Only Connect!

Part I: An Annotated Selection from the Literature on the Problem Structuring Methods of 'Soft' Operational Research

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Abstract

What other activities and techniques exist that are of interest to system dynamicists? Are these possibilities for system dynamics itself to contribute to them? These questions have been of interest to the authors for some time and now the 1994 System Dynamics Conference is helping to advance the debate. This paper tries to help things along.

We consider two areas of interest: the problem structuring techniques of 'soft' operational research and the wide range of systems thinking concepts employed in the systems movement. Both involve valuable ideas and experiences. Both have a more European-orientated perspective, in contrast to the mainly-US viewpoint of system dynamics. In this two-part paper we therefore offer a selection from the literature of the two as well as brief annotations.

In this first part we consider the emergence of a range of practical problem structuring methods, their grounding in respective theories of organisational interventions and group processes, their creators concern with participation and the political and power consequences of their work and, finally, the current debates in the area. In the second part (q.v.) we turn to systems thinking.

Of course, this is only our own selection but our aim is to encourage connections between these areas of activity. We have no doubt that they will be mutually beneficial.
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INTRODUCTION

The motivation of this two-part paper is twofold. Firstly, it results from the current interest in the commonalities between the theory and practise of system dynamics modelling and those of similar approaches more widely discussed in the UK and the rest of Europe. These commonalities were first explored in detail by DCL\textsuperscript{a} and are a key theme of the 1994 International System Dynamics Conference to which both authors were invited as speakers. Secondly, this paper arose because of a survey of the system dynamics literature\textsuperscript{b}. After the discussion in Cancun concerning this paper, John Sterman suggested to DCL that a similar piece on soft OR and systems thinking might be a valuable contribution to the system dynamics community.

Our intent is therefore to provide system dynamicists with the opportunity of exploring two literatures which we believe have much to offer. We refer to the written material on both problem structuring methods (PSMs) and to the broad range of activities that Europeans describe as 'systems thinking'. Those involved with this dual piece had initially intended to write a single paper but this has not proved to be a useful format. Although both literatures provide opportunities for valuable engagement, their natures are too different to be embraced within one paper without confusion. Instead, we have attempted our task in two parts, making a somewhat arbitrary division. In the second part\textsuperscript{b}, we consider the systems thinking sources. In the first part, the document that you are now reading, we consider PSMs.

With this set of sources on PSMs, the detailed points of interest for the system dynamics community have been studied in some detail elsewhere\textsuperscript{a}, so for the purposes of this selection, we need only make the following brief comments. PSMs grew out of increasing concern within the Operational Research community that more needed to be done to support managerial decision and policy making than providing mathematical tools for the increasingly accurate solution of defined, tactical problems. An additional concern was that the benefits of Operational Research were only available to those who had both access to the decision making forum (and the power to influence it) and the ability to pay the increasing cost of these approaches. What some saw as a crisis of 'hyper-rationalism' and others as an opportunity for more socially-grounded and richly inter-disciplinary Operational Research practice, yielded a shift in ideas (§1). Much theoretical work has been done on the nature of group activities and the difficulties involved with addressing the real world 'messes' that constitute strategic issues, this work being strongly influenced by the social (rather than the natural) sciences (§2). What has appeared is a set of techniques which can be used with groups to help clarify and structure the issues that confront them and which facilitate participative an exchange of ideas and views which lead to action (§3). These have been applied in practical situations (§4). A variety of debates have occurred to advance the area and they continue now. In particular, there is much concern regarding the nature of participation, the

\textsuperscript{a} Lane, D.C. 1993. With A Little Help From Our Friends: How third generation system dynamics and the issue structuring techniques of 'soft' OR can learn from each other. In System Dynamics 1993: The role of strategic modelling in international competitiveness (E.Zepeda and J.A.D.Machuca, Eds.), pp.235-244. System Dynamics Society, Boston. This paper is more widely available as:


