Social Theory and System Dynamics Practice

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"System dynamics needs a broader and deeper debate about its underlyin philosophy, the contrast with alternative philosophies, the nature of knowledge, th role of subjective and observational information, and the criteria for judgin validity.

- Forrester, 1980, p.1

Abstract

This paper explores the social theories implicit in past, present and future (envisaged) SD practic Previous work on the theory of SD is first reviewed. A framework for studying social theories is the introduced; the assumptions underlying its axes discussed and the four paradigms of social theor which these yield described. Various groupings of SD practice are then defined and these are place in the framework, primarily within functionalist sociology. Motivated by alternative paradigms, tw new and potentially productive forms of practice are envisaged. The term 'holon dynamics' proposed to describe them both. These are subjectivist and they are described briefly along with th new type of research approach necessary to advance them.

A number of conclusions arise from this analysis. Firstly, that Forrester's basic conception of the fie was spread across the schools of Social System Theory and Integrative Theory and resulted in period of interpretive division regarding validation. Secondly, that the resulting move by son practitioners towards more subjective forms of practice should be seen not as revolutionary, as son external observers assert, but as an evolutionary extension of the basic conception. Thirdly, that son current SD practice may, and the envisaged forms certainly do, indicate that the field is not wedded a particular theory but rather that the method of SD can be used in different paradigms. Th conclusion implies a greater need to be aware of, and consistent with, the social theoretic axion implicit in SD activities if practitioners are to sustain a Kuhnian 'normal science' - hence reinforcir the paper's consideration of social theory.

Social Theory and System Dynamics Practice

§1 INTRODUCTION

1.1 The Purpose Of This Paper - In this paper I try to begin the exploration of the practice of SD modelling and the theories of the social sciences. 'Exploration' here means both the unearthing of assumptions implied by practice and the consideration of new forms of practice proposed by relevant social theory. My motivation derives from a comparative study of SD and OR (Lane, 1994) which observed that connections between the grounding theories of the social sciences and OR have been explored to a greater extent than those with SD.

What do I mean by social theory, and why might SD modelling wish to establish one? At a deeper level than tools and techniques, all GDS approaches are based on assumptions of how humans behave in society and also how knowledge about such processes can be acquired and what form such knowledge can take. Such underpining assumptions may be explicit or they may remain as unexamined presuppositions but they have implications for the type of interventions that are possible. The extent to which SD has articulated a social theory for its practice is considered in §1.2 but the comment "The present [SD] paradigm is not sharply defined" (Forrester, 1985, p.1) is, I believe, referring to a lack of clarity at this level.

The advantages of debating the assumptions of SD at this level are many. The social sciences are rich in theory but limited in application whilst SD is highly practical. Interaction offers the potential of supplying SD for the practical study of a wider range of issues in the social sciences. Similarly, a suitable social theory for SD would allow more effective reflection on practice and hence more coherent re-crafting of that practice. Practice may also be enhanced by comparison with other approaches which share the same assumptions since deep commonalities will become visible (Lane, 1994). Additionally, research at this level will contribute to the debate on choice of method (Flood & Jackson, 1991), clarify appropriate validation criteria (c.f. Eden, 1995) and allow the mixing of methods not at the level of tools but with a clear understanding of theories (see Lane & Oliva, 1994).

The consideration of such fundamental issues may be found in other disciplines. We might compare the debate with that in the field of information systems; various authors have illustrated that different paradigms may be used fruitfully. Each offers different approaches and insights but, in their own terms, each appears to be valid (see Galliers, 1991 and Hirscheim & Klein, 1989). The same paradigmatic approach is taken in this paper.

1.2 SD Modelling And Social Theory: A Brief Historical Review - For the most part, the social theoretic assumptions of SD must be inferred, there being few examples of these being articulated. Forrester (1961) laid out the fundamentals of the field. From a social theoretic perspective, it offers a combination of ideas, sometimes mutually supportive, sometimes contradictory. SD models are representations of the actual physical and information flows in a system, their feedback perspective implying that, "decisions are not entirely "free will" but are strongly conditioned by the environment" (*ibid.*, p.17). Rules are described for the construction of models and for solving and interpreting the equations. However, the purpose of a model is to manifest a mental model. A range of data sources is proposed, including data held in the minds of actors, e.g, values and goals. The limited ability to share and utilise mental models would be assisted by articulating assumptions as computer simulations. The purpose was not just to explain but to aid systems re-design, to promote individual and organisational learning to impart "a better intuitive feel [which] improves . . . judgement" (p.45). As a result, the usefulness, and hence validity, of such models would only be judged in a personal way. Later works extended the applications and embellished the approach but kept to the core ideas (Forrester, 1968a&b, 1969 & 1971a), whilst Forrester (1971b) sought to improve validation and implementation by emphasising the role of a 'process' of modelling.

