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## **Advancing and Defeating the PEGS Agenda**

### **Socio-Cybernetics and Murray Bookchin**

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#### *Introduction and Overview*

In the third paragraph of its mission statement<sup>1</sup> PEG's founders note that, while "institutional analysis and reform" is crucial to tackling the problems of modern society, such matters "currently receive little attention, and existing political and economic theories offer insufficient guidance ...". The point is dramatised in the film *Lions for Lambs* – thus suggesting that many people are aware of the problem. The authors go on to say that they hope that PEGS, via *The Good Society* in particular, will help to promote new thinking. It would appear that, by "new" they really do mean *new* since they go on to say that the "great traditions of good society thinking – modern liberalism, socialism libertarianism, and conservatism – have been unable to adapt". My own impression is that, over the 15 (?) years of its existence most of the articles published in *The Good Society* have offered contributions *within* these domains rather than broken out of the mould. In this brief article, I will attempt to go further.

I will suggest that the intractable nature of the problems that confront us stem from the fact that they are fundamentally interconnected as part of a single system. As such, they cannot be tackled one at a time: any attempt to do so will be negated by the reactions of the rest of the system. Moving forward depends on finding ways of conceptualising, mapping, measuring and harnessing the currently invisible socio-cybernetic<sup>2</sup> forces which control our destiny. This task is equivalent to the Newtonian elucidation of the concept of physical force<sup>3</sup> and demonstration that its components could be mapped, measured, and harnessed. A second crucial development, in part dependent on the first, involves devising *new* socio-cybernetic – viz feedback and guidance systems – for managing society in the long-term public interest instead of the short term interest of dominators.

Unfortunately, faith that it might be possible to do these things within the time apparently available (see below) is seriously called into question by the (re)publication of Bookchin's *Ecology of Freedom: The Emergence and Dissolution of Hierarchy*<sup>4</sup>. Bookchin appears to have demonstrated: (a) that the societal management arrangements we need are precisely those that we have been evolving *away* from over tens of thousands of years; (b) that this

process has continued inexorably despite the protests of endless thoughtful people and practical demonstrations of the viability of alternatives; (c) that crucial to the maintenance of the socio-cybernetic network that is driving us toward our own extinction lie some of our most cherished beliefs and activities. These include (i) the myth that the kind of work that is most characteristic of our society represents a necessary and desirable contribution to well-being and (ii) the myth that hierarchical organisation is both characteristic of nature and efficient. Bookchin argues that, on the contrary, hierarchy itself lies at the heart of many of the problems we face and that its main function is to compel everyone to engage in the destructive activities that not only constitute the economy of hierarchical society but also legitimise, indeed *constitute*, hierarchy itself; and (d) that it is precisely this mountain of senseless work that is consuming the resources of the planet and destroying its soils, seas and atmosphere – in essence destroying our habitat – thereby heading us toward extinction as a species carrying the planet as we know it with us.

If he is right, developing an understanding of the network of socio-cybernetic processes that has been driving this evolutionary trend is crucial to finding a way forward.

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### *Conceptual Clarifications*

I must begin by clarifying the way the terms “systems thinking”, “systems”, and “socio-cybernetics” are to be used here<sup>5</sup>.

It is easiest to do so by summarising the results of half a century’s research into the so-called educational system<sup>6</sup>. We began with a series of studies of what pupils, parents, ex-pupils, and employers wanted from it. It emerged that their top priorities were that the system should, on the one hand, nurture a wide range of different talents in different pupils (i.e. both cater for and nurture diversity) and, on the other, nurture generic, high-level, transferable, competencies like initiative, the ability to work with others, problem-solving ability, and the ability to understand and influence the workings of organisations and society. We then demonstrated that these opinions were essentially correct by studying their differential implications for individuals, workplaces and society<sup>7</sup>. We also showed that most schools do little to either promote or cater for diversity or to nurture high-level competencies.

