A multi-modal systems extension to soft systems methodology

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A MULTI-MODAL SYSTEMS EXTENSION
TO
SOFT SYSTEMS METHODOLOGY

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**ABSTRACT**

This thesis develops a design method for social systems that do not fit the conventional industrial pattern and that consequently are not apt for regulation through mechanical means. It builds upon Soft Systems Methodology (SSM), one of the most widely used and well regarded of design methodologies. Yet, the systems science literature has identified some weaknesses in this methodology, and these have been confirmed in the critical evaluation and the empirical study of this thesis. It was found that SSM tends to be relativistic in normative issues, that its modelling is at times reductionistic and that there are philosophical inconsistencies between its different phases of design.

The task in this thesis has been to preserve the methodological strengths of SSM while at the same time attempt to correct its weakness by combining it with another systems science approach: Multi-modal Systems Thinking. This approach incorporates a multi-dimensional framework of life and a management model to attain viability in social systems. The combination of SSM with this new framework results in a Multi-modal Soft Systems Methodology (Arvidsjaur Method for short) that has been tested empirically in a project for unemployed youth in Arvidsjaur, a small municipality in the north of Sweden.

The Arvidsjaur Method is an effective tool in four ways. Firstly, it incorporates normative standards that overcome the criticisms regarding SSM's relativistic stance. Secondly, it enhances philosophical consistency in the complete design process. Thirdly, it provides a managerial design structure and fourthly, it offers a potential for designing systems that support a holistic, complete and dignified human life. Such an approach is also likely to assist us in appreciating different perspectives of our post-modern society and in making appropriate choices.
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PREFACE

The aim of my research has been to address a social problem we face today. This aim led me to explore a severe problem – youth unemployment. I have applied systems design methodology to a project that deals with unemployed youth to learn more about how systems design could improve their situation. I cannot claim that I have ‘solved’ the problem, or even alleviated it, but I have taken one small step towards framing this situation in a holistic and more humane manner. Hopefully this step will lead onto new perspectives and new ways of thinking for dealing with social problems.

Although I am responsible for the work in this thesis, I am naturally indebted to many people for their contribution, both in academia and in practice. Many people have helped me in different ways and made this research possible. First, I wish to mention my former supervisor, now retired, Professor E. Torsten Lundquist who led me into the field of systems science. Next, my present supervisor Professor J. Donald R. de Raadt continued the professional support and brought my work further through his academic teaching, support, advice and encouragement. I am greatly indebted to him for the focus and outcome of this research. A further acknowledgement goes to Professor Pertti Järvinen who has supported me in this endeavour throughout my years of studies and to Dr. Mary Huston-Somerville.

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errors still remain they are naturally all of my own). Further gratitude is owed to the people who made the empirical study possible: Göran Sjöberg and the ADVANCE people, and the young people at CYA in Arvidsjaur.

I owe a great deal to my family for all their support and help. My mother Mirijam, Göte, my sister Birgitta and her family have all done their share. I also wish to mention my children Alexandra and Samuel, who acted as my research assistants in data gathering and helped me to focus on main issues in young people's lives. Alexandra has also provided me with some of the illustrations in this thesis. I am also indebted to the rest of my family – including Margareth and Malia – who perhaps without knowing it have contributed significantly. Finally, I wish to particularly mention Ulf and dedicate my thesis to him. He has helped me in many ways: contributed in discussions, sorted out my confusions and taken care of practical problems. For this I am most grateful.

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Anita Mirijamdotter
CHAPTER 1:

INTRODUCTION

In the area where I live – in the north of Sweden – the opportunities for young people to enter the labour market has decreased dramatically during the last few years. Every third youth is unemployed or placed in temporary trainee positions. Towards the inland of this part of the country these figures climb to two out of three youth. The situation is even worse since this does not include those who are in re-training schemes and unemployed only part-time. Since they usually are not qualified for unemployment funds, because they have not had a job, social security provides an allowance for these young people. However, even economic compensation would not compensate for the mental distress that people undergo. Social isolation, depression, problems with alcohol, suicides and attempted suicides are on the increase among youth.

The municipalities arrange workshops to keep these young people occupied until they find a job. However, not many opportunities arise for young people with no academic education, low motivation or capability for study and practically no professional experience. There is an increase in available jobs, but these go to qualified people working with technology, such as computer consultants. Furthermore, increases in industrial demands are often met by rationalisation and mechanisation rather than by job creation. The municipalities have tried to create jobs by courting technically oriented companies to set up operations in their areas but this has not worked. Rather there is a growing awareness among them that new ways of thinking are needed and that people may have to create their own job opportunities.

Moreover, young people who have grown up in a rich society are not attracted to mechanical and monotonous jobs. They wish for interesting and stimulating jobs
where they are challenged and where they can grow and develop. The frustration of these unrealistic expectations often leads to anxiety, loss of confidence and fears about the future. Young people experience a lack of humanity in our modern society and see no role for themselves in the world. “People become suffocated in their souls” (Engberg 1997).

It is common practice today for governments to attempt to regulate this kind of situation by pure economic means and by rationalisation and mechanisation using information technology (IT). This economic regulation is exercised at the expense of other types of regulations, such as the social, emotional, ethical and historical aspects of social systems which are as important to humanity as economics. Yet they are largely ignored in modern organisations. Organisations are now expected to function as businesses. Services which in the past were not dominated by economics, have now been transformed into industries such as the sports, arts and health industries (de Raadt 1996). We are designing systems that are less and less humane. One reason for this is the influence of a mechanistic view of life that has dominated since the industrial revolution.

The mechanistic view has raised much critique in the systems sciences. In the fields of management and information systems this critique has resulted in attempts to develop methodologies to design systems that view man as other than a mere machine. Soft Systems Methodology, SSM (Checkland 1981; Checkland & Scholes 1990; Wilson 1990) is such an attempt. SSM started from the premise that human systems are different and need to be dealt with in a holistic way. SSM addresses culture, norms, roles and what is meaningful to the individual. It sees the system as being shaped by its cultural and historical context which must be understood in problem solving. SSM also recognises different roles, both formal and informal. In addition, norms and behaviour associated with these roles are also addressed. The belief is that in order to function, systems need to be meaningful to individuals. The individual is important.

However, SSM has its limitations. While the methodology emphasises the different perspectives of men and women and their ability to understand the system by relating it to previous knowledge, meaning and values, it does not offer a standard
against which these different perspectives can be measured. A repeated critique of SSM is that one perspective is as valid as any other, e.g., Flood & Ulrich (1990), Ivanov (1991), Jackson (1991). When a standard is not provided there is confusion over which perspective should guide us. It may be that of those who are most powerful. In a business system SSM may thus become one more tool to manipulate the organisation to serve the needs of management while ignoring other aspects.

Thus, the problem of differing perspectives points to the need for systems designers to establish a standard against which the design is directed when considering the aspects or dimensions necessary for a truly humane system. This is the point of departure of this thesis. It attempts to develop a new framework for systems design that incorporates dimensions outside mere economics. It builds upon Soft Systems Methodology and it incorporates the work of Multi-modal Systems Thinking, MST (de Raadt 1989; 1991; Strijbos 1995), to address the criticised limitations of SSM.

Multi-modal Systems Thinking strives to incorporate the various dimensions of human life. This methodology builds upon the work of the philosopher Herman Dooyeweerd (1953) who, through studies of the philosophy of law, identified distinct modalities in human experience and thought. The new framework presented here guides each stage of design: the collection of data, the analysis, the modelling and the evaluation of the proposed changes. It is my aim that through the application of this framework designers will incorporate dimensions of human life that have been neglected in the past. If some dimensions are not considered, it should be a conscious choice; it should not be out of ignorance or neglect.

This framework has been applied in Arvidsjaur, a municipality situated in the inland in the north of Sweden, to a project dealing with unemployed youth. Job opportunities in this municipality, based on forestry and mining, have decreased dramatically. The municipality’s strategy to overcome its problems by attracting IT companies has failed: the unemployment rate among youth has climbed even higher. Fearing the tragic consequences for these young people, the unemployment project aims at keeping them occupied and at the same time providing some work experience. It is within this context that this thesis has been evaluated empirically.
Introduction

The thesis is organised as follows: Chapters 2 to 6, comprise a critical review of Soft Systems Methodology (SSM), one of the two systems approaches upon which this work builds. Chapter 2 focuses on SSM’s main characteristics and how these are depicted in its process, while Chapters 3 to 5 examines each of its design phases. SSM has been criticised for its lack of guiding standards. A brief summary of this critique is included in Chapter 6.

Chapters 7 to 10 examine the second systems approach in this thesis, Multi-modal Systems Thinking (MST). Chapter 7 is an overview of the main ideas adopted in this research, while Chapters 8 to 10 illustrate similarities and relationships between MST and SSM. In these chapters I have also developed my framework for merging the two approaches. The framework is a Multi-modal Soft Systems Methodology (MSSM) but I shall also refer to it as the Arvidsjaur Method for convenience.

Chapters 11 to 13 comprise the empirical part of the thesis in which the Arvidsjaur Method is applied to the unemployed youth project in Arvidsjaur. Chapter 11 introduces the study and the area of application. It also recounts the methods for data gathering and the findings. In Chapter 12 we continue to the modelling phase. In this chapter different models are developed to test the effectiveness of adding multi-modal capabilities and to build in accordance with the Arvidsjaur Method. Chapter 13 evaluates the two approaches (SSM and the Arvidsjaur Method) in terms of their modelling capacity, their ability to set standards, to adequately represent human situations and facilitate learning.

The final chapter of the thesis, Chapter 14, summarises this research and gathers its findings. The conclusion is that the Arvidsjaur Method provides the necessary extension to make SSM a more effective design tool. It alleviates the criticism regarding SSM relativism, it enhances philosophical consistency in the complete design process and it provides managerial components lacking in SSM. Finally, it offers a potential for designing systems which support a holistic and dignified view of human life.
PART ONE:

SOFT SYSTEMS METHODOLOGY (SSM)

This part comprises a literature review of Soft Systems Methodology, SSM. It begins by giving a background to the development of SSM and by introducing its main ideas. The use of systems ideas to illustrate purposeful activity is then reviewed in the section on soft systems thinking. It is followed by a delineation of SSM’s interpretivist philosophy. In the light of SSM’s view on design as a learning process Stolterman’s model of the design process is then discussed. The learning models of SSM are examined in three subsequent chapters (Chapters 3-5) which follow the SSM phases, Finding Out, Systems Modelling and Taking Action.

In Chapter 3 the techniques offered for finding out about the real-world situation are examined. We also discuss some problems principally related to SSM’s subjective nature. Chapter 4 focuses on systems concepts. It reviews those concepts that are recommended for use in the modelling of this phase and problems that emerge because recommended techniques are based on an engineering perspective. Chapter 5 reviews the application of these models and the learning process that follows.

Chapter 6 concludes Part One. It examines the criticism of Critical Systems Thinking. This is followed by a summary and conclusions of the previous chapters.
CHAPTER 2:

BACKGROUND

Soft Systems Methodology, SSM, evolved through an action research programme at Lancaster University, starting in the late 1960 (Checkland 1972; 1981; Checkland & Haynes 1994; Checkland & Scholes 1990b), as a reaction against the traditional management sciences' view of reality as being objective, neutral and value free. The main aim of the programme was to explore the contribution that system ideas could make on managerial real-world problems. These problems are different to the problems that researchers study in a laboratory environment. In a laboratory setting the researcher can define the problem and control the environment (Checkland 1981: 150). A real-world problem is not well-defined and, because of its complex relation to the environment, cannot be studied in isolation. Rather, these problems are “multi-faceted and resist solution by any single technique” (Checkland & Griffin 1970: 29). Furthermore, because of the complexity, one real-world problem is not identical to another and therefore it is not reasonable to work out techniques that are problem-related (Wilson 1990: 101). Hence, the concern of the programme was to provide principles to act on which the analyst can adapt and which enables him to remain problem oriented. Since experience from engineering had shown the strengths and benefits of using a systems approach to integrate different analytical approaches in technical problem, the Lancaster program began to explore the possibility of using similar concepts to managerial problems. The intention was to use systems ideas to find a structure in many-sided and apparently unstructured real life problems.
2.1: Soft Systems Thinking

To understand the existing systems methodologies, Checkland made a categorisation of the universe into five different classes: natural systems, designed physical systems, designed abstract systems, human activity systems, and transcendental systems (Checkland 1971; 1981: 109ff); see Figure 2:1. He stated that anything in the world that may be described as a system either belongs to one of the classes or to a combination selected among the five.

![Diagram of system classes](image)

Figure 2:1. Basic Classes of Systems (after Checkland 1971; 1981).

Natural systems, the first class, are those which originate with the universe. Human beings are a part of this class of systems. Designed systems have their origin in man. They are designed as a result of some human purpose, and they exist to serve a purpose. Designed physical systems, the second class, represent concrete ‘things’, while the third class, designed abstract systems, are a product of the human mind. The fourth class, human activity systems, are directed, firstly, towards:
the physical collections of components which are the ‘structured’ set which make up the system; and secondly, because of the nature of the human component, there are the activity systems which are concerned with the management, in the broadest sense, of these systems (Checkland 1971: 110).

In this definition, everything that is carried out by humans is labelled a human activity system. Members of this class consist of a number of activities that together form a ‘whole’, and that are linked to each other as a result of some principle of coherency, some underlying purpose or mission.

However, although everything that is carried out by humans is placed in the category ‘human activity system’, social and cultural systems are not (illustrated in the right bottom of Figure 2:1). “Social systems are a special case”, Checkland (1971: 110) states, and places them in-between natural systems and human activity systems. Most human activity systems exist as, or within, a social system and there are many human activity systems whose objective is mainly social.

But it would be wrong to place social and cultural systems within the boundary of human activity systems. ... They are the context of virtually all human activity but at the same time they are also natural systems due to the fact that man is a gregarious animal who has a basic need for the supports provided by his fellow human beings in community life (Checkland 1971: 110).

Thus, social and cultural systems are stated to be something ‘more’ than just formed out of human intentions. They are also a kind of natural system which has its origin with man. Furthermore, human activity systems and designed systems are seen as fundamentally different from natural systems, since they are designed by humans.

The difference lies in the fact that such systems could be very different from how they are [because they have a purpose in mind], whereas natural systems, without human intervention, could not. And the origin of this difference is the special characteristics which distinguish the human being from other natural systems. ... the uniqueness of man include the same common factor: self-consciousness (Checkland 1981: 115f).

Hence, the physical man and aspects of cultural and social systems are not self-conscious and therefore cannot choose their ‘destiny’. They are ‘determined’ to be the way they are. But other aspects of man, and of cultural and social systems, make it possible to intervene and decide on ‘destiny’, that is, decide on one way rather than another. However, Checkland does not further elaborate on determinative and normative aspects of man, and of cultural and social systems.
The fifth basic class, transcendental systems (left bottom of Figure 2:1), represent systems beyond knowledge, e.g. the concept of God.

Human activity systems as well as designed systems exist to serve a purpose but, because humans attribute meaning to what they observe, the purpose of human activity systems is not as obvious as that of designed systems. A further aspect is that the purpose of a designed system is static, regardless of time and situation, while the purpose of a human activity system may change, and therefore, change the actions taken within the system. For instance, the purpose of a refrigerator is always to chill groceries so that they will keep, but the purpose of designing a refrigerator might one day be to save humanity from getting sick by bad food, another day to make money through technological invention or to exercise the mind. The purpose of designing determines what activities are relevant and in what order they are performed. Hence, independent of our belief on the nature of reality, human activity and its interpretation can be conceptualised as a system. This realisation marked a shift in the epistemology\(^1\) of systems thinking and distinguished two paradigms\(^2\): ‘hard systems thinking’ and ‘soft systems thinking’\(^3\) (Checkland 1981; 1985a; 1988b; Checkland & Scholes 1990b).

The starting point for the Lancaster group were the methodologies available at that time – Systems Analysis and Systems Engineering (Checkland & Griffin 1970). These methodologies, now called ‘hard systems methodologies’, start by defining a problem, a need or an objective we wish to accomplish, followed by definitions of alternatives by which the need can be met and choice of the best alternative to be implemented. These methodologies have their strengths when there is a clear understanding of the problem and of what one wishes to accomplish. But the Lancaster researchers found that this is not the case in complex managerial real-world

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\(^1\) Epistemology refers to origin and nature of our knowledge; in particular, how we acquire knowledge (Hirschheim 1985).

\(^2\) Paradigm includes “the most fundamental set of assumptions adopted by a professional community that allow them to share similar perceptions and engage in commonly shared practices” (Hirschheim & Klein 1994: 108).

\(^3\) Other scholars have also contributed in creating a ‘soft’ tradition, e.g. Ackoff (1979); Churchman (1971); and Mason & Mitroff (1973).
problems. Here the difficulty, the real problem, lies in defining the problem itself. In this context a ‘problem’ is seen as “a mismatch between intention or expectation, and outcome” (Checkland 1972: 88). In a real-world problem many different and interrelated facets are present and therefore numerous definitions of the problem are possible. Once a problem is defined its solution is usually implied. Therefore, the ‘hard’ methodologies had to be adjusted to fit the managerial problems that the Lancaster researchers focused on; the methodology had to become “a means of organizing discussion, debate, and argument rather than a means of engineering efficient ‘solutions’ ” (Checkland 1981: 191).

Hard systems thinking assumes the world is mechanic, that is, contains systems which can be modelled and ‘engineered’. It is characterised by its reasoning in terms of means and ends to be achieved. Hard systems thinkers assume reality to be objective, that is, that reality looks the same regardless of who is the observer. Consequently, the ‘system’ itself is not perceived as problematic; problems are defined as the difference between the present situation and a desired situation. The role of methodology is to provide systematic (and by that, it is assumed, efficient) guidance in the process of finding the solution. This is usually done by searching for alternative means and then choosing the optimal for meeting the desired end. In Checkland’s words (1988b: 242), methodologies based on this approach

assume that what ‘the system’ is is not problematical, that the system's objectives can be defined, and that alternative means of achieving them can be modelled and compared using some declared criteria, enabling a suitable selection to be made of the most desirable form of the system. This can then be implemented and monitored.

Soft systems thinking does not assume that the world is systemic and well-ordered; on the contrary, it assumes social reality to be ‘problematical’, characterised by multiple angles of approaches and perspectives. The understanding of reality is dependent upon the observer, his interpretations and what he chooses to focus on. Consequently, it considers that the real ‘problem’ is not to find solutions, but to define the problem itself4; and there are many possible perceptions of what constitutes the problem. The view of social reality, implied in SSM, is that

4 Once a problem has been defined its solution is usually implied.
it is the ever changing outcome of a social process in which human beings continually negotiate and renegotiate, and so construct with others their perception and interpretations of the world outside themselves and the rules for coping with it. These rules are never fixed once and for all (Checkland 1988b: 246).

Thus, SSM does not make any ontological\textsuperscript{5} statements about a systemic reality. Instead it uses systemic models as epistemological devices to inquire and learn about the different perceptions of reality, being conscious of that these models are not models of real-world activity, they are models relevant to debating it (Checkland 1988b: 244).

Checkland suggests the word ‘holon’ (Checkland 1988a) to distinguish the epistemological use of ‘system’ from its use in everyday language, for example, juridical system. This word (holon) has been adopted from Koestler (1989). He suggested the name for the abstract concept of a whole having emergent properties, a layered structure and processes of communication and control that in principle enable its survival in a changing environment.

Hence, in soft systems thinking the systemicity is no longer assumed to be in the outside world; it is in the methodology for enquiring into the perceived world. The difference between ‘hard’ and ‘soft’ systems thinking is summarised thus

the ‘soft’ tradition regards system models as models relevant to arguing about the world, not models of the world; this leads to ‘learning’ replacing ‘optimizing’ or ‘satisficing’; this tradition talks the language of ‘issues’ and accommodations' rather than ‘solutions’ (Checkland 1985a: 765).

Furthermore, besides making use of these systemic models to learn about the world, the process of inquiry is itself constructed as a system, thus being capable of adapting to the achieved learning. This makes SSM in fact “doubly systemic” (Checkland 1985b: 821). It is, as a whole, a learning system that makes use of systems models.

The distinction between the two paradigms, ‘hard’ and ‘soft’ systems thinking, is recognised as a major contribution and has attracted much attention. In Flood & Ulrich (1990: 8) it is pronounced as “the first epistemological break in our

\textsuperscript{5} Ontology refers to the nature of the world around us; in particular, that part of reality which the scientist chooses to address (Hirschheim 1985).
understanding”. Instead of assuming the nature of reality (ontology) to be systemic, SSM claims that the process of inquiring into reality (epistemology) can be systemic and makes no assertions about reality itself.

However, SSM’s neglect of making assertions about reality and thereby of giving direction for its inquiry, has resulted in “a call for a second epistemological break toward a critical approach in systems thinking” (Flood & Ulrich 1990: 8). This second break is discussed in the final chapter of Part One.

2.2: INTERPRETIVISTIC PHILOSOPHY

The central idea around which SSM developed is that individuals interpret situations according to what they find meaningful. What is perceived as meaningful is based on individual preferences, background, knowledge and experience. Thus, SSM positions itself within the interpretivistic tradition and particularly in the philosophy of phenomenology\(^6\) and hermeneutics\(^7\). This kind of thinking can be contrasted to the positivistic tradition in social science. Walsham (1995) identifies precisely the core of their difference: positivism takes the position that facts and values are distinct and that scientific knowledge consists only of facts; interpretivism views facts and values as intertwined and hard to disentangle. This means that both facts and values are involved in scientific knowledge.

Positivism\(^8\) originates in the work of August Comte (1798-1857). Its basic beliefs are that the world exists externally and that it is objective. This means that scientific knowledge about the world is derived independently of the observer, that it is value-free and that it consists only of facts. Furthermore, these facts are experienced by our senses; thoughts or ideas that cannot be derived from our senses

\(^6\) Phenomenology originates from Edmund Husserl’s (1859-1938) work and concerns mental processes in our thinking about the world rather than the external world itself (Checkland 1981: 273).

\(^7\) Hermeneutics refers to the study of interpretation, particularly the process of coming to understand a text (Boland Jr. 1991).

\(^8\) For accounts of the positivistic stance, see for instance: Checkland (1981: 267ff); Easterby-Smith, Thorpe & Lowe (1991); Hirschheim (1985: 22ff); Hughes & Månsson (1988: 12ff); and Patton (1989: 269ff).
are not ‘real’. The positivistic tradition views the natural and social sciences as based on the same logical foundation and transfers therefore the method of natural sciences to the studies of social phenomena. Social science is thus taken to be the objective study of social facts.

Interpretivism criticises positivism for placing scientific knowledge above ordinary knowledge: Positivism regards ordinary knowledge as incomplete and easily misrepresented. Interpretivism also criticises positivism for discussing subjective factors and actions as pre-determined by causal laws. Hughes and Månsson (1988: 30ff) points out that the model of social reality built by positivists will always compete with models built by the social actors themselves. Members of a society need knowledge to build up and maintain a co-ordinated social life; this knowledge resides on the models of the social actors rather than on the fragmented models of traditional science. To understand the actors’ models, a new way of thinking, the Verstehen approach or understanding from within, has been developed.

The verstehen approach assumes that social sciences need methods different from those used in natural sciences because human beings are different from plants and nuclear particles. This approach stresses understanding that focuses on “the meaning of human behaviour, the context of social interaction, an emphatetic understanding based on subjective experience, and the connections between subjective states and behaviour” (Patton 1989: 45). Wilhelm Dilthey (1833-1911), who was concerned with establishing the fundamental difference between the social and natural sciences, is associated with this approach. Dilthey argued that social phenomena, in contrast to natural, cannot be studied in isolation but needs to be put in context because “individuals do not exist in isolation, they need to be understood in the context of their social and cultural life” (Hirschheim 1985: 22).

Dilthey also developed the concept of the “hermeneutic circle” (Dilthey 1961) and argued that it was a necessary part of the learning process. The hermeneutic circle refers to the recognition that the social whole cannot be understood from any

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9 For accounts on Dilthey's contribution, see for instance: Checkland (1981: 276f); Hirschheim (1985); and Stowell (1993).
part in isolation. A single part can be given meaning but, when placed within the whole, may take on a different meaning. Therefore, to understand the actions of individuals we need to include the totality of the human world; “we must interpret the inner meaning of outer manifestations and relate the part to the whole” (Stowell 1993: 93). The idea of the circle is that no knowledge is possible without presuppositions and that the learning process is circular with no fixed or starting points. Iterations between interpreting parts and relating them to the whole gradually lead to increased understanding of social reality.

Dilthey's ideas on interpretation and understanding were adopted by Max Weber (1864-1920 who introduced the interpretivist perspective and made the subjective aspect as a central part for social research. Contrary to positivism, which regards the subjective dimension as an irritating problem or of no relevance, Weber considered it a necessary part of social science which the researcher cannot exclude. The subjective aspect is, in Weber's view, what characterises social science and distinguishes it from natural science\(^\text{10}\). But Weber did not, as Dilthey did, regard the world as consisting of two fundamentally different ontologies\(^\text{11}\), one objective and open for studies in the natural sciences, and the other subjective and only able to analyse through empathy and \textit{verstehen}. Weber advocated that the difference was rather methodological than ontological and due to different ways of knowing. The same reality can either be represented as history or as natural science. By assuming only one reality, Weber capitalised on the advantage of both \textit{verstehen} and scientific objectivity.

Weber's methodology for \textit{verstehen} includes both the meaning of an action to the individual and the meaning that the social group as a whole ascribes to that action. For instance, my neighbour is painting his fence and I offer to help him. My neighbour and others (the social group) think that I am a very nice person and that it is very kind of me to offer my help. However, I intend to repaint my house and

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\(^{10}\) See for instance, Checkland (1981: 268ff); Hughes, Martin & Sharrock (1995: 87ff); and Hughes & Mårtensson (1988: 37ff) for accounts on Weber's work.

\(^{11}\) Ontology refers to the nature of the world around us.
therefore I offer my help because I expect to get the same offer back from my neighbour. So, I offer my help not out of kindness, but mainly out of selfish interest. These two types of ‘meanings’ are, by Weber’s methodology, incorporated in a scientifically constructed ‘meaning’, the ‘ideal type’. This is a theoretical model reflecting the phenomenon and consisting of elements the researcher considers to be of interest. The model is compared and evaluated in relation to actual social behaviour. The purpose of this approach is not to describe the world nor to criticise or judge it; the purpose is to identify problems important to consider when designing social actions and, linked to the requirement of science, to find causal laws or causal connections which explain social behaviour.

Weber’s theories of the subjective meaning behind social action was carried on in the work of Alfred Schutz (1899-1959). However, in Schutz’ view the social world is not solely subjective; the world is not private, personal and unique to each individual, but rather an intersubjective phenomenon. In order to create and maintain social relations we have to assume that the world is similarly understood by every individual, that it is experienced as something we have in common. Schutz criticises Weber’s model for not dealing with the intersubjective nature of social reality. It does not give us any explanation of how each individual’s understanding becomes sufficiently reciprocal and similar in nature to be able to produce the orderly world we live in. Weber never clarified what the interpretations really look like. Instead Schutz looks for guidance in the phenomenological tradition, mainly founded by Edmund Husserl (1859-1938) who also was Schutz’s teacher.

Phenomenology searches for the foundation of human knowledge, but not (as in positivism) by studying our sensations of the outer world. Its search is based on the structure of human consciousness. Phenomenology aims at understanding reality as a construct of the human mind, either psychologically (subjectively) or socially (intersubjectively). The assumption is that we do not meaningfully experience unorganised data, but always attempt at making sense of them by capturing their essence in a holistic construct, in a Gestalt. Further, prejudice (or pre-understanding) is a necessary condition for our constructs; the phenomena are the totality of what we can know. Thus, in order to understand what we encounter we build on to previous
experience. Husserl himself was interested in the basic elements of human consciousness. Because of the above assumptions, he approached the problem by the method of “epoché”, i.e. by reducing, one by one, our experiences and pre-knowledge of the world we live in (Lebenswelt) till finally reaching the ‘pure’ consciousness. This, Husserl believed, would explain the universal structure of mental processes.

Schutz did not continue Husserl’s work on disentangling human consciousness. He took more interest in what Husserl termed the Lebenswelt and studied the structure of every-day knowledge or common sense and how the common-sense knowledge is socially structured and distributed. Schutz’s model of the phenomenological life-world recognises three types of relevant structures: motivational, thematical, and interpretational. He saw the task of sociology to be to study to what extent these three types are socially and culturally conditioned. The motivational aspect is relevant as a result of current interests, the thematical rests on our conscious knowledge, and the interpretational applies to prevalent standards. This model is close to Soft Systems Methodology’s view of social reality in that it assumes the individual to single out what is not of current interest and focus on what is meaningful in the light of preferences, background, knowledge, experience, etc.

Another strand of thinking, also represented in SSM, is the philosophy of hermeneutics, i.e. “the theory, art or skill of interpretation and understanding the products of human consciousness” (Checkland 1981: 276). However, hermeneutics is not a homogeneous trend. In studies of modern philosophical schools, Visala (1993: 104f) points at ambiguities in the hermeneutical tradition.

Hermeneutics is generally considered a doctrine of the philosophy of science opposed to positivism. It strives to exceed the objectivism of positivism, accepting the meaningful character of things of human origin, though some hermeneuticians believe in the objectivity of hermeneutic knowledge.

Hermeneutics originally concerns interpreting texts to create shared understanding, recognising that knowledge is created in humans and not solely to be picked 'out there'. Yet in contemporary applications there is not a clear-cut definition of what distinguishes the position of hermeneutics. Visala (1993) identifies three strands of thinking: hermeneutical theory, hermeneutic philosophy and critical hermeneutics.
The first strand is concerned with correct understanding and “strives for an objective interpretation of ‘meaning-full’ (sinnhaltige) forms” (Visala 1993: 105). The second matter, hermeneutic philosophy, disagrees with hermeneutical theory with reference to the objectivity of understanding and focuses on language, stating that “language conveys the pre-knowledge of tradition” (Visala 1993: 106) and that our knowledge is always bound to our prejudices. Thus, every interpretation is always a new one and is dependent on the situation. Hence, we cannot reach objective knowledge about the past. Finally, critical hermeneutics draws upon hermeneutical philosophy in that language may be rooted in tradition but claims that it may also convey ‘false consciousness’ due to distorted communication. This strand alleges that science has the task of emancipating people from being dominated by other people or their own ‘false consciousness’.

Where SSM stands among these three is not quite clear. On one hand Checkland strives for ‘correct’ interpretations. When giving accounts of various SSM cases, there seems to be one appropriate way of interpreting the situation. For example in the textile firm, a new Marketing Director wanted to put pressure on the production section

whose planning and scheduling performance he regarded as inadequate. It was at once apparent that this was correct, but equally apparent was the fact that perfecting the production planning system would have a negligible effect on the Company’s main aim, which was now nothing less than survival (Checkland 1972: 94).

This way of valuing the situation, stating that there actually was inadequate planning and scheduling performance, lead one’s thought to hermeneutical theory. The reader assumes that the situation has been studied carefully and, since “it was at once apparent that this was correct”, the reader is also lead to assume that this reality also consists of incorrect interpretations.

However, in the very essence of SSM is the idea of interpretation linked to weltanschauung, or world view, which points at the second strand, hermeneutic philosophy. In Weltanschauungen analyses the common underlying view is that “observations and facts are theory-laden and meanings are theory-dependent” (Visala
1993: 110). Thus, there cannot exist any correct interpretation since interpretations are bounded to our beliefs, assumptions and our theories about the world.

Finally, concerning the third strand of thinking, SSM is criticised for its lack of ‘objective’ standards; it is regarded as conservative in nature, management-driven and preserves status quo (e.g. Flood & Ulrich 1990; Ivanov 1991; Jackson 1991; Mingers 1984). Soft Systems Methodology’s intention is not to “diminish the freedom” nor “to force it [real life] into a more rational form” (Checkland 1981: 173; 181). Instead it wishes to portray itself as being open and participatory. But, as Jackson (1991: 133) points out

the kind of open, participative debate which is essential for the success of the soft systems approach, and is the only justification for the results obtained, is impossible to obtain in problem situations where there is fundamental conflict between interest groups which have access to unequal power resources.

This criticism, which is directed towards all subjectivist methodologies, looks for support in critical hermeneutics. However, Atkinson and Checkland (1988), Kreher (1993a) and Walsham (1993) claim that recent developments in SSM that include some analysis of power and conflict, show it as being capable of applications other than purely consensual.

