Editorial (17.4)

The wonderful world of complexity

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The diversity of titles in this issue demonstrates the wide range of issues that the reality of complexity raises. We and our diverse understandings of what is going on, are emergent products and participants in an on-going evolutionary world.

But this recognition of evolution and change doesn't mean that we can just let the world carry on evolving in the hope that things will just get better and better. Once we admit that evolutionary change is a multi-level dialogue between existing stable patterns of organization and destabilizing disturbances to these from above and below. We must then face the idea of permanent redefinitions of our descriptions of 'reality' and of any proposed solutions to problematic questions we perceive within them. Even the underlying elements of our description need constant revision and redefinition, as new ideas, behaviors and technologies emerge, as do the groups and networks of which they are part. We face a Nietzscherian world in which Apollonian visions of beauty and form are disturbed intermittently by Dionysian madness and creativity. The science of complexity is how previously rational and reasonable people try to make sense of things, and thereby attempt to come up with 'fair' suggestions, for the real world of conflict and change. The real world does not necessarily make sense, and is driven by the ambitions, beliefs, fears and even (hopefully) kindnesses of individuals and groups, struggling to work out what they should do, and who to do it to. We must also remember that in the real world the underlying components of a complex system are not necessarily explained by their apparent functionality, since that would assume that there is an overall purpose to the system and that its components have been designed to achieve it. So we are led to a way imagining different possible futures, and trying to steer a way to ones that betray our goals and values less than they might.

Complexity also rules out such simplistic ideas as 'the Market', 'planned economies and social systems' successfully providing optimal benefit for all and managing, magically, to improve the lives of everyone in the chosen, lucky society. Similarly, single word ideas like democracy, communism, socialism or any other 'ism' are in reality all flawed and corrupt to some degree when put into actual practice. Individuals and networks are creative and clever in their links and impacts, and history shows us successions of tyrannical, aristocratic, religious and even democratic political leaders (and their families) exploiting less powerful individuals, and struggling to increase and reinforce their own hold on that system. Of course, revolution eventually tends to occur when the lower orders have nothing to lose.

When we look around the world today at the leaders in place, should we be surprised by the idea that 'conflict theory' does not seem to have been able to reduce conflict very much. This reflects the fact that complex systems, certainly social systems, are made up of interacting elements and networks, each of whom may have their own views of what is desirable, fair or unfair, and each of whom may fail to comprehend (or possibly care about) the overarching, collective outcome of the system. But there is also an upper level of description of the system as a whole and its collective functioning, and how 'good' this is. The point is that there is a feedback between the collective performance and fairness of the system as a whole and that perceived by its constituent individuals and networks. Their behavior may well depend on their perceptions of how the collective system is serving them, and so this could lead either to cooperation and harmony or to sabotage, and ultimately revolution and armed struggle.

I remember reviewing a whole series of studies of 'coastal zones' around Europe, in which the stakeholders had been brought together in order to participate in developing models of their local situation, in which farmers, hotel owners, fishermen, boat owners, restaurants, shops and civic authorities all contributed to building a 'picture' of their system. They provided information about their actions and choices and the idea clearly was that it could improve future planning and administrative decisions thereby favor successful collective outcomes. But knowledge of the possible future dynamic of the local system then becomes available to the participating stakeholders, who might decide to change their actions or desire in the light of this information. Indeed, they may even have a legal duty to do the 'best' for their own shareholders and owners and use information about the future to their own benefit and profits. This is the Principle of Reflexivity which haunts all modelling work, and which can invalidate any model that has been developed on the basis of the previously declared actions of players.

Only if you have a genuine 'community', where people, for the sake of others, are willing to sacrifice some of their own potential gains to increase the collective good, can such modelling really pay off. Otherwise the strong simply use the knowledge gained through the modelling process, to advance their own interests. In some of the zones studied, fortunately, there was a real sense of social solidarity, and so benefits genuinely arose from the exercise. In other places however, the disputes and selfishness that have plagued them for centuries were destined to continue into the future. If you don't have a real community, with social solidarity, then it is not something you can get easily. It requires an historical process, and in fact this may be linked to a realization that in humans 'gossip' (relatively pointless exchanges that create familiarity) may provide the real social glue that creates social solidarity[1] and some collective identity. You probably cannot get social solidarity from pointing out its rational

benefits.

So, because individuals, groups and societies are in evolution, new functions and characteristics appear, with new measures of performance and fairness. Many of these 'perturbations' will not disturb the existing overall regime of things, but some will grow and create new niches in the world, either replacing older ones or finding synergetic alliances with them. So the different levels of description of a system will co-evolve and change both the qualitative performances of the system as a whole, and also the participation and rewards for the qualities of individuals and groups within it.