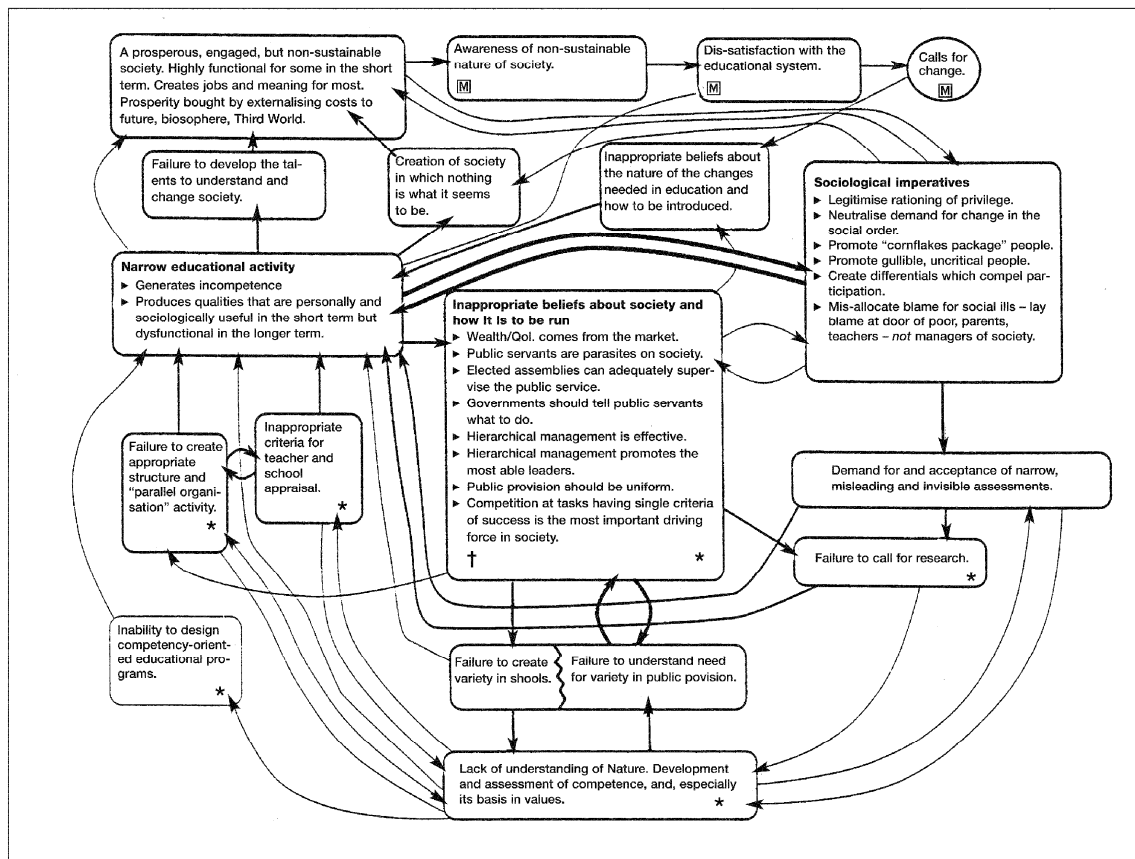
There are many reasons why schools tend to neglect these goals<sup>8</sup>. They include the absence of a shared, formal, understanding of how to nurture the desired qualities or how to find out whether one has done so, and, especially, how to nurture and recognise multiple and alternative talents in a single classroom. They include an inability to handle the value conflicts which surface as soon as one tries to introduce educational programmes which actually set out to reach these goals. They include an inability to initiate a network of experiments aimed at different aspects of “the problem” and make appropriate arrangements to learn from those experiments.

But the *most* important lesson we learned from this work was that these contributors to systems failure *do not operate independently* but form a network or system (using the word in another sense) of social forces the effect of which is that it is more or less impossible to change any one part without changing others (otherwise those changes are either negated by the reactions of the rest of the system<sup>9</sup> or produce entirely unanticipated changes elsewhere)

and which, taken as a whole, perpetuates, even leads to the progressive elaboration of, the system itself.

This network of feedback loops is sketched in Figure 1<sup>10</sup>.

Figure 1  
Feedback Loops Driving Down Quality of Education



\*Intervention in these cells would help change the nature of the qualities nurtured and rewarded in the system. Motives which could be harnessed to do this are marked M.

†These need to be replaced by acceptance of the need to make managed economies work – to find way of giving effect to information concerning the public long-term interest, the need to explicitly create variety and information on the personal and social consequences of the options, and to find ways of holding public servants accountable for, and getting them to at in, the long-term public interest. This means systematic, broadly based, evaluation and participative democracy.

Although many of these feedback loops merit discussion, two may be highlighted:

1. The loop which points to the conclusion that what happens in the “educational” system is not mainly determined by the *educational* aspirations of parents, teachers, pupils, employers, ministers of education or anyone else but by the *sociological* functions which the system performs for society – and especially by its role in contributing to, legitimising, and perpetuating a hierarchical social structure.
2. The network associated with widely held beliefs about the processes and procedures – the forms of democracy and bureaucracy – the nature of the *governance* process – the socio-cybernetic system – that it is appropriate to adopt when seeking to manage public provision.

Note the word “Socio-cybernetic” in the last sentence. Cybernetics is the study of the guidance and control systems of animals and machines. One has to mention animals,

otherwise people think cybernetics is concerned solely with the design of man-made systems. So *socio-cybernetics* becomes the study of the (largely invisible, and certainly rarely discussed) guidance and feedback processes which control the operation of society – and the design of better ones.

Having sketched at least some of the feedback loops that seemed relevant to understanding the workings of the educational system, we spent five years trying to work out how one might harness those forces<sup>11</sup> to create an alternative system that would deliver the desired benefits.