Which strand of hermeneutics that SSM supports is, thus, not quite clear. There have been attempts to strengthen the hermeneutic theory within SSM by combining it with grounded theory (Brown 1992). However, Kreher (1993a) dispute this approach and builds his arguments on SSM’s interpretivistic nature, and hence, hermeneutic philosophy. Other work, based on SSM (Stowell & West 1994), points towards critical hermeneutics. Thus, there is a need to clarify the hermeneutic thinking within SSM. Firstly, with reference to hermeneutical theory and hermeneutic philosophy, since the former strives for authentic and ‘objective’ interpretation while the latter focuses on subjective interpretation. Secondly, with reference to hermeneutic philosophy and critical hermeneutics, since the former gives no direction for the interpretations while the latter looks ‘outside’ for reference (Grahn & Bergvall 1994). Thirdly, with reference to critical hermeneutics and hermeneutic theory, since the former has a political purpose in emancipating people while the latter claims a more neutral position.
Thus, in SSM social reality is assumed to be different from the reality that is researched in the natural sciences. According to Checkland (1981: 285), it is reasonable to assume that there is an unchanging physical, chemical, and biological world ‘out there’ and that we can find out about it by using the method of the natural sciences.

However, concerning social reality Checkland (1981: 285) states that no once-and-for-all substantive account of social reality is possible because there is no social reality to set alongside what appear to be the well-tested physical regularities of the universe.

Instead, he continues, since our knowledge cannot hope to achieve the kind of certainty as in the natural sciences the way one finds out about it may in principle be reasonable stable; hence the importance of methodology rather than findings, of process rather than content (Checkland 1981:285).

Checkland emphasises methodology rather than findings because he believes that there is no universal knowledge about social reality to discover. He rather believes that knowledge is its own end; that “continuous, never-ending learning is a good thing” and that “learning and re-learning is worth-while” (Checkland 1981: 285).

### 2.3: Systems Design

Soft Systems Methodology (SSM) has raised much interest and attention within the interpretivistic strand of information systems. It was recognised that SSM models of human activity systems could be used to draw information flows (Checkland 1984; Checkland & Griffin 1970). Much research has aimed at using SSM for information requirement analysis, e.g. Checkland & Holwell (1993), Mingers (1995), Wilson (1990) and Winter, Brown & Checkland (1995). Other research has combined SSM with information systems design methodologies, e.g. Avison & Wood-Harper (1990), Gregory (1995), Khlaif, Malbaski & Obradovic (1989), Moll (1986), Savage & Mingers (1996) and Stowell & West (1994). In addition to this, there is research which point at problems of combining methodologies with different philosophical underpinnings, i.e. the problem of combining interpretivistic and functional
methodologies; see for instance, Checkland (1992b), Holwell (1992), Jayratna (1992) and Lewis (1993). SSM aims at understanding different interpretations in inquiring and learning about reality and recognising that there is no single, correct interpretation. Functional methodologies, on the other hand, formalise reality into functions and since their aim is to engineer such functions, they are only interested in one single interpretation of that reality. Conventional information systems design methodologies are usually based on a functionalistic approach and therefore, since SSM's and these latter methodologies' views of reality are different, their combination may cause problems. Finally, in an attempt to view the information systems field as a whole, a process model is developed based on SSM which links human agents, organisation and technology (Checkland & Holwell 1998).

The aim of this thesis is to strengthen, support and further develop the interpretivistic aspect of SSM by proposing a theoretical framework to be incorporated into its design. The framework is not based on functions but on a diversity of aspects that humans experience in their daily life and these aspects should therefore be reflected in the systems we design.

Systems design is in this context viewed as a creative process to design a ‘new’ reality rather than ‘fixing’ a malfunctioning one. It is found similar to other design processes where each design is regarded as unique and with an end product that is not given (Stolterman 1991). Furthermore, the design process is constrained by restrictions or ideals and formed by ‘template models’ that further strengthen its unique character. It is often believed that creativity presupposes no constraints, but others advocate that without constraints there is no creativity, only fantasy:

Real creativity, in contrast to phantasy [fantasy], is immediately confronted with the constraints generated by the means, the resources, the material support of creative expressions (Hoebcke 1988: 337).

In being creative one works within given means and explores how to make the best out of them to convey the intention of the work. Furthermore, “struggling with those constraints in a social context creates meaning out of it” (Hoebcke 1988: 337), that is, learning.
A simplified description of the design process comprises, according to Stolterman (1991: 79): thought figure, design situation, vision, operative image and product. Figure 2:2 illustrates this simplified description.

The assumption is that the designer has gained knowledge through life of different aspects of practice and formed them in a collection of thought figures. These are illustrated in the top left of Figure 2:2. The thought figures, or ideals, are the intellectual tools of the designer and, when faced with a design situation (left centre of the figure), they give birth to a vision (depicted to the right in the figure). The vision is the first design proposal and will influence the relation between the thought figures and the design situation. The vision is transformed into an operative image (right centre of the figure) which is a more concrete design suggestion. The operative image is contrasted with the design situation and the vision and further developed until a basis for work is reached and a product (the centre bottom of the figure) can be made.

Figure 2:2. A Schematic Model of the Design Process (after Stolterman 1991).

The dotted line that crosses through the figure is to differentiate mental activity (illustrated above the line) from the more concrete and visible aspects of the design process (beneath the line). The outcome of the design process, the product, is thus the result of a merging between the designer’s abstract mental models and the more
concrete specifics of the situation that in turn are also interpreted and understood through the designer's mental models. The design process then becomes mainly concerned with mental activities; to put it boldly, “to construct in the head, that is to design” (Le Moigne 1989: 332). In this light it is crucial for systems designers to be aware of their intellectual tools (ideals, thought figures, mental models) and that systems design methodologies further the development of these tools.

There is much attention, in past and present information systems research, on developing design methodology. The attention has often resulted in recommendations for ‘good practice’ with the aim of systematising and improving the process of designing information systems. Avgerou and Cornford (1993) give a historical perspective on methodologies for information systems design and the issues that have been addressed by this movement. The authors note that the information systems community have been much pre-occupied with methodologies,

indeed, so pre-occupied has the information systems community been with devising and discussing methods, that even major new themes, such as information systems management and the strategic uses of information systems, have been dominated by the same concern, namely how to carry out the job methodically (Avgerou and Cornford 1993: 277).

Stolterman (1995), after reviewing published articles in the Scandinavian Journal of Information systems, also finds that information systems research, as represented by this journal, is mainly dominated by the practice of developing information systems. It seems as if researchers within information systems

see research [either] as a way of helping systems designers in their practice or as a way of helping users or buyers to get what they want or need (Stolterman 1995: 124).

Stolterman’s point is that research related to practice should not be limited to the workplace but needs to be put in a larger context, for instance, as a part of modern society and should be analysed in terms of some overall values and ideals. “If we want fundamental change in practice we need to influence the values and ideals of practitioners” (Stolterman 1995: 125). The contribution of research should be to criticise, analyse and provide reinterpretations of practice, thus enabling designers to increase the awareness of their intellectual tools and develop their design abilities, i.e. their skill to “construct in the head”. By that, the designer's readiness to act in practical problem situations is also improved.
Frameworks of ideas enable creative thinking in design actions. Such frameworks provide the means for the designer to develop his design ability. The design process which supports the further development of the designer’s design ability, i.e. the further development of his intellectual tools, becomes then a process of learning. Thus, frameworks of ideas empower the designer in the development of his intellectual tools and enriches his learning.

Soft Systems Methodology claims to be such a methodology for learning. The use of models of individuals' interpretation in a discourse enables learning to take place. SSM itself is also constructed as a learning system.

2.4: The Learning System of SSM

Soft Systems Methodology adopts the learning approach of Vickers’ appreciative systems (Vickers 1983b). After his retirement Vickers tried to make sense of more than 40 years of working life experience. The outcome of this work is a number of books and papers. Vickers is resembled to Chester Barnard and Henri Fayol, both classical management scientists who also provided reflective contributions to management thinking after successful practical careers (Blunden 1985). Vickers interprets management in a very broad sense as a part of governance in which forming judgement is the central task. The rationale for forming these judgements, whether in government, in management or in private life, is based on human activities as regulating a relationship. The regulation consists of attaining or maintaining desired relationships through time or of changing and eluding undesired ones. This view can be contrasted with Simon’s model (1960) of human activities as goal seeking which Vickers regards as inadequate.

Most of these individual activities have indeed their own goals. The complex negotiation has an object; the difficult meeting must reach some conclusion; but these ends derive their meaning from the on-going relations which they mediate (Vickers 1983b: 32).

Vickers sees goals or objectives as means to mediate relations rather than as ends in themselves. He means that the goals we seek are changes in our relations whether concerning time, space, ourselves or other human beings; or changes in the very
opportunities for relating. The body of the activity consists in the ‘relating’ itself, not in the hunting for raised goals. These ideas on forming judgements based on regulating a relationship, he claims, correspond better to real-world experience and provide a richer concept of human action.

Vickers’ discovery of systems thinking ideas in the early 1950s, particularly cybernetics\(^{12}\), was a great excitement to him. Yet it was also a disappointment due to its narrow application to computers. He claimed that the cybernetic model was inadequate for describing human regulatory activity (Vickers in Checkland 1994a: 81) because it assumes

a single course given from outside the system, whilst the human regulator, personal or collective, controls a system which generates multiple and mutually inconsistent courses. The function of the regulator is to choose and realise one of many possible mixes, none fully attainable.

His critique of cybernetics is based on the fact that during this period (1950s), systems thinking was mainly concerned with operational research involving algorithms, modelling, game theory, queuing theory, simulation and optimising. “Vickers sensed that systems thinking had a much broader relevance to problems of organisation and control” and was surprised that no one else ‘of his sort’ seemed to respond. Instead systems became embedded in faculties of technology and the word became dehumanised (Blunden 1985: 108).

Vickers sees the experience we acquire in our day-to-day life as based on a two-stranded rope of interacting events and ideas.

The history of events and the history of ideas develop in intimate relation with each other yet each according to its own logic and its own time scale; and each conditions both its own future and the future of the other (Vickers 1983b: 15).

This flux of interacting events and ideas is interpreted, valued and judged according to norms, or standards, created by previous experiences. Observing ‘what is’ and comparing it to its norm is what Vickers calls appreciation. The appreciation, in turn, forms a decision on whether to act with the intention of maintaining or regulating a relationship. The appreciation of whether and how to act will, in turn, affect our

\(^{12}\) Cybernetics is briefly discussed in Chapters 4, on systems modelling, and 7.
appreciative settings by either conforming or slightly changing them. This is Vickers’ theory of how we learn through experience.

Checkland and Casar (1986) have made a model of Vickers’ appreciative system derived from his writings, shown in Figure 2:3. The starting point for the model is the interacting flux of events and ideas – illustrated in the top of the figure – i.e. Vickers’ two-stranded rope. This concept of day-to-day experience is associated to what Schutz refers to as Lebenswelt (discussed above). The concept of appreciation (centre of the figure) involves selectively perceiving reality and making judgements about it. The judgements are based on standards (to the left of the figure) of ‘what is the case’. These standards are interpretations of what we perceive and of ‘what is humanly good or bad’, i.e. value judgements. The judgements form decisions on whether and how to act (the right of the figure) with the purpose of managing desired relations. Finally, since this is a dynamic system, the action itself will affect the two-stranded rope and influence the next cycle of appreciation. The process of appreciation and its related standards will, at least slightly, be modified.

![Figure 2:3. The Structure of Vickers’ Appreciative System (after Checkland 1994a; Checkland & Casar 1986).](image)

Vickers claimed that he had constructed an epistemology that could provide credible explanations of the process by which people contemplate and act. His epistemology is based on making sense of real-life experience by a process of appreciating what is perceived and using systems ideas to describe that process. The appreciation is based on the readiness to notice particular aspects of the situation, to
understand them in particular ways and to evaluate them against certain standards or norms created by previous experience which have been built up in a similar way. Vickers' aim was mainly to understand social processes. Soft Systems Methodology, however, claims to make practical use of the concept; SSM can be seen as the orchestration of the operation of an appreciative system in a human situation perceived as problematic (Checkland 1985a: 763).

Soft Systems Methodology, like Vickers' appreciative system concept, accepts that in social life there are multiple realities rather than “a single course given from outside the system”. It attempts at capturing these different realities in models of purposeful activity systems and comparing the models against what is perceived as a means of examining the underlying appreciative settings in the situation in question. Through the process of comparison, appreciative settings of people will be revealed, as will the degree to which they are changing, or could, or should be changed. This modifies the readiness of the people in the situation to perceive the world in a particular way. The process is illustrated in Figure 2:4.

The SSM process usually starts by an exploration of a ‘real-world situation of concern’ (the left centre of the figure), because someone perceives it as problematic. In order to get a better understanding of the situation, relevant issues are illustrated in activity models that are based on system concepts. These models are depicted in the square boxes of the upper right hand corner of the figure. They illustrate different perceptions of the real-world situation under study and represent activities that logically need to be performed in order to reach a certain purpose. The models are then compared with what is perceived: they are compared with actual perceptions of the situation based on individuals' appreciative settings. Through the comparison (the right centre of the figure) new insights are revealed, and appreciative settings may be changed and lead to actions to improve the situation.

The basic shape of SSM in Figure 2:4 can also be applied to distinguish three methodological phases: Finding Out, Systems Modelling and Taking Action. These are represented by the dotted square boxes in Figure 2:4. The first phase, finding out, corresponds to activities that explore the ‘real-world situation of concern’ (the left centre of Figure 2:4) and in which the SSM practitioner is actively involved. The
second phase, systems modelling, answers especially to SSM’s principles of systems thinking and is depicted in the square boxes of the upper right hand corner of the figure. The third phase, taking action (in the right centre and bottom of the figure), corresponds to the part of the process where comparisons are made, perceptions are accommodated and subsequent ‘actions to improve the situation’ are taken.

![Diagram of Soft Systems Methodology]

Figure 2:4. The Basic Shape of SSM (after Checkland & Scholes 1990b: 7).

The categorisation into the three phases stems from comprehensive research on the use of SSM (Davies 1989). Originally Soft Systems Methodology was summarised in a seven-stage model (e.g. Checkland 1981: 163; 1984; 1985b): the first two stages correspond to finding out about the situation and structuring the findings; the third and fourth stages include thinking about the real-world situation by means of systems concepts; the fifth stage compares the systemic concepts with the findings of the situation. In the sixth stage, changes are identified and valued, leading to actions to improve the situation (the seventh and last stage). Davies loosens up the framework of this model to allow “for a more varied use of SSM thus treating it more as a methodology than a method” (Davies 1989: 234).
In her model of the structure of a system to use SSM (Davies 1989: 240B), in addition to the three methodological phases Davies includes an appreciative system and an evaluation process. However, in this review we will only examine the three methodological phases. These phases are used for action, and also for structuring our thinking.

2.5: Conclusion

Soft systems methodology, SSM, evolved through an action research programme at Lancaster University in the late 1960. Its aim was to explore the contribution that system ideas could make to managerial real-world problems. SSM has made a significant contribution in its differentiation between hard and soft systems thinking. It has placed the soft approach in an interpretivistic philosophy, although this review has pointed at some confusions as to which strand of hermeneutics that SSM adopts. There is an emphasis in SSM about ‘solving’ problems through learning and learning about different perspectives. Systems design is also directed towards learning why we turn to exploring the learning system of SSM in next chapters.
CHAPTER 3:
FINDING OUT

Finding out means being actively involved in a real-world problem situation with all the dimensions of information that are conveyed in it, and trying to make sense of all the impressions. The focus is on a “non-systemic analysis of what exists at present in the problem situation” (Checkland 1972: 98). The analyst will use many techniques of enquiry, for example report monitoring, interviewing, financial analysis, cultural analysis, historical analysis, surveys, ethnographic fieldwork, observations, etc. to gain an understanding of the situation. The level of psychological complexity that the analyst must deal with can be extremely high. The complexity further points to the multiplicity of information inherent in the situation which may be very confusing. This may lead to an information overload as the complexity level of understanding is beyond acceptance. “It is during this stage of initial data gathering that there is a lack of structure, and this can be a very uncomfortable time for the investigator” (Davies 1988: 132).

The starting phase of a SSM study is an arbitrary choice but for the purpose of describing the process a chronological sequence is most suitable to follow. Therefore this review of SSM’s methodological phases begins in Finding Out.

3.1: GUIDANCE FOR FINDING OUT

To avoid the “uncomfortable time” due to lack of structure, SSM offers some guidance for finding out about the situation. The recommendation is to look for “elements of slow-to-change structure” and “elements of continuously-changing process” and how these elements relate to each other within the situation climate (Checkland 1981: 164). Structure may be examined in terms of physical layout, hierarchy, patterns of
communication, etc. Process may be analysed in terms of basic activities for the organisation. Finally, “the relationship between structure and process, the ‘climate’, is a core characteristic of any problem situation” (Checkland 1972: 99) and therefore important to get a grasp of if the situation is to be dealt with adequately. “It is in achieving as neutral a display as possible that the concepts of ‘structure’, ‘process’, and ‘the relation between the structure and process’ have been found useful” (Checkland 1981: 166).

To manage the complexity in the Finding Out phase it has proven useful to differentiate between the “problem-content and problem-solving system” (Checkland 1981: 237ff). This analysis identifies the roles ‘problem owner’, occupied by those who perceive the problem, and ‘problem solver’, occupied by those who wish to tackle the problem. These terms are not meant to imply that there are systems in the problem situation but that the situation may be explored through the use of the abstract notion of system (Davies 1988).

In later versions of SSM these frameworks, i.e. ‘problem-content’ system and ‘problem-solving’ system, as well as the notion of ‘climate’, have been further developed and are now guided by SSM’s Analysis One, Two and Three (Checkland & Scholes 1990b).

Analysis One concerns analysis of the intervention in the problem situation and explores the roles of client, problem solver and problem owner. The role of client is given to the person (or persons) who commission the study. The role of problem solver is assigned to those who wish to do something about the situation. Finally, and of crucial importance to the remainder of the study, is the analysis of the problem owner. Every one can be considered a problem owner. The role is defined as “the person or persons taken by an investigator to be those likely to gain most from achieved improvement in a problem situation” (Checkland 1981: 316). Thus, the people selected as problem owners is a choice made by the investigators, i.e. the problem solvers. It has proven beneficial to make a long list of possible problem owners consisting of people in the situation including the client and problem solvers as well. The analysis of the intervention is done by asking each person, who is assigned to any of the roles, about the situation, why they perceive it as problematic,
their version of the problem, and what they would regard as improvements. Since this analysis mirrors the perception of the people in the situation, it has shown to be the best source for finding out about what is regarded as relevant for them.

Analysis Two studies the situation as a social system and examines elements including social roles, norms and values, and the interaction between them. The model that is used assumes a ‘social system’ to be “a continually changing interaction between three elements: roles, norms and values. Each continually defines, redefines and is itself defined by the other two” (Checkland & Scholes 1990b: 49). ‘Role’ indicates a social position, both formal and informal, recognised by the people in the situation. The concept in SSM conveys essentially the same concept as the social science literature in which “the taking and making of roles are seen as fundamental to the process by which social groupings become more than mere aggregates of people” (Checkland 1981: 231). Closely allied to any role are some expectations which others have of the behaviour of anyone occupying a role. These expectations are referred to as social norms. Performance in a certain role is judged and valued as either good or bad according to the accepted standards in the culture of the situation. Finally, the interaction between the elements is described as a social process in which appreciation from day-to-day life experiences is related to fact and value standards and affect the individual’s deliberation and action (Checkland & Casar 1986).

Finally, Analysis Three pertains to exploring the political dimension of the situation. Politics is taken to be “a process by which differing interests reach accommodation” (Checkland 1986: 4). Thus, political system analysis concerns studying power-related activities of managing the relation of different interests in the situation. Stowell (1989) suggests that thinking about organisational power in terms of a commodity metaphor may help to understand it. ‘Commodity’ refers to things that represent some kind of value in an organisation. Analysis Three is, hence, made practical by looking for the ‘commodities’ of power, i.e. how power is embodied in the situation; and how these commodities are expressed, obtained, gained, used, preserved, passed on, etc.

The explorations in the Finding Out phase normally result in representing the problem situation in, so called, “Rich Pictures” (Checkland 1981: 317; Checkland &
Scholes 1990b: 45). There is no formal technique for this but typical is “expressing relationships and value judgements; finding symbols to convey the correct ‘feel’ of the situation; indicating that the many relevant relationships preclude instant solutions” (Checkland & Scholes 1990b: 45).

In a study of the nature of rich picture building and its role within Soft Systems Methodology (Lewis 1992) it was found that there is confusion about the concept. Confusion was over whether a ‘rich picture’ is considered to be an abstract, conceptual understanding of a problem situation or a literal diagram; whether rich picture diagrams are a requirement of SSM and their content and format; and whether a rich picture “may be recognised as a subjective conceptualisation or as an objectively true representation of reality” (Lewis 1992: 357).

From an examination of published literature and accounts of the use of the methodology, Lewis (1992) concludes that the term Rich Picture not only includes the pictorial representation itself but the whole process of appreciating the situation. Thus, the term ‘rich picture’ should not be reduced to a diagram and there are no formal requirements for producing such a diagram. However, as is typical in systems work, the emphasis is on representing relationships and connections and therefore a diagrammatic representation has proven more powerful in expressing these relationships than linear text. Therefore the Rich Picture has come to be associated with this diagram, although as referred to in the above, the diagram is rather “a by-product of the process of investigation of the problem situation” (Lewis 1992: 358).

3.2: Whose Interpretation?

There is an agreement in the literature that SSM is pluralistic in its understanding of reality. But a confusion arises which concerns subjective versus ‘objective’ representation of the problem situation. The emphasis has been on correct understanding, i.e. ‘objective’, rather than individual subjectivity, in which the Finding Out phase should lead to “an account of what exists” (Checkland 1972: 96) and result in “as neutral a display as possible” (Checkland 1981: 166). However, in the very essence of the methodology is the idea of interpretation linked to weltanschauung
which points at the understanding of the rich picture as a subjective representation; “drawing the Rich Picture is a subjective process” (Avison & Wood-Harper 1990: 46). But, as Mingers (1992b) points out, subjective representations in Rich Picture building also cause confusion.

The problem is whose view does it represent? SSM emphasises that there can be no single, objective description of the situation, simple different interpretations from different Weltanschauungen. So, is the rich picture supposed to be the analysts view of the situation? Or should it try to map all the different actors’ views? Or is it the analyst's view of the actors' views? Or what? (Mingers 1992b: 55)

Others have also pointed out that there are few useful guidelines or aids for drawing rich pictures. Stowell (1991) argues that the lack of rules for drawing a rich picture diagram, and thus, for what to look for when appreciating the situation, can be overwhelming to newcomers of the methodology. Lewis (1992) points out that in recent Lancaster Master of Science dissertations the trend in Rich Picture diagrams has been toward symbolic representations and metaphors, as well as humorous additions, and that this has certain dangers, especially when no key for the diagram is provided. There have been an increasing number of suggestions that some set of standard symbols might be used, perhaps to overcome the ambiguity problem. The lack of guidance and rules for Rich Picture building have proven to be one reason for additions and modifications to the methodology. In a survey of how SSM is used in practice Mingers and Taylor (1992) found that the main modifications to the methodology were mainly centred on the rich picture stage. Some modifications were replacements, e.g. personal constructs, while others complemented SSM's original technique.

3.3: Systems Thinking

The focus for the SSM research programme is on complex managerial real-world problems and the contribution of systems ideas to structure these kinds of problems. Systems thinking make use of an approach to knowledge that is different from the kind generated by the traditional analytical one and which systems researchers find inadequate.
It is assumed that, in order to study reality and understand real-world problems, holistic thinking is needed in which holistic parts of reality and their relationships to other holons are studied. This way of thinking can be contrasted with the more traditional scientific method of reductionistic analytical thinking in which the researcher reduces reality into its parts in order to study the parts in isolation, and consequently, does not examine the part in its holistic function, nor in its relationship to other holistic parts. The complexity in real-world problems are in both approaches reduced to less complex parts, but, as Kreher (1993b) points out, the aim of reducing complexity in systems thinking approaches is to make it more manageable, but still remaining a holistic orientation, whereas the aim of reducing complexity in analytical thinking approaches is to make possible the study of the specific parts separately.

Although it is recognised that reality is complex and that systems thinking can be used to make sense of that reality, in the first methodological phase of SSM it is stressed that systems thinking should not be used. When, in the early 70’s, summarising the experience of the first few studies, Checkland (1972: 96) notes:

> it was found most useful to make the analysis stage a building up of the richest possible picture of the situation being studied without pressing the analysis in systems terms.

Later on in the same article Checkland continues:

> it has already been argued that the analysis phase should not be in systems terms unless the problem situation is a relatively structured one. If it is unstructured then seeking out 'systems' at the start almost always leads to the identification of organisational groupings – departments or functions – as systems, which may or may not be appropriate (Checkland 1972: 98).

However, in later developments of SSM the concepts ‘problem-content system’ and ‘problem-solving system’ are introduced. Both are defined as “one of the two systems in terms of which any tackling of a real-world problem may be conceptualised by an investigator” (Checkland 1981: 318) and with reference to each other. It is also clarified that the word system is here used as “a teleological indication that the investigator will use systems concepts in perceiving the substantive content of the problem” (Checkland 1981: 318). However, still it is emphasised that “the best studies have been characterised by ... a determination not to press the analysis in systems terms at all” (Checkland 1981: 165). So, on the one hand this recommends
that a systems study begin by analysing the situation in terms of problem-content system and problem-solving system, and on the other hand it does not recommend the use of systems concepts at all.

In further developments of SSM, when the terms Analysis One (the analysis of the intervention), Analysis Two ('social system' analysis), and Analysis Three ('political system' analysis) are introduced (Checkland & Scholes 1990b), the recommendation of not to use systems terms for this phase is dropped without any discussion. Also, how these systems terms relate to Checkland's definition of the core idea of systems thinking, that is, as consisting of two pairs of properties, emergence and hierarchy, communication and control (Checkland 1981; Checkland & Scholes 1990b) is not further elaborated or discussed, neither is how these ‘systems’ relate to Checkland’s categorisation of the universe into five different classes (Checkland 1971; 1981). However, a discussion of the social systems and political systems concepts, as they are used in everyday language and their relation to soft systems thinking is provided (Checkland 1981: 230):

What must be avoided in enlarging upon stage 2 [i.e. expressing the problem situation in the conventional seven-stage model of SSM] is any introduction of the idea that the problem situation is some obvious hierarchy of human activity systems. It is necessary to re-emphasize this because the additional help available at stages 1 and 2 [i.e. the Finding Out phase] comes from the recognition that every soft problem situation will contain what in everyday language are usually described as ‘systems': social systems and political systems.

This indicates that SSM uses the everyday meaning of ‘systems’ and not the meaning of the term that has been referred to in previous definitions. Further it is stated that social science does not provide any “generally accepted and well-tested models of social and political systems” (Checkland 1981: 230), only guidelines based upon elements of these. However, Checkland recognises that there are some complete models that illustrate aspects of social and political systems, e.g. Talcott Parsons's (Parsons 1951) model of social systems, but these models have not been found relevant. They were too complex and complicated and because of this were not regarded as useful for the methodology (Checkland 1981: 230).
What has been useful is the idea that, whatever else it contains, the problem situation will contain the special kind of structures, processes, and relations between the two which we recognise as constituting, in everyday language ‘social systems’ and ‘political systems’. It has been found useful explicitly to look for some of the elements of such systems rather than to try and use any complete models of such systems.

Thus, the terms social and political systems are coherent with everyday language use and with social science definition and consist of some elements of such systems, but they are not coherent with Checkland’s definition of systems.

3.4: VALIDATION OF THE REPRESENTATION

The idea of the Finding Out phase is that this analysis “enables selection to be made of a viewpoint from which to study further the problem situation, and enables some relevant systems (relevant, that is, to improving the problem situation) to be named tentatively” (Checkland 1972: 96). However, there is no validation in SSM about what is seen as relevant. Although the Finding Out phase holds some recommendations of what to look for and frameworks to guide the analysis, there is no validation that the problem situation has been adequately reflected against these recommendations or frameworks. Nor is there any validation that the representation of the situation encompasses the elements and relationships judged pertinent by those actors involved in the problem situation and in conformity with the tools and techniques that are available for use in the other phases of the methodology. Others would argue that model validation without any framework of reference causes a dilemma because the problem situation is very much defined and determined by the perceptions and behaviour of the actors; while the ‘mental image’ of the problem situation, the way the problem situation is perceived and presented, is formed by the perceptions and value judgement of the model builders (Landry, Malouin & Oral 1983). Therefore, the degree of relevance of the assumptions that is formed by the perceptions and value judgements and that underlies the model of the problem situation is the main concern for validating this ‘mental image’. Establishing both to what extent the problem situation is represented from appropriate perspectives, and that elements and relationships are representative of the situation as perceived by the actors, is needed because “continuous validation by an individual is a necessary
condition for his or her learning” (Landry, Malouin & Oral 1983: 211). Not to offer any framework to reflect upon leaves this process in the hands of the individuals and their ‘sense-making’ abilities without any support from the methodology.

3.5: Related Research

In an attempt to strengthen the validity and reliability of SSM, Brown (1992) proposes that it be combined with Glaser and Strauss's Grounded Theory. SSM claims “to take seriously the subjectivity which is the crucial characteristic of human affairs and to treat this subjectivity, if not exactly scientifically, at least in a way characterised by intellectual rigour” (Checkland & Scholes 1990b: 30). In the light of this statement Brown objects to the methods of SSM and refers to the absurdity of referring to intellectual rigour when it is a well-known fact that cognitive processes have limited information handling capacities and that generated analyses are heavily affected by existing knowledge structures and judgmental heuristics. By not adding a theoretical framework to assist the analysis, the analyst is left to the informants’ motifs, qualities and abilities. Brown gives examples of how informants can act: they may deliberately mislead and deceive; they may themselves be mislead about matters of their concern; and they may be unaware of vital facts. Finally, the researchers need a framework to assist them in understanding what to observe and in reflecting upon their own biases. Further benefits of combining SSM and Grounded Theory that Brown points out are related to pragmatics. He says that guidance, especially for the inexperienced, is needed and is also achieved by this approach. Finally, conditions for third party comprehension is improved. By explicitly stating one’s own reference model, other people are given opportunity to value the researcher's interpretation of the findings. “For only by revealing these rules does the researcher yield sufficient contextual information for others to understand the results and critically evaluate their implications and limitations” (Brown 1992: 390). When there are no clear rules the researcher is given the important task of data collection and analysis from his/her own (often unstated) perspectives and previous experiences. The considerations concerning appreciating the situation are of crucial importance since gaining an appreciation of the problem situation is a vital step in SSM, “for it is the basis not only
for identifying relevant systems that may later be modelled but also for deciding the scope and nature of the intervention” (Lewis 1992: 359).

Davies (1991) also aims at improving the guidance for the Finding Out phase. Her course of action concerns organisational culture and she concludes that no such frameworks that deal with organisational culture context, are available within SSM. Therefore, a framework for the analysis of organisational culture is presented and further developed and piloted in a series of case studies. “The framework is intended to provide a basis for the selection of relevant data from the mass of data generated in fieldwork, and then to allow for sensible interpretation of that data”. Further, “the model is used to look at the potential effects of future information technology use in a particular organisation” (Davies 1991: 163, 164). Hence, Davies uses her framework both to make sense of the mass of information inherent in a real-world situation and to anticipate future changes in the culture of that situation.

Other attempts at making sense of the complexity inherent in the Finding Out phase is through structuring the situation in a variety of dimensions recognised in human experience and thought (Bergvall-Kåreborn & Grahn 1996b). Further modifications have been proposed. In addition to identifying relevant systems through analysis of the role ‘problem owner’, a stakeholder analysis is suggested, in which different weltanschauungens are identified (Vidgen 1994).