\textsuperscript{y} Lane, D.C. & M.C.Jackson. 1994. Only Connect! Part II: An Annotated Selection from the Literature on the Breadth and Scope of Systems Thinking. In System Dynamics 1994: Exploring the boundaries, this volume.
effects of unequal power and the limits to democratic access involved in sessions involving PSMs: - whether they concern a management team or a debate on public policy. Similarly, there is interest in how one can choose between the different PSMs, whether they can be combined and whether new ones can be usefully crafted. The attachment to social science concerns is also a crucial element in these debates (§5). In our last section we have located collections of material spread across the previous five sections (§6). This indicates the difficulty of the quasi chronological structure that we have chosen for our selection. To surmount this further, we have tried to show the connections between works in different sections by numbering each selection. The primary emphasis is on the aspects which seem most clearly related to system dynamics: the concept of practic - in particular group decision support - or those which contrast with the system dynamics approach in the most striking, challenging and illuminating way. Some historical works are included in order to provide a perspective on the evolution of the approaches.

We should state again that the division of systems thinking from PSMs is difficult and artificial because of the areas of overlap. Some items are, in fact, repeated, though the differences in their annotations reflect the different emphases of the two bibliographies. We would therefore encourage interested readers to consult the sibling selection.

A final, and perhaps unnecessary, comment is that this selection is just that: a selection. It does not aim to be definitive or authoritative. It is a partial account of the literature of PSMs and we mean partial in two senses. Firstly, the authors themselves are not impartial: the selection that we offer draws on our own knowledge and research interests. Secondly, in the space available, we cannot hope to do full justice to the enormous efforts that researchers have invested in this area. Nor can we directly contribute here to the discovery and mapping of the terrain shared by system dynamics, systems thinking and the PSMs of soft Operational Research. Our hope can only be that our paper might add to the exploration of mutually interesting areas by supplying a crude signpost to possible destinations and connections. If it does so then it will have served its purpose. The exploration itself must continue elsewhere but we would commend it to our colleagues. With this paper, we can only connect.

§1 THE SHIFT OF IDEAS

In this short piece Churchman takes up the idea of 'wicked' problems from his Berkeley colleague, design professor Horst Rittel. Wicked problems are those which are capable of conflicting interpretations by interested parties with different perspectives. Analysis may be used to support one viewpoint, but not to 'solve' a problem on which all are agreed. Operational Research has tended to deal with 'tame' problems, for which a consensus exists (or is assumed). See 22.

Classic study of decision-making in a large British city. The authors (operational research observers) come to the conclusion that decision-makers need help, not in finding optimal answers, but in managing uncertainty and the process of commitment. This realisation led to the development of the Strategic Choice Approach, the first early version of which I described in this book. See 21.

Provides an extended account of the notions of 'wicked' and 'tame' problems summarised by Churchman. The authors propose the notion of 'second generation' design methods, to be used argumentatively. See 10 & 22.

Ackoff argues that Operational Research has lost its way, becoming enmeshed in mathematical sophistication while remaining naive about the context in which decisions must be taken. The result is that Operational Research has been relegated to lower and lower levels of the corporate hierarchy to deal with relatively minor issues where technical considerations predominate.


Ackoff describes how Operational Research has seen its subject matter as discrete 'problems', whilst the managerial reality is better conceived of as 'messes'. These are interacting systems of problems, where steps taken to 'solve' one of them are likely to have knock-on effects on others. Different approaches are necessary, therefore, to make progress. See 10.


Shows how Operational Research can be seen as one of a family of systems-based approaches to practical problems. These include systems analysis, systems engineering and Soft Systems Methodology. Operational Research, though by no means alone in this respect, is seen as a 'hard' rather than a 'soft' systems approach, in that it conceives of a single objectively defined problem for which a technical solution should be sought. See 19 & 27.


Rosenhead describes how the practice of Operational Research has been one-sided, serving managerialist interests using methods which seek solutions to well-formulated problems. There are many other groups which could benefit from formal analysis of their situations, notably interest groups of the disadvantaged. Equally there are big strategic problems in the public domain to which Operational Research has made little contribution. 'Problem structuring methods' have the potential to make Operational Research more relevant and accessible. See 23 & 45.