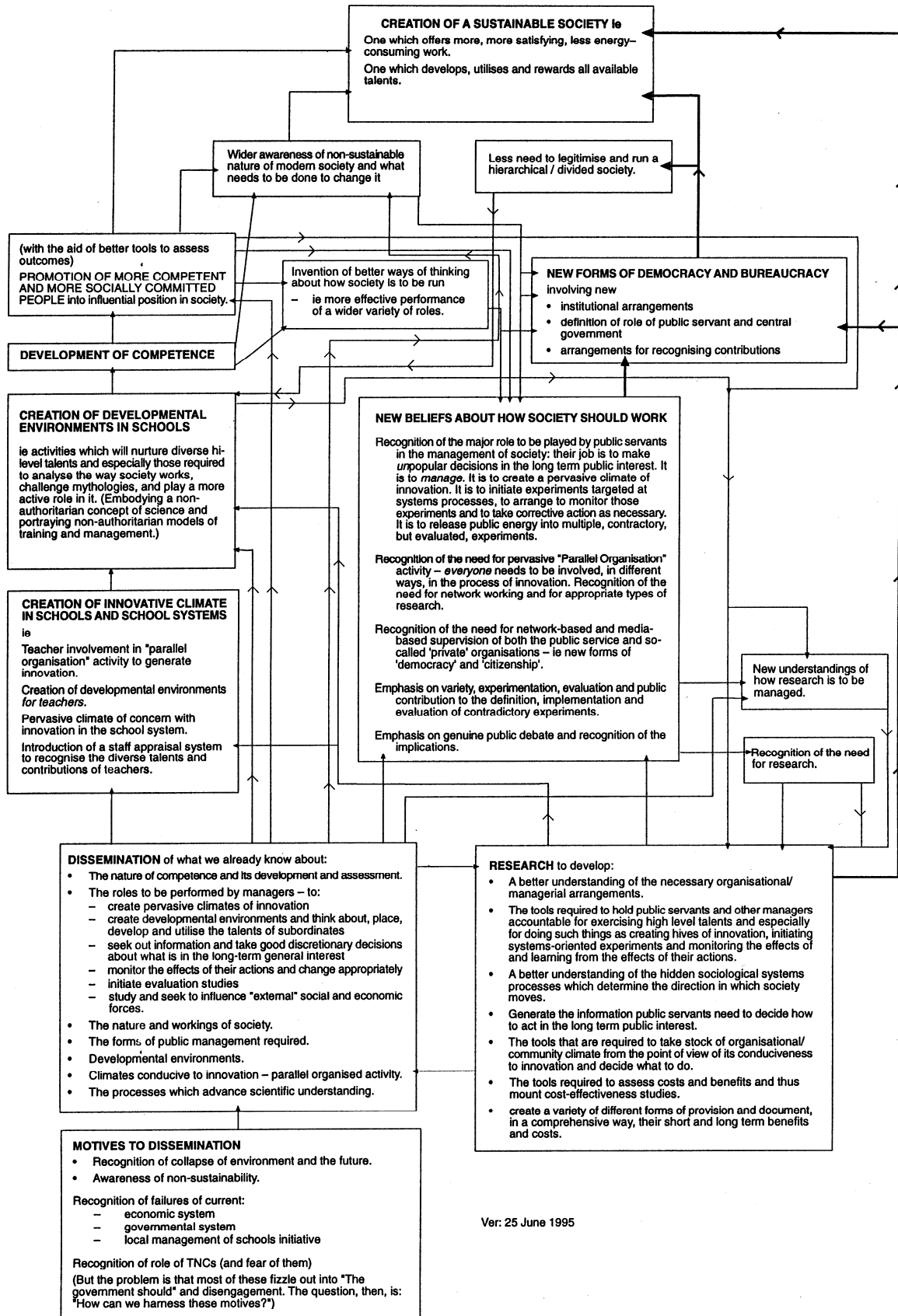
We failed, and published *Managing Education for Effective Schooling*<sup>12</sup> without it.

But, as a result of an argument that developed at a subsequent conference, we had the bright idea of changing the contents of the boxes in our map. The result is shown in Figure 2<sup>13</sup>.

Figure 2  
*New Societal Management Arrangements*

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**DIAGRAM 20.5 NEW SOCIETAL MANAGEMENT ARRANGEMENTS**



Ver: 25 June 1995

Although this does, indeed, yield useful insights, we, 15 years later, realised that it does *not* do what we set out to do.

In effect, the task we had embarked on was to map the network of forces determining what happens in the educational system in a manner analogous to the way in which a physicist would map the forces acting on a sailing boat – and thereafter use that map to work out how to harness those forces to push the boat where its captain wanted to get to (most notably upwind) instead of allowing them to crash it against the rocks.

It is now apparent that we did not do that. In effect, what we actually did was suggest that a marine engine be substituted for the sails.

With this insight behind us we may again return to Figure 1 and see what it has to tell us about the design of an a more appropriate governance system for society.

Among other things, it shows that so many things need to be done that no one person, or group of persons, could generate a blueprint for what needed to be done. It follows that a key development would be design a system which will promote a ferment of experiment, comprehensive, systemic, evaluation, and learning.

Now, doesn't that just ring a bell? Were not Adam Smith and Fred Hayek concerned to create – design – a societal management system – a socio-cybernetic system – that would innovate and learn without central direction? A system which would take account of the inter-related and mutually influencing components of the system? Is there something wrong with their answer? If so, can one suggest alternatives? We will return to these questions.

