

the Role of a Guardian". Bruce structures the instrument as a resolution because, after reviewing the advantages and disadvantages of "hard" versus "soft" law that are made earlier in the book, he feels that a resolution, being part of "soft", or unenforceable law, is nevertheless more practically achievable. It is more difficult to garner consent among nations for the rules and treaties of hard law, says Bruce. I would go further by re-emphasising the point that I made earlier: in pluralistic societies, law plays a very large part in establishing norms and values. It is not the linear case that norms always precede laws, which then follow only as a codification of the norms. So-called soft law contributes greatly to this norm-establishing function. We can embrace soft law documents as the vehicles of establishing the normative notion of a guardian. We need not think of them as a regrettable second position only.

Making choices for future generations can be like ordering food for restaurant guests who have not yet arrived and whom one does not know, while sitting in a restaurant which will change menus and staff by the time the guests arrive. And yet it is necessary if they are to eat. Consequently, what we do today regarding future generations may indeed say more about us than about what will happen in the future. In this realisation lies both the possibility of simply practising a Whig futurism, and of coming up with new legal tools, perhaps other than rights, for addressing sustainable development in a world of others. So what do we want to say about us?

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***Emergence* John H. Holland. Addison-Wesley, Reading, Mass, 1998, xiii + 258 pages, \$25.00**

***The Evolutionary Outrider* David Loye (Ed.). Adamantine Press, Twickenham, 1998, xv + 281 pages, hardbound, £32.50, paperback, £14.50**

***Evolution, Order and Complexity* Elias Khalil and Kenneth Boulding (Eds.). Routledge, London, 1996, xvii + 276 pages, £35.00**

These books are about, to use a phrase formed by cutting and pasting from their respective titles, the emergence of complex order. They are also in somewhat different ways concerned with evolutionary process, with contingent development through history, but the account of evolution presented in them is the absolute opposite of the reductionist neo-Darwinian synthesis best known through Dawkin's *The Selfish*

Gene (1976) and extended into the social world by Ridley in *The Origins of Virtue* (1997) (although Ridley does often stray into emergence in the latter text). The best way to explain their content is to begin with a careful consideration of the words ‘emergence’, ‘complex’ and ‘order’. Holland, as might be expected, defines ‘emergence’ for us:

Emergence is above all a product of coupled, context dependent interactions. Technically these interactions, and the resulting system, are *nonlinear*. The behavior of the overall system *cannot* be obtained by *summing* the behaviors of its constituent parts (pp. 121–2, original emphases).

In other words, the Newtonian/Cartesian programme of reductionist analysis which has been the primary form of scientific reasoning since the seventeenth century, will not work for systems in which there are emergent properties. It is important to note that Holland’s emphasis on interactions indicates that we are not dealing here with a simple turn to holism instead of reduction. This is not a turn to explanation based on the unanalysed whole rather than the analysed discrete parts. What matters is the existence of interactions among the parts, the failure in mathematical terms of superposition. This is extremely important because for those systems with emergent properties we cannot generate universal laws. All solutions must be local and contingent. Holland in this book is actually primarily concerned with abstracted systems in games and computer simulation, with “systems where we have useful descriptions in terms of rules or laws”, although he does discuss neural nets which do not fit easily into a law described category. In reality, as opposed to abstraction, the search for formal dynamics to describe the evolution of non-linear systems is probably pretty pointless because tiny changes in parameter values will produce radically different outcomes so the establishment of a non-linear dynamic does not give us the basis for prediction which we get from the establishment of a linear dynamic as a linear equation.

‘Complexity’ is the term which we must use to describe the character of systems which are the product of emergent evolution. Pribram in the Khalil and Boulding collection quotes from Lévi-Strauss: “when we are confronted with phenomena too complex to be reduced to phenomena of a lower order, then we can only approach them by looking at their relationships, that is by trying to understand what kind of original system they make up”. He develops this idea thus:

Complexity (encompasses) two levels or scales—a multi-form interior or micro-level and a macro-level whole. Complexity is a cross-scale, cross-level concept, and it must be measured accordingly. The paradox: an intricate diverse micro-level embraced within a simpler macro-level entity—unity in diversity (p. 41).

Here we can see the importance of the emergence of order. The ordered character of the whole is the product of the complex interactions among the elements which make up the system. Khalil develops this idea in his interesting discussion of ‘structure order’, order which is the product of spontaneous process in which order seems

to emerge from chaos. He distinguishes such spontaneous order from ‘organization’ order which is the product of conscious, self-referential organizational principles or goals. In other words organization order is the product of agency. As Khalil recognizes in the real world these two domains intersect. Indeed, in my own work, I have examined one of the examples Khalil gives of structure order, urban social polarization, as precisely the product of agency in urban development, although not necessarily the intended product. Planning regimes directed towards equality can create egalitarian cities.