Bell & Bell (1980) directly addressed questions of ontology and epistemology. Refutationism was advanced as appropriate for SD since causal models offer clear test points by which problems can be solved and theory advanced. Meadows (1980) discriminated between SD and econometrics on the use to which models are put. Sterman (1988a) revisited this debate, emphasising that, "modeling [is] a process rather than . . . a technology for producing an answer" (p.165). Concern moved to the process of 'implementation' (e.g. Roberts, 1978), causing Richardson & Pugh

(1981) to enhance Forrester & Senge (1980) and describe 'validation' as a process of interwove technical and subjective elements intended to ensure that models are suitable for their intend audience and command their confidence. The tension implicit in this combination may be four in Forrester (1980), in which he takes a strikingly deterministic, indeed, nomothetic approach human decision making whilst re-emphasising the role that personal experience plays in gainir insights from a model building process. The approach of Richardson and Pugh can be seen presaging what became two different responses to the issues of validation and implementatio The more technical approach pushed the refutationist line (Bell & Senge, 1980) and introduce some statistical validation tests as a means of generating confidence (Sterman, 1984). Similarl the behavioural decision making wing of SD, including the bounded rationality work of Morecro (1983) and exemplified by Sterman (1989), employs controlled experiments to demonstrate ho system structure influences decision making.

The alternative view focussed attention on the social requirements of model building. The u of CLDs was re-crafted to render models and model building more accessible to clients (Goodma 1974, Roberts et al., 1983) and 'qualitative SD' appeared (Wolstenholme, 1985). The notion learning in an organisational context began to be studied explicitly (Senge, 1985 & 1990a) ar new software tools were developed to break down the barrier between model and model-own (Richmond, 1985). Morecroft (1988) reported that Papert's idea of 'transitional objects' had bee united with (a very US view of) GDS to produce a role for SD modelling as a process f supporting strategic debate. The use of 'micro-worlds' was proposed as a way of accelerating th process of conveying insights (Sterman, 1988b). Senge (1990b) united many existing ideas propose certain SD approaches as tools for negotiating and sharing vision and enablir organisational learning and commitment. Richardson *et al.* (1992) described the differe technical and social roles that were required for group model building to be effective and Lar (1992) explored how the 'Modelling as Learning' GDS approach fitted in with similar tools ar began to advance a more socially subjective understanding of such processes, in line with practi in Europe. This view was taken further in Lane (1994)

From outside the field, Keys (1990) offered the view that SD as originally created had the sar assumptions as hard system approaches but underwent significant change when it engaged wi pluralist contexts, becoming more subjective and shifting towards the theory of soft approache This attempt to occupy two philosophical stances opened up SD to criticisms from both side This analysis is in harmony with the work of Flood and Jackson (1991) in which SD is labelled being based on 'unitary' assumptions about organisations.

Other contributions include Radzicki (1990) who confirmed the poor esteem in whi economist hold SD. He offers the diagnosis that this difference is located in the utilisation by th majority of economists of the logical empiricist approach, whilst SD can be seen as pragmat instrumentalism. Barlas and Carpenter (1990) employed a reading of Forrester on validation support the proposal that a Quinian, relativistic approach is appropriate. Hence, "Validation is matter of social conversation" (p.157). Finally, Cavaleri (1992) considered the social theory SD (and used Burrell & Morgan, *q.v.*) but claimed that the discipline had such powerful integrati properties that it could be placed in the centre, straddling all four paradigms and failing to de with the question of inter-paradigmatic incommensurability.

§2 ESTABLISHING A FRAMEWORK FOR STUDYING SOCIAL THEORY

We are seeking a means of exploring the social theory of SD practice. Various differe approaches, operating at different meta-theoretical levels, are available. We might operate at th grand level of unproven and unprovable fundamental assumptions, in the spirit of Frankfor Nachmias & Nachmias (1992). We could employ Habermas' theory of human cognitive interes (White, 1988) or view SD using the metaphors of Morgan (1986). A choice must be made. W shall operate at the level of paradigm or disciplinary matrix. In describing different approach to the study of organisations, Burrell & Morgan (1979) concluded that the various schools thought can be conceived as residing in four paradigms. Although there are differences emphasis between schools, the distinctive meta-theoretical assumptions are shared within particular paradigm and are in opposition to those of the other three. The advantage of choosir this framework is that it is useful for debating underlying assumptions whilst still being based straightforward definitions. This, combined with its use in similar studies, motivates its selectic here. To set the scene for the examination of SD the two axes of this schema, concerning th

philosophy of social science and the theory of society, are described in more detail below and the constituent paradigms are then explored.

2.1 The 'Nature of Social Science' Axis: Subjectivism/Objectivism - In proposing this axis, Burrell & Morgan are bundling together four strands of theoretical assumptions implicit in social science thought (overleaf). Ontological assumptions concern the very nature of the phenomena, or 'reality', being studied. The realist view takes the social world as being prior to individual humans, formed of tangible structures which have existence even if they are not consciously recognised and named and which may be empirically studied. The nominalist position views the social world as being a product of human consciousness; there is no 'real' structure to the world, only the artificial descriptions and names that humans agree to use as tools to make sense of it. Epistemological issues concern the type of knowledge that is possible and the means by which it can be communicated. The positivist view is that knowledge can be revealed by searching for laws perceived from the perspective of an external observer. Hypothesised laws are verified or falsified and hence accepted by others. The anti-positivist stance takes knowledge to be personal and lacking laws. 'Understanding' is manufactured and the notion of the observer is worthless since understanding is meaningful from the perspective of those involved and can only be conveyed in these terms. Inevitably, the social sciences adopt a position on 'human nature', a model of humans and their relationship with their environment. The deterministic view has people functioning as products of an environment which both forms the situations which they encounter and the conditioning which they imbibe. The voluntarist approach ascribes a much more creative, free-will approach to humans, having them create their environment by their thoughts and actions.