### *Contextualising the Discussion*

But, before doing so, we should return to PEG's mission statement. This mentions the need to develop governance arrangements which will address the problems arising from "increasing disparities in economic and political power and environmental damage". True, but perhaps insufficiently compelling or comprehensive as an starting point.

In reality, our way of life, our species, and our planet face at least the following imminent disasters:

- **The collapse of the financial system** due to usurious money lending (especially to the third world) and the degradation of the nature of money<sup>14</sup>.
- **The collapse of the biosphere** – the destruction of the soils, the seas, and the atmosphere – due to such things as chemical and energy intensive agriculture, the consumption of fossil fuels and irreplaceable minerals, and our inability to dispose effectively of the products and by-products of industrialised production<sup>15</sup>.
- **The collapse of our food base** due such things as the destruction of the fertility of the soils and seas on the one hand and the population explosion on the other.
- **The collapse of the world order** arising from the increasing international differentials exacerbated in part by such things as the policies of the IMF and the WTO<sup>16</sup>.
- **The danger of a nuclear winter** stemming from the conflicts that are likely to arise as nations fight over diminishing resources.

Many people know we face these problems<sup>17</sup>. And they are also vaguely aware of something else. This is that the problems are interlinked and form a *system* in the sense in which we have been using the term here. It is not possible to address any one of these sets of problems – let alone any of their components – on its own because any attempt to do so would, just as a non-systems oriented attempt to fix one component of the dysfunctional network of processes undermining education on its own, be negated by the reactions of the rest of the system. (One cannot, for example, fix the oil dependency problem without destroying our food base and our trade and commerce – and thus the economic system as we know it.)

Perhaps even more importantly, although many of these problems are typically presented as technical – as biological, physical, meteorological etc. – they are all, in reality, *symptoms of dysfunctional social organisation* and, as such, cannot be fixed on any long-term basis without changing those arrangements. Although social arrangements are often changed on the basis of opinion, especially ideology, the results are typically very different from those anticipated. If we are to do better, it will be necessary to develop a more complete understanding of the forces at work.

One thing will by now be clear. While PEGs is clearly right that new institutional arrangements are required, it is not at all clear that they realise just how radically different those arrangements will have to be from anything we are used to. As Bookchin<sup>18</sup> put it in this very journal, the requisite arrangements will not even be recognisable *as* a political economy.

Put another way, to be sustainable, the way we live will have to differ as much from the way we live now as life in an agricultural society differed from that in a hunter-gatherer society ... and just as no one in a hunter-gatherer society could envisage what an agricultural society would look like, so no one in our society can envisage what a sustainable society will look like. There can be no blueprint.

So, if we cannot specify the institutional arrangements that are required to run our society in a sustainable way, what are we to do? The answer is that we need to take a step back and think about the arrangements that are required to “learn our way out” of our current situation without central direction and without any clear idea of where we are going. We have noted that this was the question Smith and Hayek sought to answer. What is wrong with their answer?

Unfortunately, although their answer – characterised as “the market” – is not widely understood ... indeed is widely *misunderstood* ... I do not have space to summarise it here<sup>19</sup>. Suffice it to say that what they offered was a design for an organic societal management system which would, because it had many, non-hierarchical, feedback loops, experiment, innovate, and learn without central direction. It was, above all, a design for an *information management* system. Currency units were merely something like electrical pulses in the circuitry of a computer. Money was not important in itself. The system did not eulogise money let alone riches ... still less a divided society designed to coerce labour into activities designed to enhance the wealth of a mercantile or capitalist class.

The problems with this solution are too many to list here<sup>20</sup>. Here are a few of them:

1. Despite widespread rhetoric, *the society in which we currently live in no way approximates a “market economy”*. We live in a *managed* economy. To illustrate: In all countries of the European Union, some 45% of GNP is spent directly by central

governments. This does not include local government expenditure or the nationalised industries (remember the banks!). Adding these in brings the total to some 65%. And this still does not include the effect of endless regulations designed to get corporations and individuals to spend their money in ways in which the government has decreed – on pensions, insurance, safety equipment, etc. etc. In the end, it emerges that the expenditure of some 75% of GNP is in some sense under government control or, at least, the control of those who stand behind them<sup>21</sup>.

Figure 3 also illustrates the point.