The implications of this sort of approach are spelled out in essentially similar terms by the editors of the two collections. Khalil’s is the more restrained in that he confines his propositions to the nature of the scientific project, noting that the essays in his collection “...challenge one of the most trenchant assumptions in modern social and economic theories: the natural/social dichotomy” and goes on to argue that “The complexity perspective may elucidate the unity of social and biological phenomena without resorting to reductionist and mechanical accounts.” Essentially this is an argument for the reunification of the scientific programme with that programme’s future being understood as founded on a development of the understanding of complexity rather than simplicity. Loye’s approach is both rather more simplistic, in that unlike Khalil who absolutely challenges the notion of a hierarchy of explanation in which the ‘natural’ sciences somehow precede the social, he sees natural science as the foundation and social science as the superstructure, and more assertive in that he proposes human agency as the potential active constitutive principle in social evolution. Indeed, in a way which is rather characteristic of those with a strong scientific fix on complexity, Loye indulges in apocalyptic prognoses and, following Lazlo, issues a call to all scientists to act before it is too late. I am not entirely unsympathetic to this, but it is a bit simply put for a book founded around the complexity programme. Let me turn to an account of the content of each of these texts.

Holland leads the reader by the hand through a series of arguments and illustrations based on the way in which apparently simple rules can generate very complex systems. This is a very clear and persuasive book, but it is rather limited as a general treatment of complexity. Essentially it is written for those who do think about the world through the use of relatively formal models which are inherently linear. That category in principle ought to, but almost certainly doesn’t, include everyone who has had at least a decent secondary education in science. However, those who have gone through a scientific education at whatever level have not always been taught, and if taught do not always retain, a clear and coherent grasp of ‘scientific method’, although it must be admitted that a kind of semi-conscious grasp of some of the essentials is to be found among most of us. What Holland is trying to do, and in this limited but very important objective he succeeds, is to persuade people with this cultural conception of science that there is another way of looking at things. He does so through a careful development of logical account and only starts to get to grips with real examples at the very end of his argument. I can appreciate why he confines his discussion to ‘rule based’ complex systems, but this does mean that the book is

an argument in logic rather than any sort of demonstration of the nature of the world and of the potential for human action in relation to it.

Loye's collection is quite the opposite. It is founded around Lazlo's conception of the role of human agency as an active force in evolutionary process. This is not really an original notion. Teilhard de Chardin, cited in one of the contributions to the collection, developed pretty much the same sort of idea in a sophisticated and important attempt to reconcile the historically convincing accounts offered by Darwinian theory (*not* the neo-Darwinian synthesis) and the doctrine of free will which is central to all three of the Abrahamic world religions. For Loye there is an ontological break between the prehuman and the human, although at least by implication the reflexive potential for human action in relation to the natural world is allowed for. The objectives of the collection are founded around a need to unify science in order to confront the complex social and ecological problems facing us at the onset of a new millennium. Loye and Lazlo both challenge the disciplinary fragmentation of contemporary science, a constant theme in discussions of complexity in science and one with considerable force. However, I found this collection rather weak. There are interesting ideas but the credence given to Lazlo's notion of quantum vacuum interaction in many of the contributions indicates the general character of the book. Capra is in it as well with his own quantum account. Frankly I find this turn to the quantum level wholly unconvincing. It is an effort at achieving respectability for considerations of domains in which linear prediction collapses by going down even further than the mechanical universe of Newton. This is, I think, oddly enough, a search for respectability. The thinking runs somewhat on these lines: Quantum theory is well established. Uncertainty is central to it. If we can link the biological and the social to the quantum level then we are real scientists. The most informative chapter in the collection is Lazlo's own which gives an account of the development of his ideas on systems theory. There are lots of interesting titbits and throw away thoughts in this book but it is really something of a mess taken as a whole.

The Khalil and Boulding collection is a much more serious enterprise. Boulding played an important part in the initiation of the project which it documents but died during the preparation of the book and in part it serves as a tribute to him. It is indeed a worthy tribute to a considerable thinker. Again, the contributions are uneven but those by Khalil himself, Pribram (who has a less coherent chapter in the Loye collection), Dupuy, Eldredge and Ulanowicz are all interesting and informative. I have to confess that I have read this book twice, first on original publication and second for this review. On first reading I was less impressed with it as a whole, although even then I got a lot from Khalil's own chapter. Rereading it about eighteen months later I made better connections between the style of the arguments and my own interests and concerns. The common core of the arguments presented lies in the rejection of the social/natural dichotomy. The implications of this are perhaps best developed by Khalil in his arguments for naturalism and against crude naturalism, which might with some brutality be identified as arguments for complexity and against reductionism. Khalil's "...exploration of the contested terrain which separates science from philosophy" is extremely impressive. I found his discussion of metaphor

and analogy to be both exciting and profoundly useful. This is a very important chapter indeed.