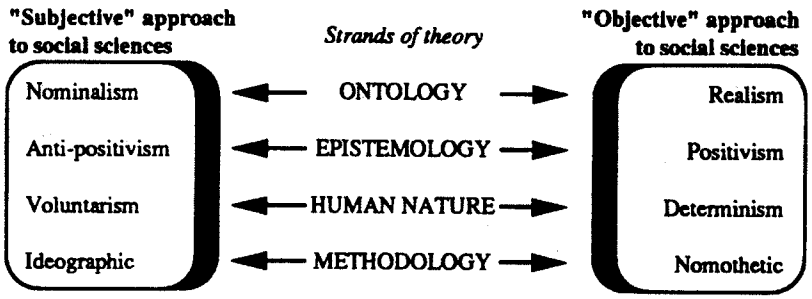

Figure 1

Finally, two different forms of methodology indicate the processes by which phenomena are investigated and knowledge obtained. The nomothetic theory promotes the search for laws by identifying tangible concepts and constructing tests which allow the concepts to be measured to establish relationships between them. An ideographic approach is relativistic, concerned with accessing the understanding that an individual uses to interpret the world. To obtain such an account it is necessary to use methods which, "[stress] the importance of letting one's subject unfold its nature and characteristics during the process of investigation" (Burrell & Morgan, 1979, p.6). Although there are degrees of emphasis in the schools of thinking, illustrated by their placement on this axis, the two sides are fundamentally different, being constituted by the broad traditions of 'sociological positivism' and 'German idealism'.

2.2 The 'Nature of Society' Axis: Regulation/Radical Change - The poles defining this ax involve schools of social thought with the following concerns:

"REGULATION"	"RADICAL CHANGE"
- *Status quo* regulation - Describing social integration, cohesion and order - Describing processes of need satisfaction - Creation of consensus - Solidarity with fellow society members - Explaining actuality	- Inspiration of radical change - Describing structural contradictions - Describing deprivations and exploitatio (psychic and material) - Articulation of modes of domination an sources of power - Emancipation from "prison" of society - Envisioning potentiality and facilitatin emancipation

Regulative theories concern the *status quo*, seeking to explain the processes of consensu creation and need satisfaction that result in the continuation (though also evolution) of a societ Social interactions are studied to understand their function in respect of social cohesion. Radic change theories concern structural conflicts. Interactions are seen from the perspective c ineradicable conflicts of interest; the 'consensus' of regulative views is seen as being false, resultin not by voluntary means but as a consequence of ideologies and imposed norms which defir acceptable discourse and govern thought and action. Society is seen as predicated upc exploitation, the power which allows this being hidden. These theories seek to transcend prese limitations to produce emancipation, the debate appearing to some to be ludicrously Utopian c dangerously paternalistic in outlook.