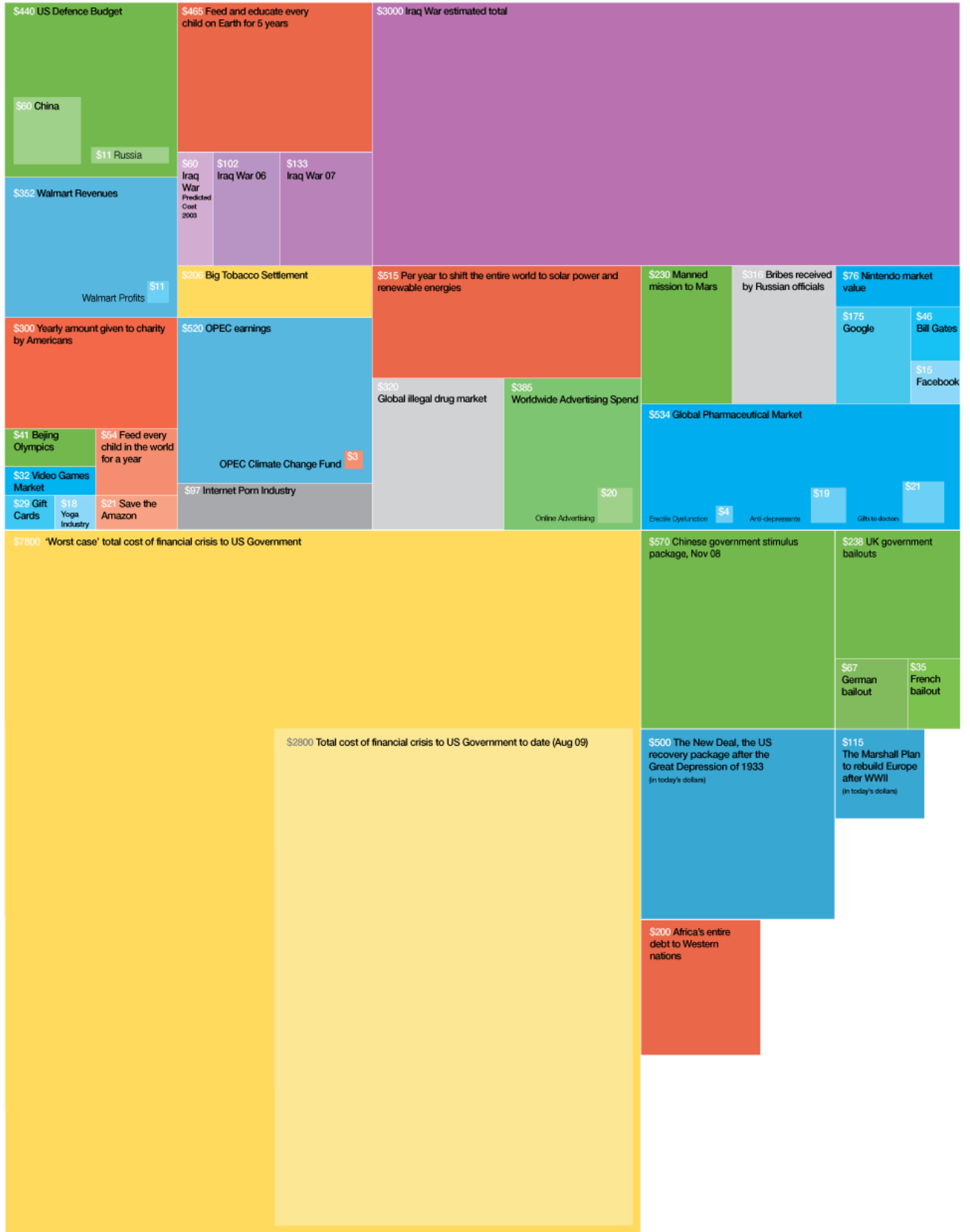
Figure 3



# The Billion Dollar Gram

Billions spent on this. Billions spent on that. It's all relative right?

■ spending ■ earning ■ giving ■ fighting ■ losing ■ illin'



This – viz. the overwhelming role of government – has major implications. For example:

(i) the “customers” in the market are not individuals purchasing with their dollars or euros but corporate customers spending someone else’s money on behalf of defence alliances, educational and hospital systems, etc. This almost completely undermines the role of one of the most fundamental feedback loops in market management.

(ii) the “costs” and “prices” on which a society managed by “the market” would depend end up being almost entirely nebulous. It emerges that they are mainly determined by an accretion of expedient decisions taken by public servants. One effect of this is that even such things as the credo that centralised production is more efficient than decentralised production are without substantive foundation. This apparent reality is entirely dependent on man-made decisions about such things as which costs are to be counted directly into the “costs” of production and which are to be spread over the whole community<sup>22</sup>.

2. *Major costs are typically ignored in market calculations* of costs. In the jargon, they are “externalised” and paid by someone else. Such costs include many incurred in the “third world” or left to be paid by future generations. These include most of the costs of clearing up pollution and environmental, even human, destruction.

3) *The most important components of quality of life* and future productivity – i.e. of wealth in any meaningful sense of the term – *lie in the public domain and cannot be commoditised and bought and sold*. These include the social networks that are so important to health and well being, security for the future, clean air and water, and absence of plague and famine<sup>23</sup>.

It follows from these observations that management via the “market mechanism” offers no solution to our problem.

So what alternatives are there?

Let us return to the educational system for some insights. And let us focus for the time being on the objective of nurturing and catering for a wide variety of different talents. And let us skip over the problems involved in developing a conceptual framework for thinking about diversity in the context of the insistent demand that the system provide a single and unarguable criterion of merit to implement and legitimise both hierarchy and a divided society that compels all, despite their better judgment, to participate in the destructive activities of which modern society is so largely composed<sup>24</sup>. And let us skip over the task of clarifying the curriculum processes that are to be used to nurture diversity<sup>25</sup>.