Finally there are studies which suggest software tools for supporting rich picture building: e.g. a hypermedia laboratory for assembling information about the situation and representing it through the combination of various computerised media (Lundquist & Huston 1990); a proposal to combine the emerging technologies of multi-media, graphics and object orientation to support software tools for soft approaches (Avison & Golder 1991a; b); and specific software tools for drawing rich picture diagrams (Avison, Golder & Shah 1992). However, Kreher (1993a: 307) points out that “there are dangers in reducing a user-dependent methodology to a hard technique with specific requirements when ‘rich picture’ is defined and limited to its literal meaning”. This warning raises the concern of focusing too much on the drawing and thus confusing the pictorial diagram with the actual process of appreciating the situation.
3.6: Conclusion

SSM is pluralistic in its understanding of reality and therefore, in using the methodology for finding out, multiple perspectives are emphasised. However, SSM’s pluralistic nature is also its problem; the methodology does not take any standpoint, or make any recommendations, about the nature of social reality. Thus, there is no framework offered for validating the gathered data. The problem is recognised by several scholars and is why attempts have been made to strengthen the data gathering and the analyses in this phase.
CHAPTER 4:
SYSTEMS MODELLING

In the second methodological phase, System Modelling, the SSM user leaves the
complexity of the real world and enters the world of logic-based thinking. In this
phase SSM uses the core ‘system’ metaphor of an adaptive whole which has emergent
properties, a layered (hierarchic) structure and processes of communication and
control (Checkland 1981) to structure the thinking about the real world. Foundations
and implications of this concept are reviewed. Some precise techniques are developed
to guide the inquiries in this phase. These are also analysed.

4.1: SYSTEMS THINKING

Underlying much systems thinking is the concept of the metaphor of an
adaptive whole which interacts with its environment. Atkinson (1984: 4ff) has
explored metaphors in systems thinking. He suggests that the following seven
characteristics are those that are most typical of the metaphorical notion of “an
adaptive whole system”. First, there will be a boundary which separates the system
from its environment. Second, the system has an emergent property which also
distinguishes it from its environment. Third, within the system there are two
internally linked domains, one which constitutes a material basis, and one which
constitutes transformation processes. Fourth, the system itself consists of a set of
subsystems, found in various degrees in both domains, i.e. in material and processes.
The subsystems constitute properties of autonomy that characterise the system in its
own right. Fifth, the variety of states in the environment must be matched by a variety
of states in the system’s own organisation. Sixth, the system interacts with its
environment via processes where inputs are transformed to outputs. Seventh, the adaptive whole is not static, but dynamic in nature. The systems concept that was first used in SSM was formalised in a model, “the ‘formal system’ model” (Checkland 1981: 173) which can be thought of as an adaptive whole. This model draws on two strands of thinking. The first is Churchman’s ‘Anatomy of Systems Teleology’ (1971), which builds on the assumption that systems have properties of which some are functional and where the function is to a gross extent a choice by the designer. The second is Jenkins’ (1969) proposal for systems definition. In Checkland’s words (1981: 173) Jenkins’ definition is stated as “groupings of men and machines with an overall objective and characterized by an economic criterion which measures performance”. The definitions are extended into the ‘formal systems’ model which is characterised as consisting of nine attributes: it has an on-going purpose or mission; it has a measure of performance; it contains a decision making process; it has components which are themselves systems; it has components which interact; it exists in a wider system or in an environment; it has a boundary; it has resources; and, it has some guarantee of continuity (Checkland 1981). The ‘formal system’ model is then set against the concepts which are used to structure the thinking, and which are presented later in this chapter. However, it is also recommended to use “any other systems thinking which the analyst reveres” (Checkland 1981: 176) why the formal systems model is not compulsory for the methodology13.

Systems thinking assumes that when studying a real world phenomenon there are some characteristics that cannot be identified by studying its parts separately, but are only visible when combining the parts. This is what Checkland refers to as “emergent properties” (1981: 74ff). Checkland relates the idea of emergence to the concepts of complexity and hierarchy. He argues that organised complexity is the subject matter of the discipline ‘systems’, and organisation of the complexity can be made in terms of hierarchical levels (Checkland 1981: 78).

13 In later writings the ‘formal system’ model has been dropped.
The general model of organised complexity is that there exists a hierarchy of levels of organisation, each more complex than the one below, a level being characterised by emergent properties which do not exist at the lower level.

In one hierarchical level there are such emergent properties that do not exist on lower levels and that would be meaningless to discuss at these levels. For instance, one emergent property of a car is being a vehicle for transporting a person from A to B. That property is an outcome from processes working on the level of the ignition system, the steering system, the fuel system, the brake system, the wheel system, the chassis system, etc. However, the transportation property has no actual meaning when used on the level of each of these systems. Only when taken together on a higher level of complexity does this property become meaningful. Thus, the fact that organisms and artefacts have properties as wholes on each hierarchical level calls for different levels of description, corresponding to different levels of reality, and suggests the idea of emergence and hierarchy as a foundation of systems thinking.

A second suggested foundation, closely related to different hierarchical levels of complexity are the concepts of communication and control (Checkland 1981: 82ff). These concepts are borrowed from the field of cybernetics (Ashby 1976; Beer 1981; Shannon & Weaver 1949; Wiener 1948), one part of systems science which evolved in the late 1940s and was concerned with theory of messages, and of message transmission for purposes of control. The word cybernetics stems from the Greek term kybernetike meaning ‘the art of steersmanship’ (Schoderbek, Schoderbek & Kefalas 1990) and is defined by Wiener (1948), its main originator, as the science of communication and control, in the animal and the machine.

Cybernetics originates from studies related to problems in control engineering and communication engineering (Wiener 1948), and from work in statistical information theory (Shannon & Weaver 1949). In this context the fields of control engineering and communication engineering were found inseparable because both core concerns are about messages and their transmission. Statistical information theory focuses on the related technical problems in information transmission.
Processes of feedback, i.e. the transmission of information about the actual performance of any machine in order to control its operations, were one focus for the studies. This work was continued and further developed by Ashby (1976), the leading theoretician on cybernetics in the 1950s and 1960s. He emphasised the extension of cybernetic theory to all kinds of behaviour, whether natural or man-made, and not just limited to the machine. In his “Law of Requisite Variety”, Ashby demonstrates that continuing effective control of all kinds of behaviour requires a control system that can adapt its controlling processes to environmental information. Thus, to be able to respond, the controlling system needs a variety of information that matches the variety of the environmental information that is transmitted through the system. Ashby's work is followed by Beer's (1981) who applies cybernetics to organisations and information systems. For Beer, cybernetics is “the science of effective organization” (Beer 1985: ix). In his work on the Viable Systems Model (1981) Beer identifies essential functions and associated information processes, which are required for a system to function effectively and be viable. Viability means being capable of living and of maintaining a separate existence; in systems terms, being able to survive by self-regulation in a changing environment. The concept of self-regulation with autonomous control over behaviour is, thus, a further contribution of the systems movement.

The purpose of the systems modelling phase in SSM is not to describe what the content of the organisation ought to be, but to explore the situation through the abstract idea of system. This notion is used as “an intellectual construct which is considered to generate (intellectual) order” (Woodburn 1988: 53) to conceptualise different perceptions of the situation. It is emphasised that “conceptualisation is not design, it is a means of structuring the thinking about fuzzy problem situations” (Checkland 1972: 102).

Checkland, thus, differentiates between conceptualisation and design. However, since this statement was made the process of design has been studied and it has been suggested that design cannot occur without concepts to guide the process.
(Stolterman 1991). I assume that Checkland when referring to design is thinking of one of four steps (Systems Analysis, Systems Design, Implementation, Operation) in the application of Systems Engineering (Jenkins 1969). I draw a parallel between the concepts of design and development, which include the process of conceptualisation, and also relate both of them to learning. This view is supported by later writings on SSM (Checkland & Holwell 1993) in which the need to conceptualise in information systems development is recognised. The strategy that is proposed is, first conceptualising the activities of the organisation, then identifying the information needs to carry out these activities, and finally deciding on the technology to support it. Further it is noted that:

it is the *conceptualisation* domain in which coherent thinking about organisational nature, about structure, and about information support is carried out. ... it is the crucial domain if a satisfactory combination of organisational purposes, activity, structure and information support is to be achieved (Checkland & Holwell: 13).

Thus, it is recognised that designing systems involves a conceptual linking of structure, role and nature of the object in question that is to be designed (or developed).

When emphasising that systems are not designed I assume that the term is equated to its definition in Hard Systems Methodology, or Systems Engineering:

*Any design and implementation* is, in general terms, the design and implementation of an agreed change rather than of a system. Design of a system emerges as a special case, appropriate when the problem definition is sufficiently sharp to enable objectives and measures of performance to be defined and hence to allow the thinking to be in terms of model building, simulating performance and optimising (Checkland 1972: 97).

Thus, ‘systems’ pertain to a classification of the situation, while ‘change’ pertains to a concept, that is, a ‘new’ or changed perception of the situation. In later publications Checkland (e.g. 1988a; Checkland & Scholes 1990b) argues for adopting the word ‘holon’ for the abstract idea of a whole having emergent properties, a layered structure and processes of communication and control, to differentiate from the word
'system' used as a label of parts of the world. Using the same term for two different meanings causes confusion as is shown in the previous chapter (3.3: Systems Thinking). However, although it is suggested to use a different term the step is not fully taken yet: in Tsouvalis and Checkland (1996) the intellectual constructs are still referred to as 'human activity systems', but the term ‘purposeful holons’ is also used synonymously.

Fuenmayor (1991), however, points at a need for defining an epistemology and ontology for systems thinking. He argues that Checkland conceives systems as interconnected complexities exhibiting emergent properties and when “stripped to its core ideas, two pairs of concept remain: emergence and hierarchy, communication and control” (referring to Checkland 1983), while Fuenmayor sees wholeness as the most basic concept for system thinking. Further, when exploring the notion of wholeness he finds two different strands of meaning, the pragmatic and the cogitative. The pragmatic refers to wholeness for the sake of efficiency and, quoting Plato, “the part can never be well unless the whole is well” (Fuenmayor 1991: 229). In the cogitative context the intention is of theorising; “i.e. offering conceptual constructions that explain (answer the questions) and bring forth new questions” (Fuenmayor 1991: 229). This is related to different strands of systems thinking. Those who support the pragmatic approach produce models for decision making often based on mathematics and often viewed as not very useful for real and effective decision making. Those who support the conceptual approach rely on the ideas behind cultural or Weltanschauungen relativism. Different societies, different groups, different individuals have different interpretations of facts and, in particular, human actions. Value systems are not the same and there is no universal or absolute values. Further, individuals might have different interpretations of what is believed to be the same thing, without being aware of each other’s differences.

This shows that SSM is also concerned with the concept of wholeness, for instance in its use of ‘holon’ and reference to the phenomenologic ‘Gestalt’. Continuing on Fuenmayour’s thinking, in its purpose SSM is pragmatic, while in its
process it is cogitative. It offers “conceptual constructions that explain and bring forth new questions”. While there is benefit in defining more clearly epistemology and ontology for systems thinking, this may not be possible. Systems thinking as utilised in Soft Systems Methodology does not make any statement about ontology while other systemic approaches do. Therefore, although one uses the same kind of holistic thinking, approaches with different ontological assumptions cannot be united in one definition for systems thinking. The main characteristics in SSM's systems thinking are the two pairs, emergence and hierarchy and communication and control, and relevant systems of human activity.

4.2: Guidance – Relevant Systems

In choosing systems to be modelled guidance is suggested by SSM according to the unit’s, under study, “primary task”, or to some issue in the situation (Checkland & Wilson 1980: 52). Primary task systems are related to the mission of the unit, while issues pertain to a temporary situation. It has been useful to model both ‘primary task’ and ‘issue-based systems’ in the same situation (Checkland 1984: 17f).

It is useful to start with Definitions relevant to issues in the situation ... and then see whether mapping one perception to another can yield any primary task Definitions on which there can be general agreement.\(^\text{14}\)

However, Checkland (1981: 173) states, relevant systems are not meant to mirror the situation, nor are they “accounts of what ought to exist in the real world”. Their only purpose is to be statements of what the system perhaps is. Thus primary task definitions, which are hoped to be found and on which there can be general agreement, do not represent any ‘oughts’. I find it difficult to understand that there can be a general agreement on “a primary task which must be manifest if the real-world organisation is to be capable of fulfilling its public function” (Checkland &

\(^\text{14}\) A model which there is a general agreement on is referred to as “consensus primary task model” (Wilson 1990: 93).
Wilson 1980: 52) and that this agreement does not represent an ought. It is further stressed that the primary task should not be transferred from epistemology to ontology. It then becomes even more confusing that the term primary task is exemplified with “the task assigned to the engineering division of an international airline, namely to carry out planned maintenance on a fleet of aircraft” (Checkland & Wilson 1980: 52) and that “it would be hard to argue that within an airline there might not be a manifestation of such a system”.

Von Bülow (1989), moreover, notes that there is a conflict between the ‘formal system’ model and how systems are bounded in the Systems Modelling phase. According to the ‘formal system’ model, the system has a boundary which separates it from the environment and this boundary is defined by “the area within which the decision taking process has power to cause action to be taken” (Checkland 1981: 174). However, von Bülow (1989: 38) points out, “the user of SSM in fact defines and by that adds this decision-taking body after having defined the system’s boundary by formulating the root definition”. Thus, there seems to be a contradiction between the system’s boundary as defined through the ‘formal system’ model and as defined through the choosing of relevant systems.

There are more problems. Mingers (1992b: 55) argues that generating ‘relevant’ relevant systems is a key problem:

In many ways this seem to me to be the key point of the methodology – it is the point where some view(s), implicit or explicit, is taken about the nature of the ‘problem’ and ultimate success depends on the appropriateness of the view(s) taken. Yet there is little help in the methodology save to say that time will tell and if you get it wrong then iterate (i.e. do it again).

The aid for deciding on the relevancy of chosen systems is through Analysis Two and Three, i.e. ‘social’ and ‘political systems’ analysis, and through Analysis One, of ‘the intervening system’, in which possible ‘problem owners’ are identified (Checkland & Scholes 1990b). These analyses are carried out in the Finding Out phase. However, as Mingers points out, although these analyses give some insight into the situation it is
left for the SSM user to relate the outcomes of these analyses to choices of issues or primary task.

Once relevant systems have been chosen there are some precise techniques developed for their formalisation. These are root definition, CATWOE, and conceptual models of activity systems with a monitor and controlling sub-system (Checkland 1981; Checkland & Scholes 1990b).

4.3: GUIDANCE – ROOT DEFINITION AND CATWOE

Root definition means naming, in a short statement, a system of purposeful activity. The formal rules for a well-formulated root definition is that it should contain the elements of the mnemonic word CATWOE (Smyth & Checkland 1976): the C stands for customer, which means the person or persons who would be beneficiaries or victims of the system; A for actor, that is the person or persons who perform the transformation process; T for the transformation of some input to output, the core purpose of the chosen system in which some entity is changed to some new form of that same entity; W describes the world view which makes the transformation meaningful; O stands for the owner, the person who can stop the transformation; and finally, E, constraints from the environment that is taken as given.

The core of CATWOE is the pairing of transformation process (T) and the worldview, or weltanschauungen, (W) which makes it meaningful. The importance of stating ownership and aspirations in SSM models are illustrated in the term weltanschauungen. Checkland and Davies (1986) clarify the use of the term weltanschauungen in SSM by distinguishing three categories, W1, W2 and W3 used in SSM. W1 (also termed just ‘W’, i.e. the ‘W’ of CATWOE) is a taken-as-given set of assumptions which makes a particular statement about a system meaningful and exists only to help in model building. It should be stated as pure as possible. The purpose of this W is to be an epistemological device, to make the models meaningful, not to make attempts at capturing the whole reality.
W2 is related to a version of the problem situation, and thus, related to the taken-as-given assumptions in W1 in the sense that W2 makes W1 relevant. Finally, W3 is of wider concern and related to the social reality in which the problem situation is embedded. W3 is linked to our beliefs and assumptions about reality and makes us understand social situations. “SSM works upon the principle that problems are part of the social interpretation of human action; the problem is a phenomenon of the social situation and not of the individual puzzle-solving capabilities” (Davies 1989: 87). Problems are seen as social constructions, that is, interpretations of a situation according to a particular weltanschauung. Thus, the aspiration for problems’ improvement is also related to interpretations and weltanschauung.

Mingers (1992b) criticises the lack of theory behind CATWOE; the elements stem from intuition and experience of using the methodology. A hypothesis was set up that these elements would be traceable in a well-formulated root definition. The hypothesis was tested by examining a range of root definitions and relating them to the happenings to find out whether any of the elements was missing and, if so, whether the absence had mattered. The elements were also compared with the ‘formal system’ model to establish a logical connection (Checkland 1981). It was found that ownership (‘O’) and actors (‘A’) were common omissions and that they, if included, would have enriched the debate. So, a well-formulated root definition should follow the form: A O-owned and A-operated system, which, affecting C, transforms T to a new state of T according to some W, within the given constraints E.

In later accounts of SSM, the six elements of CATWOE are not requested to be explicitly stated in the root definition. “Each one does not have to be explicit in the definition, but if they are to be omitted that should be a conscious act” (Checkland & Scholes 1990b: 36). The simplest version of a root definition is stated as “a system to do X” where the X is the transformation process (‘T’). However, the ‘O’ in CATWOE implies the concern of some owners who can cease the transformation if it does not meet their aspirations and therefore this element in the form of stating aspirations (“in order to achieve Z”) needs to be included. Thus, in later development of SSM it is
found that minimum requirements for a root definition should follow the form “do X in order to achieve Z” or, if it is useful to constrain the system to some particular means (‘Y’), “do X by Y in order to achieve Z” (Checkland, Forbes & Martin 1990).

In research related to information systems development (Mathiassen & Nielsen 1994), one of the six elements of CATWOE, the transformation of input to output (‘T’) is proposed to be complemented and/or replaced by the process of interaction. Mathiassen & Nielsen (1994: 291) mean that “the underlying understanding of human activities as transformation is too limited for many of the practical purposes of IS organisations” and their experience is that a management system is not easily understood as transformation of input into output. In such cases they propose that the transformation system be replaced by an interaction system that:

operates in an interactive fashion on some material (e.g. processes, actors, objects, information) and which focuses on achieving invariance in the state space (e.g. satisfactory distribution of resources, provision of relevant information, effective coordination between individual actors) (Mathiassen & Nielsen 1994: 296f).

When the hypothetical elements of CATWOE were compared with the ‘formal system’ model to establish logical connections, the transformation process of CATWOE was traced to the interaction which goes on between the model’s components “such that the effects and actions can be transmitted through the system” (Checkland 1981: 174). However, the ‘formal system’ model is no longer referred to; “its use has declined in the last decade, CATWOE has virtually eliminated it” (Checkland & Scholes 1990b: 41). The logical connection of the CATWOE elements was established by means of the ‘formal system’ model, which is no longer in use. Hence, there is no theory in use that supports the CATWOE elements. So, there is nothing in theory that rejects or supports this new proposal of replacing the transformation system by an interaction system. How it affects the principles of SSM is something that needs to be further explored.

Hence, it is useful to name a system including the elements of CATWOE. Especially ‘ownership’ and ‘actors’ were common omissions in earlier SSM studies.
However, in later developments the formal rules have changed; the ‘formal system’ model, which established the logical connection between the elements, has been dropped\(^\text{15}\) and there are no formal requirements to include all the elements in the root definition. The latest recommendation focuses on the transformation process, constrained by a particular means and bearing in mind the owner's aspirations ('a system to do X by Y in order to achieve Z'). The weltanschauung is thus not explicitly stated in the later version, nor are the actors and customers. The strength of the methodology that this author advocates, i.e. that it includes the individual’s perspective, has degenerated. Furthermore, as pointed out in the above, there is no theory to support the root definition, neither as based in the CATWOE elements, nor in its XYZ formula. The purpose of the root definition and CATWOE analysis is to provide a short statement about a human activity system which enables a conceptual model of it to be constructed. This means that the construction of the model becomes dependent on the designer’s choice of structure and, thus, richness in root definition.

4.4: GUIDANCE – CONCEPTUAL MODELS

The conceptual model is a representation of the minimum activities necessary to accomplish the transformation (‘T’ of CATWOE). “The aim is to achieve a pairing of root definition (what the system is) and conceptual model (what the system does) which are mutually consistent” (Checkland 1981: 290). Thus, nothing but what is stated in the root definition should be portrayed in the purposeful human activity system. The purposeful activity systems approach embodied in SSM is, according to Burgoyne et al (1997) a development of activity modelling in work studies “where activities are first identified and defined and then subjected to critical analysis from a rational efficiency point of view” (Burgoyne et al 1997: 41).

The conceptual model itself contains an operational sub-system, which consists of a set of activities linked together in a coherent whole by some underlying purpose,

\(^{15}\) It is stated that “CATWOE has virtually eliminated it” (Checkland & Scholes 1990: 41).
and a monitoring and control sub-system (discussed in the following sub-section). The recommendation for the operational sub-system is to aim at 7, plus/minus 2, activities. This is based on findings in cognitive psychology concerning simultaneous human brain capacity (Checkland & Scholes 1990b). The language of the model is verbs; arrows between the activities link these according to their logical dependencies. Because of the common error to “slip into modelling part of the real world rather than building the model of the system named in the root definition” (Checkland 1981: 292), it is constantly emphasised that the model is a purely logical construct which is consistent with root definition and CATWOE, thus pointing at the importance of the semantics of language.

To construct such a model is to construct a logical machine which would meet the requirement of the root definition of the relevant holon. Thus there must be a close and defensible relation between the root definition (including its CATWOE elements) and the model of the holon which would do the purposeful activity described in the definition. There must be a link between the words and the phrases in the definition and the activities in the model. The former should contain no words or phrases not traceable in the model, which for its part should contain no activities except those justifiable against the words and phrases of the root definition (Checkland & Scholes 1990a: 39).

However, Gregory (1993) has a different view of logics. He argues that “the connectives in SSM models do not reflect the laws of cause and effect” (Gregory 1993: 336). Thus, the logics which is claimed in SSM models is inadequate:

the elements of the SSM models are commands and generally accepted logics only operate on truth bearers. Statements, or more strictly propositions, can be true or false and are, therefore, truth bearers. Commands can be neither true nor false and have no place in generally accepted logics (Gregory 1993: 336).

Thus, there seem to be different understandings of the notion of logics. Woodburn (1985) also argues that there may be ambiguities in building SSM conceptual models from a root definition. There are difficulties in developing sets of interacting activities wholly consistent with the root definition because “everyone’s ‘world of logic’ is different” (Woodburn 1985: 102) due to previous experience and background
knowledge. He therefore suggests, as an aid to identify logical dependencies, to check what “significant output of matter, energy, or information” can be expected from each activity and which also can be conceived as significant input to another activity. By enquiring into such questions the logical dependencies between activities are identified. So also are feedback loops which will have an impact on learning. Logical dependencies and feed back loops are represented by arrows in the model. Further, except improving the accuracy of the model, the amount of information will also be increased when the logical dependencies in the form of transfers of matter, energy or information are named.

Further confusion arises concerning how the logic of the conceptual models should be interpreted. The aim of the conceptual model is to represent the activities “of what must go on in the system. Particular hows (including such things as roles, organizational structures, and specific ways of carrying out the activities) must be included only if they are specifically named in the root definition” (Checkland 1981: 286). However, Mingers (1990) after closer inspection, argues that this is not adequate; on the contrary, “conceptual models are best seen not as a what but as a fairly general how (conceptual rather than actual) detailing the way in which the what, expressed in the root definition, is to be carried out” (Mingers 1990: 24). He expands his argument by giving some examples as to how the same root definition can be understood differently in how it should be carried out, i.e. by which activities it should be represented.

Mingers (1992b: 58) also experiences difficulties in drawing the distinction between conceptual world and real world:

At a very basic level, our use of language and words pre-supposes knowledge about the world. Not just knowledge in general or knowledge of what must logically be, but specific knowledge of how things are done in specific cultural and organizational situations. Knowledge is not independent and objective, but context-bound. In writing RDs [root definitions] and even more so CMs [conceptual models] we are always expressing knowledge of the real world.
The semantics of language contradict the idea of leaving the complexity of the real world and purely concentrating on a logic-based inquiry. The main problem, hence, in model building is that the ‘logical machine’ is impossible to build, since it is based on the semantics of language and, thus, on individuals’ understanding and experience.

4.5: GUIDANCE – MEASURES OF PERFORMANCE

Models are based on the system metaphor of an adaptive whole, therefore there needs to be an additional monitoring and control sub-system which guarantees continuity, i.e. that the entity could in principle survive in a changing environment. This process of the monitoring and control sub-system is illustrated through three activities, ‘define measures of performance’, ‘monitor the operations’ and ‘take control actions’. The relation between these is as follows:

[The control activity] will be contingent upon knowledge of how the operations are going, something obtained from an activity such as ‘monitor the operations’. Now, there can be no neutral monitoring. In monitoring one must be looking out for certain features related to standards of good and bad performance. Thus, the monitoring will be contingent upon the activity ‘define measures of performance’ (Checkland, Forbes & Martin 1990: 31).

Measure of performance is related to the ‘formal system’ model and defined as “indicator whose level signals progress or regress in pursuing the system’s purpose (Checkland 1981: 315). The term originates from Jenkins’s (1969) methodology of Systems Engineering and has been re-phrased by Checkland (1981: 147f), but, from what I understand, the content of the term has not changed:

In 1969, when the work began, I took as my starting point the methodological cycle shown in Figure 5 [i.e. a figure which illustrate the process of Systems Engineering as defined by Jenkins, with adding of one bubble indicating a problem situation, one bubble illustrating guidance by systems thinking and a line drawing of a man who interacts between these bubbles], and started by loosening up the phrasing of the methodology as Jenkins had expressed it, so that, for example ‘Definition of overall economic criterion’ became ‘Definition of overall measures of performance’.
The measures are not explicitly stated, but will be according to some point of view or weltanschauung which is declared in the root definition and CATWOE and will include “anything and everything associated with maintaining the structure and content of the operations” (Checkland, Forbes & Martin 1990: 31). The adaptation of the operational sub-system will in principle flow from a decision by the monitoring and control sub-system that the operations are not satisfactory. The criterion for deciding whether the operations are satisfactory originate from the question “How could the system fail?” (Checkland 1989a: 90). It was argued that in general there are three different ways in which this could happen: that the means for the transformation process might be inappropriate and not work in the sense of delivering what is counted as the output; that the means might be using up an inordinate amount of resources; and that the transformation might not relate to the longer term aim. These criteria were then related to:

- **Efficacy** - does the means work; are these activities accomplishing the transformation;
- **Efficiency** - is resource use minimum; could the transformation be accomplished better with a different technique, e.g. is it efficient to brush the pavement with a tooth-brush; and
- **Effectiveness** - is this the right thing to do; are we accomplishing our longer-term goals that are linked to our weltanschauung.

The above criteria are normally referred to as the ‘3 Es’. It is recommended that “in general a model builder ought to decide what the criteria would be for the efficacy, efficiency and effectiveness of the system modelled. This adds a useful richness to the later comparison between the model and perceptions of the real world” (Checkland & Scholes 1990b: 39). The ‘3 Es’ give a basic competent control function in terms of viewing the transformation process as a means. However, if wider considerations seem relevant the ‘3 Es’ may be extended to become ‘5 Es’, including also considerations of ethics and elegance (Checkland, Forbes & Martin 1990):

- **Ethics** - is the transformation a morally correct thing to do;
- **Elegance** - is the transformation aesthetically pleasing.
When examining the ‘5 Es’ more closely Bergvall-Kåreborn and Grahn (1996a) found that it is not argued why these particular five ‘Es’ were chosen, except that the first three originate from the question ‘How could the system fail?’. Furthermore, only two of them have a clear connection to the other concepts in the systems modelling phase: effectiveness answers the question ‘Are we doing the right thing?’ and relates to weltanschauung; and efficacy asks if the means work and relates to the transformation process. Efficiency, on the other hand, relates to economy of resource use. This consideration together with the remaining two, ethics and aesthetics, seems to be related to something ‘outside’ the systems thinking phase. The statement that the first three Es, that is efficacy, efficiency, and effectiveness “cover only the most basic idea of transformation” and that “they can be supplemented with other considerations of a broader nature if it seems appropriate in a particular field” (Checkland & Scholes 1990b: 42) supports the conclusion that ethics and aesthetics are not related to concepts in the Systems Modelling phase. Subsequently, the use of the concept efficiency is not consistent with the systems approach (Churchman 1968). ‘Efficiency thinkers’ are coloured by Taylor’s theories on Scientific Management where there is one single way to perform a work efficiently. Costs are seen as equivalent to resource use, which is measured in dollars and cents, and the objective is to minimise costs. Efficiency is a concept which is always viewed in relation to a small portion of the organisation and therefore unsuitable for an holistic approach. Churchman (1968) points out that if one is only interested in cost reductions as such the result can be quite the opposite to that which was intended. A decrease in costs of one part of a system can often lead to an increase in costs of the whole system.

Further, Gregory (1993) identifies an additional problem in the measure of performance for the criterion efficiency. Efficacy tells us whether the desired effect has occurred or not, effectiveness whether the system meets a longer term aim, but “what is the criterion for efficiency meant to measure?” Efficiency is defined as the amount of resources used in relation to output. However, SSM models consist of minimum necessary conditions and therefore no condition can be left out. Hence,
“any system that consists entirely of necessary conditions can operate in only one way” (Gregory 1993: 341). So, if minimum activities are specified as is stipulated in the definition of conceptual models, then efficiency is implicit and becomes superfluous as an explicit measure.

One of the optional ‘Es’ is addressed as an issue of an ethical dimension in SSM. Atkinson (1989) points to the importance of identifying where moral judgements are implicit in systems design in general and in SSM in particular, and uses Seedhouse’s ‘Ethical Grid’ (Seedhouse 1988) to structure moral judgements. However, Atkinson’s research on ethics in SSM does not cover ethics as a measure of performance for the transformation in conceptual models. He focuses on the question from a position where moral judgements are involved in the process of doing a systems study using SSM.

In conclusion, the monitor and controlling sub-system with its measure of performance is based on the ‘formal system’ model. This model builds partly on work related to systems engineering. Its measures of performance were chosen based on the understanding of how a (engineering) system could fail. Although it is said that the conceptual model should build on nothing but the statement in the root definition, this is not the case concerning measures of performance. It is found that efficiency relates to minimising resource use and that supplemented measures (SSM recommends ethics and aesthetics) look outside for reference.

The purpose of conceptual models is to be device for structuring the debate in the succeeding Taking Action phase. They are not meant to be models of parts of the real world, but models relevant to debating the real world situation. Thus, it can be argued that choosing a well-formulated root definition, or a shorter version, and using 3 E’s, or 5, is an arbitrary choice which will be judged in terms of how relevant the model then becomes when relating it to the real-world situation. However, this is not an arbitrary choice because “models in SSM have an impact on and effects in the real world, affecting perceptions of the problem situation” (Tsouvalis & Checkland 1996: 44). Thus, models focusing on efficacy, efficiency and transformation do not provide
a rich learning experience of a social system. However, before turning to discuss the
use of these models in the Taking Action phase we must touch upon the issue of
validity in SSM models.

4.6: Validation of Models
The aim of the Systems Modelling phase is to structure the thinking through a logic-
based enquiry using models of purposeful human activity systems. These models are
then used in a debate by setting them against perceptions of the real-world situation.
However, “before using the model as a tool in this way, most modellers will probably
be asking themselves if their intellectual construct is adequate, or ‘valid’ ” (Checkland
& Scholes 1990a).

In early definitions these models are portrayed as objective pictures, however
not representing any ‘ought’ in the real world.

The conceptual model is a picture, as objective as possible of what is implied by the
root definition. It is not a representation of the ideal which might be approached; it is
absolutely not a representation of what ‘ought’ to exist in the real situation (Checkland
1972: 102).

Hence, the model does not purport to be a description of part of the real world, so the
question does not concern whether the model is valid or invalid against that part of
the real world and the model should not be seen as normative. The role of the models
in SSM is to stimulate and structure debate about changes. The models do not
describe parts of the real world; they are models relevant to debating the real world
situation (Checkland & Scholes 1990a). Hence, SSM models are described as an
objective picture as possible, but not of any ‘ideal’, nor any ‘ought’ because
“autonomous individuals are free to place their own constructions upon the
purposefulness of action” (Checkland 1995a). The question of the validity of the
conceptual models is described thus:
they cannot be tested by checking how well they represent the world, since this is something they do not purport to do. The models in SSM have been described as ‘epistemological devices’, so that the validity question becomes the question of how well we can tell a ‘good’ devise from a ‘bad’ one. There are two aspects to this question: the question of whether a model is actually ‘relevant’ or not, and the technical question of whether a given model is competently built (Checkland 1995a: 52f).

The first aspect of validity, whether a model is relevant to a particular study, has to be answered by the learning process itself, of which SSM does not give any restrictions or directions. “In any particular situation it would then be necessary to learn one’s way to which Weltanschauung were taken to be significant by people in the situation in question” (Checkland, Forbes & Martin 1990: 34). Thus any weltanschauung would be accepted, as long as it would be taken as representative of the situation.