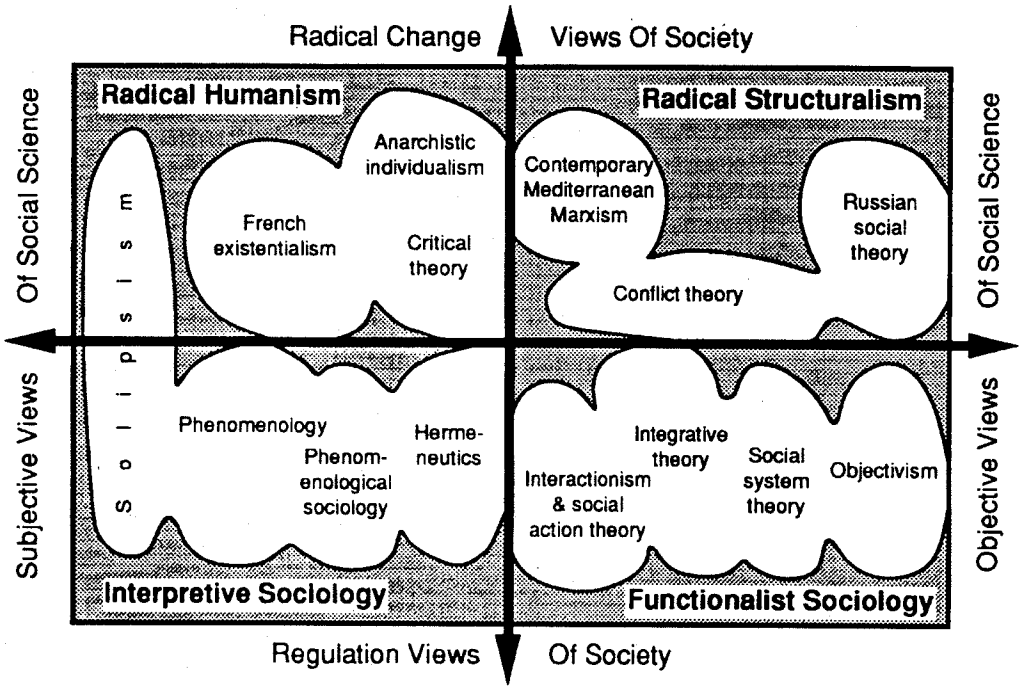

Figure 2

§3 EXPLORING THE PARADIGMS

3.1 Functionalist Sociology - The functionalist paradigm has been described by as "the dominant framework for the conduct of academic sociology and the study of organisations" (*ibid.*, p.25). The schools of social thought within this paradigm are characterised by objective, regulative assumptions. The major contributors were motivated by the successes of natural science in the 19th century and sought to emulate them. As these early workers made the assumption that industrial society was the zenith of human achievement, problems of regulating society were pre-eminent: interest centred on means by which society held together by consensus on its basic values. In consequence, this paradigm has a positivistic approach, conceptualising sociology as the objective study of existing phenomena. The application of the research approach of the natural sciences was significantly advanced by Durkheim whose work centred on the uncovering of 'social facts' and their objective measurement. The goal was to generate a theory regarding the cause of a fact and the function that it played in maintaining an orderly society. Multivariate analysis was used to compare societies and this allowed the testing of social theories (Parkin, 1992 and Cuff *et al.*, 1990). The knowledge revealed was claimed to be analytical, existing independently of individual consciousness and therefore public and value-free, subject to empirical testing, repeatable and refutable. By subjecting society to non-participatory observation, this approach gives accounts of actions deemed to be rational and describes the function that they fulfil within the context of the social structure.

'Behaviourism' is an objectivist school which aspires to causal theories of human behaviour derived from controlled stimulus and response experiments. Humans are conceptualised as passive responders, machine-like in their reactions to external conditions. **Objectivism** also contains 'abstracted empiricism', a term used to describe the functionalist schools which are seen as undermining the less objective strands of their stance with a nomothetic methodology.

In the school of **social systems theory** social life is deemed to exist because of the functioning of a structure, and the measurement of this structure is a concern. Social systems theory is thus a clear development of positivism applied to the social sciences. It consists of two schools. 'Structural functionalism' derives from Spencer's work which places heavy emphasis on analogies drawn between societies and organisms. Parsons used the approach to describe the processes by which the social system maintains equilibrium with its environment and integrated its processes to preserve its integrity. In contrast, 'systems theory' is not confined to biological analogies since its emphasis on open systems allows a range of analogies; using principles concerning boundaries, feedback, sub-systems etc. disequilibrium and homeostatic situations can be studied. The 'general systems theory' of von Bertalanffy, is an example of such a theoretical approach whilst the practical work of the Tavistock Institute and that of Katz and Kahn employ a mixture of mechanical, and biological analogies, used to explains the factors which create and maintain a stable social system.

Interactionism is a fusion of ideas from German idealism and positivism. With contributions from Simmel and Mead, the approach is the observation of the interactions of social life, concentrating on gesture and language and the activities of groups. The goal is the uncovering of the rules that underlie human associations. These are determined by social structures but acts of individual association affect them and this ontological stance places this school. Similar comments apply to **social action theory** of Weber which attempts to understand social life by interpreting actions using 'ideal types' (Gneuss & Kocka, 1988).

Finally, **integrative theory** is the term used to describe four schools which illuminate social system theory with the interactionist perspective. Of interest in this paper is Buckley's morphogenetic systems theory which rejects models based on mechanical or organic analogies. Firstly, Buckley believes that society cannot be understood using models based on equilibrium or homeostasis. Secondly, he asserts that socio-cultural systems need to be understood in terms of the transmission of information. His models treat information as a carrier of meaning subject to interpretation by actors in the system. This work therefore uses systems theory and cybernetics to organise and make use of the understanding gained from interactionist research in order to explain the means by which societies change and evolve their underlying structures.

3.2 Interpretive Sociology - This paradigm is the product of German idealism, developed from the ideas of Kant and Hegel by Weber, Dilthey and Husserl. Although interpretivism is not a uniform paradigm, there are key shared assumptions. Interpretive sociology emphasises the essentially spiritual nature of the social world which must be interpreted in terms of the subjective understanding which individuals ascribe to their situations. The paradigm is anti-positivist and views the social world as being constantly created by individuals via processes of dialogue negotiation and learning. Social reality is then an emergent property of the actions of human (operating as individuals or in concert), an outward manifestation of human consciousness brought into existence through intentional acts and intersubjectively shared meanings. As with functionalist sociology, the worldview of their proponents has aligned most interpretive theories with the sociology of regulation. Interpretation has at its core Weber's concept of the intentional act; it illuminates social action by offering an account of the acts of rational people and the subjective meaning ascribed to those acts in order to create meaning for conduct. The form of knowledge on offer makes unusual science: repetition can be impossible and disagreements arise concerning criteria for hypothesis testing and refutation. Explanations operate at the level of individual consciousness and subjectivity. Knowledge is not 'revealed', as implied by positivism but 'manufactured' by specific actors.