Let us focus on the nature of, and how to create, the climate of innovation, experiment and learning that is required to tackle the endless problems involved in releasing, recognising, nurturing, and catering for diversity: That, after all, is the question Adam Smith sought to answer. Given that we have to start from where we are now – i.e. with our extensive bureaucracy, we may ask “Whose job is it to release multiple experiments explicitly trying to

nurture different types of talent? Whose job is it to arrange for *comprehensive* evaluation of each of these options? (Note that comprehensive evaluation implies assessment of *all* the desired and undesired, short and long-term, personal and social consequences of each of the alternatives.) And whose job is it to arrange for a variety of options (and information on the differential consequences of each) to be available within and between schools in every community, and to feed the relevant information outward to the public so that they can make informed choices between them (instead of feeding it upward in a bureaucratic hierarchy to “committees of ignoramuses” to make decisions binding on all)?”

Well, yes, it is clearly a job for everyone in a community and perhaps especially for those who have found their way into niches from which they have time to engage in relevant activities. But are not our public servants currently charged with the task of managing sectors of society in the long term public interest? Is there scope to generate new job descriptions for them and new staff-appraisal arrangements to hold them accountable for such things as creating a ferment of innovation and evaluation, sifting information for good ideas, and acting on information in an innovative way in the long-term public interest? Clearly, under such circumstances, we cannot hold them accountable for the accuracy or otherwise of their decisions ... for many of them are going to turn out to have been wrong. We can only hold them accountable for following *procedures* that are *likely* to lead to social innovation and learning. So, to get the new thinking that is required to generate these arrangements, it seems that we have to press for institutional arrangements that promote innovation and research that is problem-driven and adventurous rather than literature driven. Perhaps surprisingly, then, one of our immediate priorities has to be to influence the criteria and arrangements for funding, conducting, and publishing research and, most importantly, to shift toward arrangements in which research is embedded in what Kanter calls “parallel organisation activity”<sup>26</sup> within the educational system itself. (See the bottom right hand box in Figure 2.)

How are we to give teeth to information emerging from new staff and organisational appraisal exercises? (We all know of endless reports that simply gather dust.)

At the heart of the answer to this question lies John Stuart Mill’s observation that the way to get people to act in the long-term public interest instead of their own short term interest is to expose their behaviour to the public gaze: “*Instead of the function of governing, for which it is radically unfit, the proper office of a representative assembly is to ... compel a full exposition and justification of all (acts) ... It should be apparent to all the world who did everything, and through whose default anything was left undone*”<sup>27</sup>. In the current context this points to a need for networks of open and overlapping supervisory groups, not a hierarchical structure.

In short, the answer to the question of how to move forward turns on evolving new forms of bureaucracy and democracy.

### *Understanding the Historical Barrier*

But now we are left with the even more fundamental task – which was to have been the main theme of this article – of understanding the socio-cybernetic forces which have precluded and undermined virtually all attempts to develop such arrangements in the past<sup>28</sup>.

It has long been obvious to very many people that hierarchical organisation is deeply dysfunctional: destructive of both the social fabric and the wider environment. Yet, in the recently republished book mentioned in the introduction, Bookchin<sup>29</sup> shows that the trend toward hierarchy has continued inexorably across tens of millennia despite the protests of endless thoughtful people and demonstrations of the viability of alternatives.

In order to identify the core of this trend, Bookchin first argues that the social organisation of so-called “primitive” societies is best characterised as “organic”. In saying this he means to draw attention to the fact that these societies function in a manner analogous to the way in which animal bodies operate.

The cells of an organism are differentiated. But that differentiation can also, to a remarkable degree, be reversed if the body as a whole requires it. Coordination between the cells is not brought about through a hierarchical structure but through a network of interacting feedback processes. The behaviour of the cells is not mainly determined by their chromosomes but by all sorts of inter-related, local and distal, internal and external processes and the role they (the cells) play in the (developing) organism.

However, it would appear that, at every stage in societal “development” from time immemorial (and not just over recent millennia), this organic, network-based, structure has been replaced by increasingly hierarchical structures. The legitimisation and maintenance of these hierarchical structures is dependent on the continuous creation of more and more work which, despite a mysterious growth of a mythology which asserts the contrary, contributes little to quality of life whilst wreaking endless destruction on our habitat. It is this destruction of habitat that is now subjecting us to the threat of extinction as a species carrying the planet as we know it with us<sup>30</sup>.

This senseless work has not merely been created to occupy the idle hands that might otherwise do the devil’s work or a means whereby elites can exert control over the masses. It, like the so-called educational system, has seemingly also been produced as part of a sui-generous mechanism for compelling people to participate in our destructive society.

#### *Mapping the Socio-Cybernetic Processes Behind History (and Evolution Itself)*

Why is it that this destructive process has developed so inexorably in the same direction?

Bookchin himself proceeds, after the manner of Braudel<sup>31</sup>, to identify the specific constellation of factors which were operative at each “choice point” in history. But this hardly accounts for the amazing continuity in the direction of (un)development.