The recommendation concerning the technical question of whether a model is competently built is that it can be checked against the ‘formal systems’ model (Checkland 1981) or against some other model that uses systems concepts. However, the use of the ‘formal system’ model “has fallen into desuetude in recent years” (Checkland & Scholes 1990a: 42) and it is “cheerfully dropped” (Checkland & Scholes 1990b: 42). Following the above recommendation, this means that a check should be made against some other systemic model of one’s own choice. However, the technical question has also a second, more interpretivistic, meaning, termed as “technically defensible or indefensible” (Checkland & Scholes 1990a: 43). Technically defensible means internal validity between the use of the SSM techniques root definition, CATWOE elements, conceptual model and measures of performance. This validation is carried out:

by asking whether a pairing of root definition and model is defensible. Each phrase in the root definition should lead to particular activities in the model; each activity in the model should be traceable back to a particular word or concept in the root definition. The measures of performance for the efficacy, efficiency and effectiveness of the model must be linked to words of the root definition and the Weltanschauung it expresses. If such links can be demonstrated and defended then the model can be regarded as good enough to be used in the comparison phase (Checkland 1995a: 53).
Thus, if the model is ‘relevant’ and if the techniques of SSM are used consistently with each other, then it is assumed that the model is a ‘good’ epistemological device. The importance of this consistency is emphasised “since credibility (and participants’ confidence in the process) can be diminished if some smart person in the situation points out a basic logical flaw in the model” (Checkland & Scholes 1990b: 41). However, as shown in the above, the semantics of language makes this kind of validation problematic. Due to previous experience, individuals might form different understandings of the same words and the result would be that “everyone’s ‘world of logic’ is different” (Woodburn 1985: 102).

Checkland nevertheless concludes that “model validation is not now an issue of great moment in the development of SSM” (Checkland 1995a: 53). This is in contrast with a point made by Landry, Malouin and Oral (1983) about the importance of dynamic interaction between modelling and validation for development and learning:

Continuous validation by an individual is a necessary condition for his or her learning and adaption. Indeed, for Piaget, adaption results from a dual and simultaneous mechanism. On one hand, the assimilation function integrates new information to the already-existing mental framework (model); and, on the other hand, the accommodation function modifies the already-existing framework to take into account the particularities of that information (Landry, Malouin and Oral 1983: 211).

Thus, according to Jean Piaget’s theories on development and learning, where the adaption of new knowledge is the result of a dual and simultaneous mechanism conceptualised as assimilation and accommodation functions, and which the constructivist model of learning is founded on, validation is a necessary pre-requisite for learning. However, SSM has chosen not to define criteria for validating and reflecting on the learning but states that “learning is an ultimate good” (Checkland & Scholes 1990b: 300).
4.7: CONCLUSION

SSM has developed some precise techniques, based on the concept of an adaptive whole, for inquiring into the real-world situation. This powerful concept has its base in systems engineering and we also find relations in the field of cybernetics. But, the purpose of systems in SSM is not to describe what the content of the organisation ought to be, but to explore the situation by means of an abstract concept which has emergent properties, a layered structure and processes of communication and control. To differentiate this concept from other kinds of systems thinking, it is suggested using the word ‘holon’. This review has identified different implications of wholeness, pragmatic and cogitative, where the first points to efficiency and the latter to cultural relativism. There are traces of both in SSM.

The techniques developed which guide this phase are also derived from action research. They have been formalised in some rules. We find, however, that these rules have changed over the years. Some have been dropped without appropriate replacement. For instance, systemic elements that were common omissions in earlier SSM studies are, in later writings, purposefully left out. This creates a confusion, especially to ‘newcomers’ to the methodology, when there is no explanatory theory that supports the choice of these elements and puts them in a context. This means that the inquiry is purely in the hands of the designer and his individual knowledge.

Problems have also been identified with the rules that are in use. For instance, the activity model is impossible to build as a ‘logical machine’ since it is based on the semantics of language and, thus, on individual understanding and experience. Further, the monitor and controlling sub-system in the model is based on measures for controlling a mechanical system but has no theory that supports their choice. Finally, the validation of models is impossible since they are based in individual understanding of what is relevant. Validation is a necessary condition of constructivist models of learning why SSM’s position is inadequate.
CHAPTER 5:

TAking action

In the third methodological phase, taking action, the models built in the previous phase are “brought into the real world’ and set against the perceptions of what exists there” (Checkland 1981: 164). The purpose is to generate a debate between the people concerned and to identify changes that could ‘improve’ the problem situation.

SSM assumes that “change occurs through learning as much as through systematic engineering” (Davies 1988: 131). Organisations are social worlds and changes within them are often ambiguous and misunderstood. This creates problems, which are not of the equation type and which cannot be ‘solved’ through systematic engineering but by negotiation and debate. SSM assumes that by making explicit the different constructions of meaning that people place upon happenings, “it is possible to improve the communication in social situations, and hence to clarify the visions and purposes which individuals may share” (Davies 1988: 131). By using the models as learning device, distinguishing “between activities in the real world and the intellectual activity that is concerned with the related thought processes” (Wilson 1990: 300), the actors in the situation reinterpret, learn and thus understand actions needed to change their situation. In order to bring about changes there needs to be an interpretative learning process.

5.1: GUIDANCE FOR TAKING ACTION

This phase is the core of learning. Learning is attained by using the models in a debate to question different perceptions of the situation. By comparing the models to the real world, questions are asked that probably never would have been asked
otherwise. Checkland (1991a: 70) claims that it is virtually impossible to take part in a SSM process without getting new insights.

The debate which SSM engineers through the comparison phase reveals the norms, the standards, the values extant in the problem situation and contributes to their changing. It is virtually impossible to perform the comparison phase of SSM without modifying the readiness of the participants to perceive the world in a particular way. ‘Appreciative settings’ will be revealed, as will the degree to which they are changing, could be changed or – in the framework of stated Weltanschauungen – should be changed.

Thus, learning is achieved through the comparison\(^{16}\). Four different ways of using the models for making the comparison are outlined (Checkland 1981; Checkland & Scholes 1990b): question definition, scenario construction, general discussion, and model overlay.

The first technique, question definition, has emerged as the most common. The models are used as sources of formal questioning of the existing situation. Each activity in the model is compared to the real situation. It is asked if the activity exists, how it is done and how it is judged. Through this a debate is raised on sources of ideas for change and for ‘systems’ to be further explored in ‘new’ root definitions.

The second technique, scenario construction, uses the models to write scenarios and set them against history. The comparison is done by reconstructing events in the past and comparing them to what would have happened if the operations had been shaped by the model. However, it is stated that the conceptual models “have an antiseptic, inhuman air” (Checkland 1972: 110) and that implemented models “would require inhuman beings to operate them”. They are there only to help tackle the problem solving in a structured way, not to prescribe what ‘ought’ to exist.

The third technique is general discussions. These are somewhat informal discussions in which strategic questions rather than detailed queries about the activities in the model, are raised.

The final technique is model overlay. A model of the real world with the same structure as the conceptual model is built and one model is laid over the other to

\(^{16}\) This phase, where real world and models are compared, discussed and formulated, is also referred to as “metamodeling” (van Gigch 1991: 133).
show mismatches. Possible changes are then considered on the basis of these mismatches.

The discussion is assumed to take place among people concerned in the situation and results in an accommodation between different interests. “The purpose of the debate is to find an accommodation (not necessarily a consensus) which enables action to be taken to improve the problem situation” (Checkland 1995a: 51). It is assumed that action to improve is accomplished through learning and through commitment. Further, design is viewed as the creation of a modified situation (Checkland 1972: 110):

‘Design’ becomes design of a ‘change’ selected as a result of the root definition/conceptualisation/comparison process. Design here is not the creation of something which will perform in some specified people-proof way to achieve some defined objective, it is the creation of some modification to which purposeful individuals are prepared to give their commitment.

Some have expressed concern about the possibility of communication being distorted by people exercising their power. In such situation, the force of the better argument (Habermas 1973) in an ‘open participative debate’, will not dominate. This is in conflict with SSM’s claim of being a participatory approach. “Soft systems thinkers should therefore be critical of all social arrangements which prevent the kind of open, participative debate which is essential for the success of their approach, and which is the only justification for the results obtained” (Ivanov 1991: 45).

Besides the problem of unequal power, cultural constraints and authority control also affect the debate stage. Therefore a suggestion to modify this stage is an “indirect debate” (Kartowisastro & Kijima 1994: 245) whereby subordinates do not join the debate directly but instead their opinions are gathered in informal discussions and presented to their superiors by the analyst.

A final problem identified is generated when models are compared with reality; “one is not comparing like with like: systems models are represented in systems language, and the initial perception of reality is expressed in another language, usually relating to the users’ interest groups” (Aison & Wood-Harper 1990: 66).
5.2: Validation of Changes

The aim of the debate in SSM is to generate ideas about possible changes which meet two criteria: systemic desirability and cultural feasibility (Checkland 1981: 181).

They [the changes] must be arguably systemic desirable as a result of the insight gained from selection of root definition and conceptual model building, and they must also be culturally feasible given the characteristic of the situation, the people in it, their shared experiences and their prejudices.

‘Systemic desirability’ is defined as being generated by models “whose comparison with the expression of the problem situation [from the finding out phase] will yield possible changes which this systems analysis recommends as being desirable” (Checkland 1981: 318). By this I understand that the criterion has its base in the logic that frames the systems modelling phase, but what the criterion really means is not clear; a definition cannot contain words being defined. (Desirability is not defined by referring to “being desirable”.)

‘Cultural feasibility’ implies that “the culture of a particular problem situation, with its unique norms, roles, and values will be able to accept, as meaningful and possible, a certain range of changes” (Checkland 1981: 313). Culturally feasible means that concerned people’s understanding of the suggested changes is meaningful and acceptable. Changes in what is viewed as culturally feasible means changes in attitude. This occurs steadily as a result of shared experiences among people and is what Vickers refer to as ‘the appreciative system’ (Vickers 1983b). Feasibility, defined as what is useful in practice, is also a criterion of the American Pragmatist schools of thought (Le Moigne 1995). Cultural feasibility becomes then what is useful in practice, given the culture of the situation.

An objection to the appeal “to ‘effective-efficacious-efficient’ systems or activities” which are “culturally acceptable solutions” or “agreed-accomodated purposeful activity systems” (Docherty & Ivanov 1991: 170) is that this is based on an “attempt to bypass the assumedly old-fashioned question of [ultimate] purposes”. Docherty and Ivanov (1991: 170) argue that the reason for this can be found in “a symptom of the inadequacy of available theories in accounting for the ethical dimension”.

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The notion of culture is not further elaborated in this SSM phase; it is not linked to ‘social systems’ analysis and ‘political system’ analysis of the finding out phase. It is not discussed in relation to ‘the systems map of the universe’ (Checkland 1971) in which one category of systems of “equivocal nature” (Checkland 1971: 110) is labelled ‘social and cultural systems’.

Thus, models built in the previous phase (systems modelling) are selected as being relevant to the problem situation. The changes which come out of debating these models are systemically desirable if these models of ‘relevant systems’ are perceived to be “truly relevant” (Checkland & Scholes 1990b: 52). Further, implementation of changes will modify the culture of the situation “but the changes will be implemented only if they are perceived as meaningful within that culture, within its worldview” (Checkland & Scholes 1990b: 52), i.e. they have to be perceived as culturally feasible. This means that if there is a conflict between what is systemically desirable, based in the – so called – logic of the model and what is perceived as culturally feasible, Checkland and Scholes state the change will not be implemented.

In early attempts at defining SSM (Checkland 1972: 115) it is stated that “it is not optimum-seeking; it seeks what are agreed by concerned people to be ‘improvements’”; further, “it is not utopian; it does not require any definition of ultimate goal or objective, only an elucidation of ongoing purpose”; and, finally, “it is hence not a methodology of systems design, only of conceptualisation and design of changes”. In a more recent attempt, however, at making generalisations about SSM (Checkland & Haynes 1994: 195) it is stated that ontological statements about SSM “are virtually never defensible”. Further, SSM is rather the name of an ‘ideal type’:

the name of a framework for thinking about, making sense of, and finding ways of improving real-world situations that are perceived as problematical (Checkland & Haynes 1994: 195).

The essence of SSM lies in five related concepts (Checkland & Haynes 1994: 195). First, “the process as described on paper is an ideal type, which users must mold to their own purposes”. Second, the principal systemicity of SSM “lies in the process of

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17 See Chapter 2.
inquiry rather than in the world” and SSM uses holons to inquire the real world. Third, “the focus of the approach is on the interaction between theory and practice”, i.e. systems theory guide practice which is itself the source of modified theory in a never ending learning process. Fourth, the underlying assumption in SSM is that “learning is a good thing” and that the SSM process “can generate continual learning about human situations, the intentions that arise in them and the realization of those intentions through accommodations between conflicting interests”. And fifth, finally, participatory use of these concepts is “the most stimulating and fruitful way” (Checkland & Haynes 1994: 195).

The above definition stresses that SSM is a methodology which uses systems principles for inquiring and learning. It does not give any directions for the learning but assumes that “learning is a good thing” and that learning may solve problems with conflicting interests. Other definitions also emphasise learning. In von Bülow (1989: 35) SSM is described as

a methodology that aims to bring about improvements in areas of social concern by activating in the people involved in the situation a learning cycle which is ideally never-ending.

The learning aspect is also stressed in Checkland’s recent writings (e.g. Checkland 1994a; 1994b) but without elaboration. The use, validation and judgment of the methodology are left for the users to decide upon “in the sense that things ‘improve’ as measured by some agreed criteria, or that concerned people in the situation themselves feel that insight has been gained or useful changes made” (Checkland 1981: 192f) or that learning has been achieved. The users must judge about what to use of the methodology and how to use it in any particular situation. SSM gives no directions.

There are two possibilities in the paradigm of learning (Fuenmayor 1991): one regards learning as a tool for managing human organisations and the other learning as the key focus itself. The first possibility means that the systems practitioner helps management to assess the ‘cultural feasibility’ of the organisation and thus provides a tool for management. This is referred to as “pragmatic-regulative interpretive management” (Fuenmayor 1991: 232f). The variety of Weltanschauungen that are displayed, and thus, the variety of the learning, goes “as far as is ‘relevant’ to the
pragmatic purposes embedded in the particular problematic situation under consideration” (Fuenmayor 1991: 233). Fuenmayor concludes that “systemness (or wholeness) is not really an issue”.

Atkinson’s (1984) acknowledges the criticism that SSM provides yet another tool ” (Checkland & Haynes 1994: 195) for management. Atkinson found that the systems metaphor of an adaptive whole was of considerable value in revealing both historical and current notions of the nature of ‘systems’: particularly how it was used in structuring all aspects of soft systems methodology, even to interpretations of its very nature. The influence, and identification, of this metaphor cannot be overlooked, for even in alternative interpretations of soft systems methodology [i.e. using the metaphor of a contradictory system], this metaphor is at work structuring our conceptualisations and even our activity that could be termed purposeful (Atkinson 1984: 378f).

Thus, although SSM claims to use the metaphor of systems only as a device to structure our thinking, this metaphor of an adaptive whole, with emergent properties and processes of communication and control, monitored through measures of efficacy-efficiency-effectiveness, will inevitably also influence our activities. As Vickers argues, “men and their cultures are profoundly influenced by the tools they use” (Vickers 1983a: 8).

5.3: CONCLUSION

In taking action, the final phase in SSM, the core of the learning takes place. The models built in the previous phase are set against perceptions of reality in a debate. Mismatches indicate possible changes that are judged according to their desirability and feasibility. The purpose is to achieve an accommodation about changes. However, we have identified some problems in this approach which affect the debate stage and may lead to a distorted communication. This, in turn, may lead to failure in reaching accommodated changes. One is the problem of unequal power relations. A second problem relates to cultural constraints and authority control. A third problem is that the models have reduced the richness of the real world to systemic concepts aimed only at logic and efficiency.

The criteria that SSM offers for judging changes, systemic desirability and cultural feasibility, are not well defined. They are moreover criticised as avoiding the
ethical dimension. SSM does not take any standpoint but assumes that “learning is a good thing” and that learning may solve problems with conflicting interests. This attitude may lead to learning becomes a manipulative tool for management.
CHAPTER 6:
CONTEMPORARY CRITIQUE AND SUMMARY

The criticism that SSM gives no directions for learning and, thus, risks in becoming yet another tool for management, have been repeatedly stated by Critical Systems Thinking, CST, as defined mainly by scholars at Hull University in the United Kingdom. CST evolved out of a critique of traditional management science as well as out of a critique of SSM; traditional management science was criticised for being positivistic and because of that, inadequate in practical applicability; whereas SSM was criticised for its interpretivistic stance. In the following the basic ideas of Critical Systems Thinking are reviewed followed by a summary of Part One of the thesis.

6.1: CRITICAL SYSTEMS THINKING

The basic philosophy behind Critical Systems Thinking is, as in SSM, also interpretivistic, but complemented with “issues of sociological epistemology” (Flood & Ulrich 1990: 9). This means that interpretivistic systems thinking needs to be placed in a social context to critically reflect upon such interpretations. But the social context itself also needs to be critically analysed and reflected upon. This is done from the standpoint of emancipation, i.e., an interest in “an equal distribution of power and chances to satisfy personal needs and in liberating people from dominance by other people” (Flood & Ulrich 1990: 9). Mingers (1992a: 174) reveals problems with this approach, “in overcoming the subjectivist arguments of interpretivists and theorising an objective, external world”. Interpretivism focuses its attention on the individual’s internal world while sociological issues imply an external world believed to exist outside the individual. As a philosophical base CST proposes critical idealism which states that all knowledge and understanding are confined to the knower. However
they also state “that ‘out there’ are some hard factual conditions that do not exist in
the mind only” (Flood & Ulrich 1990: 18). To resolve the interpretivist/objectivist
dilemma and strengthen the philosophical underpinnings of CST, Mingers suggests
the work of Bhaskar (1986), which has come to be termed critical realism and is a
non-objectivist version of realism. It strongly asserts that there is an independent
world consisting of a system of causal laws. We cannot, however, directly experience
this world. The phenomena we encounter are generated by the above mentioned
causal laws, and it is only through these phenomena that we can indirectly experience
this world. I also support this view.

Instead of defining causal laws and phenomenon that we can expect to occur
CST chooses a different approach. It attempts to define a critical rationality, which
“‘reaches out’ toward the systems epistemological ideal by accepting the critical
idealism of Kant, Hegel and Churchman; and besides Marx’s critical ideas of historical
materialism” (Flood & Ulrich 1990: 25). The authors, Flood and Ulrich, do not
expound what they mean by the above quote, nor do they spell out how this “system’s
epistemological ideal” is linked to emancipation.

However, CST’s criticism towards SSM points to the lack of ‘objective’
standards for the interpretative task. If we live in a ‘perfect’ world where everyone is
concerned with improving the organisation as a whole, then the debate in SSM will
be impartial to particular persons’ or interest groups’ own objectives. This, however, is
not the case. Real-world situations are very much characterised by power and politics
where persons and groups, regardless of the benefits for the organisation, aim at
furthering their own ends. The characteristics of Soft Systems Methodology imply the
intention not to “diminish the freedom” nor “to force it [real life] into a more rational
form” (Checkland 1981: 173, 181). Instead it wishes to portray itself as being open
and participatory. But, “the kind of open, participative debate which is essential for
the success of the Soft systems approach, and is the only justification for the results
obtained, is impossible to obtain in problem situations where there is fundamental
conflict between interest groups which have access to unequal power resources” (Jackson 1991: 133).

In order to manage situations characterised by conflicting interest groups and get a more democratic approach, Critical Systems Thinking suggests a philosophy which rests on three ‘commitments’. These are commitments “to critique, to emancipation and to pluralism” (Schecter 1991: 213).

The second ‘commitment’, emancipation, is of interest as an ‘objective’ criterion for systems design. Emancipation is considered by seeking to develop emancipatory systems approaches and methodologies to deal with problem situations in coercive contexts. Additionally, there is also a reference to Habermas’ theory of human interests and his social theory. For all Critical systems thinkers aim at achieving the maximum development of their potential. This is said to be done by raising the quality of work and life in organisations and society. In the theory of human interests, Habermas (1972) argues that there exists three different kinds of knowledge interests, namely, a desire for technological control, a desire for understanding and a desire for emancipation. The desire for technological control is linked to hard systems methodologies, which aim at assisting material well-being by improving production and steering capacities. The desire to understand is connected to interpretive methodologies, which look at promoting and expanding mutual understanding among individuals and groups. Finally, to serve emancipatory interests means to protect one domain of interest from being dominated by the other “by denouncing situations where the exercise of power, or other causes of distorted communication, are preventing the open and free discussion necessary for the success of interaction” (Jackson 1991: 141).

CST’s choice for ‘measuring’ the performance of a system is found in emancipation. Though I agree that we need a standard ‘outside’ ourselves for guiding the design, I do not agree with CST’s measure of performance, “emancipation”, as the solution since it is too narrow in scope. To measure a system only in terms of whether
it sets its members free “especially from legal, political or moral restraint” (Hornby 1986: 281) cannot be a sufficient solution. If a bus driver decides to set himself free from the legal restraint of having to obey the traffic rules and decides not to respect the traffic light, the consequences can be fatal. The only emancipation that is likely to occur is liberation from life, something that may have not been requested by the victim(s). So, emancipation for one person may cause oppression for others. This leads to an important aspect which, to my knowledge, has never been discussed among Critical systems thinkers; that is, freedom always implies responsibility. Hence, the performance of a system needs to be measured in more than the emancipatory aspect.

6.2: SUMMARY OF PART ONE

Soft systems methodology, SSM, evolved through an action research programme aimed at exploring the contribution that system ideas could make on managerial real-world problems. The starting point for the work was the available methodologies at that time, based on Systems Analysis and Systems Engineering. When interacting in real-world situations it was found that these can be thought of as purposeful activity systems, or human activity systems. People in a situation try to take purposeful actions and these can be described as a set of activities linked in a coherent whole. The activities embody a transformation process in the light of a particular worldview, or weltanschauung. The realisation that human activity can be conceptualised as a system illuminated two different paradigms in systems thinking, ‘hard systems thinking’ and ‘soft systems thinking’. This is one of the main contributions of Soft Systems Methodology.

Hard systems thinking assumes the world is systemic while soft systems thinking does not make any assumptions other than that social reality is ‘problematic’ and characterised by multiple perspectives. How it is understood is dependent upon the individual observer, his interpretations and what he chooses to focus on. This is
the central idea around which SSM developed. Thus, it positions itself within the interpretivistic tradition and particularly in the philosophy of phenomenology and hermeneutics. Interpretivism in SSM is methodologically associated to the *verstehen* approach, linked to Wilhelm Dilthey and carried on by Max Weber. The nature of the actual interpretations is close to the ideas in the phenomenological tradition, particularly Alfred Schutz’ work. In this it is assumed that humans attempt to make sense of experience by capturing its essence in a holistic construct, or Gestalt. The hermeneutic tradition is represented by several strands of thinking of which hermeneutical theory, hermeneutical philosophy and critical hermeneutics are discussed in the above (Chapter 2). Although these three strands have different basic assumptions there are signs of all three in SSM, especially when related to SSM’s development over time.

Soft Systems Methodology views systems design as a process of learning. The model of learning that SSM builds on, is based on Sir Geoffrey Vickers’ work on making sense of a long working life experience. Vickers sees the experience that we acquire in our every-day life as a two-stranded rope of interacting events and ideas. This flux of events and ideas is interpreted, valued and judged according to norms, or standards, formed by previous experience. Vickers calls this appreciation. The appreciation forms a decision on whether to act, but with the intention of maintaining or regulating a relationship, not to fulfil a goal as an end in itself. This model differs from traditional decision models which assume human beings to be rational and goal-seeking. Vickers’ model, besides explaining the learning that takes place in the systems design process, is also a model for the SSM process. This process is divided into three methodological phases, of which the first (the finding out phase) represents the flux of interacting events and ideas, which are interpreted according to previous knowledge, experience and intentions. These various interpretations are depicted in models of purposeful activity systems in the second phase (the systems modelling phase), to be set against actual perceptions in the third methodological phase (the
taking action phase). In this last phase the systemic models, in turn, represent the flux of events and ideas, which are then weighed up against norms and standards leading to new knowledge and a decision about whether to act. The new knowledge will, in turn, inform the next cycle of appreciation.

To support learning, SSM has developed some techniques in each of its methodological phases. In finding out (Chapter 3) there is a recommendation to visualise concerned people as ‘problem owners’ and analyse their interest in the situation. There are also recommendations to explore the situation as social systems and as political systems. These recommendations are valuable since in the beginning of a study one usually gets overwhelmed by all the information. However, there is a common perception that there is a need for more guidance for this initial data gathering stage. If the representation is to be as ‘objective’ as possible and keeping in mind the interpretivist nature of SSM, the question is then whose interpretation should such a representation depict. SSM neither makes any assumptions about reality nor offers any framework to reflect upon. This process is left in the hands of the individuals and their ‘sense-making’ abilities without any support from the methodology.

The next phase, systems modelling (Chapter 4) is introduced by the identification and selection of relevant systems. The techniques developed for this phase concentrates on systems thinking. Underlying much systems thinking is the concept of an adaptive whole. This concept is in line with SSM’s core idea of systems thinking. The systems concept that was first used in SSM was the ‘formal system’ model. This builds on C. West Churchman’s model named ‘Anatomy of Systems Teleology’ and Gwilym M. Jenkins’ work on a version of hard systems thinking. The components of the model are ongoing purpose or mission, measure of performance, and decision-taking process. Further, the system itself consists of sub-systems which interact with each other. It exists in wider systems, has a boundary, resources, and some guarantee of continuity. The last element implies a feed-back cycle. The systems
model was used to test the basic adequacy of the techniques in this phase. In later versions of SSM, however, it has been dropped. But the techniques, which were partly formed by the model, remain.

The techniques developed for the systems phase aim at modelling purposeful activity. This is done in several procedures; first by stating the system in a root definition. The basic elements for the root definition (CATWOE) stem from experience. SSM has been criticised for not having any theory to support the choice of these elements. Their logical connections were established by means of the ‘formal system’ model, which, however, is no longer in use.

The second procedure refers to making an activity model of what the stated system does. This model is to be built like a ‘logical machine’ and should also be consistent with the root definition. However, since the language of the model is natural language and based on the semantics of language, this logical machine is difficult for most people to build. Rather the activities of the model become based on individual's understanding and experience of what would be ‘logical’.

Included in the activity model is a monitor and controlling sub-system. This system has similarities with cybernetic theory about self-regulation, or feedback processes. Besides its activities for monitor and controlling, the system incorporates three recommended measures of performance. They are efficacy, efficiency and effectiveness. These measures originate from reflections on the question how a system could fail, but they are not supported by theory. Moreover, only two of these measures are supported by statements in the root definition. According to C. West Churchman, efficiency is coloured by Tayloristic Scientific Management which implies that there is one single way to perform a work efficiently. We understand that the monitor and controlling subsystem and its basic measures of performance are still very much based on the hard systems thinking that partly forms the ‘formal system’ model. It is however recommended that the three basic measures are supplemented if wider considerations seem relevant. Any reasons for the suggested supplements,
ethics and elegance, are not given. We see a need to define a coherent theory to support the choice of measures of performance for the system.

The validation of the models was formerly done by checking their adequacy against the ‘formal system’ model, or some other systems model. As mentioned, the ‘formal system’ model has been dropped and there are no other recommendations given. The validity question asks whether the model is competently built and is relevant. Competence in SSM systems modelling refers to internal validity with consistent use of the modelling techniques. The relevancy question, it is said, has to be answered by the process itself; SSM gives no directions to what is relevant. Thus, any interpretation would be accepted as long as it is taken as representative of the situation. The purpose of the model is to be a learning device but, as well as giving no directions as to what is relevant, SSM gives no directions as to learning. The assumption is about knowledge as an end in itself and that learning is ultimately good.

SSM’s core idea of systems thinking, as fundamentally based on emergence and hierarchy and communication and control, is also criticised. It is suggested that these pairs be substituted in favour of the concept of wholeness. However, when adopting the notion of wholeness we find that it exhibits two strands of meaning, one which sees wholeness for the sake of efficiency and one which emphasises theorising, explaining and coming up with new questions. We recognise that both these meanings are visible in SSM. The first is discernible in the purpose of intervening in a real-world situation. The second is identified in the making of models to illustrate different understandings of that situation and learning from these. However, what is not explicated is how far the efficiency issue is taken, nor where learning will lead us.

The third phase, taking action (Chapter 5), is the essence of the learning, in which systems models are compared against perceptions of the real-world situation. This phase is the least developed in SSM although there are some techniques to guide the comparison. Using the models as sources for formal questioning of these
perceptions, is the most common. However, the review has identified a misfit when models represented by systems ideas are compared to perceptions of reality. In early developments of SSM it is stated that the conceptual models “have an antiseptic, inhuman air” and implemented models “would require inhuman beings to operate them”. Likewise we have not found any improvements in SSM in this respect, so the uncomfortable misfit remains also in later accounts of the comparison phase.

The aim of comparison is to generate ideas about possible changes to improve the situation. The suggested changes are valued against systemic desirability and cultural feasibility. Systemic desirability is defined as being generated by the models. Cultural feasibility refers to acceptability of concerned people within the norms of the situation. Systemic desirability is brought back to SSM’s second phase and its “inhuman” models, but cultural feasibility is not discussed in relation to any of the other methodological phases. Neither is it related to the analyses in the cultural enquiry (intervening system, social system and political system), nor to cultural systems in Checkland’s systems map of the universe.

A point of criticism is directed towards the accommodation of different interests. The debate in SSM has raised some concern about distorted communication related to power among people in the situation. The foremost advocates of this critique are related to the school of Critical Systems Thinking (see the previous section in this chapter). In order to manage situations characterised by conflicting interest groups and get a more democratic approach, Critical Systems Thinking suggests a philosophy which rests on three ‘commitments’, critique, emancipation and pluralism. Their choice for measuring the performance of a system is emancipation. Though it is agreed that we need a standard ‘outside’ ourselves for guiding the design, I do not agree with CST’s measure of performance. The system needs to be measured in more than the emancipatory aspect.
6.3: Conclusion

The review of SSM has identified some problems and confusions related to the methodology and its guiding techniques. The first problem is that there is no theory in use that supports, explains, and puts the systems modelling techniques in a context. Nor is there any theory in use that supports the choice of systemic elements and their interrelation. Finally, the lack of theory makes validation of models impossible. Therefore there is a need to include systems theory to strengthen the modelling of SSM.

The second problem relates to SSM's pluralistic and subjective nature. The analyst has to decide what issues and whose perspectives to explore; SSM's guidance for this endeavour is not sufficient. Further, in deciding what to model, any perspective could be taken as long as it is representative of the situation. Finally, in debating changes there is nothing in the methodology that prevents power abuse and distorted communication. Thus, we see a need to include a standard to which we can relate issues and perspectives.

Thirdly, SSM was begun out of one of the engineering methodologies and, although it has changed to adapt to human situations, we still find signs of this inheritance. The main problems are related to the systems modelling phase. We find that there are problems in using techniques aimed at engineering systems, to model social systems. The focus on industrial concepts like efficacy, efficiency and transformation may be why such models lack a human touch. Therefore, there is a need to include a more humane content in this phase which, additionally, will make systems modelling more coherent with the first and third methodological phases.

We found that the SSM techniques are of different nature in the different phases. This means that we first use humane concepts to enquire into the situation; then reduce our understanding to logic and efficiency models in the light of different perspectives, and finally we value this reduction according to some person's or persons' understanding of what is feasible and desirable. So, although SSM provides
some standards to aid in making sense of real-life experience, its guidance is inadequate: it is inconsistent (it differs among the design phases), reductionistic (its focus on the logic modality), and relativistic (its direction to individual's judgement on feasibility and desirability). It may even be manipulative. Consistency and concepts we can relate to (and find meaningful) are important from a learning point of view for achieving valuable and helpful guidance. Therefore there is a need for philosophical consistency in the learning phases of SSM.
PART TWO:  
MULTI-MODAL SYSTEMS APPROACH

This part presents the second major source of ideas for this research, Multi-modal Systems Thinking (MST) and a proposed model for merging the two approaches (SSM and MST) which is termed Multi-modal SSM, or the Arvidsjaur Method for short. It begins with a general introduction to MST and then expounds the elements that are used in this research. It ends with a comparison between the explored elements of Multi-modal Systems Thinking and Soft Systems Methodology, indicating how the first can contribute to the latter.