An early and striking plea for sensitivity to the hidden ideological commitment of Operational Research and the provision of its analytical capability to a wider audience. The paper asserts that capitalist society is filled with coercive systems which the practise of OR supports and legitimises. The authors lament its consequent manifestation as 'management science', not a workers' science. They advocate an alternative role in the provision of 'self-management science' for participative, socially orientated processes involving workers. (As published, this paper has an 'Editor's note' inserted which seeks to justify the appearance of an open political stance in the journal!). See 23 &45.


Employing the ideas of Thomas Kuhn - that in 'normal science', dominant paradigms of what constitute a meaningful problem, method of attack and form of solution are periodically challenged and overthrown by new paradigms - the authors reflect on management science. Three contending paradigms are identified: official, reformist and revolutionary. They predict that the reformist approach, typified by the work of Ackoff and Checkland, is likely to win out. A particularly important paper.
§2 THEORETICAL UNDERPINNINGS

   This weighty contribution to the history and philosophy of science offers numbers of insights into, or on, Operational Research. One is the distinction between 'technical' and 'practical' problems, which parallels that between 'tame' and 'wicked' problems, and the between problems and 'messes'. Another is the importance of craft elements in analytic practice. This work has been cited in support by Miser, Quade and Majone in their IIASA-based methodological publications. See 3, 5 & 49.

   In this book Sandberg explores the question of whether, and how, planning methods can serve a society in which democracy is taken seriously. Relevant to the debate about Operational Research are: the inescapable importance of 'perspective' when framing planning questions; the danger of 'colonising the future' by projecting out into the future the continuance of the social relationships which have generated current data sets; the consequent need to engage in 'conditional projections', which examine possible future behaviours if certain present 'givens' are replaced by new arrangements.

   Problems are not 'given', argues Eden. They are constructed by a social process within the organisation. Operational Research needs to be more sensitive to the dynamics of the decision-making process among managers. If it can achieve this, then it has great potential for managing the debate among managers.

   Just as with problem construction, so the end of an involvement of analysts with managers is a process rather than an event. There is a process of disengagement, with managers detaching themselves from the activity as they feel that it has produced enough to meet their current needs, or on the basis of expectations of the likely return from the investment of further time.

   Bryant's book is hard to describe! Its subject matter is the practical business of managing problems, its approach is eclectic (drawing on many disciplines), and its emphasis is on process. Of particular interest is the use of a theatrical metaphor for the engagement between analysts and managerial participants. Full of thought-provoking ideas and comments.

   When building models for use in helping managers to reach agreement, the model should be no more elaborate or detailed than is required by the decision at hand. See 35 & 36.

   Internal or external consultants assisting work groups to reach agreed decisions need a different range of skills than those associated with conventional Operational Research. They need to be sensitive to group dynamics, internal politics, suppressed anxieties etc. While managing this process to a constructive resolution, the authors hold that the facilitator should absolutely avoid making any contribution relevant to the content of the group task. See 35 & 36.
§3 DESCRIPTIONS OF PROBLEM STRUCTURING METHODS

Provides the most recent, book-length account of Strategic Options Development and Analysis (SODA). This employs cognitive mapping to surface the concepts which individuals involved in a situation use to make sense of it. The maps of the concepts employed by different participants are merged, and the resulting 'strategic map' is used to provide a framework for group discussion, and to take the group forward towards commitment to a coherent package of commitments. The book does not cover more recent developments, especially those based on the sophisticated software now available. See 26.

A practical guide to the nuts and bolts of conducting SODA. The explanation is within the application area of Community Operational Research, but applies more widely. See 26.

This classic text provides both a survey of the philosophy and concepts underlying Soft Systems Methodology (SSM), and an account of the methodology itself. SSM involves constructing idealised models of alternative systems each of which, from at least one perspective, might be of interest. These are used to generate debate about the systemic and cultural appropriateness of possible changes to the organisation. See 6 & 27.

A sympathetic but critical account based on the experience of using SSM in practice. Guidance is provided on the choices which a practitioner must make, and there is discussion of the validity of claims and assumptions associated with SSM.