Remarkably and disturbingly, the growth of this destructive process has itself many of the features of the organic. It appears to be an endlessly self-producing, self-extending, and self-elaborating autopoietic process.

I need to underline the significance of that statement.

The term “autopoietic” was coined to draw attention to the ability of “self-organising” systems (an oxymoron if ever there was one) to do more than *reproduce* themselves. They *produce* – *i.e. extend and elaborate* – themselves<sup>32</sup>.

Note that it is precisely these autopoietic, organic, systems processes that have enabled “life” to overcome entropy<sup>33</sup>.

Instead of descending into chaos and disorder – as the laws of physics ordain – these processes have created *order* – life – even Gaia herself – out of chaos.

How are we to represent this life force in our diagrams mapping the socio-cybernetic forces that control the operation of autopoietic sub-systems?

To underline the paradox that confronts us, let me repeat something said a few paragraphs earlier: *The network of feedback loops – the autopoietic system – heading us to extinction itself has many of the features of the organic in that it continually reproduces and extends itself.* So, paradoxically and ironically, it seems that it is an inexorable *organic* process which is driving us *away* from organic social organisation toward the hierarchical arrangements that are going to be our undoing .. and validating the second law of thermodynamics in the process.

So now it looks as if we, as social scientists, are confronted with a rather fundamental question: How are we going to contribute to understanding this life force, represent it in our diagrams, and come up with viable suggestions for how it – and the social forces subverting it – can be harnessed to reverse the process?

By the second half of this sentence I mean to reactivate interest in my earlier question: How are we to design a socio-cybernetic (governance) system which will enable us to survive as a species?

### *The Most Fundamental Questions Requiring Resolution*

At this point, it seems worth highlighting what appear to me to be the new fundamental research questions that we have stumbled upon in the last part of this article. These are:

1. How are we to represent the life force contributing to the progressive emergence of societal arrangements with new emergent properties within diagrams of the socio-cybernetic forces governing the operation of autopoietic social systems?
2. More specifically, how are we to represent the life forces which seem, paradoxically, to be leading, in an “organic” manner, to the evolution of hierarchical societal arrangements which seem likely, in the end, to defeat life – the organic – that ultimate expression of autopoietic systems having emergent properties – itself?
3. How can we use our knowledge of the socio-cybernetic system governing the operation and evolution of society to devise – design – a socio-cybernetic – governance – system which will enable our species and our habitat – the autopoietic system known as Gaia – to survive ... i.e. to continue to defeat entropy?

### *To Do List*

As I have lectured and written on these topics over the past 25 years, I have repeatedly been asked “But what can *I* do?”

Actually, it follows from what has been said that there are endless things that need to be done by somebody. But, because most of them are not immediately obvious, I have been asked to

spell them out. Although I have done this elsewhere<sup>34</sup>, I am reluctant to do so here because so many of them follow directly from the observations we have made.

Here is an example. We have seen that, to move forward, we need a paradigm shift as profound as that which Newton introduced into physics – that is, we need new ways of thinking about, mapping, measuring and harnessing social forces. Now, most of us are well aware that we are not geniuses of the stature of Newton. So the observation stymies us: we think we need a champion, but don't know where to find "him". But it shouldn't. For what it means is that we have to press for a vision of research and research arrangements which will facilitate the emergence of such a transformation in thinking. What is more, those arrangements are also required to conduct the huge range of lesser research projects that we have seen to be so important. So there are hundreds of things we can do. We can press for a change in the public image of research and the role it can play in the public service. We can press for a change in the popular image of science (reductionist science) to what may be called ecological science and evaluation. We can challenge a great deal of the research which is presented as evidence supporting current educational, health care, and social policies. We can seek ways of engaging in any one of the hundreds of specific research projects that are required.

Similar things follow from what we have seen about requisite forms of bureaucracy and democracy. We need arrangements which are, to all intents and purposes, the exact opposite of those we have at the moment. Although I have also indicated the enormous barriers to such a change, part of what I have said is that we need a ferment of innovation to which *everyone* needs to contribute. So, in reality, everyone *now* can begin to behave differently. Everyone has some freedom of movement. Once again, the things to be done are legion and not those suggested by "common sense". Rather, they follow from an altered vision of what the world is like and how it should be. Hence we can argue the case on a general basis. And/or we can begin to relate to our teachers, schools, and local authority administrators differently. We do not have to wait for central direction to set up network arrangements to supervise such officials and change our own and other people's expectations of them. Once again, there are endless formal research projects to be undertaken: to find better ways of thinking about, assessing, and nurturing multiple talents; to formalise arrangements for implementing procedural (as distinct from outcome-) accountability: What *are* the things managers need to do to create a ferment of innovation, experiment, evaluation, and learning? How are we to overcome the tendency of self-presentational strategies to undermine the evaluation of such activities? Perhaps above all we can press for, and contribute to, actual experimentation with alternative arrangements in educational, health care, and other systems.

There is no shortage of things that can and must be done. What is needed is imagination on the one hand and a willingness to commit oneself to actually doing one of the things that need to be done on the other. And there is the rub. For a commitment to doing only one of these things depends on confidence that others will do the others. And *that* depends on a vision of society and its potential operation that currently seems to be almost entirely lacking.