The three subsequent chapters follow the SSM phases and are a delineation of the proposed Arvidsjaur Method. The purpose is to mitigate some of the criticisms raised against SSM. The model incorporates a standard to relate to throughout the whole design process. It also incorporates the MST social systems framework to support the modelling. Finally, it is expected that merging the two will benefit the learning process inherent in SSM design.
CHAPTER 7:
MULTI-MODAL SYSTEMS THINKING

Multi-modal Systems Thinking, MST (de Raadt 1989a; 1991; 1995; 1997b; 1998; Strijbos 1995a), is rather new to the systems science field, but rests on some well founded theories, the Philosophy of the Cosmonomic Idea (Dooyeweerd 1953; Kalsbeek 1975) and Cybernetics (Ashby 1976; Beer 1981; Shannon & Weaver 1949; Wiener 1948). The Philosophy of the Cosmonomic Idea has its origin in the Netherlands and was founded by two Dutch professors at the Free University of Amsterdam, D.H.T Vollenhover and Herman Dooyeweerd. It is the work of Dooyeweerd (1953) that has had the greatest influence on Multi-modal Systems Thinking, particularly his identification of fifteen irreducible aspects of reality. The second theoretical foundation comes from the cybernetic thinking, based on Shannon and Weaver’s ‘Information Theory’ (Shannon & Weaver 1949) and on Wiener’s work (Wiener 1948). Their ideas, further developed by Ashby (1976) and Beer (1981), are drawn by de Raadt into Multi-modal Systems Thinking. The most influential idea is, however, Stafford Beer’s model of social systems management (Viable Systems Model, VSM).

MST criticises both the hard and soft systems approaches. The former are criticised for their narrowly focused, technological determinism in dealing with human problems, while the latter for their assumption about reality as being based on chaos and complexity. Instead, Multi-modal Systems Thinking, influenced by Dooyeweerd, suggests that there is order within complexity. The significance for systems design is illustrated by de Raadt. He suggests that when designing systems for humans, especially information systems, there is a need to incorporate all aspects of life, and keep a balance between them, so that “human life may be defined as one that displays a modal ecology very similar to the biological ecology found in the rain
forest” (de Raadt 1989a: 19). Kant, Weber and Habermas also recognise the need to incorporate several dimensions of knowledge, like ethics and aesthetics, and not just pure logics\textsuperscript{18}. Work by systems thinkers like von Bertalanffy (1968), Boulding (1985) and van Gigch (1991; 1997) also recognise different orders in reality and strive toward identifying their homomorphism.

MST aims at developing a theory for social systems management and design which is different from the utilitarian and the postmodernistic approaches for management and design. Modest advances have already been made in several fields: informatics (de Raadt 1989b; 1991; Strijbos 1995b; Winfield, Basden & Cresswell 1995), systems design (Bergvall-Kåreborn & Grahn 1996a; 1996b; de Raadt 1989a; 1997b), information systems design (de Raadt 1995), environmental planning (Lombardi & Basden 1997), transport (van der Stoep 1995), welfare systems (Hansson & de Raadt 1995), and ethics and wisdom (de Raadt 1996; 1997a; Strijbos 1995a; 1995c; 1995d). In the following the aspects of MST that are of particular interest for this research are reviewed, namely its framework of aspects in reality and its model of a living social system. Finally, I point out the convergence between MST and SSM.

7.1: Aspects of Reality

Dooyeweerd began his task of developing the Philosophy of the Cosmonomic Idea through his position as an advisor of legal and politico-economic issues at the Kuyper Institute. He felt that to properly carry out this task, systematic theoretical work was required. Therefore he began to tackle the problem of the social, economic, political and legal spheres of life from a historical and systematic point of view, as well as in theory and in practice. This work convinced him that all questions in science are consciously or unconsciously answered based on a certain belief about reality. Dooyeweerd investigated the structure of temporal reality as a product of human

\textsuperscript{18} See for instance, Stolterman (1991: 82ff) for further explorations of this point.
experience and thought. Gradually distinct dimensions of this structure were identified, analysed and discussed. Dooyeweerd’s work resulted in fifteen irreducible aspects, but he constantly emphasised that his analysis is open to correction and elaboration. The dimensions that Dooyeweerd identified are numeric, spatial, kinematic, physical, biotic, sensitive, logical, historic, informatory, social, economic, aesthetic, juridical, ethical and credal. To these two more aspects have been included by de Raadt (1996; 1997a; 1997b), epistemic and operational (see Figure 7:1).

![Figure 7:1. The Different Modalities and Their Interrelation.](image)

The figure above illustrates different modal aspects of human life. The aspects are best illustrated by an example, for instance, an industrial plant. Starting from the right of the figure towards the left, the numerical modality can be discovered by counting the workers, the machines, and the units produced per day. The spatial dimension may refer to the amount of space that the plant, machinery, workers, and storage occupy. Within the plant building there is a constant movement of people, material, and goods which point to the kinematic dimension. Both living creatures and machinery need energy in order to function (the physical modality).

The organic phenomena of life represented by the biotic modality can be viewed in the workers’ need for food, water, and air to breathe. The sensitive aspect is
illustrated in the display of emotions between the members of the work force and the managers when faced with conflicting issues. The logical dimension is present in production plans and work schedules, which are formulated from past experience, that is, the historical dimension. Orders and instructions are mediated to those concerned either through direct communication or in writing, both of them operating in the informatory modality. The know-how that is involved in carrying out the order represents the epistemic aspect.

The plant is in itself a social system, and is also part of a social community. For most people, employment is a major part of their social life. For some, it may be the only possibility to socialise. The operational aspect is the core transformation process of raw materials into some kind of product. The economic modality supports this transformation process by handling the resources.

The aesthetic dimension may be noticed in the design of the products. Perhaps the plant produces some beautiful pieces of furniture. The juridical dimension is present in the labour market laws. The ethical dimension goes beyond the Companies Act and may be found in management’s considerations for the workers’ families. Finally, the credal modality reflects people’s trust and religious faith in what they regard sacred. Furthermore, trust in the company by customers, share holders, and finance institutions is another example of the importance of this modality.

The modalities are set apart for analytical reasons. In experience and thought, however, they are bonded together as a whole as in Figure 7:1. Each feather of the fan is discernible on its own but makes up the whole only when taken together. Also, if one feather is missing the fan may still function, but not properly. If several feathers are missing the fan’s usefulness will be greatly reduced. It is likewise with the modalities. The more of them we neglect, the poorer our society will function.

19 This is something worth remembering when designing our systems.
20 This modality has come to dominate today’s business world, usually at the expense of the other modalities.
Each modality is given its meaning by a kernel, or nucleus (see Figure 7:2). The kernel of the credal modality is faith and of the ethical modality is humanitarian love. Justice is the kernel of the juridical modality, and so forth.

The kernel and order of each modality are irreducible according to Dooyeweerd's notion\(^{21}\). Thus, the numeric modality is directed and governed by discrete quantity and the informative modality by symbolic representation. There are two types of order, or sets of law, determinative and normative. The order of the lower modalities (Figure 7:2) such as the numerical and spatial is more determinative.

\[\text{Figure 7:2. The Different Modalities Related to Its Nucleus (after de Raadt 1997b).}\]

This means that the order must be obeyed. It “always exerts its own fulfilment” (de Raadt 1991: 7). In the higher modalities, such as the ethical and juridical, the order is more normative. This does not mean that these modalities are indefinite or ‘fuzzy’. They have their own set of laws, although they cannot be described through the order of the determinative modalities. Their fulfilment is contingent on people's inclination to follow this order. There is a degree of homomorphism between the orders of the

\(^{21}\) However, this does not mean that the order of the modality model is irreducible.
modalities. Homomorphism is greater the closer the modalities are to each other, according to their order. This means that orders from one modality can be used to express aspects of another.

The ordering of the modalities in Figure 7:2 is not haphazard; on the contrary its arrangement corresponds to Dooyeweerd’s perception of the order of creation, or the unfolding of nature and culture. This order also shows the interrelationships between the modalities. Thus, each lower modality forms the foundation for the modality immediately above: the biotic modality rests upon the physical modality, which, in turn, rests upon the kinematic. These foundational aspects constitute the basic condition for all of life

Further, a modality cannot be defined by concepts within itself. For example, the social modality does not get explained by the words ‘being social’ or ‘having social interaction’. Instead the informative modality is inherent to the understanding of the social modality; and the historical is inherent to the understanding of the informative modality. Thus, the social modality is defined by using symbols of language, gestures, behaviours, facial expressions, formed and agreed upon through time. This is a further example of the interrelationship between the modalities.

Dooyeweerd’s modalities can also be found in our sciences where the meaning of each modality and its order are continuously studied. Thus, the numerical dimension is researched in Mathematics, the spatial in Geometry, the kinematic in Chemistry, while the aesthetical dimension is researched in Arts, the juridical in Law, the ethical in Ethics and the credal in Theology (de Raadt 1991: 5; 1997a; 1997b). Each science allows us to learn about each modality, and also allows systems scientists to identify the homomorphism between the modalities.

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22 A different ordering of aspects of reality is found in van Gigch (1997: 383f). He discusses eight imperatives mapped to a problem space and arranges them according to a hierarchy based on their degree of abstract nature ranging from what he calls the pragmatic to the aesthetic. Although interesting, the model is not as elaborate as Dooyeweerd’s. This is why the latter has a benefit for the purpose of this research.
7.2: Social Theory

Multi-modal Systems Thinking incorporates Stafford Beer’s (1979; 1981; 1985) Viable Systems Model (VSM) as a model of social systems (see Figure 7:3). The Viable Systems Model splits a system into two main elements: an operational system (bottom left of Figure 7:3), where the actual operations are carried out, and a meta-system (top left) which manages the operational system(s). In an industrial plant the actual production is carried out by the operational system while the task of planning, organising, monitoring and controlling the production is performed by the meta-system. The meta-system is itself divided into four crucial functions or subsystems. The co-ordinating subsystem co-ordinates the interactions between operational systems. In an industrial plant, the purchase of raw materials needs to be co-ordinated so that every piece is delivered in time for production without causing delays or unnecessary supply. The functional subsystem is concerned with the present or short term of the organisation, ”its ‘here-and-now’, day-to-day management” (Beer 1985: 86). Examples of such activities are staff matters, maintenance, monitor and controlling the production and accounting. The development subsystem looks into the future; it deals with the ‘then and-there’. Activities in this subsystem are long term or strategic planning, product development, marketing, staff education, and recruitment. Finally, the directive subsystem balances the interactions of the functional and the development subsystems. For instance, a board of directors decides how much effort and which resources should be allocated toward the future of the company, at the expense of the present.
Figure 7.3. The Model of a Viable Social System.

The purpose of the meta-system is to support the operational system and ensure its viability. This is done by for instance, deciding on objectives, or purpose, for the system, and making sure that these are attained. In the figure the setting of the goals are illustrated by the angular line to the right with the arrow that points from the meta-system towards the comparator (the crossed circle at the right bottom of Figure 7.3). Beer states “the purpose of the system is what it does” (1985:99) and gives no further direction. However, Multi-modal Systems Thinking introduces the “sphere of sovereignty” (de Raadt 1991: 110). Just as each modality has a nucleus which guides and gives meaning to it, every system should be defined by a core modality which guides and gives meaning to the system’s purpose. The sphere of sovereignty gives the system its ultimate mission. Further,

initially systems can have more than one essence in their mission, but as they develop, they become more complex and difficult to manage and therefore they split away from each other and form new social systems each with its unique essence (de Raadt 1997b: 426).

If systems are complex they may have a mission which can be embodied in several modalities, but most social systems have only one modality as its essence. De Raadt interprets the system’s sphere of sovereignty as ontological. However, this does not disqualify it from being used empirically. Dooyeweerd points out that the modalities
are drawn out of human experience and can be recognised by most people (no matter what their philosophical position).

It is not always easy to determine a system’s sphere of sovereignty but an organisation should aim towards its mission. One can explore the consequences of different modalities to determine an organisation’s sphere of sovereignty. For instance, an airline company may be thought of as a business with its sphere of sovereignty in the economic modality, or as an organisation for transporting people. Its sphere of sovereignty would then be placed in the kinematic modality. The modality that is selected will affect the activities and decisions of the whole system\(^\text{23}\). Naturally there are possibilities of errors in determining the sphere of sovereignty. However, one can learn one’s way by exploring different alternatives, guided by the modalities.

A second task performed by the management system is ensuring that the best use is made of available resources. This activity is closely linked to the economic modality. A further indication of the meta-system’s link to the economic modality is illustrated in Figure 7:3 in the two lines with arrows in each direction connecting the meta-system to the operational system. These communication lines in the VSM are termed “resource bargains” and “accountability” (Beer 1985: 88). They represent channels for deliberating on resources and reporting back on used resources. The accountability for used resources is separated from assessing the output of the system. The latter is assessed according to criteria stated in the purpose of the whole system.

The aim of including Beer’s model into Multi-modal Systems Thinking is to provide a viable structure for social systems. However, de Raadt rejects a purely biological notion of viability as the essence of social systems and associates it to Dooyeweerd’s vitality in the biotic modality (de Raadt 1991: 21ff; 1997b). De Raadt means that human life is not restricted to the biotic, but there is also life in the other

\(^{23}\) The modalities should function in coherence with each other and one should not violate another. However, the importance of the sphere of sovereignty is that it gives the system its identity.
modalities, such as social life and artistic life. He thus extends the viable systems model to a living systems model to emphasise the full breadth of a cultured and humane life. The extension is operationalised by including all the modalities in the purpose of the system (illustrated by the crossed circle at the right bottom of the Figure 7:3).

The central idea in cybernetics, which is the founding theory in Beer’s work, is stability\textsuperscript{24} and equilibrium\textsuperscript{25}. This is maintained by the feedback loop; see Figure 7:3. The operational system is visualised as a transformation process that transforms input to the system to output. The output is then compared with the objectives, set by the meta-system, and the result of the comparison is reported back. Corrective actions, such as reorganising the operations or changing the objectives may then be decided and fed back to the operational system. This feedback is distinct from the feedback about used resources, which is reported through the accountability channel. Finally in Figure 7:3, the line around the model indicates that the system is surrounded by an environment with which it interacts.

The model of a social system is recursive\textsuperscript{26}. This means that all operational systems on one recursive level, together with respective meta-systems, are joined into one single operational system on the next higher recursive level. However, operational systems on different recursive levels may display different spheres of sovereignty. For instance, the sphere of sovereignty for the industrial plant may on one level be based in the operational modality (production), while on another level, focusing on the epistemic modality (research and development). The point is that they all display the same structure. Thus, the operational system, which joins systems from lower levels, is also sustained by its own meta-system and adheres to the same

\textsuperscript{24} Stability is the ability of a system to regain its equilibrium once it has been drawn away from it by an environmental disturbance or by a change of objective.

\textsuperscript{25} Equilibrium is a state in which a system functions within its objectives.

\textsuperscript{26} A recursive structure appears again and again. This means that a system on one recursive level is embedded in another system, which displays the same structure, on a higher recursive level.
patterns of communication and control as outlined in the above. The implications for this are that all social systems that comprise a society are interdependent and should therefore act accordingly. This model may be an attempt in answering Hoebeke’s (1988: 336) challenge to sociologists “to start the study of violence in society as an expression of the lack of meaningful constructive work which links social actors together”.

7.3: CONVERGENCE BETWEEN MST AND SSM

Soft Systems Methodology allows for the incorporation of the MST framework in its three methodological phases.

In the Finding Out phase the emphasis in SSM is on getting as ‘rich a picture’ as possible of the situation. The guidance that is proposed is to look for structure and processes within the climate of the problem situation. Further, role analysis is suggested with the help of three simple models of: the ‘intervention’ itself, a ‘social system’, and a ‘political system’. When relating to the modality framework of Multi-modal Systems Thinking, structures and processes can be found in the more determinative modalities. For instance, physical layout refers to numerical and spatial aspects, patterns of communication to a kinematic flow and to an informatory dimension, and production processes to a kinematic flow of physical entities. The climate and the roles within the situation point to the more normative modalities. There are some dominant perceptions of the situation that form its culture; these are based on some beliefs and assumptions about reality – the credal modality. The juridical aspect might be illustrated in the politics of the situation and visible in formal power. The importance of the social dimension of the situation is emphasised through the analysis of the ‘social system’. Finally, the situation itself is formed by a previous history and, thus, has a historical dimension important to understand if the whole situation is to be appropriately grasped.
The focus of SSM’s second phase, in which models of relevant holons are built, is on systems thinking. The metaphor of an adaptive whole, with a hierarchical structure, emergent properties on each hierarchical level, and processes of communication and control, is used to structure the thinking. Several concepts and guiding techniques have been developed for this phase:

- the choosing of ‘relevant systems’ according to ‘primary task’ or some ‘issue’ in the situation;
- statements about these systems in the format of ‘root definition’ and elements of ‘CATWOE’;
- illustrations of these statements in ‘conceptual models’ of human activity systems, which are based on the systems metaphor of an adaptive whole; and
- the monitoring of the activity models through ‘measures of performance’ defined by efficacy, efficiency, effectiveness, and if wider considerations seem relevant, adding ethics and elegance.

Since the SSM modelling phase is based on systems thinking, as is the philosophy of MST, there are many similarities and relations found in this phase. Firstly, the concept of an adaptive whole used in SSM is also a cybernetic concept on which MST is based. The emphasis is on adequate information for the processes of communication and control. This is signified by the inclusion of feedback flows, necessary to guarantee the stability of the system and its ability to be viable in a changing environment. Secondly, a core idea of SSM’s systems thinking is the concept of emergence and hierarchy. This concept is also found in cybernetics’ recursive structure. Thirdly, the technique in SSM of identifying ‘primary task’ relates to ‘sphere of sovereignty’ in MST in the sense that these two terms both define the system’s purpose. Fourthly, the concepts of CATWOE, root definition and conceptual model relate to the elements of the viable social systems model. All of them imply an input-output transformation and feedback processes to regulate that transformation. Fifthly, the aspects of the information needed, as defined through SSM’s ‘measures of performance’ for monitoring and control of the activity model, are all found in the different modalities (Grahn & Bergvall 1994). Efficacy relates to the logical aspect.
Efficiency refers to resource use, which in MST applies to the economic dimension. Effectiveness defines the aspirations of the system and thus pertains to beliefs and assumptions – the credal modality. Ethicality is not defined in SSM but I interpret it to correspond to both the juridical and the ethical modalities in MST. Elegance, last, is not defined either, but I assume that it is in accordance with the aesthetic modality.

The third SSM phase, Taking Action, is the essence of learning. In this phase the actors in the situation compare the models, built in the previous phase, to what exists in the real-world situation. It is assumed that the actors, when discussing the models and comparing them with reality, reinterpret, learn, and understand actions needed to change their situation. The guidance SSM proposes for judging suggested changes (resulting from the comparison) is through the criteria ‘systemic desirability’ and ‘cultural feasibility’.

Systemic desirability applies to the logics of the situation as defined by the models. A change is judged systemically desirable if the model which initiated the change is perceived as relevant. The model, besides the logic modality, also includes the economic, and, to some extent, the credal modalities through its measures of performance. (Ethical and aesthetic aspects are also recommended to be included if broader considerations seem relevant.)

Cultural feasibility, the second criterion, concerns what is meaningful and acceptable within the worldview of the particular situation. As pointed out in Chapter 2, Checkland discusses culture as being both normative and determinative. He sees cultural and social systems as consisting of groupings of people who function according to agreed norms within the group. At the same time these systems have such characteristics which imply that they are systems which could not be other than they are (Checkland 1981: 112f), that is, natural systems. Due to their ambiguous nature they cause a problem in Checkland’s typology of systems classes - they do not fully and solely belong to any of the defined classes. Therefore Checkland places these
kinds of systems astride the boundary between human activity systems and natural systems.

In the modality framework the social and cultural systems are more expounded and have a natural place: the social aspect is defined on its own (the social modality), yet depending on the subsequent lower modal levels; the cultural system needs the interaction between all modal levels, ranging from numerical to credal, to be explained. Hence, in MST we get a framework for understanding both normative and determinative aspects of social and cultural systems.

7.4: Conclusion
Multi-modal Systems Thinking, rather new to the field of systems science, criticises the narrowly focused, technological determinism used by the hard systems approaches in dealing with human problems, as well as the soft approaches where the assumption about reality is based on chaos and complexity. Instead, MST, influenced by Dooyeweerd, suggests that there is order within complexity. This new and challenging way of thinking is explained through a model of interrelated dimensions. The dimensions have been uncovered and arranged in a specific order. MST puts these dimensions in a model of a living social system, consisting of meta-system, operational system and feedback processes.

I believe that Multi-modal Systems Thinking, focused on the dimensions of reality and the viable social systems model, offers a great contribution for guiding systems design. The modality framework gives a coherent framework of both determinative and normative aspects to be applied in analysis and design. Further, there is an interrelation between the modalities so that one builds on another and therefore no dimension can be ignored. In designing systems, hard systems methodologies have devoted most of their attention to the more determinative aspects of systems design. The normative dimensions have been left unconsidered. By analysing the system in different modalities and in several recursive layers, new
insights are discovered. By applying the modality framework we also expand our knowledge of the more normative aspects, often called soft and fuzzy, in real life, and develop a vocabulary that makes it easier to form and express our thoughts about these dimensions.
CHAPTER 8:

MULTI-MODAL SSM IN FINDING OUT

This chapter explains how the modality framework can be used to assist the analysis of gathered data. The modalities’ significance in real life are also illustrated.

8.1: GUIDANCE FOR FINDING OUT

Our inquiry about the situation logically begins in the Finding Out phase. SSM offers, as its guidance for finding out, its analyses in the cultural stream of enquiry\(^\text{27}\). However, more help seems to be needed; scholars like Mingers (1992b) and Stowell (1991) point to the problem, especially for newcomers to the methodology, of what to look for when appreciating the problem situation in question. A further problem pointed out is validation of the finding out phase. There is no framework offered to reflect on whether the problem situation has been adequately and accurately represented.

The cultural framework, developed by Davies (1989) and to a certain extent utilised by Checkland in the social systems analysis, is one attempt to structure the gathered information. In a prior study I, too, was engaged in an attempt (Bergvall-Kåreborn & Grahn 1996b, reprinted in appendices) to structure gathered data, but ours was according to a framework of modalities. The data that we analysed was collected in an Arvidsjaur survey in 1994 on young people’s everyday situation and their thoughts about the future. In the modality structure a clear picture appeared of different, and often conflicting views concerning young people’s perception of the role and responsibilities in society, in contrast to that of adult citizens’ and local decision

\(^{27}\) The cultural stream of enquiry consists of three examinations of the problem situation in question: the analysis of the intervention itself, of the situation as a ‘social system’ and as a ‘political system’ (see Chapter 3).
makers’. However, when analysing the second data collection, which aimed at following up the answers from the first survey, we found that the data tended to focus on social aspects of young people’s lives. In the light of the modality framework the social aspect is one part of human life, but not the only part. So, to avoid social, economic, or any other kind of reductionism, it is proposed that this framework should not only guide the analysis of data but also its collection.

8.2: Normative Modalities

Besides being a framework for structuring data gathering and analysis, the modality framework may be also be used as a tool for identifying important dimensions and interrelated systems. Dooyeweerd’s systemic framework of modalities supports a broad approach for information gathering and should therefore lead to an enriched picture of the situation.

Figure 8:1. A Work Situation\textsuperscript{28}.

Figure 8:1 illustrates a mechanical work situation. In this situation most of the modalities can be recognised although they are not found in isolation but interrelated.

\textsuperscript{28} The fan and its modalities in the upper right of Figure 8:1 are also included in an enlarged version in Chapter 7, Figure 7:1.
Our perception of the modalities has its base in beliefs and assumptions about the world and human beings. This belongs to the credal modality. The beliefs and assumptions, if visible, are manifest in such things as religion, political programs, ideologies, visions, ideals, self-image. Both visible and invisible beliefs govern our normative actions. These beliefs and assumptions need to be examined since they are the underlying base which to a great extent determines and explains our choice of action. This modality corresponds to the SSM notion of weltanschauung.

The ethical modality involves attitudes towards other people like sharing, helping, forgiving, caring for other people and showing human consideration. The juridical modality next to it, refers to what is due to people. These two dimensions are often mixed up in everyday language and used synonymously. Ethics is normally seen as the study of right and wrong – in SSM ethics is related to being morally correct. Because of the close connection between right and just, the distinction between ethics and justice becomes a bit blurred. However, in Dooyeweerd’s thinking the ethical aspect is based on charity, that is, on the willingness to judge other people with kindness, and its core is “humanitarian love for one’s neighbour” (Kalsbeek 1975: 102). The ethical modality, thus, takes one step further than what is expected according to what is due (juridical modality). For instance, not keeping one’s working hours (such as leaving the workplace 15 minutes before due time) we say is unethical and immoral. However, according to Dooyeweerd’s distinction between ethical and juridical this does not refer to ethics but justice; it is being unjust. There is a contract between employee and employer that settles, among other things, working hours. Not adhering to the agreement in the contract, something that should be expected, is therefore going against the juridical modality.

The juridical modality and its kernel, justice, focus on what is due to a person. Common understandings of justice are that everyone should be treated according to the same terms or everyone should be given the same conditions. There are many examples of systems and situations where justice is the prime consideration. For example, in activities associated to the police and court system we expect to get fair and just treatment. The aim of the state and municipalities lies in this modality, that
is, to follow instituted laws and rules in managing societal resources, and in the interest of every citizen. (This might mean accommodating different interests\textsuperscript{30}, and in this case, in the light of ‘justice’.) Other examples are the right to decide upon one’s own property and the right to autonomy, both in private and in one’s working life.

Things, ideas, thoughts, messages are often expressed by means of aesthetics. This is a well-known fact in the advertising business and where it is often combined with the sensitive modality. In SSM the aesthetic aspect of a system is not well elaborated; it only refers to elegance and beauty. In Dooyeweerd’s definition, however, the meaning of aesthetics is harmony, which, in turn, implies some kind of balance. What is also significant is the interplay between aesthetics, juridics and ethics in the design of viable systems. Therefore their counterparts in the real-world situation should be examined. For instance, in President Mandela’s strategy for rebuilding a democratic South Africa these three dimensions are apparent. President Mandela wishes to shape a stable and harmonious (aesthetic modality) South Africa by giving the people what is due to them (juridical modality) while forgiving (ethical modality) the unjustness they have been subject to. My belief is that due to the emphasis on the ethical modality the country has a better chance of succeeding as a viable system. If the juridical modality is emphasised and the ethical neglected, as is the case in Bosnia today, there would be less chance of coming to some agreement on peace and stability.

The economic modality is based on the ancient meaning of oikonomous, that is, household, and it involves judgement on making use of resources. This dimension focuses on management. In Dooyeweerd’s concept of economy the meaning is the frugal use of scares resources. In SSM the use of resources is discussed in terms of efficiency. However, in the proposed methodology for systems design the notion of sustaining or viability (Beer 1981; de Raadt 1997b) is preferred, that is, the economical use of resources for being viable but also prosper. The aim is thus not to be stingy, or to minimise costs or make more out of less, but to make the best use of

\textsuperscript{29} The word charity usually means actions for the needy or things given to persons in need. However, in this context the word represents Christian love or love for one’s neighbour - agape.

\textsuperscript{30} Accommodating different interests refers to “the business of politics” and applies to “a company, a work group, a sports club as well as to a city or a nation state” (Checkland & Scholes 1990b: 50). This discussion belongs to SSM’s ‘Political System’ analysis or ‘Analysis Three’; see Chapter 3.
available resources. How resources are managed and made use of are most certainly of interest to find out about.

The essence of the *operational* modality (de Raadt 1997b), is work or production. By finding out about the operational modality the heart of the system (Beer 1979) is identified. In SSM this corresponds to finding out about “elements of continuously-changing process” (Checkland 1981: 164). The relationship between the operational modality and the economic is multifold, for instance the managing of operations, the granting of resources and accountability for their use, and the follow-up of the outcome.

The *social* modality governs people’s interaction, for example working life, family life, clubs, and associations. One of the analyses in the SSM cultural stream of inquiry concerns ‘social system’ analysis (see Chapter 3 or Checkland & Scholes 1990b: 48ff). The model of a social system is defined as being an interaction between the elements roles, norms and values. In Dooyeweerd's concept of the social dimension the focus is on normative laws and rules for social interaction. It is thus more specific than the SSM definition which may also include other dimensions’ norms of behaviour in certain social settings (like ethical, juridical and aesthetic). When referring to, for instance, the term professional role, the operational and social aspects are in focus, as well as the knowledge, the epistemic aspect (illustrated next), associated with that profession.

One of the theories on knowledge is that it is socially constructed, another that it is objective and independent of human beings (Leidner & Jarvenpaa 1995). However, knowledge, whether it is constructed or discovered, is related to social settings. Knowledge would be meaningless without being in relation to human beings. The *epistemic* modality, included by de Raadt (1996) in the modality framework, focuses on this aspect. Its meaning is ‘true’ understanding and insight into matters (which in turn may result in causes of action based in the operational modality). This modality is (or should be) the main purpose of schools and universities. Epistemic aspects are not only found in theoretical studies, by means of the analytic modality (illustrated below). The skilled master teaching the trainee is another example of the epistemic aspect; in this case the knowledge is mediated by means of the operational
modality. Finding patterns for how knowledge is obtained, valued, used, preserved, and passed on in a system is of vital importance to the system’s ability to prosper.

The *informatory* modality involves such things as data, symbols, language, communication, and information. The aim of the informatory modality is to express something by means of symbolic representation. These symbols we interpret by means of the other modalities. For instance, interpretation is based on our beliefs and assumptions, indicating the credal modality. It may also include the logical (or analytical) modality and what are common within our cultural and social setting. It relates to previous knowledge as well (epistemic modality) and to past experience (historical modality, to be illustrated next). Symbols can be of different kinds, for example lingual following the rules of language, graphical following the rules of space (distance and proportion), religious symbols, gestures and body language adhering to social rules, etc. In systems design the informatory modality is central in finding out about, for example, information needs for decisions, for monitor and controlling activities, and for co-ordinating activities. Further interests are means by which the information is channelled through the system and exchanged with the environment.

The *historical* modality reflects the ‘forces’ that form us and also guide and shape the future. In SSM history is an implicit part of the cultural analyses. The real-world situation itself is a product of a particular history, and “of which there will always be more than one account” (Checkland & Scholes 1990b: 28). To find out about the situation it is essential to learn and reflect upon this history and not, as classical management science, “limit itself to dealing only with the logic of situations” (Checkland & Scholes 1990b: 28). SSM claims to go beyond logic to enable actions to be taken which are in line with a full representation of the situation. In the modality framework the historical aspect is also one that goes beyond logic (to be illustrated next). The historical modality demarcates the limits, the boundaries, and thus forms us. It gives us the limits within which to operate. The musician in his work is limited to the musical scale and operates within this boundary. Within the musical scale there is almost an indefinite number of combinations, but still, they are kept within the scale. The designer most certainly makes use of experience to find out about design
and about the boundaries of the situation. However, besides logic and history this methodology also proposes other aspects, to get a full representation of the situation.

The logical modality stands for distinction. It is visible in such as analytical thoughts, theories, models, and plans. In SSM logic claims to be the dominating aspect in its stream of logic-based enquiry (Checkland & Scholes 1990b: 31ff). This stream is referred to in the second phase of SSM, the systems modelling phase. It is discussed in its relation to the proposed methodology in the next chapter. The act of analysis relates to the logical, or analytical, modality and it concerns the act of bringing out a conceptual entity from its background. Synthesis is an idea often mentioned as a complementary part to analysis. Although they are closely linked in practice, they are of different aspects; synthesis is of the shaping aspect, that is, of the formative (historical) modality.

8.3: Determinative Modalities

None of the more determinative modalities are referred to in SSM. Determinative aspects cannot be designed in the same way as normative ones. However, they still need to be taken into account since they may limit the possibilities for design.

In every-day language we talk about the psychic (psychological) aspect meaning non-physical and so include both thinking and feeling. However, Dooyeweerd separates these two in the logical (discussed previously) and sensitive modalities. The sensitive pertains to feeling. The notion of this modality is, in principle, based on the presupposition of psychology, that feelings are something that happens to us in a deterministic way. However, we are often guided by feelings when we function in the more normative modalities. We know, through feelings within our body, for example that we have been unethical to someone, that we have been unjustly treated, what is an admirable aesthetic expression, what is improper social behaviour, and even lingual miss-spelling. A further example of the sensitive modality, of growing importance to modern Western life, is recreation and relaxation which are sensitive feelings based on the aesthetic modality.