This all means that complexity science is not about a new, improved mathematical tool to solve the problems we previously failed at. It means that it is about recognizing the limits to our possible knowledge of the future and the difficulty of our exercising, or even having, value judgements about our actions and plans. Complexity and its attendant science is much more profound than that. It represents a major change in our self-belief and our belief in what science can tell us with certainty. We need to adopt a much more experimental approach to our decisions and beliefs, stating our assumptions and the mechanisms we think are involved and then checking whether they seem to be holding or not. In true post-Popperian style we need to realize that we only learn something when it does not fulfil our expectations. But of course we only learn what is not true as opposed to what is, and so the natural process is to proceed with new assumptions, models and experiments. Indeed, Complexity Science tells us that every experiment might be a 'new' situation with some novel aspects present that could change the outcome. So although we have a process for 'learning' we also have to admit that what we think we have learnt might already be out of date as the result of some new changes within the elements, the networks or the structures that are present.

In a way complexity is telling us that we can never know for sure that a new 'case' will behave as expected on the basis of previous examples. If we could, then it would imply that we 'knew' exactly the details of the constituent elements and the mechanisms linking them, in which case it would not be 'complex' but merely 'mechanical'. The truth is that evolutionary systems always have hidden ambiguities inside them, so that novel experiments and experiences are always occurring and testing the stability of the previous regime. But models and understanding in biological or social systems will always be based on elements that are far 'above' the atomic level, hence will have plenty of internal structure below the lowest level used for the model. So all models of ecological, social, cultural or economic (to name but a few) will all be 'complex' in that the lowest level of description (flora, fauna, individuals, groups and economic systems) will all rest upon 'average' descriptions, in terms of types and classes, at the lowest level. Clearly, inside each individual element will be an individuality that hides precise genetic, behavioral and learnt factors, and so these models will be descriptive, and their behavior will be based on calibration by observations. Whatever futures they reveal will therefore be based on the extrapolation of these average individual performances. But this will not anticipate novelty, or individual learning which may lead to important reorganization of the system. Furthermore, it will miss 'cunning' effects of group influences, where young learn from their elders, or where 'shoals and herds' offer collective advantages in spotting predators, or shielding the vulnerable. Obviously, this is even more true in human systems were any functioning society must have both a range of skills necessary for survival, but also the means of their renewal and up-dating. From models based on simple quantitative values like biomass, production or profit it will be impossible to anticipate how the system may develop – particularly qualitatively, when new behaviors, technologies and ideas can radically reorganize things.

Complex systems reflect a (long awaited) humility on the part of science, as it succeeds in showing the limits to science. Looking back, we can see that our false sense of power and success was based on the study of closed or isolated systems, where we really could build a mechanical model of the system under study. But, once we accept that all living systems are open systems, and exchange matter and energy with their surroundings, then we see that this breaks the seeming infallibility of science and its capacity to predict what must happen. We are forced to see that hidden internal details and seemingly irrelevant collective effects can change entirely how a system develops. Above all we see that history, and detail are all important in complex, evolving systems. We can never really say that one system or city is 'like' another since their histories cannot be identical. This means that we cannot build up a set of 'exemplars' of like systems, whose observed behavior can safely and certainly be supposed for the next 'case'. Everything we do or suppose is an experiment. When things work out as expected we are content and reinforce our views. When experience denies our expectations we are (or should be) interested to understand why. What was different? What hadn't we thought of, or noticed, that turned out to matter? What we find then is that the 'scientific method' of observations, hypotheses, observations etc. is correct and is all we have, but can no longer be assumed automatically to give allow us to arrive at definitive conclusions, because the system and the world can evolve and change. The scientific method is fine, but the 'science' it arrives at for biological and human systems is subject to change and revision as evolution continues. There are dark forces at work constantly in complex systems – new behaviors and new states of organization – not necessarily evil of course, but creative and powerful. Our reflections, models and thoughts are now part of the complex universe, as we experiment, explore and establish our new limited understanding of how the world seems to work. We can finally acknowledge the wonderful gift of having a universe in which science could establish definitively that only limited knowledge is possible, and that creativity, irrationality, our own will and values can influence what occurs. Instead of an Orwellian nightmare in which power and control dominate, complexity tells us that the future is not given and many things are possible, including even a wonderful world – at least in places and some of the time!

References

1. Dunbar, R. (2014). Human Evolution: A Pelican Introduction, ISBN 9780141975313.