## Notes

- 1 Page 2 of this Journal.
- 2 The meaning of this term is clarified below. Here it is sufficient to note that cybernetics is concerned with the feedback, guidance and control systems that determine the behaviour of animals and machines. So socio-cybernetics becomes the study of the, mainly invisible, feedback loops which control the operation of society.
- 3 Before Newton there had just been the wind and the waves, falling apples, and moving planets. Newton had first to show that there was something *common* to these processes. To do this, he had to show that whatever it was was *measurable*. Along the way he had to redirect everyone's attention and reverse their assumptions. Before him, if things moved or changed direction, it was because they were *animated*. Afterwards, it was because they were acted upon by a network of invisible *external* forces. In a parallel way we need to de-animate the way we think about control in society and map the invisible social forces involved.
- 4 Bookchin (2005). A précis of the book and a more detailed account of the critique presented in this article will be found in Raven (2008).
- 5 Actually both terms have acquired multiple meanings: see Mulej *et al.* (2009) and François (2004).
- 6 More detail will be found in Raven (1977) and Raven (1994).
- 7 Raven (1977); Raven and Stephenson (2001)
- 8 Raven and Stephenson (2001)
- 9 e.g. one cannot make significant changes in the assessment system without changing the curriculum so that alternative talents become visible, nor vice versa, and one cannot change either of these without changing the interface between schools and workplaces and universities.
- 10 Reproduced from Raven (1994).
- 11 Preparation of this article has led to considerable discussion of the nature, or status, of the "forces" depicted. Hopefully, this will lead to the preparation of another article. At the most basic level, Figure 1 is analogous to a map of the interacting gravitational forces controlling the orbits of the planets. But the nature of the *social* forces involved has yet to be elucidated. What is clear is that they are not flows of e.g. resources as in the models developed by Meadows et al. (2008). Nor are they flows of "information". Nor are they flows of e.g. people from e.g. one part of the "educational system" to another. The contents of the boxes are not people or stocks of food or components. Only if they really are *forces* in some sense analogous to physical forces does it make sense to ask how they can be harnessed (as in the forces acting on a sailing boat) or amplified or damped down (as in electrical energy flowing through a radio). But note that, just as one can "feel" the force of gravity acting on an object held at arms length or the force of an electric current passing through the body, so can one "feel" social pressures. Note, too, that one does not have to fully "understand" the nature of these forces before one can set about harnessing them.
- 12 Raven (1994)
- 13 Reproduced from Raven (1995).
- 14 The deep seated source of these problems has hardly ever surfaced in discussions of the current financial crisis, yet they are, in reality some of the most serious we face: see Raven (1995), Pettifor (2006) and Grignon (2007).
- 15 Again see Raven (1995) for a review of the evidence.
- 16 These are again reviewed in Raven (1995) and, more fully, by George (1998).
- 17 Although graphs showing that virtually all indices of diminishing resources and negative impacts of destructive technologies are increasing exponentially are widely available it is much less widely appreciated that the actual *impact* of these changes will not increase steadily, even exponentially, but rather suddenly and dramatically. This will arise from the phenomenon known as "Overshoot". Species (and some human societies) that are making excessive demands on their habitats are able to maintain their populations long after they have consumed all the resources they normally depend upon by extending the range of resources they consume. Once these, too, have been exhausted they collapse back, not to the level that could have been possible in a steady state, but to a level far below that and from which they are often unable to recover. This is precisely the position in which we find ourselves as a species.
- 18 Bookchin (1992)
- 19 For a concise, but complete, summary see endnote to Raven (2006). More detail will be found in Raven (1995).
- 20 See Raven (1995).
- 21 These, of course, include the TNCs and, perhaps more importantly, the WTO, IMF, Federal Reserve Bank, and World Bank
- 22 For example, if the costs of highway construction, police and legal (court) systems, and care of the injured are spread over the whole community it removes the cost of transportation of products, employees, and customers from the differential cost of centralised production.

- 23 Lane (1991); Marks et al. (2006)
- 24 Raven, (2008)
- 25 Raven, Johnstone, & Varley (1984).
- 26 Kanter (1985)
- 27 Mill (1859/1962)
- 28 It is facile to attribute this problem to “the capitalists”.
- 29 Bookchin (2005)
- 30 See Lovelock (1979).
- 31 See e.g. Braudel (2002).
- 32 I am not the first to encourage socio-cyberneticians to address this problem. For example, Gerard de Zeeuw organised a whole symposium (in 2001) to address the problems of emergence. (My own contribution to that symposium can be found via <http://www.eyeonsociety.co.uk/resources/100UA.pdf>)
- 33 Authors such as Lovelock (1979) drew attention to the fact that life ... and Gaia herself ... depend on such things as salting away carbon so as to create an atmosphere in which other forms of life can survive. Robb (1989) heavily underlined the conflict between these processes and the entropy predicted by the laws of physics.
- 34 Raven (1994, 1995) and, most comprehensively and concisely, Raven (2006).

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