My response to Pribram's chapter titled 'Interfacing complexity at the boundary between the natural and the social sciences' was somewhat mixed. I found the ontological discussion in this piece fascinating and the account given of the multi-level character of complex systems wholly persuasive. I was less taken with the exemplary material which was drawn from Pribram's own field of neuro-science. The discussion is interesting but I think I am personally too much of a social scientist here. I can see that the complexity approach is going to generate a link between biology and psychology which is going to mean a lot, but it hasn't yet succeeded in overcoming my distaste for the reductionist programme which has previously dominated the research agenda in this crucial area.

In contrast I was excited on second reading by Dupuy's examination of the contribution of systems theory to the theory of society. There are lots of interesting ideas in this chapter, although the discussion of Freud's theory of the crowd lost me. In contrast the discussion of Hayek was absolutely fascinating. The contrast between the responses to these two illustrative examples is not really any kind of comment on their respective quality. Rather, it is an excellent example of the extent to which arguments about complexity appeal best when they are presented through examples which are part of the 'problem field' of those reading them. I have just completed a book on 'social exclusion' which necessarily required me to think about Hayek's arguments about freedom and the limitations of the competence of governance. Dupuy's discussion of these issues in terms of the relationship between structure and agency in the social world and the way in which this crucial dichotomy can be understood by using the idea of emergence is entirely convincing.

There is a lot of good stuff in most of the chapters in the Khalil and Boulding collection but the other two which I found particularly interesting were Eldredge's attack on the 'ultra-Darwinians', his term for the extreme exponents of the neo-Darwinian synthesis in biology, and Ulanowicz's exegesis of Popper's ideas in the latter's proposition of a 'world of propensities'. Eldredge is just the person to call into play when next you are confronted by some half informed individual spouting Dawkins as holy writ, and this happens rather a lot these days. Ulanowicz introduced me to Popper's ideas about the nature of probability and the relationship between this and information theory. I am still thinking about this but I have thought enough to be convinced that this has enormous significance both for inductive reasoning in general and for consideration of risk in particular.

There has been an explosion in the publication of books and articles informed by the complexity perspective. I have contributed to it myself. I do think there is a good deal more to this than mere fashion. The central ontological argument of the complexity position is correct. Much of the world consists of complex systems, ordered not so much hierarchically as in a nested fashion with interaction among all the levels and among the components of the discrete levels. Lots of implications flow from this. Perhaps one of the most important is that there is likely to be a fairly rapid change in the organization of formal scientific activity. There have been profound institutional pressures which have led to the fragmentation of the scientific project

over the last hundred years. Not only has there been a radical cleavage between the physical and biological sciences on the one hand and the social sciences on the other, with psychology uneasily bridging the divide; there has also been a massive fragmentation of scientific activity into a range of discrete disciplines. It is certainly true that the years since World War II have seen a considerable development of area and field studies which are inherently multi-disciplinary and often inter-disciplinary. Business, Social Policy, Urban Studies, East Asian Studies: the list could be much expanded. The recent Gulbenkian Commission which called for the opening of the social sciences (1996) was stimulated in no small part by the significance of this inter-disciplinarity. That commission, of which Prigogine was a member, also recognized the significance of the ontological foundations of chaos/complexity for the general character of scientific practice. These books go somewhat further. In the Khalil and Boulding collection where the project is most clearly expressed we can see an argument, to my mind a convincing argument, not only for the collapse of disciplinary boundaries but for a reunification of the social and natural sciences on terms which will recast the nature of science as a whole.

I very much like the general usage of the word *Nauk* in the slav languages. It is often translated as science but is generally employed as a term for all organized knowledge and for the process of obtaining that knowledge through any kind of systematic investigation. Part of my job is to deliver research training to social science postgraduates. Frankly, I am convinced that the social science of the 21st century will have something like Khalil's sophisticated naturalism at its heart. Moreover, I would argue now that we need to recast our whole understanding and presentation of the scientific method in general. If it were up to me I would teach the general principles of complex causation to sixteen year olds, but that may be a while coming. I certainly see the organization of postgraduate generic training, and here generic would include all biological and biomedical as well as social science training and is very likely to include all computer science training as well, as founded around this sort of material.

It would be unfair to conclude this review without returning to the urgency of the demands posed in the Loye collection about the need for complex science as the basis for an informed practice directed at resolving fundamental problems both of the social world and of the interface between the social and natural worlds. Sure, the actual formation of these demands is naive and there is a kind of unquestioning belief in the potential of rationality which seems strangely at odds with the very ontological premises of complexity itself. Nonetheless the identification of issues is correct. The most crucial implication of the complexity position is that human agency has creative potential—that it is not a matter of what will happen but what can be made to happen. That is an interesting thought!

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