Beautifully organised and presented account of the Strategic Choice Approach. This methodology is concerned to assist decision-making under uncertainty. A range of 'soft' decision technologies, evolved out of practice, are deployed to take groups through the various stages of decision-making. The emphasis is on managing uncertainty, and the visible end-product is a 'commitment package' of shorter term actions and explorations, and of longer-term possibilities for action based on those explorations, plus contingency plans. See 2.

This book describes Strategic Assumptions Surfacing and Testing (SAST). This is a methodology the purpose of which is to expose policy to dialectical debate. Different groups of participants develop alternative strategies, and identify their key assumptions. Discussion of these between the assembled groups aids a broader understanding, and the consequential adjustment of assumptions. A consensual strategy, or at least a clarified disagreement, should emerge. See 1.

A description of Robustness Analysis, a methodology concerned to identify initial decisions which preserve useful flexibility. The approach is relevant under conditions of high uncertainty, and when there is the possibility of sequential commitment. It rates alternative initial commitments in terms of their abilities to keep useful future options open, and to exclude possibly damaging routes into the future.
An introduction to Hypergame Analysis, an approach to the management of conflict situations. The special feature of this methodology is its treatment of the possibility that different 'players' in the situations may have differing perceptions of the strategies available, or even of the preferences which other players may have over possible outcomes.

An account of Metagame Analysis, an approach to situations of potential conflict and co-operation which integrates within one framework both threats and temptations, and the emotional dimension which may be crucial to persuasion. See 46.

§4 APPLICATIONS OF PROBLEM STRUCTURING METHODS

A richly described case study of the application of SODA in the publishing industry. See 17 & 18.

This book provides the most extended account so far of SSM applications, with detailed case studies of work in government agencies, major corporations and other bodies. It also updates the methodology. The new form responds to various criticisms, not least that of cultural conservatism(see 37 & 38) which is (partially) addressed by the introduction of a 'stream of cultural analysis'. See 6 & 19.

A survey among potential users of SSM reveals quite widespread adoption. It also shows where it is being used and where it is not, and those aspects of the approach which do, and do not, meet with general approval. See 19.

An unusual case study in Community Operational Research in which women dissatisfied with what the health services had to offer them, were helped by an operational researcher to articulate their demands for better birthing facilities. The Strategic Choice Approach enabled the group to crystallise what they wanted. Their greater effectiveness enabled them to influence provision. See 21 & 45.

A hybrid case study dealing with the application of SODA and SSM in the National Health Service. The work was carried out with a specialty medical audit team at a local hospital. SODA was employed to identify relevant dimensions of how the introduction of audit was viewed by team members, and SSM was then used to explore possible system re-designs. See 17, 18 & 19.
An application of Robustness Analysis to the planning of health services for Ottawa and the surrounding region of Ontario. DELPHI analysis and cluster analysis were used in conjunction to generate alternative possible futures. Extensive consultation with health care deliverers and with the public were other features of the study. See 23 & 45.

A paper which discusses and compares three applications of metagame analysis.

Gives a broad view of the provision of Operational Research techniques to community, voluntary and other non-hierarchical organisations. Also offers a restatement of the sense of social responsibility that lead to the initiative. See 7 & 8.

The largest community Operational Research project carried out to date has been with the Thurnscoe Tenants Housing Cooperative. This paper tells the story of that work, which included the use of a range of soft and problem structuring methods. Some preliminary conclusions are drawn, including on the appropriateness of hard and soft methods. See also Part 2, in the same volume, for more extensive discussion. See 45.

See 36.

Both 35 & 36 are case studies. The use of carefully designed room layout, non-threatening computer support and attention to group dynamics allows the facilitated application of decision theory with managers. See 15 & 16.

§5 ADVANCES AND DEBATES

Examines the specific connections between SSM and Critical Theory and concludes that although there were many similarities, SSM at that time suffers in comparison because it lacks a political stance and because it would tend to conserve and support rather than challenge the status quo. See 27 & 44.

A dissection of the assumptions underlying the work of three leading Operational Research/systems writers. The gist of the criticism is that the authors make strong claims for the capacities of their respective methods to deliver radical change which cannot be justified. Their approaches are characterised as supportive of the status quo, and compromised by the relationship with management necessary for them to be put into operation. In the same issue the objects of criticism respond - Churchman testily,
Checkland reasonably, Ackoff going for the jugular. See Volume 10 for Jackson's response.