The least subjective view is that humans externalise their inner life through the creation of objective social phenomena which can then be interpreted The need to establish criteria for validation lead Dilthey to the science of **hermeneutics**, in which an approach similar to textual analysis is used to interpret the meaning and significance of these artefacts. General laws are not pursued. The research method is *Verstehen*. It is employed to place researchers in the role of an individual concerned with the phenomenon, to re-experience what had been felt. The goal is the retrieval of the meaning he imparts to his actions so it can be communicated to others Interpretation is done with 'ideal types', which may be read as thinking aids with which a situation is compared in order to generate explanatory value (Cuff *et al.* 1990).

With **phenomenology**, Husserl attempted to probe individual consciousness itself. As his research tool he used the procedure of *époche.* This involves the researcher's 'suspension of complicity', allowing the nature of consciousness to be described purely from the subjective viewpoint of those being studied (Husserl, 1907). Beyond Husserl's ideas lies **solipsism** in which the Universe is reduced to the contents of an individual's consciousness, this view rendering the issue of society's nature irrelevant. In **phenomenological sociology** a balance is struck Through social interaction humans swap individual subjective meanings and so negotiate a shared meaning. Knowledge of this network of intersubjective meaning allows the understanding of the *Lebenswelt* ('life-world') of everyday experiences in society. Whilst phenomenological ethnomethodologists seeks to articulate the aspects of the *Lebenswelt* that are taken for granted phenomenolgical symbolic interactionists are particularly concerned with the creation of intersubjective meanings which result in co-ordinated action in groups.

3.3 Radical Structuralist Sociology - Deemed to have been founded by Marx , this paradigm uses a natural scientific approach to critique the *status quo* and to understand the conflict inherent in the structure of society. The advances of industrialisation seek efficient production so the link between people is the impersonal 'cash nexus' of labour transactions. This generates an ideology which distorts understanding, alienating individuals from the social world (Cuff *et al.* 1990). Since the economic and political crises generated by these conflicts afford opportunities for social re-organisation and emancipation, Marx sought to create new ideas which would reshape this social system (Singer, 1980). Variations include **Russian social theory** emphasising the scientific rationality of Marx, and **contemporary Mediterranean Marxism** which re-emphasises Hegelian influences, reducing the role of economic factors to allow a role for ideological developments. Finally, **conflict theory** contains a radicalised version of interactionist ideas and Dahrendorf's post-capitalist Marxism.

3.4 Radical Humanist Sociology - In contrast, the paradigm of radical humanism, with its roots in German idealism, offers a radical critique of society based on individual consciousness Burrell & Morgan (1979) describe the fundamental concept, "the consciousness of man is dominated by the ideological superstructures with which he interacts, . . . these drive a cognitive wedge between himself and his true consciousness. This wedge is the wedge of 'alienation' or 'false

consciousness', which inhibits or prevents true human fulfilment" (p.32). Viewing society as essentially anti-human because it limits personal development, this paradigm therefore takes as its aim the emancipation of humans so that they can achieve their full potential.

Within this paradigm lies the **Critical Theory** of Habermas who sees social development not in Marxist terms of the growth of economic production but centred on the accumulation of knowledge (White, 1988). He argues that knowledge is never objective but always serves an interest which leads to - 'constitutes' - a particular form of knowledge. Habermas then proposes three areas of interest and knowledge. Instrumental reason, or 'technical knowledge', arising from the need to control the physical world, has a positivistic approach and is viewed as a creation of advanced capitalism; its controlling purposes being used to manipulate people and coerce them into accepting such 'rational' thinking as the only acceptable knowledge. 'Practical' knowledge arises from the human need to communicate, to discuss in order to make sense of what others mean in order to reach consensus. Such knowledge is derived from the interpretive view. Habermas finds these two knowledge types insufficient. Technical knowledge, he argues, is applied illegitimately to social issues and puts power in the hands of 'experts' since the issues left open to debate and the 'rules' of that debate are subject to the coercive nature of power structures and the ideology of 'instrumental rationality'. Practical knowledge is either transformed erroneously into technical knowledge or 'systematically distorted', undermined by the illusions imposed on people's understanding of themselves because of ideological influences on language and even thought produced by the specific historical and sociological context and the personal neuroses and repressions which result. With Critical Theory, he seeks a form of knowledge which he calls 'Emancipatory'. He argues that truth and rationality in the *Lebenswelt* are a matter of agreement, phenomena of communication; knowledge arises from free discussion, from debate which is aware of the interests behind contributing views, proceeds with complete freedom and treats all contributors as equals. Such processes will lead to 'enlightenment' - an understanding of technical ideology and power structures and personal values and behaviour. They will allow the creation of rational consensus via undistorted debate, or communicative competence.

Located within this paradigm we also find **existentialism**, associated with Sartre, a radical form of transcendental subjectivity, and the **anarchistic individualism** of Stirner, which advocates change of the most extreme kind. The strong individualism of these schools and their limited engagement with the *Lebenswelt* make them less relevant to this paper.

§4 SOCIAL THEORY AND SD PRACTICE - A TENTATIVE EXPLORATION

The problem facing the researcher interested in the social theory of SD is the enormous variety of practice. I deal separately with different types of practice, initially taking a chronological view then moving to treat tailored uses of SD. In the first sub-section I attempt to unearth the theory implicit in existing forms of practice. In the second, I propose two innovative forms of SD activity, grounded in new areas of theory.