31 This aspect is also emphasised by Schön (1987).
The *biotic* modality pertains to life and its kernel is vitality or vital force. Situations that relate to life are, for instance, birth and death, reproduction, feeding, respiration, health, and overall environmental issues like work environment, recycling and waste production. The *physical* modality fits well with the dictionary definition of physical in that it is everything of the biotic, except for what differs between them, namely life. It is defined as “pertaining to the properties of matter and energy other than those peculiar to living matter” (Webster’s Dictionary 1989: 1087).

The *kinematic* modality pertains to movement. The term kinematic is defined as a part of the field of mechanics that deals with a body's motion without any consideration to forces that cause the motion or the mass of the body. In everyday life the kinematic modality does not functioning in isolation. For instance, due to the law of gravity movements are interrelated with the physical modality. So, when running, jumping, dancing, and so on, we are relating to the kinematic modality although our movements are constrained by other modalities, especially space and physics. This becomes even more apparent when we use vehicles (cars, trucks, snowmobiles, aircraft) for transportation.

The *spatial* modality can be related to nature. The beauty of nature is an expression of an aesthetic experience associated to space. However, space is also needed to store and keep things. Moreover, human beings require a certain private space surrounding them, and which is not to be intruded on by others, to feel comfortable. Finally, the *numerical* modality is visible in anything that can be expressed in numbers. This modality refers to amount and/or quantity, for example, number of produced goods, number of rooms in a house, number of walls, number of persons in that room, etc.

### 8.4: Conclusion

SSM proposes no coherent guidance for making sense of all the impressions gathered when finding out about the situation. Therefore analysts make their own often implicit framework of reference formed by experience, preferences and interests. By

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32 See Chapter 4 for SSM’s systems modelling phase.
using the modality framework of MST to complement the SSM analyses, researchers are assisted in understanding what to observe, in interpreting the findings and in reflecting upon their own biases. Finally, by explicitly stating one's own reference model, other people are given an opportunity to value the researcher's interpretation of the findings.

The above modality framework used to inquire and interpret the problem context, enriches the rich picture. Finding out about the behaviour related to the above normative and determinative aspects is a guide in understanding the culture of the situation. It is also a guide in identifying aspects that later can be listed as relevant systems to be further enquired.
CHAPTER 9:
MULTI-MODAL SSM IN MODELLING

This chapter recounts some of the problems perceived in SSM’s systems modelling phase and presents a framework for mitigating these. It also illustrates how the modality framework can be used to direct the designer to incorporate dimensions important for social systems if they are to function in a holistic way.

9.1: PROBLEMS IN SSM SYSTEMS MODELLING

In the systems modelling phase SSM has developed some precise techniques based on systems thinking, with an emphasis on logic-based enquiry (Chapter 4 or Checkland & Scholes 1990b: 31ff). The techniques concern selecting and naming relevant systems, and modelling these. The purpose of the model is to be a device in subsequent debates about the situation. The model does not purport to be an adequate or valid representation of the situation since it does not aim at describing the real world itself. It is “merely a holon relevant to debating perceptions of the real world” (Checkland & Scholes 1990b: 41) and therefore the question of adequacy or validity is not applicable according to the authors. Instead of validity they emphasise “technically defensible” (Checkland & Scholes 1990b: 41) models, that is, that each aspect of the model can be shown to stem from words in the naming of the system. That the models are technically defensible is said to be most important to the credibility and the participants’ confidence in the process. However, the statement about the models’ status is confusing to most people. It is often asked what the purpose of model building is if the models do not represent the real world situation. SSM models, on one hand, represent parts of the real world situation in the form of perceptions, but, on the other hand, are not intended to be representations of the situation. So, a
question that rises then: are perceptions of the real world situation not part of the real world, according to SSM?

An additional criticism is directed towards the logic of the models. Gregory (1993) has a different view of logic; he argues that “the connectives in SSM models do not reflect the laws of cause and effect” (p. 336); thus, the logic that is claimed in SSM models is inadequate. Woodburn (1985) also criticises the logic of SSM models and argues that there may be ambiguities in building the models. He means that what is logical (meaningful) to one person does not have to be experienced the same by another. What is logical has its base in the individual's previous experience and background knowledge. Thus, “everyone's ‘world of logic' is different” (Woodburn 1985: 102) due to the fact that each individual has different experiences. He therefore suggests, as an aid to identify logical dependencies, to check the input-output aspects of the model.

Authors also see difficulties in drawing the SSM distinction between the conceptual world and real world. Mingers (1992b), who believes that knowledge is not independent and objective but context-bound, notices that when naming relevant systems and modelling these we are always expressing knowledge of the real world. Knowledge is also, as is argued in the above concerning logic, related to previous experience and background knowledge. So, building SSM models like logical machines is not a straightforward task and independent of the model builder. By including the techniques in a frame of reference the underlying understanding is revealed, thus, mitigating the problem of solely relying on different individual understandings of the semantics of language.

A final problem in modelling relates to SSM’s suggested measures of performance. When examining these more closely – the ‘3 Es’, efficacy, efficiency, and effectiveness (possibly supplemented with ethicality and elegance) – they become more and more nebulous in several aspects. It is not mentioned, nor clearly stated, why these particular ‘Es’ were chosen, how they should be used, what they exactly mean, what they should relate to and how one knows if they are achieved. While two
of them, efficacy and effectiveness, are interpretivistic, the remaining three look ‘outside’ for reference. Efficacy and effectiveness are related to transformation and weltanschauung respectively, that is, they are internal judgements based on one interpretation. Efficiency, on the other hand, is related to minimising costs, which has nothing to do with the root definition or CATWOE. Ethics and elegance as measures of performance have not been clearly stated. However, I regard SSM’s intention in using these measures is to look beyond mere interpretation. This is a clear indication that SSM’s measures of performance would benefit from an expansion of its theoretical framework to address these sorts of problems.

9.2: Systems Framework for Modelling

To alleviate some of these problems and ambiguities in model building while keeping the strengths of the SSM techniques I suggest the inclusion of the naming and modelling of the system into a context. By that a framework is given against which the validity of the models can be checked and against which the logic of the model can be defined. Further, the framework is based on extensive research, which clarifies the purpose of model building and gives a common context to relate to. The suggested framework originates in Stafford Beer’s (1979; 1981) work and is that of a viable social system.

The main features of the structure for the Viable Systems Model (Beer 1979; 1981) are adopted. These are: firstly, five crucial functions for a system to be viable (the operational system, the co-ordinating system, the functional system, the development system, and the directive system); secondly, the notion of recursive levels\(^{33}\); and thirdly, information flows with feed back loop, and channels aimed at resources allocation and accountability\(^ {34}\). This model of a viable social system gives the

\(^{33}\) Recursive levels means that the same structure appears again and again on different hierarchical levels. The term is further explained in Chapter 7.

\(^{34}\) Beer terms these channels “resources bargain” and “accountability” (1985: 88). However, to avoid the word bargain as it also means to buy and sell, indicating personal interests, and instead emphasise deliberation of resources we suggest the term ‘resources allocation’.
context in which the SSM techniques are included\textsuperscript{35}. The model is also adopted in Multi-modal Systems Thinking (MST) and will here be referred to as the MST social systems model.

Soft Systems Methodology has made a great contribution to systems thinking in its emphasis on using systems in problem structuring. For this purpose well-tested techniques have been developed which illustrate different interpretations of the problem situation. A selection of relevant representations are stated in the elements of CATWOE\textsuperscript{36} and put together in the – so called – root definition. Here, in guiding the choice of relevant and consistent elements of the selected representation (which the SSM technique does not offer) I suggest the inclusion of the elements into the MST social systems model.

![Diagram of the Elements of CATWOE in the MST Social Systems Model]

Figure 9:1. The Elements of CATWOE in the MST Social Systems Model.

The model in Figure 9:1 above illustrates the relation between the CATWOE elements and the subsystems of the MST social systems model. The conversion of input to output – the Transformation process – takes place in the operational system and is carried out by the Actors; see left bottom of the figure. The output of the

\textsuperscript{35} Paton (1993) has also made attempts at combining SSM and Stafford Beer’s Viable Systems Model (VSM) to strengthen the management, or control mechanism. He suggests to link SSM’s Primary Task Model to the structure of the VSM, thus include the VSM in the SSM model. My suggestion is to do the opposite, to include the SSM techniques in the structure of the VSM.
operational system is related to the W [weltanschauung], that is, the stated worldview which makes the transformation meaningful in context (which, in turn, decides the purpose of the system). The output arrow indicates that the effect of the transformation benefits the Customers; see the bottom right of the figure. The Owner, illustrated in the top left of the figure, is in SSM defined as the person(s) who has the possibility to stop the transformation process. This means that they also ought to set the standards for the performance of the system, that is, its objectives or purpose, as well as give corrective actions. The person(s) in this role of having the possibility to stop the transformation process ought also to be responsible for giving out resources for continuing the process. These are all tasks of the meta-system. The final element, constraints from the Environment that are put upon the system, is illustrated by arrows pointing from the outside towards the system.

A second SSM technique concerns conceptual models of human activity systems. These models are in the proposed methodology also put in the context of the MST social systems model. By that a structure for activities is given which are essential for a system to be viable and the – so called – logic of the model is made more visible.

In Figure 9:2 general activities, identified by combining the MST social systems model and the CATWOE elements, are defined. They are illustrated as numbers in the figure. Number 1, to the top left, represents activities analysing the constraints from the environment and valuing their effects on the system. Number 2, in the left centre, relates to the input selection for the transformation process, while number 3 concerns activities for carrying out the operations. Number 4, to the right, applies to evaluation and reporting routines for the output of the system. Number 5 concerns activities for setting, or defining, the purpose and objectives of the system, and its evaluation criteria. Numbers 6 and 7 (in the centre of the figure) focus on allocating resources and being accountable for their use while number 8 pertains to corrective actions deemed necessary from the evaluation. Activities related to 4-8 correspond to the monitor and controlling subsystem of the SSM activity model. Number 9 regards additional meta-system tasks aimed at day-to-day managing of the system.

36 CATWOE is a mnemonic for Customer, Actor, Transformation process, Weltanschauung, Owner, and
10 refers to the managerial function of co-ordinating operations. Number 11 looks after meta-system tasks that are related to the environment and the future of the system. These are additional to the activity that concerns the environmental constraints (number 1). Finally, number 12 illustrates the managing of the interaction between activities 10 and 11.

![Diagram](image-url)

Figure 9:2. Activities in the Context of the MST Social Systems Model.

The SSM model does not distinguish between managerial and operational activities as clearly as the proposed model does. Consequently, it does not mark the information flows between operational and meta-system as distinctive as in the proposed model. Overall, SSM gives no guidance on functions in activity models, except for the monitor and controlling subsystem. The SSM models therefore tend to become more closed to its environment, besides what is defined as environmental constraints. Further, SSM models tend to focus more on planning activities for the operations than stating the actual operations and managerial activities that go with them. The proposed model, however, suggests activities related to both managerial and operational functions, to information flows, and to the monitor and controlling of the system’s performance. These activities are all in a coherent context. The main benefit of making the monitor and controlling subsystem, information flows,
managerial and operational activities more clear and distinct is that it strengthens the design.

9.3: Humanity-Based Standards
The overall assessment of the system’s performance is, in the proposed model, done with regard to its sphere of sovereignty and other significant and substantial modalities. By this, the purpose of the system and the worldview which makes the transformation meaningful in context (W) are made more clear. For instance, in the SSM example of a fence-painting system (Checkland and Scholes 1990a; 1990b: 37ff), the output of the transformation process is a painted fence that is kept with the “overall decoration scheme of the property” (p. 37). W is stated as “amateur painting can enhance appearance” (p. 37). The monitor and controlling of the system is according to measures of performance for:

- efficacy – “does this count as a painted fence?”;
- efficiency – “was resource use minimum?”; and
- effectiveness – “does the fence enhance the property?”

(Checkland and Scholes 1990b: 40).

These are also referred to as the ‘3 Es’ and are said to cover the most basic idea of transformation (Checkland and Scholes 1990b: 42). For the fence-painting example, this system’s sphere of sovereignty is in the aesthetic modality since the purpose of carrying out the transformation (paint the fence) is to enhance the appearance of the property. Therefore the performance indicator for this system should focus on the aesthetic modality.

In Figure 9:3 the main modalities for the fence-painting system, as defined by Checkland and Scholes (1990a; 1990b: 37ff) are illustrated. The operational subsystem’s sphere of sovereignty is in the operational modality, in this case guided by the skills and techniques of hand painting, but the whole fence-painting system’s sphere of sovereignty is in the aesthetic modality (enhancement of the visual appearance). Therefore the overall assessment of this system should be according to the laws of aesthetics. The use of resources is also included in the figure, however not in assessing the output of the system, but in accounting for how the system makes use of its resources. The benefit of relating to the modalities in judging the performance is
that the indicators become more distinctive and clear. The efficacy measure in SSM is, in this case, related to the operational sub-system and its hand-painting operations.

![Diagram of Main Guiding Modalities for Assessing the Fence-Painting System]

**Figure 9.3.** Main Guiding Modalities for Assessing the Fence-Painting System.

The efficiency measure asks about resource use and is therefore put in its appropriate place, that is, in the channels for resource allocation and accountability. Thus, it does not dominate in judging the output of the system. Finally, the effectiveness measure judges the transformation process according to the idea behind painting the fence, namely the expectation that the painted fence would enhance the property. It is hence related to aesthetic laws and appreciation.

Other kinds of systems would, in the proposed model, be assessed according to other modalities. Some examples are illustrated in Figure 9:4. The mission of an insurance company, the first example, is to provide some help and comfort by economic means when emergencies, accidents and the like happen. Its sphere of sovereignty is in the economic modality although ethical and juridical aspects also play a significant part. The second example illustrates a manufacturing company of fine china. Its mission lies in the aesthetic modality, that is, to produce very fine and high quality china. However, fine china may be produced at high cost but to be able to survive on the market, the impact of economic aspects need to be considered. The third illustration is a restaurant. Its traditional mission is to give its customers a culinary experience. Its sphere of sovereignty is thus in the sensitive modality.
However, aesthetics is important for vitalising sensitive feelings and is therefore included as a significant modality. Economy may also be important in valuing the culinary experience and in affecting how much it attracts customers. The final example is a school. The area where it serves the community is in the epistemic modality; its purpose is to teach and educate. The subjects within which the pupil is educated are related to other modalities. The social modality is also significant for the school because knowledge is developed in a social setting. Moreover, the role of the school is to prepare the pupil for functioning in society. As the above examples show, by relating to the modality framework in the assessment of the system's performance, the light is put on aims and mission and other significant aspects that together make the system purposeful.

Figure 9:4. Organisations, Related Sphere of Sovereignty and Other Significant Modalities.

There are resemblance between most of the SSM concepts and MST modalities. However, SSM only includes a few such aspects in evaluating the system’s achievement, while in the proposed model each of them is represented. Starting from the top of Figure 9:4, the credal modality is linked to the SSM notion of weltanschauung for the system. It is linked to our beliefs and assumptions about reality and helps us understand social situations. The ethical dimension looks, at first appearance, to be identical to supplemented SSM's measure E4. However, when judging the ethical performance of the system, SSM reviews whether the
transformation is morally correct. This review is also associated with the juridical dimension (to be discussed next). The essence of the ethical modality is humanitarian love, that is, a preparedness to relate to other persons with kindness and generosity. Thus, to be ethical is to cherish other people, not because the law stipulates that you have to, but because you want to.

The juridical modality is not clearly represented in SSM. It may have a relation to SSM’s ethical measure. However, this aspect concerns balancing different interests and it may therefore also be seen as resembling parts of the SSM ‘political system’ analysis37. Justice is based on the assumption that every human being is of equal value and it normally concerns ‘equal’ distribution and ‘equal’ opportunities. This dimension is, to a certain extent, guided by juridical laws. The purpose of these laws is to balance different interests, and their function is both to direct actions and to guide sanctions to maintain and restore respect for the law. The idea of politics is, in SSM, “taken to be a process by which different interests reach accommodation” (Checkland & Scholes 1990b: 50). Thus, the outcome of this process is similar to the purpose of juridical laws in their aim at serving justice. However, dissimilar to juridics, politics rests on a disposition of power, either formal, for example role-based, or informal, for example related to a person’s characteristics. The full definition of politics in SSM is “a power-related activity concerned with managing relations between different interests” (Checkland & Scholes 1990b: 50). So, although these concepts differ, by including the juridical aspect on the base of balancing different interests according to justice, and not to power, the concept of identifying power-related activities – Analysis Three – will be complemented and further enriched.

The aesthetic modality is represented through SSM’s measure E5 - elegance, and checks the beauty of the system. It focuses on the system’s modelling phase and asks if the transformation is aesthetically satisfying. This aspect needs to be further expanded, both in understanding its nature and its role as a SSM measure of performance. In the modality framework the meaning of the aspect is harmony. The proposed methodology, thus, adds a purpose to this aspect and incorporates it in the whole process, that is, all three phases.

37 The analysis is also referred to as ‘Analysis Three’ in the cultural stream of enquiry; see Chapter 3.
The spirit of the *economic* aspect in MSSM is similar to keeping a household to sustain the system. The word economy has its origin in the Greek word ‘oikononomous’ which means household, and to keep a household means to manage it within given resources. In SSM resource use is referred to in its measure E2 - efficiency, and it implies minimising use. However, due to the word ‘efficiency’ the SSM aspect can easily be associated with minimising costs to maximise profit. To minimise costs is nothing wrong in itself. The problem occurs when short term reasoning is taken too far and costs are minimised to maximise profit with disastrous long term consequences. A decrease in costs viewed only from a short term basis can often lead to an increase in costs of the whole system, especially seen in a wider perspective. The economic modality suggests a different approach to resource use. Sustaining the system proposes the sparing use of scare resources “whereby our needs are fulfilled while at the same time sufficient is kept for other people and also for nature” (de Raadt 1991: 27).

The *operational* aspect represents work which means what the system does. In SSM the operational aspect is visible in its human activity system. In MSSM the human activity system is adopted but put in a context of a viable social system, thus clarifying the monitor and controlling subsystem and additional meta-system activities.

In the cultural enquiry of SSM the *social* aspect is discussed in the analysis of roles, norms and values. The analysis concentrates on a present situation which has been formed by its history. Thus, even though SSM recognises the importance of analysing the social dimension from a historical perspective, it does not evaluate it from a future perspective in the design. In the proposed methodology the social aspect permeates the whole process and is also present in the phase of designing systems and valuing possible changes. Further, the SSM social analysis of roles and related norms and values is likely not to be restricted to the social modality but mixes a social role to other modality norms. For instance, a role may be attached to ethical and juridical norms, in addition to its social aspect. In MSSM the ‘social system’ analysis is informed by the modality framework while the social modality itself means social
interaction. This is, for example, represented by SSM’s intrinsic dialogue guided by respect, consideration, observance of conventions, etc.

Since SSM claims to be a learning system its process is based on the *epistemic* modality. However, SSM does not give any directions for learning but states that learning is ultimately good. Learning is implicitly referred to throughout the SSM process, for instance, when deciding on relevant systems and accommodating changes, but the underlying purpose of learning is not explicit. Therefore SSM has been the subject of much critique. In MSSM the direction of the epistemic aspect is wisdom. Further, it is one among many aspects, of which each is generally equally important for the system to prosper.

The *informatory* modality with its nucleus of symbolic representation permeates the whole process. SSM specifies the rich picture, the formulation of the root definition and the listing of changes to be valued; these are examples of symbolic representation being clearly visible. In MSSM the informatory aspect is especially apparent in the idea of a feedback loop between the meta-system and the operational system. The meta-system feeds information to the operational system, which through its operations, transforms input to output. The output that is generated is then compared to standards, and deviations are reported back to the meta-system, which, based on this feedback information, decides on a course of action. The decisions are then fed back to the operational system, and so the loop continues. In this context questions arise like:

- which data is relevant to collect;
- which information is relevant to feed into the operational system;
- which information is relevant to feed back to the meta-system and what should be filtered out;
- what frequency should the status of the measures be checked;
- which are the appropriate channels for the information; etc.

This modality is the focus of information systems research.

The *historical* modality predominates the design through its formative power, “today’s problems comes from yesterday’s ‘solutions’ ” (Senge 1990: 57), and is also a prerequisite for future changes. The historical aspect is emphasised in SSM in finding

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38 This analysis is referred to as ‘social system’ analysis, or ‘Analysis Two’, in the cultural stream of
out about the situation and in appreciating changes that are culturally feasible. However, it is not explicitly considered in the modelling phase. However, it is a benefit to consider the historical aspect in all phases, also in the systems modelling phase instead of leaving it to the debate about what is culturally feasible to implement.

Logics is the ‘outside’ standard that SSM claims. Logics is used in the systems modelling phase; the idea is to look upon some aspect of the situation and model it, using the techniques of SSM, as a logical machine. Further, there is a relation between logics and the SSM measure E1 - efficacy. The measure checks whether the activities together perform the transformation. In the modality framework logic is distinction, for instance to distinguish between the different activities that together make up the system as a whole. This distinction is, in MSSM, looked for both in finding out about the situation, in modelling systems, and in actions to be taken.

The more deterministic modalities, the sensitive, biotic, physical, kinematic, spatial, and numerical, are not explicitly considered in SSM. In MSSM they are identified as they constrain the system further. However, the proposed methodology focuses on contributing to the more normative aspects in systems design and therefore does not, for the time being, elaborate the determinative further.

Although Multi-modal Systems Thinking partially incorporates mechanical aspects in its cybernetic model of a social system, it strives towards a more humane systems design and the incorporation of the modality framework into this model is such an example of this endeavour. The modality framework is extracted from human experience and it considers this experience to be personal and unified. It does not put reality, or systems, outside the person. SSM also emphasises the human being as a freely thinking and reflecting person who can choose to do one thing or another; humans are not machines that follow pre-determined rules. However, due to its origin in systems engineering methodology SSM is coloured by ideas that are based in industrial thinking, thus, the way machines and industry function. This raises some problems when we deal with human systems. For instance, human systems like schools and hospitals are not easily characterised as an input - output transformation.

enquiry; see Chapter 3.
Further, it is not sufficient to measure these systems for efficacy, efficiency and effectiveness. Human systems also have a social function. Moreover, they use information and communication in interaction processes and as managerial means. They build on deliberation and views of justice, are formed by culture and history, involve ethical and aesthetic considerations, and so on. These aspects can be found in the modality framework but not explicitly in the design guidance of SSM. Although the SSM measures of performance and the modalities somewhat correspond to each other, they are not the same.

Further, the efficacy and effectiveness measures do not say anything in themselves. They are related to the interpretation of the situation while their counterpart in the modality framework has a defined kernel as its meaning. Therefore these latter, when functioning as performance indicators, bring a meaning to the system that is found outside the system itself and not related to one particular interpretation\(^\text{39}\). In this sense the modalities offer a frame of reference that is not solely dependent on an individual understanding of the situation.

Finally, incorporating the modality framework supports defining systems’ objectives that have a qualitative base. Hence, the modality framework provides a much richer language than the ‘3 E’ measures of SSM. By referring to the modalities the performance indicators of the system become more clear, distinctive and more based in human aspects.

### 9.4: Conclusion

Multi-modal systems thinking provides a useful analytical framework to the SSM systems modelling phase. The MST model of a viable social system strengthens the SSM techniques and puts them in a coherent context. Further, the modality framework expands the inquiry by adding normative aspects which are recognisable in some way or another to most human beings and therefore suitable for SSM’s

\(^{39}\) To understand the function of a system we have to look outside for reference (Ackoff 1995).
learning system. Multi-modal systems thinking in SSM’s systems modelling phase improves the design.
CHAPTER 10:
MULTI-MODAL SSM IN TAKING ACTION

10.1: GUIDANCE FOR TAKING ACTION

The SSM Taking Action phase comprises the comparison between models and perceived reality and the actions taken to improve the situation. This is the core of the learning process. Some guidance for structuring the comparison is given of which formal questioning has become the most common. The activities in the model of the previous phase are set against perceived reality and questions are asked whether the activity exists or not, how it is done and judged. Answering these questions raises debate resulting in ideas for change or for further inquiry. SSM stresses that possible changes have to be perceived as both relevant and meaningful for the people in the situation. In other words, they have to meet the criteria of being systemically desirable and culturally feasible. In modality terms this means that possible changes have to be logical and fit within the culture of the situation (that is formed by its history).

However, as discussed in the above (Chapter 4), logic in SSM models is highly dependent on the model builder and the notion of culture is also relativistic. Therefore this is one of the main criticisms of SSM. By not stating explicit criteria any interpretation may be taken as valid as another. In such cases, having a standard to which we can relate offers a potential for validating arguments and ideas for change. The modality framework gives such a standard. By raising questions concerning each modality’s effect and relevance to the situation, along with comparing each activity, more knowledge is sought about the situation.

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40 See Chapter 5.
Some modest attempts have been made in incorporating the modality framework for comparing purposes. I found it impractical to use all the modalities due to their number, so in a first attempt I only used the more normative ones (Bergvall-Kåreborn & Grahn 1996a, included in appendices). This meant, though, that I did not take advantage of the completeness that the modality framework offers so a second suggestion is to group them. However, more work needs to be done in this phase.

A benefit of including the multi-modal framework in evaluating the changes is, though, that we get a broader perspective of the situation which enriches learning. Furthermore, debate and agreed changes presuppose an accommodated solution where every one has a shared understanding, intersubjectively41 created. However, due to the phenomenological assumption that the phenomena are the limits for our knowledge and that we base our interpretations on previous knowledge or interpretations, intersubjective knowledge might be difficult to achieve, particularly in a heterogeneous group. By relying on the multi-modal framework, which assumes that all dimensions are familiar to everyone, a frame of reference is defined which is not implicit, but open for discussion.

### 10.2: The Learning System of Multi-modal SSM

Soft Systems Methodology aims at learning and motivating for changes in areas of social concern where improvements are felt needed. It builds on change and development as accomplished by learning processes and supports learning by its techniques. SSM has a strength in being able to illuminate different understandings of the situation. Further, SSM has benefits compared to the systems methodologies that it builds on; it emphasises the human being as a freely thinking and reflecting person who can choose to do one thing or another, not as a mechanistic person who follows pre-determined rules. SSM incorporates culture and climate in its analysis and refers to models of ‘social’ and ‘political system’. It also values changes according to being ‘culturally feasible’. However, in its systems design phase it mainly relies on ideas suitable for mechanistic interventions. So, SSM builds on different epistemologies in

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41 Intersubjective means a concept similarly understood and used by a number of persons.
different parts of its process\(^{42}\); SSM does not have a well-grounded theoretical foundation for social systems to be applied in the systems design phase.

Multi-modal Systems Thinking is not as well established as SSM and is not as developed in its methodology. However, it provides a model for a viable social system in which it incorporates a multi-modal framework of life. This framework captures a wide variety of human thought to elucidate us and most people, if not all, recognise the dimensions of the framework as natural aspects of their life. Therefore I propose to extend SSM with these features of MST. The proposed methodology is, thus, based in Soft Systems Methodology but enriched with Multi-modal Systems Thinking. I name it Multi-modal Soft Systems Methodology (MSSM), or the Arvidsjaur Method.

![Diagram](image)

**Figure 10:1. The Basic Shape of the Multi-modal SSM.**

Figure 10:1 illustrates the basic shape of the Multi-modal Soft Systems Methodology. It follows the process of SSM\(^{43}\) but adds features of Multi-modal Systems Thinking in each of the three design phases. In finding out about the situation of concern (in the left centre of Figure 10:1) the modalities complement SSM in the inquiry. In the modelling (top of the figure) the modalities direct us towards purpose and other significant aspects to consider. This phase also includes a social systems framework to which the SSM modelling techniques are related. Finally,

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\(^{42}\) This differentiation is also pointed out by Rose (1997).

\(^{43}\) See Chapter 2, Figure 2:4.
in the comparison phase (illustrated in the centre bottom of Figure 10:1) the modality framework gives us direction in valuing suggested changes. It gives us something to relate to in our learning. Hence, besides consistency throughout the design process, the modality framework provides a structure outside ourselves which guides and illuminates us.

Finally, standards and modelling tools are of vital importance\(^\text{44}\). They direct us towards what to see and they guide us in how to make sense of real-life experience. Moreover, they simultaneously tell us what to ignore. This means that we focus our inquiry on aspects, or standards, that the model emphasises and, hence, judge other facts that we also experience as irrelevant. It could even occur that we make ourselves blind to other aspects than those in the model when we look for corresponding information in the real-world situation. This is what happens in reductionistic management. Therefore I see an additional need to strengthen the philosophy of SSM by the inclusion of a non-reductionistic model for human conduct.

**10.3: SUMMARY OF PART TWO**

Multi-modal Systems Thinking (MST), rather new to the field of systems science, criticises the narrowly focused, technological determinism used by the hard systems approaches in dealing with human problems, as well as the soft approaches where the assumption about reality is based on chaos and complexity. Instead, MST suggests that there is order within complexity. This new and challenging way of thinking is explained through a model of interrelated dimensions which have been uncovered and arranged in a specific order. Additionally, these dimensions are put in Beer’s model of a viable social system which is adopted by MST. I believe that the framework of interrelated dimensions and the social systems model give substantial benefits in the design of social systems and may stave off some of the criticisms that have been levied against Soft Systems Methodology (SSM). Therefore I propose to include these features into the design phases of SSM.

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\(^{44}\) Or, as sir Geoffrey Vickers (1983a: 8) puts it: “men and their cultures are profoundly influenced by the tools they use”. The quotation is also included in Chapter 5.
In the Finding Out phase, in addition to the SSM techniques, I propose the inclusion of the modality framework to guide the data gathering and subsequent analyses, and validation that the problem situation is adequately represented. In the modelling phase I propose the merging of the MST social systems model and the SSM techniques. A further inclusion is the modality framework to assure humanity-based standards in the design. Finally, in comparing models and valuing changes for action I suggest the modality framework as a standard to relate to, which, hopefully, prevents the discussion from being distorted by power-related activities or false consciousness.

The benefits we gain by the multi-modal systems extension to SSM are, firstly the incorporation of a well-researched social systems framework to be used in modelling. This inclusion supports the choice of appropriate systemic elements to be modelled. Further, the social systems model includes managerial components, channels for feedback and communication, and a recursive structure that links social actors together.

Secondly, we get a standard based on multiple dimensions of life which provides a source of knowledge and to which we can relate perspectives, relevant models and suggested changes. It, therefore, has the potential to prevent us from the negative aspects of relativism. Furthermore, the model is quite complete and, hence, supports us towards a non-reductionistic view of design.

Thirdly, the modality model, being based in human experience and thought, improves design. Its inherent dimensions support and clarify the identification of its mission and other significant aspects that together make the system purposeful. Moreover, the interrelations between the dimensions are made explicit as are implications for ignoring them.

Fourthly, a further benefit with the modalities, from a learning point of view, is that they may be uniformly applied in all phases. Most people recognise the multiple dimensions as natural aspects of their own life. Since the dimensions in themselves are not new knowledge, but rather provide a framework for incorporating both past and new knowledge, they support the creative process when carrying out design actions. Such frameworks provide the means for the designers to develop their design ability, that is, they promote the development of designers’ intellectual tools.
Finally, the multiple dimensions in the modality framework are recognised by most people and, thus, exist in human consciousness. However, whether these dimensions are innate in human beings or acquired through life this research does not attempt to answer. It only concludes that they are recognised and therefore exist. An assumption, however, is that these modalities are equally important in human life and systems we design should therefore reflect most of these. This goes for all systems, whether organised as a family, a work organisation, or a society, in order to support a complete and dignified human life.
PART THREE:

EMPIRICAL STUDY

This part includes the empirical study where both SSM and the MST approaches were used. It is divided in three chapters following the SSM phases. Chapter 11 concerns the Finding Out phase and describes the area of application and data collection. Chapter 12 recounts the modelling phase and is followed by an evaluation in Chapter 13.
CHAPTER 11:

EMPIRICAL STUDY PHASE 1 – FINDING OUT

The description of my empirical work begins by (1) introducing the area of application for this case study, (2) the presented problem and (3) the particular project studied. Soft Systems Methodology mainly guided this initial finding out. In the more specific data collection I continued with multi-modal systems approach. I describe (4) the model that was employed for identifying issues and (5) the data collected in interviews. Finally, I summarise the data in the light of the modalities (6).

11.1: AREA OF APPLICATION

The empirical study concerned young people in Arvidsjaur, a thinly populated shire in the inland of north Sweden (see the map in Figure 11:1). The shire has around 8000 inhabitants and is surrounded by forests, mountains, rivers and about 4000 lakes (one lake for every two inhabitants!) For decades the main employers have been state and municipal organisations, especially the army, medical and nursing centres, forestry industry and mining. Due to cuts in governmental expenses, as well as rationalisations occurring almost everywhere in the Western world, the shire is experiencing a high and also growing rate of unemployment. In this respect the shire's situation is no different from many other inland shires of northern Sweden; that is, they are sparsely inhabited, have a high unemployment rate and are very dependent upon the state and the public sector for employment.