The first version of an attempt to categorise both problem situations and the methodologies appropriate to tackle them. Subjected to sustained criticism (and robust defence) the categorisation and its justification have shifted periodically. The typology is based on whether the systems involved are relatively simple ('mechanical') or complex ('systemic'); and on whether the participants are in agreement ('unitary') or have divergent views ('pluralist'). Later a third type of context ('coercive'), in which the exercise of power between participants is significant, was added and used to create 'total systems intervention' (TSI). The major disputes have been over whether such problem contexts can be objectively identified, and then used to choose methods; and over whether the authors claimed this in the first place. See 44 & 47.

Operational Research and related approaches, from being relatively monolithic, are seen as having now achieved a striking diversity. Jackson lays out the varieties on offer, and discusses the various ways in which the component parts could decide to co-exist (or not). He suggests that 'imperialism', the persistent, uncritical advocacy of one method over any other, is likely to be destructive. A 'pluralism' in which we all learn from each other is to be preferred.

As discussed, as a general rule Operational Research's traditional optimising techniques are seen as dealing with the content of problems, while problem structuring methods attempt to handle issues of the process of decision-making as well as those of problem content. However, this paper demonstrates that this demarcation line is not absolute, using as evidence reported work in which process issues were addressed while working with a linear programming formulation.

An exploration of the possibilities of combining different problem structuring methods in joint use.

Details the assumptions behind methodologies purporting to structure 'rational' choice. Concentrates on various forms of decision theory and their implicit axioms - presumptions about human judgement - before discussing SODA and SSM. Concludes that the idea that any unique prescriptive decision making methodology can be shown to be better than any other is itself a false presumption. Any choice is probably based on personal experience and conviction; research programs intended to understand this are fraught with difficulties. This has implications for attempts to categorise the situations in which a particular methodology may be 'best' for decision making. An interesting alternative to the TSI approach.

Engages with the ideas Jürgen Habermas on the nature of knowledge to critique both traditional and soft practices of Operational Research. Reviews, predominantly unfavourably, attempts to utilise Habermas' Critical Theory to create empowering situations for participants, in particular TSI. Reference is also made to the problems of power in interventions and to post-modernist questioning of the notions of rationality. See 37.
45. J. Rosenhead. 1992. Into the swamp: the analysis of social issues. *Journal of the Operational Research Society* 43(4):293-305. During the 1960s and 70s, policy analysis got a bad name through its overweening ambition. In the 1980s in Britain, the government demonstrated the alternative dangers of analysis-free policy formation. The middle way suggested here is multiple advocacy, with interest groups empowered to make their cases by widely distributed analytical capability. Problem structuring methods have the characteristics required to service a more active policy debate. See 23 & 31.


§ 6 COLLECTIONS


49. H. J. Miser and E. S. Quade (eds.). 1985. *Handbook of Systems Analysis Vol.1: Overview of uses, procedures, applications and practice*. Chichester: Wiley. Systems analysis fights back! A distillation of the sophisticated wisdom of widely experienced practitioners at, particularly, the RAND Corporation. That is a little unfair to the authors from other organisations and countries who contributed to this International Institute of Applied Systems Analysis (IIASA)-based compilation. However, the pages contain an unusual density of common and uncommon sense on how to practice relatively conventional analysis and stand a very good chance of being helpful - through knowledge of the technical repertoire, sensitivity to the organisational politics, etc. See 10.


The proceedings of a conference, this book provides, perhaps, the most concentrated collection of papers about the process aspects of analytic assistance to decision processes. The focus is on how support for decision making in groups using problem structuring techniques can take account of the dynamics of such situations.


Over the years 1990-3, a series of 9 seminars on the interface between Operational Research and the social sciences was held in Britain. This issue contains papers given at two of the seminars, dealing with the nature of problem-solving interventions, and with approaches relevant to work across multiple organisations. The topics covered range from the process of facilitation to the analysis of conflict.