4.1 Explicating the Theory of SD Practice - I deal first with practices which began with the creation of the discipline (1958) and followed on for the next two decades. I therefore call this grouping '**D1&D2**'. Its location is crucial to the argument which follows. Forrester proposed a form of systems theory based on a servo-mechanistic view, taking a realist, nomothetic and determinist stance, the contribution to strategic change giving a weighting away from the regulative extreme. However, the ability to treat dis-equilibrium and the interest in the flow and interpretation of information allows the extension into integrative theory. Most important are the notions of mental model representation, validation by confidence and the provision of learning experiences. These ideas, clearly present at the creation of the field, indicate an inclination towards a more interactionist stance. For two decades these ideas were used in an increasing range of applications. The publications reflect on experience and add detail but fail to advance theory to any great extent; the tension innate in these contradictory ideas remained.

We may say that these tensions began to be worked out in the third decade of the field's life; '**D3**'. In this '**period of interpretative division**', we see the effects of two emerging challenges to the field; the poor reception of SD among economists (Meadows, 1980) and difficulties in implementation (Roberts, 1978). The responses that sought to rise to this dual challenge can be viewed as a division in approach, centred around interpretations of 'validation by confidence'. Firstly, when Bell & Bell (1980) search for a philosophical approach for SD, their support of

refutationism as a theory - so that causal and behavioural hypotheses are stated and tested (ar approach extended by Bell & Senge, 1980 and Forrester & Senge, 1980) - and the subsequen employment of statistical techniques, advanced the theory in the objective direction. In thi interpretation, 'confidence' is created by 'truly scientific' means; the methods were familiar t managers and thus implementation would be eased and also SD would be able to present itself a different in style to econometrics but, crucially, not different in kind.

The alternative response saw confidence arising from personal experience or from socia conversations. Meadows (1980) rendered SD distinct from econometrics on these grounds an went on to expend her energies on making insights derived from SD more comprehensible Similar attempts to cope with implementation difficulties concentrated on developing approache by which the experience of modelling could be brought closer to the user. The emphasis on CLD and the advocacy of 'qualitative SD' can both be seen as attempts to make models carry mor meaning for users and STELLA was an advance in this regard. The combination of technical an less objective elements to validation can be seen in Richardson & Pugh's (1981) approach an shows this interpretation moving to the subjective end.

Arising from these developments we may now identify the emergence of specialised forms o SD - along with the development of existing ones. It is to these that attention now turns.

The broad region **'GDS&OL'** encompasses the application of SD-based intervention performed in a group decision support style and the use to support organisational learning. Thes ideas can be seen as a significant extension - albeit natural and evolutionary - of the leas objective view of confidence: the emphasis throughout is on the provision of tools whic facilitate individuals and groups to take a systemic view of their environment and of the curren goals, actions and policies of the actors within it. The tools provide a language and a process o group association with which opinions can be articulated clearly and discussed so that individual learn together about that environment and decide on a course of action which they believe wi achieve agreed aims and which they support. It is this focussing on group understanding and th belief in the feedback relationship between actors and environment which places these activitie This area contains the majority of SD activities in the world today. The contributors to thi region are large in number so that any list of influences risks offence. Sterman's (1988a) piece o the need to convey understanding and Richmond's concept of the 'strategic forum' (Richmon 1987) are important influences but there are many others. These include Morecroft's (198 connection with the transitional object idea and and Vennix's (1990) Lane's (1992) advocacy c increasingly personal and participative modelling, Lane using 'Modelling as Learning' to describ this form of GDS. Tools include even more usable software, microworlds offering pre-built mode as a path to rapid understanding and archetypes, which provide readily usable CLDs for debatin system problems. Richardson *et al.* (1992) contributed to the understanding of the way c patterning a group process, whilst Senge (1990b) is the most popular expression of the OL usag However, the question of whether the ideas that he advocates can be located within this paradig is problematic.

Some of the activities in GDS&OL have the advantage of a clearly stated theory in Barlas Carpenter (1990). Although they preserve the realist view of what a set of causal links impli about the world, their social conversation view of validation, based on Quine's relativism, may b a significant withdrawal from a positivist and a determinist view. The full importance of th paper has probably not been appreciated to the extent that it deserves.

A number of usages constitute **'Nonconformist Economics'**. Radzicki (1990) describes ho institutional economics draws on the work of Dewey, using pragmatic instrumentalism as attempts to place events into known patterns in order to offer explanations of those events in style akin to cultural anthropology. The proposed use of SD as a modelling tool for institution economics would be located in integrative theory. In this region we can also locate the work c evolutionary economics and stochastic recausalisation.