The problem for these small shires – small in terms of inhabitants – is survival, especially in questions of how to create employment opportunities for the young people and how to enable people to manage their difficult situation. Due to rationalisation, mechanisation, restructuring of businesses, and cuts in governmental
expenses the younger generation does not have the same employment opportunities as their parents had when they were young. Every third youth in this shire is out of work or in an unemployment programme.

Figure 11:1  The Location of Arvidsjaur

This high rate of unemployment is a trend that arose in the late 1980s and which is getting worse. This has had adverse economic and mental effects on people; attempted suicides and thoughts of suicide are increasing among youth. It is an established fact that if someone is unemployed for a long period that person will experience depression, drug addiction and will lose all opportunities of employment. Something needs to be done to avoid losing this generation.

The Arvidsjaur municipality responded with three strategies to create employment opportunities. The first encouraged self-employment through owning one's business. There is a growing awareness that people in Arvidsjaur cannot rely on the state and municipal organisations for job opportunities and that it is necessary to create one's own job opportunities. The second strategy supported the development of already existing companies. However, this strategy has been used to rescue organisations that are faltering or threatening to move from the shire. The third
strategy attracted companies from outside the area. This is done by offering premises, well-educated and loyal staff, and school education focused on the company’s special needs.

The Arvidsjaur municipality has concentrated on the third strategy: to create employment opportunities based on information technology (IT). It sees IT as an opportunity for remote areas and aims to attract companies in the IT service sector (as do many other inland municipalities of northern Sweden). The municipality has also aimed at attracting firms that support the companies in the IT service sector, such as computer programming consultants. Thus it has focused on both users and producers of IT. Consequently there are now discussions going on about adapting the upper secondary school to the requirements of these companies.

There have also been discussions about forming a new vision for the municipality. Due to the rapid changes, people felt confused and decision makers were no exception. There was no clear picture of where the municipality was heading, nor where it ought to be heading – “what does a good society look like; is it when everybody has a job, is it when no one has to work, or …?” were questions that were posed. However, there was a growing awareness that new ways of thinking and changes in attitudes were necessary. An example of such a change was that entrepreneurship had suddenly become a fashionable word and a straw that was being grasped at (Forslund 1996). This was remarkable since traditionally earning a living has been through employment while being an entrepreneur and a self-employed person has often been equal to having a “capitalistic” set of values. These were not well seen in Arvidsjaur nor in other traditional social democratic regions.

Another initiative has been to initiate projects. One such project was named ADVANCE which focused on developing methodologies to facilitate the transition of youth from school to working life. It included, among other things, exploring attitudes and prospects for education and entrepreneurship. The immediate target group for ADVANCE was adults working with youth on these issues. The project was transnational and partly EU-financed and the Swedish involvement extended to six municipalities situated in the northern inland, of which Arvidsjaur was one. A methodology was developed which involved youth in processes where their views and
ideas were ventilated and which centred on the exchange of these experiences among the participating municipalities and the countries involved.

The empirical project in the present research was included under the umbrella of ADVANCE but limited to the one municipality presented above and to one of their youth projects.

**11.2: The Presented Problem**

The client\(^{45}\) of the empirical study was the project manager of Swedish ADVANCE. He was responsible for managing and co-ordinating the work among the participating municipalities. He was also responsible for reporting back to the Swedish EU support office about the progress of ADVANCE and for its conclusions. The main interests of the client were:

- to involve youth in processes that motivate, stimulate, and evoke new ideas;
- to find out about the life dreams of young people and their thoughts about the situation; and
- in developing qualitative methodologies.

ADVANCE was also interested in finding out about young people’s attitudes to business and entrepreneurship, education and social life. Other problem owner\(^ {46}\) issues related to:

- lack of concern for fellow beings;
- an expectation that everything in life will be provided for you – “just open your mouth and someone will feed you”;
- a view that those in power are only concerned about economics; and
- global problems, like industrial rationalisation, generation gaps and unemployment.

Given the nature and the interests in the situation I decided, in collaboration with the client, to focus the study on a specific youth group and to adopt a broad approach in finding out about their view of the situation. We also decided that individual interviews would be the most appropriate means to use. Thus, this study could

\(^{45}\)‘Client’ in this context is a role in SSM that is given to the person or persons who commission the study; see Chapter 3.

\(^{46}\)Problem owner is a SSM role in the analysis of the intervening system (Analysis One) given to those who are likely to benefit most by improvement in the problem situation; see Chapter 3.
contribute to the interests of the ADVANCE project while gaining knowledge about the methodologies that are the focus of this thesis.

11.3: THE PROJECT STUDIED

The group that was chosen for this study consisted of about twenty unemployed young people that were included in a project named Creative Youth in Arvidsjaur, CYA. The CYA project was run like a factory-work shop with the aim of teaching young people aspects of work while helping them to shape their future. It was initiated in June 1994 by the municipality’s social services department. Each youth was allowed a period of six months which meant that the project population changed over time. The first group of young unemployed people that took part in the project decided its name and its abbreviation. In Swedish the abbreviation is KAOS, chaos. The young people thought this a fitting name; besides being an acronym for the project’s full name they felt that it was a metaphor which truly reflected their lives. However, at the time of the study it had been hard for the people who worked close to the youth, to get decision makers to realise the extent of the problem or even to admit that there actually existed a problem.

The project involved, besides the youth, three members of staff. Originally the it was set up by a group of people of which one came from the employment office and one from the social services department. Further members included a study counsellor from the upper secondary school and a project leader. This team outlined policies for the project and the selection of youth. The young people who were enrolled were aged between 20 and 25, were unemployed, however usually not covered by unemployment insurance but received public assistance. Although they were normally allowed 6 months in the project extensions in time period could be made.

Each youth decided on an individual plan of action with specific objectives. The idea was that the young people themselves should come up with thoughts for small work projects or trainee situations. The first idea that came up was to repair the place where they were to carry out their activity because it was run down. They also did some work on marketing themselves in the municipality. In the beginning there
were few demands from ‘customers’ but later, at the time of the study, the demands had increased and there were plenty of requests, many of which had to be turned down. This was partly because one of the prerequisites was that they not compete with local business. The kind of work they carried out varied. Some examples included: selling coffee and sandwiches (which they made themselves) to people employed in municipality administration; repair and upholstery work on municipality chairs and armchairs; small repair work and services for private persons and private and public organisations, like aid in removals, garden work, weekly shopping for elderly people, etc. They charged a small sum per hour and made therefore careful cost estimates before they accepted an order.

Apart from the actual work, the aim of the project was to provide personal growth and development. The project management organised lectures on various relevant topics which were followed by discussions. Further arrangements included courses related to everyday management, such as personal management of finance and money. The young people were also guided and supported in seeking jobs and applying for education. The participating youth developed a strong identity for the group which resulted in the stronger ones supporting the weaker ones. The overall idea was that the young people should take responsibility for their lives and be helped to take decisions for their future.

The area of application is interesting for this study for several reasons. It concerned unemployment among young people, the loss of motivation and loss of direction in life, problems recognised world wide. It also concerned a design situation; these young people were in the situation of deciding about their future, with the help and support of youth workers whose work, I later found out, could be characterised as multi-modal. Further, the problem situation concerned changes in attitudes, perceptions and ways of thinking – aspects which pertain to learning and developing creativity in the person. Such aspects are also needed in today’s rapidly changing organisations and systems design ought to support and act on developing such abilities.
11.4: A Model for Data Gathering

The model employed for structuring and analysing the data was first used in an earlier study which has been discussed in Chapter 9. In the present study I also tried out the modality framework for gathering the data. At first I used the modalities as a basis on which to understand how people interact with different social systems. The purpose was to find systems whose core, or mission, is based in each modality (thus forming an ‘ideal’ model of a municipality) and to use these as a focus for the interview questions. However, this approach tended to become too complex and still risked leaving out relevant domains. Some systems can be thought of as being based in several modalities depending on whether they are considered as objects or subjects and, in the latter case, depending on individual interpretation and experience. For instance, nature is, according to the modality philosophy, qualified as an object by the biotic modality. However, as a subject it may be of its main importance in other modalities. The sensitive implies giving refreshing and relaxing feelings, the social denotes activities in company with friends, and the aesthetic signifies its beauty. Thus, the subject gets different meanings depending on the intention.

Moreover, when using this approach, due to that a system is already defined as being based in one modality, other domains based in the same modality, and of central concern to the target group, may be left unconsidered. For instance, religious belief has its core in the credal modality and may seem to be the most apparent topic to ask questions about concerning this modality. However, given the strong secularism of Sweden, questions regarding religious belief may be strange to people, while visualising this modality as related to political position or visions for the future may not.

So, to avoid this kind of problems I adopted a brain-storming approach, and involved two young people, who had some knowledge of Multi-modal Systems Thinking, to find out about main issues in young people's life. We categorised these according to sphere of sovereignty\(^{47}\), and other main modalities, and put them into the modality framework in a tabular form. Clusters and gaps were subsequently

\(^{47}\) Sphere of sovereignty refers to the mission of the system; see Chapter 7.
identified and discussed, which resulted in the removal, grouping or adding of issues. Since I decided to use a broad approach in data gathering, covering many areas in young people’s life, I could not make deep inquires into each. Therefore we also made our categorisation according to the most immediate and pressing modalities in each interview area. Thus, we did not make a full modal analysis of each area but focused on the main ones\(^{48}\). I used this model as a frame of reference and for explicating two perspectives (one defined in the brain-storming approach and the other conceived among the interviewed young people) that I contrast and discuss.

Finally, I included demographic information, like age, family, and education to the data gathering model. The model is not an ‘ideal’ of a municipality, or of young people’s life. Instead it is meant to be a practical tool for covering a variety of aspects relating to young people, hopefully focusing on the main ones, in designing interview questions. The model also served as an analytical tool for reflecting on the interviews.

The model was tested in a pilot study involving individual semi-structured interviews with three young people enrolled in the project Creative Youth in Arvidsjaur (CYA). Some days before the interviews I sent out a letter to be distributed among the intended interviewees. The purpose was to introduce them to the ideas of the study, in a simplified form, and to prepare them for the kind of questions that would be asked. The interviews were then recorded and later analysed according to my MSSM model for data gathering. After the pilot study I made some minor modifications to issues and to the ordering of questions. I also defined more specific questions concerning each domain.

11.5: Interview Data

The interviews were carried out by a research assistant and myself. We interviewed a group of young people in the CYA project, aged between 19 and 25. Besides the three persons in the pilot study, 14 agreed to be interviewed. In total, 17 young people,

\(^{48}\) The model focused on the modalities we believed to be the main ones for each interview issue. It did not consider the variety of normative aspects inherent in each issue. Other, more in-depth, analyses could however be designed in this manner by means of the modality framework. But, such an analysis requires a different data collection strategy than the one I adopted.
aged among 19 and 24, were interviewed (10 men and 7 women). Each interview was carried out in a semi-structured conversational way covering background information, clubs, friends, work, school, businesses and shops, means of transportation, pleasure, media, nature, family, accommodation, municipality, impact of history and visions for the future. Not all the specific questions that were defined beforehand were posed to every individual; the conversation flow determined the questions. The interviews took about one hour (45 - 90 minutes) each and were recorded.

The young people who were interviewed had all left school; most, but not all of them, completed upper secondary school and were from a practical study programme. They were unemployed and very few of them had ever had a job, except during summer holidays. Half of the youth were living on their own while half of them lived together with parents or grand-parents. Two had a family of their own. Although they may have a steady partner whom they share apartment with, most of them counted their parents and siblings as their family (except the two mentioned). There was a general interest among these interviewees in sporting exercises and in activities related to nature, like fishing. Further, common interests among the men included cars, snowmobiles and motor sports. I asked some of them specifically about music\(^49\); it was usually not thought of as an interest, but as something belonging to everyday life and taken for granted. The other domains that were asked about focused on its function and relevance for the individual, and on their experience of being affected or being able to affect the particular domain.

Six concerns were identified after compiling the answers. These were responded to in a lively way and were therefore brought to our attention.

Figure 11:2 illustrates the main concerns that occupied the young unemployed people. We grouped them in: work, school, pleasure, nature, friends and future. Starting at the upper left-hand of the figure, friends were seen as very important, much more important than family. The theme of friends (i.e., peers) ran through many of the interview issues. Friends were gained during school years and they

\(^49\) A local rock band had been practising in a room next to where some of the interviews were carried out.
largely influenced interests and decision about educational programs. Much experience was gained in the company of friends. Recreation and relaxation were normally held in their company. They had fun with friends and they did not want to move from the municipality because of the fear of losing contact with their friends. Even though they would learn to know new people, they thought that these would not become as close as the friends acquired during childhood. Hence, their friends were central to most of these young people and in many spheres of life.

Figure 11:2. Main Themes from the Interviews.

Proceeding towards the right of the figure, to have work was considered very important, mainly due to economical reasons. Many interviewees talked about things they could not afford, like a snowmobile, travel, visiting night-clubs as often as they liked, and buying the clothes they liked. If they had a job they felt they could afford more. However, work also gave a feeling of social belonging and made them feel needed which was very important for their self-image. Being out of work tended to make them isolated and feeling mentally distressed. Some of them said that even the smallest things, like buying milk, could become like climbing a mountain. Even though they acknowledged psychological stress and weariness in not having a job, they usually did not want to take any job. Some of them had held uninteresting jobs
(mainly in practice or temporary positions). They did not wish for such jobs as long-standing employment.

The factory-workshop project (CYA) that these young people were enrolled in was not regarded as proper work, mainly due to the low salary. The payment they got for their work in this project was, for most of them, not sufficient to make a living and they were compensated by social security funds. When individual youths combined the work in the CYA project with a trainee position, a difference in payment became very apparent; they did the same work as hired staff but got only one third, or in some cases even one fourth, of regular salary. This they regarded as unfair; they felt exploited. However, the CYA project had invaluable educational and informative functions. Besides giving them practical skills the young people were also taught norms related to work (like social, juridical and ethical). They were also supported in finding information for making decisions about their future. They would not get such full support in traditional work or trainee positions.

Their experience of compulsory school (right centre of the figure) was mainly negative. They felt that most of the teachers could not motivate and engage them. Youth meant that teachers’ skills were insufficient pedagogically and that they failed to communicate the usefulness or impact of their subjects. Because of this experience, few were interested in further studies. Some experienced being treated unjustly and many felt that teachers did not show human consideration; they did not care. This also discouraged studies and resulted in doing poorly at school. Many had low marks in some or most subjects which led to great obstacles to further studies. However, they appreciated the practical study programmes that they had taken in upper secondary school. There they could more easily understand the purpose of what was taught. Another positive aspect they pointed out about school was the friends they learnt to know. The interviewees often talked with joy about their friends during school years and the mischief they had been up to.

The years in school gave them neither a vision for the future, nor was the knowledge necessary for furthering their understanding about operations of society. They had difficulties in having an appreciation for and deciding on future professional roles. However, most of them recognised the importance of having an education and
said that if they were to start school today they would take more responsibility for their studies. But studying would also mean a changed situation. They would probably have to move from Arvidsjaur, which would mean a change of their social circle. They also thought that studying was too demanding and did not know whether they could cope; they also thought it too expensive. Although they would get student loan to cover their expenses some of them feared that they would not get a job and that they would be in an even worse situation; besides being unemployed they would also be in debt. Finally, they were unsure about area of study.

Pleasure, listed in the bottom right of the figure, such as parties and night clubs during weekends, was important to most of the young people. The importance lay in the social aspect, also in taking part in where “things happen” and having a good time. About half of the interviewees often went out to a night club during weekends, most of them to the local night club. Before and after the night club friends gathered at someone’s place for drinking and partying. These ‘before-’ and ‘after-parties’ were generally seen as the peaks of the night. During the weekdays pleasure continued to be in focus; experiences from past events like parties was shared, happenings were discussed, and plans for the forthcoming events were made. Pleasure was closely associated to friends (peers), who are of most importance to the young people.

Being close to nature was of prime importance to most of the interviewed (bottom left of Figure 11:2). Nature gave relaxation and refreshing experiences and also had a social significance. People made an excursion, in winter on snowmobile, had a picnic, did some fishing, or just relaxed and enjoyed the beauty. Nature also gave a sense of safety and security, perhaps not nature itself but its location, and the fact that it was related to their history and upbringing. However, few showed an interest in growing environmental problems, such as pollution, and their ability to make an impact. On questions related to re-cycling only few had begun some attempts in this direction, for instance, to sort their trash for recycling and choose environmentally friendly products. Most of them knew of programs for re-cycling and environmentally friendly dispositions introduced by the municipality. Common responses about these matters were that other people can occupy themselves with such matters (and they admired them for that) but they themselves had very little
refuse or actually did not care. They did not regard that snowmobiles had negative effects on nature. They expressed surprise at the question. Moreover, they stated that environmentally friendly products were either more expensive, were not as good, or had some other problems so the young people were not prepared to use them.

With regard to the future, only some of the interviewees had decided what to do after the period in the CYA project ended (usually education or military service); but for most of the interviewees this issue was quite uncertain. Also, their thoughts in this respect were often contradictory. On the one hand they believed themselves to be in control of their decisions. (“No one decides for me.”) On the other, they saw so many constraints that made it hard for them to decide on action. (“There are so many obstacles, so many problems.”) Few had visions or plans for their future, which made it even harder for them to make decisions. These seemed to be made more often by chance rather than by careful consideration.

Some of the interviewees said that they took one day at a time and that they wished something would happen to solve all their problems. A common line of thought was that the municipality ought to provide them with jobs. Since the municipality did not, they concluded that they – youth – were not important enough. Some wanted to move in the hope of getting a job, but most of the interviewees wanted to remain in Arvidsjaur. Being near friends and family made them feel safe and secure. The general opinion was that in bigger cities there may be more opportunities for work, but there was also more violence and crimes and they would not be as close to nature, and people in common were more stressed. Thus, the general theme concerning the future was feelings of worries, especially about work and how they would be able to support themselves, besides not knowing where they were heading.

I met with the youth, their leaders and two local representatives from the ADVANCE\textsuperscript{50} project and presented the compiled answers from the interviews. Most individuals recognised themselves in the answers presented. They were even surprised that their answers were so similar. The session raised some discussions that also confirmed the data collected or provided additional information.

\begin{footnote}{\textsuperscript{50} The EU-financed project to which this research pertains; see the previous section.}
\end{footnote}
11.6 **Summary of Data Using Modalities**

The content of the five themes – work, school, pleasure, nature and friends – were analysed according to the modality framework. (See Figure 11:3.)

![Modality Categorisation Diagram](image)

Figure 11:3. Modality Categorisation of the ‘Worldview’ of the Respondents.

The vertical axis in Figure 11:3 illustrates modalities while the horizontal shows the domains that emerged in the interviews. The most predominant modalities for each domain are indicated. These modalities are illustrated by black dots surrounded by a rhombus. The grey dots indicate only a weak presence of that modality in the interview answers.

In Figure 11:3 two modalities dominate, the psychic (or sensitive) and the social. Throughout the analyses the psychic indicates a pleasure orientation towards life, while the social aspect involves peer interaction. Starting from the right-hand side of Figure 11:3, a psychic appreciation of friendship results in friendships that are not based on commitment (ethical modality), but rather regard the pleasure. There were some evidence that this was the case among some of the young people. With their peers youth enjoyed life and had a good time. Almost everything they did together with peers was mainly for fun.
Proceeding towards the left-hand side of Figure 11:3, the relationship with the natural environment that surrounds these young people tended to be commodity oriented; that is, the environment was seen as an object that could be used for one’s own purpose, for one’s own psychic pleasure. Further to the left, amusements that gave pleasurable psychic feelings were very important to most of these young people and central in their life. Night clubs and parties, or nature, were means for their amusement, and the company of peers.

Attitudes towards school tended to be negative (psychic) and the young people did not value the epistemic function that these institutions play in life. School was disliked mainly because teachers failed to motivate and stimulate them. However, interacting with peers was a positive part of school. Finally, expectations of work focused on pursuing the purely economic goal of getting money, that is, that work should give them the possibility to give them pleasure and not just provide for a living. They also hoped for social status, and preferably high status; there was a dislike for unqualified jobs. They wanted work that provided fun (psychic modality). Thus, we can conclude that the young unemployed people were driven mostly by the psychic modality, which resulted in a rather reductionistic perspective towards life.

The modalities missing in Figure 11:3, are interesting to ponder on. The absence of the ethical and juridical modalities in many domains indicates a quite selfish and irresponsible attitude towards life. This is in accordance with my perception that many of the interviewed did not show an inclination to take responsibility for themselves. They expected other people to solve their problems, or hoped that something would happen that would change their situation and give them the comfortable life they counted on.

Moreover, Figure 11:3 indicates that deterministic aspects predominate in these young people’s lives. The normative proportion is small. The normative allow for choice; we can choose one thing or another – this is what differentiates humans from animals. Thus, there is little free will and choice when we allow deterministic
orders to dominate. Consequently, we may as well put on a selfish and irresponsible attitude (toward whatever our deterministic impulses direct us) when we do not operate in a normative way. Hence, when the deterministic modalities dominate there is little support for forming a vision in life nor an ability to exercise our free will. Rather it leaves us without power. The young people expressed their powerlessness with feelings of worry and uncertainty about the future.

The CYA project worked towards increasing the young people’s functioning in the more norm-based modalities. Staff in the project emphasised such aspects that were found neglected the analyses of the interview data.

![Modal Analysis of the CYA Project’s Main Ideas](image)

Figure 11:4. Modal Analysis of the CYA Project’s Main Ideas.

Figure 11:4 shows a modal analysis of the CYA project. The vertical axis illustrates the modalities while the black dots in rhombuses in the column indicate the predominant modalities. The aim of the CYA project was to develop competence and the self-esteem of the person. It was an educational project. Hence, its purpose was in the epistemic modality (the first indicated modality starting from the bottom of the column) and work was the pedagogical means. Other relevant modalities that were found in this system’s operations were (proceeding upwards in the column) the social, juridical, ethical and credal. By carrying out work the youth were taught normative behaviour inherent in work and life. They were trained in social skills and in working

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51 de Raadt (1997a) compares the lack of normative order to the determinative impulses that rules the behaviour of animals. Thus, when abandoning normative order there is little that differentiate us from
together (social modality). They had to interact with people in the municipality and most of the tasks were organised as co-operative work (although they could be carried out individually).

The young people were given responsibility for work tasks (juridical modality) and the responsibility was gradually increased as they learnt to cope. Ethical behaviour was encouraged in being service minded towards ‘customers’ and other people, but also in teaching the youth to help each other (also after working hours). It was expected that ‘stronger’ youth should help and guide ‘weaker’ ones and that ‘older’ project members should help and guide newcomers to function in the project. Both youth and youth leaders found that this approach (helping, guiding and being responsible) contributed to individual growth and maturity.

Finally, by the end of their period in the project each youth should have made some decision about how to proceed (normally in terms of applying for a job or resuming education). Thus, the young people at CYA were supported in their attempts to develop a vision for the future, to set some goals in life and to develop a trust in themselves (credal modality).

When the CYA project was evaluated at a later date the official report of the outcome of the project was done in traditional mechanical terms. It was not done in terms of the main idea for the CYA project; that is, in the development of norm-based aspects within youth. Changes in maturity, changing perceptions, increased ability to take on responsibility, increased social skills and more developed competence were missing. This may point to a managerial interest, on higher recursive levels, in information that on the whole can be reduced to mechanical ideas. But, this may also point to a lack of evaluation models to appropriately reflect the norm-based aspects which staff in the project emphasised. Therefore we turn to the contribution that systems science can make in developing such models.

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animal behaviour.
CHAPTER 12:
EMPIRICAL STUDY PHASE 2 – MODELLING

This chapter describes the second phase of the study in which four modelling activities were carried out. We begin with (1) participatory soft systems modelling and continue with (2) non-participatory soft systems modelling. Then follows an intermediate step where (3) soft systems modelling was combined with the multi-modal approach. Finally we conclude by (4) modelling according to the proposed multi-modal systems approach.

12.1: PARTICIPATORY SSM MODELLING

The investigation was continued by means of a workshop on SSM systems modelling with the concerned people. Youth and staff from the CYA project and representatives from the ADVANCE project were invited. To get the most out of the workshop, and bearing in mind that the intended participants were not familiar with SSM modelling techniques, I made some preparations. A simplified description of SSM modelling and a list of relevant systems\(^\text{52}\) relating to the actual CYA project were put together. The CYA project was chosen as a theme for the modelling because it was known to all the participants and it currently concerned the day-to-day life of the majority of the participants.

The systems modelling workshop in Arvidsjaur took part during two half days. Seventeen people participated in building models of primary tasks and issues related to the CYA project. I first introduced the participants to three SSM techniques:

\(^{52}\) Selecting relevant systems is one of the SSM techniques in its logic based stream of enquiry; see Chapter 4. This technique was very valuable in helping to sort out the initial information and in judging the pertinence of different systemic concepts. Overall, the SSM techniques aimed at initial information were found very helpful in making sense of the complexity of the real world situation.
CATWOE definition\textsuperscript{53}, activity model\textsuperscript{54}, and comparison of models with perceived reality by means of formal questioning\textsuperscript{55}. They were then asked to explore, “a system to run a factory-workshop which is based on the idea that work makes the person feel useful and appreciated by others” (listed as one of the relevant systems) and to use the SSM techniques. They were also asked to form groups of their own choice, although the CYA staff and other youth leaders were asked to work together and not to mix with the youth as I assumed that there could be different perspectives about the system between the youth and staff. Three groups were formed, here named A, B, and C, with 5-6 participants in each group. Group A consisted of young males, group B mainly young females, while C included the leaders. The groups worked with the task for 30 minutes and then presented their work.

Since I found that it was not that easy for novice users to properly use the SSM techniques and thinking that “practice makes perfect”, I suggested one more exercise. The groups were asked to make a definition of their own, related to the CYA project, or pick one from the list of suggested relevant systems. The groups worked again for around 30 minutes before presenting to the rest of the workshop participants.

SSM techniques seemed to be hard to fully follow for naive users. Some of the CATWOE elements gave good guidance while others proved difficult to define. For instance, it rarely made sense to the participants to describe the modelled system as an input - output relation. Also, the participants had some problems in determining the element ‘owner’ and in not mixing several recursive levels in the modelling.

The activity model seemed to be easier to define when the participants made use of previous experience in work (and if previous experience was applicable). This usually meant that the model did not focus on the CATWOE definition but more on modelling reality itself. The young people who had less working experience had

\textsuperscript{53} CATWOE is an acronym for the SSM terms Customer, Actor, Transformation process, Weltanschauung, Owner, and Environmental constraints; see Chapter 4.

\textsuperscript{54} SSM activity model is expounded in Chapter 4.

\textsuperscript{55} See Chapter 5 for discussion of SSM comparison techniques.
consequently more difficulties in defining activities. The monitor and controlling subsystem of the activity model was not used at all, nor commented on.

Finally, the SSM technique for model-defined questions to compare models with reality was not used, but informal and unstructured comparisons were made during oral presentations.

This modelling workshop was a rather new encounter, especially to the young people, and the purpose and benefits of this kind of activities were not obvious. Though the participants made the models, few of them got anything immediate out of the modelling experience. Also, they were not particularly excited by the exercise. (Additionally, the setting may have reminded them of school, which these young people in general loathed.) When the modelling concerned what was familiar it was carried out quite willingly, but when it came to modelling things they had no, or very little experience of, it was done rather reluctantly. I judged that this kind of activity was not particularly meaningful, at least not to the younger participants of the workshop.

Beside giving experience in participatory modelling, the modelling workshop gave additional data related to the CYA project. Models and acts of modelling mirrored three perspectives of the participants, and contributed to the continuing modelling investigation.

Two youth perspectives became visible. One, represented by the mainly female group (Group B), showed concern for their future. Responsibility was a key issue, especially for this group. They saw the importance of being given responsibility and of becoming aware of that they managed to live up to the responsibility given. That made them feel more self-secure which contributed to their individual growth. They pointed to a desire and longing for being able to provide for oneself, and said that they did not feel that they were taken seriously by society while they were not able to support themselves. They wanted to fill a role in society.

The other perspective (represented by the young men) was not easily pinpointed. It could either be characterised as being childish and not taking life seriously, or being ironic or cynical, or bored, or perhaps having lost belief in society.
The models from this group showed that these young men were either not quite clear about the purpose of the project, or did not want to give their opinion. But they indicated that their contribution was to work to make money for the sake of the project, to be cheap labour for the interest of private organisations, and to take on unqualified work that no one else would carry out for the kind of compensation they got. These aspects, in turn, expressed a feeling of being exploited and may be the reason that this group acted with irony (or perhaps cynicism) in their modelling.

The staff models, besides pointing to the normative modalities as being the main ingredients in the running of the CYA project, also related that human consideration, found in the ethical modality, was what made their work meaningful. They repeatedly talked about the need for this kind of project and the need for everyone to fill a role in society, to be given a place where one is needed. As it is, they saw a need to make the project a permanent activity within the municipality. They did not believe that the problems of unemployed youth would disappear in the near future and therefore wished to be able to further develop the CYA activities and establish the programme in proper premises.

Participants in all three groups pointed out when modelling and making presentations, their disappointment with the municipality. They felt constrained by the municipality’s low level of interest in allocating resources; in fact the project was, at the time of the study, provided only with premises (and part of staff salary that was not covered by state money). To cover their expenses they carried out work for which they got paid and even tried to make a surplus of their work!

Only one evaluative project report existed, which included the first eight months of the activity. This report covered the period October, 1994 to May, 1995. (The present study took place from October 1996 to April 1997.) The report contained information about the project’s organisation, activities and results, and opinions why it ought to be extended. Result of the project concerned young people’s present occupation, i.e., how many of them had got a job, how many had moved on to education and how many were unemployed. I concluded therefore that management at higher recursive levels did not take much interest in the project because, as long as it ran smoothly and covered its own expenses, it could continue
and be extended, even without formal reporting. Furthermore, although there was some difference in perspectives between the participants in the modelling workshop, the biggest difference seemed to be between recursive levels, i.e., between the participants of the modelling workshop and senior municipal management.

A final observation concerns interacting systems outside the project such as the employment office, the social services department, the upper secondary school, local businesses and private persons. The ultimate aim of the CYA project was to support and guide youth in the process towards being able to provide for themselves. Thus, support and guidance could not only be provided by staff in the project, but were also needed by other people and organisations. As the project manager said: “We could continue our activities on our own, for instance, repair furniture and store them. However, it would be meaningless if no one wanted to buy them. The fact that people ask for our services and products indicates that we are needed and we are doing a good job. That makes the youth grow.”

12.2: Non-Participatory SSM Modelling

After summarising reactions of the first workshop I concluded that that there was little interest in the theoretical concepts and modelling processes among these people. This kind of thinking did not occur in their everyday life, at least not explicitly, and was therefore not natural and meaningful to them. I therefore decided to continue the modelling process on my own, making the models from the modelling workshop into complete SSM models. I began with the youth leaders’ model of “a system to run a factory-workshop” since that one was the most competently built. They had made a CATWOE definition and an activity model for this system. However, their activity model was not consistent with CATWOE but rather included principle factors of the CYA project. Therefore I made a new activity model where the activities illustrate a “logical machine” based on the youth leaders’ CATWOE.

Table 12.1, left-hand column, shows the youth leaders’ CATWOE definition for “a system to run a factory-workshop”. The right-hand column shows my logical activities derived from CATWOE definition. These activities were then arranged in a logical sequence and put against the activities defined by the youth leader.
### Youth leader’s CATWOE definition:

<table>
<thead>
<tr>
<th>C</th>
<th>Most areas of which the municipality is responsible for and private persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Youth and youth leaders</td>
</tr>
<tr>
<td>T</td>
<td>Requisite resources for running a factory-workshop → a factory-workshop in operation</td>
</tr>
<tr>
<td>W</td>
<td>Create occupation which is meaningful, raises consciousness and develops competence</td>
</tr>
<tr>
<td>O</td>
<td>Management [in this case, the same as youth leaders]</td>
</tr>
<tr>
<td>E</td>
<td>Competition restrictions, time period, premises, youth’s and youth leaders’ competence</td>
</tr>
</tbody>
</table>

### Activities corresponding to CATWOE:

1. ‘receive orders’
2. ‘appreciate effects of constraints’
3. ‘appreciate customer good’
4. ‘appraise the individual youth in terms of competence and maturity’
5. ‘value meaningful, consciousness-raising and competence-developing effects’
6. ‘calculate price’
7. ‘deliberate with customer’
8. ‘decide on order and carry out’
9. ‘monitor’
10. ‘define evaluation criteria’
11. ‘control’

Table 12.1. Activities Derived from Respective CATWOE Element.

