutionary development of finger joints, fingernails and the articulation of the thumb. However, the ***ecology*** of the human hand is the space between the digits. This is the context for how and why the hand operates the way it does. [12]

So, this ecology of space takes me to my favorite quote from *Lila: an inquiry into morals* by Robert Pirsig; 'The most moral act of all is the creation of space for life to move onwards'. [13] For the past twenty years or so, this idea has become my personal mantra. And if we then take the meaning of the word 'art' from its etymological Sanskrit origin, '*Rta*', we discover that art is the dynamic process by which the whole cosmos continues to be created, virtuously. [14]

And art is not design. Art is acting and being in harmony with evolution; the right way of doing or brining forth, with excellence (the art of gardening, the art of football, the art of archery, and so on). We may then consider art to be a means for making the right conditions for life to emerge. As Fritjof Capra puts it:

> … emergence'… 'has been recognized as the dynamic origin of development, learning and evolution. In other words, creativity – the generation of new forms is a key property of all living systems. And since emergence is an integral part of the dynamics of open systems, we reach the important conclusion that open systems develop and evolve. Life constantly reaches out into novelty.' [15]

Here, not in an instrumental way, but as an included necessity, the practitioners of creative arts may contribute skills and envisioning capabilities to the processes of transformation. Perhaps this is 'Eco Action'?

But please note the moral imperatives and values both explicit and implicit in the emergence of evolution – the *right way* for things to progress ecologically, with art and science being two aspects of the same thing. And so, we may see our relationship to our environment and our engagement with each other as many diverse realities, each pregnant with a potential future.

Perhaps data is a resource, like a natural resource, and like every resource it has its own particularities? Perhaps, Data Science is the opposite to Eco Action? And perhaps, when the two come together, they form a symbiotic dynamic bond – one providing material of a kind, the other providing energy of a kind. And instead of thinking of these initiatives as being separate or representing conflicting interests, it may be more useful to consider them as dynamic resolution – resolving duality – a process emerging from one state to the next. So, the art of Data Science is not about the myth of truth, recreating past entities, or sustaining the status quo, but making the space for life to move onwards, and to do this, we need to deploy diverse methods of ecological resilience. As we move on from COP21, Paris, December 2015, the question regarding Climate Change is no longer one of sourcing accurate data, but how to process, manage and interpret the data we have already generated; and then act on it. Perhaps, by forming and asking the right questions, Data Science will become Eco Action?

Strange attraction
The remedy and poison
The unknown unknown
✣
Time to move onwards
The most moral act of all
Making space for life
✣
Seeing into the past
Walk back to many futures
Dancing in the now

[16]

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