'Strategic Management Simulation' contains the application of SD almost as tradition simulation modelling by consultants as part of top-down corporate planning. The goal supporting large scale decisions moves this activity further up our diagram but the size of th models, the statistical validation approach and the optimising processes used cause a retreat fro the more subjective, personal experience interpretation of confidence creation

'Austere SD' brings together applications which emphasise the objectivist approach. Here locate the work on the validation of microworlds in which emphasis is placed on collection data. Similarly located is the behavioural decision making work in SD. Mis-understood as

extremist, determinist type of SD (see Jackson, 1993), this is best seen as an attempt to provide an academically irreproachable platform for SD within MIT. The intent is the validation of the feedback perspective as a tool for understanding social systems. This work does not mean that SD is, "caught in an appalling paradox" (*ibid.*, p.22). Rather, by showing that the determinist approach has explanatory power, it arguably underwrites SD as a form of voluntaristic modelling. However, it may be that the search for experimental support of clear rules underlying modelling undermines the subjective elements of these two activities; if a microworld is a transitional object involving personal experience, can it be validated in this way? Or does such an approach smack of abstracted empiricism? Finally, the ideas on bounded rationality may be placed here since their treatment of humans as 'satisfisers' is a modified behaviourism which leaves them responding to their environment in a deterministic way.

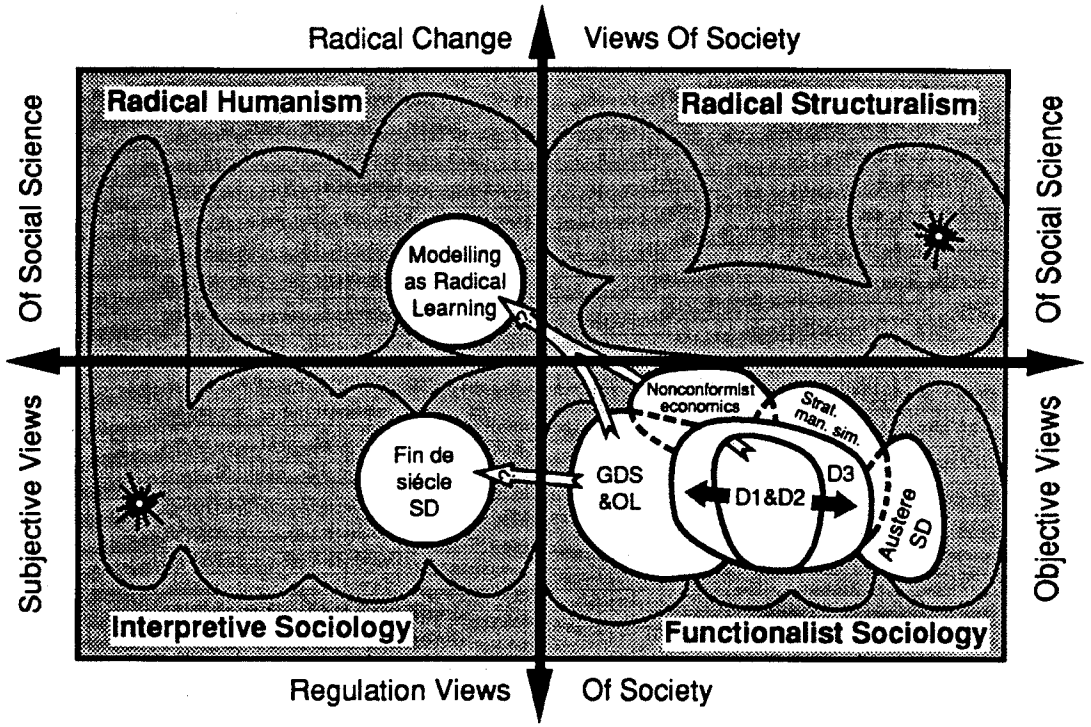

Figure 3

4.2 Using Theory to Propose New Types of SD Practice - When Forrester & Senge (1980) assert that nothing can be proven, only produce a degree of confidence about itself, they hint at the subjective/objective tension at the centre of SD. All approaches have unprovable assumptions; the real issue is the nature of these assumptions. SD practice has shifted the assumptions on ontology and human nature in a more subjective direction but has cloaked this with some stances on epistemology and methodology which remain soundly objective. However, if we probe the evolving understanding of 'confidence' in SD we can see that the 'personal experience' perspective derives from at least three ideas. Firstly, confidence derived from agreement on issue focus. Secondly, the confidence that model builders have in the mental models that they articulate, communicate and are therefore made aware of in the form of a model. Thirdly, confidence engendered by insight generation and knowledge creation and internalisation. These can be viewed as social phenomena, involving multiple perspectives and/or consensus on issue focus, the attachment of meaning to mental models and a personal, experiential and nominalist, approach to learning. These comments open up the possibility of practices grounded in the two subjective paradigms, we call them **'holon dynamics'**.

'Fin de siècle SD' is an envisaged practice grounded in interpretivism. Here modelling as a social process is embraced whole-heartedly. The models are nominalist representations, devices which help humans create their social worlds via debate and the construction of shared meaning.

A nomothetic methodology is inappropriate since model building is accepted as a deeply person experience which can only be understood in its full richness. Papers adopting this paradigm wou take a hermeneutic approach, giving rich and deeply personal accounts of projects, perhaps usi *Verstehen* to enable readers to share in the meaning that had been installed in any models. offering GDS within this paradigm, a phenomenological approach might be adopted, with t creation of a model acting as a powerful device for co-ordinating meaningful group action. both cases generic structures and archetypes may find a new role as ideal types, as suggested Lane (1994). Such practice is influenced by some of the work in GDS&OL, the subjectivist stan being one towards which Lane and Vennix have been moving. The most challenging question does such practice already exist? Perhaps in the works of these authors and others reaching o from GDS&OL? It is this uncertainty that motivates the imprecise name. Senge's (1990b) wo in pluralist contexts (Flood & Jackson *N.B.*) and his ideas on the participative creation of visi statements, may be describing the creation of inter-subjective meaning. The difficulty wi concluding that this work is interpretive is the lack of espoused theory, making any placeme extremely hard. Some commentators feel that the activities described lack any clear methodolo (Oliva, 1993). It will be interesting to see whether Senge ever does choose to articulate a cle social theory for his work and whether he will make the paradigmatic break with functionalism so doing. Perhaps such a step is more likely to derive from more theoretically concern practitioners. Certainly the continued work of Vennix appears to take such an orientation a this author is of the view that his Modelling as Learning can best be advanced in such a wa However, we should not underestimate the careful theoretical efforts needed if the methods of S are to be successfully re-grounded in a different paradigm. Lane & Oliva's (1994) synthesis of t method of SD with the method and theory of SSM aspires to this objective, paying particul attention to ontological issues.

With '**Modelling as Radical Learning**' the field might respond to the challenge that "takes too much for granted in its current belief that learning and freedom can be promoted SD" (Lane, 1994). Clearly the issues concerning political power, ideology, coercion a communication addressed in the radical humanist paradigm are relevant for SD. Can the fie respond by re-crafting in this paradigm? Influences from existing practice support such r crafting. GDS&OL activities offer useful experience. Forrester's New Corporate Design propos that the use of SD insights in an organisation would have anti-authoritarian effects, offering ne freedoms to staff (Forrester, 1965). A great deal of theoretical work will need to be done develop such an approach but, as the name reveals, this is an interest of the author. The high innovative idea of mixing SD with critical theory - using modelling to further communicati competence - offers a truly exciting approach to individual empowerment.

A final point to be made is that such work is under way in other fields, see, for example, Lan (1994) description of 'soft' OR approaches and Walsham's (1993) application of an interpreti approach to information system design. The study and application of subjective approaches management is a minority but nevertheless active area of research.

§5 CONCLUSIONS

Many elements of the analysis in this paper may be subject to dispute. Perhaps the regions SD practice will raise objections, or their positions in the schema. Some readers may dispute t usefulness of the four paradigms, or even the coherence of the two axes. On these points I appe to a maxim from OR, 'all models are wrong but some models are useful'. If this analysis leads debate on the social theory of SD I will count it useful. My belief in the importance of soc theories is different. My reasons are practical and motivated by the experiences in OR in the U They may be expressed in a single quote, "Some practitioners . . . have alleged that the recour to social considerations is an attempt to shelter behind the obfuscations provided by 'sociologic jargon' . . . One could argue the contrary, that the exclusion of such considerations has often be a factor limiting OR's acceptability" (Eden, 1989, p.22). On the relevance of examining soc theory, whatever the approach, I stand firm.

The social theory most consistent with the ideas of Forrester and much of SD practice functionalist sociology. However, over time it has extended in two directions. This was possit because, as created, the field was consistent with a mixture of ideas from systems and integrati theory. D3 can be seen as arising from reasonable interpretations of Forrester's ideas; GDS&C shows the new ideas of other contributors significantly extending the implied social theo

Hence, the subjective region of D3 and GDS&OL arise from an evolutionary development of the field's early assumptions. Keys' almost revolutionary view of these developments is false. Furthermore, the GDS&OL region indicates the field's ability to operate in pluralist contexts; Flood & Jackson's (1991) unitary categorisation is consistent with an outdated, or objectivity-slanted, reading. The new, very different, applications of the SD approach which have either arisen or which now appear as reasonable prospects, use many of Forrester's methods but are (arguably) located in different social theoretical paradigms. However, SD is not an amalgam of approaches (with the contradictions that implies). It cannot break through paradigm incommensurability. Rather, it can be grounded in other paradigms. This is an important assertion since it suggests that although Forrester held certain views in this regard, the range of activities of the SD community does not, as such, have to reside in a particular social theory. Put another way, it may be that, in the sense of Eden (1989), SD does not constitute a (social) theory but may, instead, be a method, which can be applied in different paradigms. This key conclusion implies that knowledge of the paradigm in which the approach aspires to operate is vital to any such applications if scientific consistency and coherence is to be maintained. I state this because I retain my belief in the necessity of some form of scientific rigour. I have no wish to see SD degenerate into an undisciplined approach no better at adding explanatory value to the *Lebenswelt* than astrology or crystal waving. Although this paper advocates the investigation of interpretivist and radical humanist applications of SD, with all the strange difficulties that these imply, this is an attempt to motivate a subjectivist stance properly grounded in the social theories of these paradigms so we continue to practice 'normal science' in the Kuhnian sense. My hope is that a recognition of the implications of my key conclusion will advance the purpose of this paper: to encourage practitioners to reflect upon and explicate the social theory of their practice.

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