These activities can also be found in Figure 12.1 where we compare the two activity models for “a system to run a factory-workshop”. To the left is my model made according to SSM, while to the right is the youth leaders' model. Both models show activities for the stated system and their logical contingencies.

**Figure 12.1.** Researcher’s SSM Activity Model and the Youth Leaders’ Model for “a system to run a factory-workshop”.

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A comparison of the two models in Figure 12:1, shows that my activity model is more impersonal and general than the youth leaders’ model. Moreover, the latter shows greater concern for the upholding of norms, which was regarded as very important for the functioning of the factory-workshop. My SSM model failed to address the normative issues and missed an important component of the CYA project.

The definition of evaluation criteria (activity 10 of Table 12:1) according to SSM made the deficiency even more apparent. The evaluation criteria for this model were expressed in terms of:

<table>
<thead>
<tr>
<th>efficacy</th>
<th>‘are these activities working together in running a factory-workshop’;</th>
</tr>
</thead>
<tbody>
<tr>
<td>efficiency</td>
<td>‘are minimum resources used’;</td>
</tr>
<tr>
<td>effectiveness</td>
<td>‘is the factory-workshop as such creating meaningful, consciousness-raising and competence-developing occupation’.</td>
</tr>
</tbody>
</table>

Table 12:II. SSM Measures of Performance for the CYA Project – “a system to run a factory-workshop”.

Since efficacy relates to whether means are appropriate for the task, this criterion was somewhat obsolete because the overall aim of the model was to define logical activities necessary for performing the transformation process (T). It is inherent in the modelling technique to find the right means – no more and no less – so this criterion had already been considered when designing the activities of the model. The right means identified signified a rational approach and did not include important norms for the CYA project.

The second SSM criterion – efficiency – refers to minimum use of resources in relation to outcome. I argue that in this context the system could not measure its performance for efficiency because its outcome was not clear, neither was it clear how it should be calculated. For instance, was the outcome how many youths had got a job or had been accepted to higher education after their period in the CYA project? Was it how much money the municipality had saved on the tasks the youth carried out, or on the savings that the social authorities had made due to the fact that the youth got a state allowance when they were enrolled in the CYA project? Was it how much the municipality had saved by preventing these youths from becoming social
outcasts? Therefore, the second SSM criterion did not improve the relevancy of the model.

The third criterion, effectiveness, relates to the core idea of the system. It evaluated whether the factory-workshop as such created meaningful, consciousness-raising and competence-developing occupations. However, the terminology was not appropriate. The CYA project leaders had a different perspective about the system, namely human considerations directed first and foremost towards the youth; not effectiveness.

12.3: Intermediate Modelling

To reflect these humane aspects more intensively in the model I replaced the SSM efficacy-efficiency-effectiveness with modalities as criteria for evaluation. However, this inclusion did not make the models more humanly rich; instead the modalities became a device for furthering insight into the real-world situation. The modalities can be used both as criteria for evaluating the system’s achievements and in the comparison phase of SSM. Thus, in the present research the extended evaluation criteria were used to compare the model with perceptions of reality.

The seventeen modalities were grouped into six categories (restraining, logical, directing, economic, guiding, and belief) in an attempt to follow their resemblance to the SSM measures. The first category (restraining) included the most determinative modalities, that is the numeric, spatial, kinematic, physical, biotic and sensitive. They have no equivalents in SSM. The next category, the logical, resembles the SSM measure efficacy, but provides more information in understanding the situation. The third category, the directing dimensions, involved the historical, informatory, epistemic, social, and operational modalities. These have no equivalent to SSM’s measures of performance.

The fourth category comprised the economic modality. It resembles the efficiency measure in SSM, but as argued above concerning efficiency, the stress is on reflections on the use of resources and not their sparing use. Thus, the term economic was found more appropriate for furthering such reflections than the more industrial
term efficiency. The fifth category (guiding), which involved the aesthetic, juridical and ethical modalities, can be included in SSM as additional criteria to supplement the efficacy-efficiency-effectiveness measures. However, in this framework, contrary to SSM, they have a defined meaning. The final category, belief or view-based factors, included the credal modality. This modality resembles the effectiveness measure in SSM in that it refers to the long-term aims of the system. The ultimate aim of the CYA project was to enable young people towards being able to support themselves. The traditional means to independent living in this shire is through employment, which is a term that originates in the industrial age. Some say that we have left the industrial age and are now entering the knowledge and information age which have different views about work; one focuses more on body and the other on brain, one on long-term employment and the other on projects, i.e., time limited engagement.

In conclusion, the modality framework provided a much richer evaluation criteria and provided additional concepts to reflect on than that offered in SSM. In every case where I exchanged the SSM evaluation criteria for the modalities the modality framework was superior. However, the reflections concerned the situation itself, not the SSM model, which points to the third methodological phase.

In this investigation the SSM measures were used as the basis on which to group the modalities, believing that I could supplement the 3 Es with modalities. This was not possible. The modalities were of a different character and therefore meant different things. Hence, it was not possible to mix these two evaluation approaches; I had to decide on one or the other. I also found that to group the modalities according to their resemblance to the SSM measures of performance (3 Es) was not be useful. It may be more useful to focus on a few modalities of particular interest to the situation in question.

The SSM model was then included in the MST social systems model. This was done because when I entered the comparison phase of SSM I noticed that the models were my own interpretations of what would constitute logical activities given the defined situation, and did not really represent anything substantial. They were merely a description of the situation according to my understanding of what would be logical. There was nothing against which to relate model and performance (except to my own
understanding, which could be claimed to be insufficient, wrong or invalid). Therefore I decided that a theoretical framework, which provides a source for knowledge, would be of benefit and so the SSM model was combined with the MST model of a social system.

![Diagram](image)

Figure 12:2. CATWOE Definition for “a system to run a factory-workshop” in the Context of the MST Social Systems Model.

Figure 12:2 illustrates the CATWOE-elements of “a system to run a factory-workshop” put in the MST social systems framework. It shows the gaps and deficiencies of the SSM model previously built. The stated input (resources for a factory-workshop) and output (factory-workshop in operation) do not necessary lead to an occupation that is meaningful, that raises consciousness and develops competence (the W in the SSM model). Thus, there is a gap between stated output and what is interesting to assess\(^{56}\). These had not been noticed before in the pure SSM model.

Figure 12:3 adds the logical activities to the CATWOE definition and puts these in the context of a viable social system. As illustrated in the middle of the figure, the

\(^{56}\) Given the stated W, the factory-workshop can only be a means, not an output to be assessed according to this purpose; output should be qualities within the youth themselves.
previously listed activities – except those included in the monitor and controlling subsystem – focus on the operations of transforming input into output. The activities concentrate on the recursive level of the operational system while the meta-system\textsuperscript{57} activities that are included ("monitor" and "control") focus on one managerial function, namely the functional. There is not only a lack of managerial functions in

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{activity_model.png}
\caption{Activity Model for "a system to run a factory-workshop"
Included in the Context of the MST Model of a Social System.}
\end{figure}

the SSM model, such as co-ordination and development, but also the communication between meta-system and operational system is limited to monitoring and controlling. Although one arrow goes \textit{from} the operational system it indicates a one-way communication in the choice of the word ‘monitor’. Consequently, it does not include a two-way deliberation about resources. Finally, the efficacy-efficiency-effectiveness of the SSM model ("define measures of performance") are deficient for the situation. Hence, the model lacked important managerial functions necessary for a system to

\begin{footnotesize}
\textsuperscript{57} Meta-system is equivalent to management system.
\end{footnotesize}
possess viability, indicated a one-way communication between meta-system and operational system, did not include deliberation and used measures for the system’s achievement that were not suitable for this situation.

12.4: Multi-modal Systems Modelling

To improve the deficiencies isolated a new model, based in the proposed multi-modal systems approach, was used. Below is a figure which elaborates the findings of group B (the female dominated group in the modelling workshop). In this model the core purpose of the CYA project – facilitating young people in their process towards maturing and personal development\(^{58}\) – was in focus.

Figure 12:4. CATWOE Model of the CYA Project Based on the Design Model of Multi-modal Soft Systems Methodology.

Figure 12:4 illustrates a system which aims to make youth mature, take more responsibility for themselves (T) and, thus, become more independent of others for their well-being. The worldview that makes this transformation process purposeful (W) is one in which occupation, or work, that is perceived as meaningful also raises

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\(^{58}\) This objective was implicitly stated in the project manager's report concerning the CYA project’s activities and results during its first eight months of existence (October 1994 to June 1995).
consciousness and develops competence (which is equal to personal growth). The operational system in the bottom of the figure, where the actual operations are carried out, is where youth are ‘transformed’ to become more responsible youth. In this model it consists of the youth themselves and their supervisors\(^ {59}\) (A). On a lower level of recursion each youth is an operational system on its own so that each individual youth, with his or her special needs, comes in focus\(^ {60}\).

The meta-system of the model (O) to which the operational systems are accountable and to which deliberations of resources are directed, is represented by a management group of the CYA project. This group includes professional people from state and municipality organisations who become involved with youth, but usually function independently and in different matters. Examples include the social services department, the employment agency, study counsellor and project leaders from the youth project.

The constraints which I put upon the system from the outside (E in Figure 12:4) are factory-work shop, competition, time limits, available premises, limited means, youth and supervisor competence, and admission criteria\(^ {61}\). The first constraint refers to the idea that work, if meaningful and valued by others, develops the individual and supports personal growth. However, the work should not compete with local businesses (second constraint). Time limits, the third constraint, refers to the specified amount of time each youth is enrolled. The enrolled youth should not be ‘caught’ in this system. The premises are those available and, thus, the fourth constraint. Means are limited, the fifth constraint. The sixth constraint refers to staff’s and young people’s competence that limit the activity. Finally, admission criteria put constraints on which young people are approved to join the project.

The activities designed for this model, besides operational activities, are based on meta-system tasks, inherent in Beer’s viable system, and in CATWOE definition\(^ {62}\). Thus, the managerial activities not present in previous SSM models are included.

\(^{59}\) Besides supervisor, other terms used for this professional role are also staff and youth leader.

\(^{60}\) A different structuring could be according to different work tasks. However, bearing in mind the ultimate purpose of the project we decided to focus on the youth themselves.

\(^{61}\) These are, in principal, the constraints that those concerned put forward in the modelling workshop.
These are, for instance, activities that analyse the environment and take actions, manage the day-to-day operations of the system, deliberate on resources, set the objectives, evaluate the progress, take measures and co-ordinate between operational systems.

In this design model and its feedback cycle, as shown in Figure 12:4, the monitor and controlling system was made more clear. This supported the definition of appropriate performance indicators. The W of the system indicates that norm-based aspects should be considered in assessing the output (the development within the young person). For instance, social competence, the ability to empathize and to take on responsibility, to develop a vision in life and to develop faith in one's abilities, were important to include in evaluation measures. I therefore chose the epistemic, the social, the juridical, the ethical and the credal modalities from the modality framework as being most relevant when assessing the system. See Figure 12:5.

The epistemic modality is the sphere of sovereignty for the CYA project. Its main purpose is to educate young people in aspects of work. However, social rules apply to work (social modality), in addition to practical skills. For example, to be on time, treat people with civility, communicate and converse with people outside the peer group is included in social behaviour. The juridical modality relates to what is just and what is due and therefore includes developing a responsible attitude to work. The ethical modality is significant as work is a contribution to the community and not something that is done for purely selfish purposes. Finally, the credal modality is of crucial importance for this system. It puts focus on visions for the future and belief in one self. Therefore, to fulfil the CYA project's mission there is a need to encourage these young people to develop a vision for the future, to set some goals in life and develop a trust in themselves.

62 These kinds of activities are defined in Chapter 9.
Figure 12:5. Performance Indicators for Assessing “a system that looks after important factors in youth development and in the process of growing up”.

The feedback cycle continues as is illustrated in the arrow from the metasystem (management group) to the operational system (youth and supervisors) at the left centre of Figure 12:5. This arrow illustrates managerial responsibility for corrective actions and for granting resources for the operational systems activities (economic modality) so that the operational system accomplishes its mission. The arrow in the opposite direction, from youth and supervisors to management group, illustrates being accountable for resources used.

12.5: Summary of Empirical Study

These two chapters comprise an account of the empirical study carried out to test the proposed methodology. It concerned a project for unemployed youth, the CYA project in Arvidsjaur, in which young people were helped in becoming independent, making decisions about their future, and how to providing for themselves. Challenges in the problem situation included changing attitudes, perceptions and ways of thinking so that each youth could enhance learning and developing creativity. Such aspects are
necessary in today’s rapidly changing organisations and systems designers ought to support and act on developing such abilities.

In the initial data gathering stage the SSM techniques were used. They provided much help in structuring the complexity and in establishing key issues such as identifying different expectations of the people involved. However, while suitable for the gathering of general data, the SSM was not as suitable for a multi-dimensional data collection. Instead the multi-modal systems framework was employed and provided a framework. This enforced a broad view and included such dimensions in human life that are not present in more traditional data gathering approaches. The modality framework also worked as a source of reference when analysing issues in the situation. It supported further reflections on these issues and aided in contrasting reductionistic perspectives on life and perspectives that included a richer understanding.

In the analyses of the data it was found that youths had a rather reductionistic and deterministic understanding of life in their focus on mainly social and psychic aspects. The analyses also showed that the CYA project was managed in a multi-modal way and that norm-based aspects within the young people were developed. Staff in the project emphasised these aspects that were found neglected in the modal analyses of the interview data. However, the data indicated that management at higher levels of recursion had a more reductionistic view of the project. They were concerned with the economic considerations and mechanistic reports of results. This lack may be due to a deficiency in available models to reflect the normative aspects which staff in the project emphasised. Therefore an investigation in modelling was made to explore the contribution that systems science can make in developing such models.

The systems modelling phase was initiated by a participatory modelling workshop in Arvidsjaur, in which the participants made SSM models of issues in their real life situation. Some of the SSM techniques were found useful while others were not used at all. More experienced participants made better use of the techniques.

In an intermediate step aspects of multi-modal systems thinking were combined with SSM. The modality framework was used as evaluation criteria in
SSM’s monitor and controlling system. This approach gave richer insight into the real-world situation and also furthered reflection. However, the reflections concerned the situation itself, not the SSM model. This led to the third methodological phase in which the responses of the participants were evaluated against the modalities. This endeavour made me realise that modalities and SSM terms were different in nature and therefore meant different things. Hence, it was not fruitful to mix them.

The models were, moreover, put in the MST framework of a social system to add a further source of knowledge in the area of application. This combination brought up the gaps and deficiencies in SSM modelling. Firstly, the choice of elements in defining the CATWOE framework was inappropriate. Secondly, the models lacked proper managerial functions necessary for a system to be viable.

The modelling phase concluded with modelling based purely on the proposed Arvidsjaur Method. The benefits that were gained, compared to previous modelling, were several. I was aided in identifying coherent design elements by their inclusion in the new framework. The adding of recursive levels increased an understanding of the context in which the system in focus was embedded. The managerial component added activities necessary for viability and made the monitor and controlling system more clear. This helped to identify evaluation criteria for the system’s achievements, which were based on relevant and meaningful human aspects for the system. Moreover, this clarification meant that the economic aspect was salient between the recursive levels and not necessary in the assessment of the output of the system.

Hence, the contributions that the Arvidsjaur Method makes to the CYA project are threefold. Firstly, it puts focus in each youth with his or her individual needs and qualifications and allows steps and actions to be directed accordingly. Secondly, it clarifies managerial roles, responsibilities and reporting routines between the different recursive levels. Thirdly, it gives guidance in evaluating the achievements of the system based in a non-reductionistic view of life.
CHAPTER 13:
EVALUATION OF THE METHODOLOGIES

This chapter evaluates the two methodological approaches described in the previous chapters in terms of (1) their modelling power, (2) their ability to set standards for learning and design, (3) their ability to represent people adequately and (4) their ability to facilitate learning. We finish the chapter by summing up with conclusions.

13.1: MODELLING

In a complex and highly unstructured situation SSM provides significant guidance in establishing the key issues in the project, such as identifying the perspectives and expectations of the people involved. However, when modelling the CYA system, two problems became apparent. Firstly, some of the elements of the CATWOE framework, particularly the owner and the transformation process, were difficult for the participants to understand and identify in their own situations. Secondly, the activity models that were built according to SSM techniques proved to be less informative than those that were built with little regard to formal methodology but were based on pure experience. Experience rather than methodology became the key factor in model building. This is in agreement with the findings of Vickers (1983b), Woodburn (1985) and Mingers (1992b). My own models – drawn up as a researcher and with the full benefit of knowledge about SSM – were not validated for I lacked the work experience in CYA. This challenges Checkland’s stress on methodology rather than findings, on process rather than content. (Checkland 1981: 285). We need an approach that values both methodology and findings.

However, when social systems theory – such as MST’s viable systems model – is incorporated rather than excluded in the CATWOE framework (see Figure 9:1) several
benefits become apparent. We become aware of inconsistencies between the elements of the framework, of the importance of giving proper regard to managerial activities and of their distinctiveness from the operational activities. The evaluation of the achievements of the system becomes an integral part of the framework and is defined in humane (e.g., development of knowledge, ethics and responsibility) rather than utilitarian terms.

Finally, models built upon a sound theoretical basis are not purely reliant upon interpretations, but also upon well-researched theories. These theories are explicit and open to challenge. SSM models cannot be challenged for there is little theory in them. Theory makes validation possible because there are now theoretical standards upon which the activity models can be judged. Furthermore, theory ensures a positive contribution to the area of application.

13.2: RELATIVISM VS STANDARDS

Soft Systems Methodology is repeatedly criticised for its relativistic stance (e.g., Brown 1992; Docherty & Ivanov 1991; Flood & Ulrich 1990; Mingers 1992a), that is, that any interpretation is judged as valid as another, no matter how detrimental it might be. Thus, SSM does not recommend any standards for human conduct.

In attempting to deal with this criticism I include a standard against which the different perspectives can be appreciated. The standard is represented by the modality framework, which I use empirically. It functions as an intellectual tool that guides and influences the design.

There are five benefits in making this inclusion. Firstly, we get a frame of reference for data gathering. This frame of reference – cf. ‘thought figure (ideal)’, to the left in Figure 13:1 – forces us to investigate the ‘design situation’ (further down in the figure) in aspects not necessarily economic, but also epistemic, juridical, ethical, credal, etc. These other aspects would most certainly escape normal data collection. Thus, we get a more complete frame of reference which directs us towards a rich, non-reductionistic apprehension of the situation.
Figure 13:1. The Modality Framework as an Intellectual Tool for the Designer\(^6^3\).

Secondly, the framework helps us to see relations between issues in the situation and the modalities, e.g., feelings of powerlessness and loss of direction point to the credal modality and a lack of vision in life. We, thus, get an explicit reference against which we can build our models (cf. ‘vision’ in the figure) to assist us in the categorisation and analysis of gathered data, which, additionally, assists us when reflecting on different perspectives and on own biases. We are also able to identify reductionistic from multi-modal attitudes. For instance, my analysis of the interview data pointed towards a rather reductionistic perspective among the unemployed young people, based in the psychic modality, while the project manager worked in a multi-modal way to develop the neglected aspects.

Thirdly, we are provided with evaluation criteria (cf. operative image in Figure 13:1) for the system’s achievements. The criteria are based on human considerations that are more appropriate to social systems than the more common industrial criteria of SSM. The latter are more suitable for mechanical processes. Further, the criteria are explicit, which means that they are not just based on individual interpretations but open for discussion and for everyone to learn.

\(^{63}\) Figure 7:10 builds on Stolterman’s (1991) research of the design process; see Chapter 2.
Fourthly, the modality framework builds on a theoretical basis which means that we are not purely directed towards individual interpretations when we critically examine model and reality. The modalities offer the same guidance for everyone and also provide a rich language for managing conflicting situations, for example, the framework's differentiation between ethical and juridical aspects. It, thus, supports ‘the force of better argument’ (Habermas 1973) and simultaneously mitigates the criticism towards SSM of providing yet another tool for manipulative management.

Fifthly, due to the modality framework’s completeness, its consistent use throughout the design and its guiding standards based in human considerations, we gain a richer learning experience. The modalities inspire and further the reflections why they support the development of the designer's analytical ability. This also means that they support and even ameliorate creative thinking in design.

However, there are some practical problems in including the modality framework that need to be studied further. Firstly, the modalities give a complete framework to relate to, but if the modalities are separated to ponder on each of the seventeen aspects, the real-world situation becomes fragmented and less meaningful. Secondly, if the modalities are grouped the nuances that may be of particular importance for understanding a situation are lost. For instance, the modality framework’s strength is in how it differentiates between juridics and ethics; if these two modalities are grouped we do not benefit from this strength. Thirdly, if there is a focus on a few modalities of particular interest for the situation, and how they interrelate, valuable insights are gained. But, then the completeness of the modality framework is not exploited. Important aspects may therefore be disregarded. Thus, more experience is needed about different approaches in using the modality framework to be able to reach some conclusions.

Further, when using the modalities as evaluation criteria more precise indicators about what to observe in the system’s achievement are needed. In this situation, measures that are quantifiable are often preferred, but if the evaluation
criteria are mainly norm-based this becomes a problem. There is little homomorphism between quantity and highly normative aspects such as ethics. (The ethical modality cannot fully be understood by counting, for example, how many times I have been helped by my friend just for the sake of kindness.) Hence, predicting data that indicate the (especially normative) achievements of the system is left for more in-depth studies.

Despite these practical problems I see clear benefits of including the modality framework. We get a comprehensive model to relate to, which is explicit and open to discussion. This, in turn, mitigates the problem of relativism. The model includes a rich language, why it strengthens creative thinking in analysis and design of systems. Finally, due to its completeness it reduces the risk of falling into reductionistic thinking.

13.3: CONCERN FOR HUMANITY

Although SSM has a strength in establishing key issues and in incorporating different perspectives through modelling, much of its guidance for systems modelling does not apply well to the real world situation in Arvidsjaur. For instance, the SSM models that were built (Figure 12:1, left model, and Tables 12:I-II) turned out to lack important and highly relevant aspects of the situation, such as the need for the CYA youth to have a responsible attitude to work. The SSM models failed to convey the gist of the issues I wished to illustrate. They failed to address the normative aspects that represented the essence of the CYA project, for example, social competence, ability to empathise, to take on responsibility, to develop a vision in life, faith in one’s own abilities, etc. Therefore SSM modelling is incomplete.

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64 van Gijch (1997: 387) refers to a similar problem when he points at a need “to find better ways to calculate the attributes of soft domains, such as … the value of quality of life, ethical values, the evaluation of rights … the value of enjoyment of music and art, the value of participation in community and cultural events, historical values” etc.

65 For discussion of normative and determinative aspects of the modality framework, see Chapters 7 and 8.
In some instances in the practice of SSM, cultural aspects and terms related to role analysis, applicable to the real-world situation, are used. In others there is a domination of engineering terms, more applicable to mechanical processes; see Table 13:1 for examples.

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<tbody>
<tr>
<td>client</td>
<td>logical machine</td>
<td>customer</td>
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<tr>
<td>problem owner</td>
<td>transformation process</td>
<td>actor</td>
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<td>problem solver</td>
<td>measures of performance</td>
<td>weltanschauung</td>
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<td>social system</td>
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<td>political system</td>
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Table 13:1. Terms of Soft Systems Methodology in its Different Phases and Techniques.66

As illustrated in Table 13:1, the terms used in the SSM techniques are of two different natures; one applies more to humanity and the other to engineering. In the column to the left we see that the main terms in the Finding Out phase are related to people and role analyses. The terms listed in the right column are also of this nature. However, the terms in the middle are not applicable to human beings, but to machines and industrial processes. This may be a reason for some of the problems experienced in modelling (e.g., Bergvall-Kåreborn & Grahn 1996a; Gregory 1993; Mathiassen & Nielsen 1994; Mingers 1992b).

SSM originates from an engineering context where the aim for developing the methodology was to explore the contribution that system ideas (from systems engineering methodology) could make on managerial real-world problems. However, it was soon found that the engineering methodology had to be changed to apply to the problems that SSM attempted to address. Such changes in the development of SSM have been made predominantly to explore different perspectives of the same situation. Thus, techniques that include the terms listed in the right and left columns in Table 13:1 have been added. The terms in the middle are inherited from systems engineering.

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66 The terms are explained in respective subsection in Chapters 3 and 4.
Although these inclusions of humanistic aspects have improved the methodology, this is insufficient. SSM still holds elements that represent a mechanist view of the world. I mean that terms related to mechanical systems are not pertinent for social systems\textsuperscript{67}. Checkland also recognises this when he points out that models “have an antiseptic, inhuman air” (Checkland 1972: 110) and, if they were implemented they “would require inhuman beings to operate them”. Hence, further adaptations are needed in SSM techniques to make the methodology coherent and better suited for social systems analysis and design. This is attempted when the model of a social system and the modality framework are incorporated in the act of modelling; see Figure 13:2.

![Diagram](image)

**Figure 13:2.** The Design Model of Multi-modal Soft Systems Methodology (or the Arvidsjaur Method, for short).

There are several benefits in incorporating the managerial model for a living social system to guide the modelling. First, the problem of building activity models of social systems as ‘logical machines’ is bypassed while simultaneously taking advantage of the strengths in the CATWOE framework. Hence, there is a mutual benefit resultant from this merger. The MST systems model links and clarifies the CATWOE

\textsuperscript{67} To clarify, the young people in the CYA project (or any other human being) are not similar to
framework, which, in turn, (because of its humane elements) also clarifies the MST systems model.

Further, the transformation process, which is a mechanistic concept, takes on a slightly different meaning because of its inclusion in the operational system and in a recursive structure. Hence, the problem of its mechanical significance is softened (but not ‘solved’). For instance, the ‘transformation’ of CYA youth in becoming more responsible is more purposeful when there is a meta-system to guide this transformation compared to when the transformation is expected to take place by itself and surveyed solely by efficacy-efficiency-effectiveness measures.

However, the coupling between meta-system and ‘owner’ is a bit far-fetched, especially in community organisations as the one we studied, but it has a pedagogical point. It makes a first step in bridging the gap between the CATWOE framework and the MST social systems model. Further studies are needed on the consequences of relating the two elements.

Finally, the achievement of the system is evaluated by means of the modalities (‘Performance indicators’ to the right in Figure 13:2). As such, the modalities replace SSM criteria more suitable for measuring mechanical processes. They add a humane dimension to modelling, which provide more insight, that is, more learning than the mechanistic foundation of the SSM measures offers.

Last, the managing of resources (economic modality, in the left middle of Figure 13:2) is put in the context of deliberations between recursive levels instead of in the immediate measuring of the system’s achievements. Therefore economic considerations are put in their appropriate place and not mistaken as the only criterion to measure a system’s achievements, where this is not the original purpose.

13.4: LEARNING METHODOLOGY

The SSM approach is different in each phase. While in the finding out phase it adopts a broad approach, in the modelling phase this narrows down considerably to a rather predictable or programmable machines.
mechanical and reductionistic view of systems. Yet, in the third phase people are expected to act in a personal way on these reductionistic models. This results in an inconsistency among the three phases by, at times, adopting a reductionistic stance (based on the logic modality) and, at others, a relativistic (in its direction to what individuals judge as feasible and desirable). This inconsistency reflected itself in the Arvidsjaur project in that much of the varied and rich data collected in the first phase, for example about responsibilities in life and the sense of social belonging of unemployed youth, was not included but discarded at the modelling stage. These models mostly addressed the flow of activities in the workshop, such as the purchasing of materials, cutting and assembly. When the third phase was reached, they failed to address the issues (e.g., responsibility and social belonging) raised in the first phase.

SSM states that learning is a good thing, but does not give any directions about learning. Yet, in the particular Arvidsjaur situation – as in so many others in a world in crisis – learning is desperately needed. Here is where the multi-modal extension of SSM plays a significant role. It teaches us that human life takes place along a set of closely interrelated modalities and each of them is important to a person. Firstly, it draws our attention to the fact that there are standards of human conduct at each modal level and it teaches us how to reflect upon these standards and to relate them to the systems under consideration. For example, many of these young people focused only on expectations on what others – state, parents and teachers – are supposed to do for them, but lacked a vision (credal) in life and a desire to contribute (ethical) to the benefit of their community.

Secondly, the modality framework points us to the variety of dimensions in human life, which directs us towards what to see and prevents us from falling into reductionistic judgements, which, in turn, limit our understanding. While the Arvidsjaur municipality has in the past limited its concern to economic matters, the leaders of CYA have strongly emphasised the key roles that the ethical, juridical and social modalities play in helping unemployed youth. This is something that the municipality is slowly recognising.
Thirdly, the modality framework provides an external source of knowledge. Thus, we are not solely dependent on relativistic judgements of people’s perspectives of what is, for example, feasible and desirable. Instead we can relate such judgements to a standard ‘outside’ of us, but still ‘inside’ and integrated in our lives. Some of the youth believed that they were entitled to do entirely what they pleased without intervention from parents, teachers or others. And yet, they were very confused as to what they should do, especially in a society that sends conflicting messages to them. The multi-modal framework can help them to understand what is worthwhile pursuing in life and how not to fall prey to their own impulses. Consequently, and fourthly, we are not entirely limited to learning purely by the exchange of knowledge among the participants, but also by the multi-modal wisdom accumulated over centuries of civilisation (and by the design model).

I found a low interest in building models and using theoretical concepts in my project. The whole approach of making models of issues in reality was foreign to most of the Arvidsjaur young people and their leaders. The purpose of building SSM activity models did not really make sense to them. Checkland’s distinction between making models relevant to debating reality and making models of reality was unintelligible to them. They built models of what they perceived of reality. Consequently, there was no point in making the comparisons that SSM prescribes for learning, nor could there be a “stimulating and fruitful” participation (Checkland & Haynes 1994:195). It seems that modelling, at least in the type of system we dealt with in Arvidsjaur, will remain an activity for the professionals who know how to model.

A final remark. The lack of authority and absolute values in our post-modern society put more demands and responsibilities on the individual for the upholding of norms.68 It is expected that people should know what is right and wrong, and make appropriate choices. The court cases of the Serbian leaders in The Hague have reminded us that there are standards of behaviour that apply to all people if we are to

68 See, for example Bauman (1995) for more in-depth discussions on postmodern morality.
recognise their atrocities as crimes against humanity\(^{69}\). Therefore, in our rapidly changing and highly complex society we see an increasing need for a framework such as the Arvidsjaur Method. In our days, the rule of rationalism and efficiency cohabits with a trend to dismount and scatter long established and tested patterns for life. Jobs that demanded a commitment for life – and bestowed a sense of purpose on those that performed them – have become temporary occupations. Industries, previously prosperous, are suddenly closing down or moving to other countries. Job qualifications quickly become obsolete and professional experience is at times more a burden than an asset. Long standing arrangements and conventions have been replaced by conditions and ‘rules’ that change over and over again. In this light the Arvidsjaur Method brings a welcome sense of human stability. It points out that there are some things which do not change, at least not as rapidly as society does. These provide a firm point of reference necessary for a fulfilling human life, a need that has been recognised as long as history has been recorded. Further, they help us towards getting a more holistic picture of our fragmented and disconnected life. They also help us to analyse and thereby understand the effects and the consequences of our post-modern society such as those caused by reductionistic thinking.

13.5: CONCLUSION

This chapter has evaluated the two methodological approaches described in the previous chapters, Soft Systems Methodology and its extended multi-modal systems version, here referred to as the Arvidsjaur Method. In applying these two approaches I found that they differed in their modelling capacity, in their interpretivistic philosophy, in their ability to adequately represent human situations and, consequently, in their ability to facilitate learning. My conclusions from the evaluation are as follows.

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\(^{69}\) A further illustration of the individual’s responsibility is Arendt’s (1985) reflections on the culprits’ inability to confess or even realise own responsibility for the Holocaust. (They claimed that they just carried out orders, had a job to be done, could not fail in their duty and towards their fellows.) Her conclusion is that it can be asked by human beings that they should be able to differentiate between right and wrong, good and evil, even though they only have their own judgement to guide them.
Firstly, while SSM provides some useful modelling capabilities, its lack of theoretical foundation deprives it of power. The Arvidsjar Method provides this theoretical basis and therefore enhances its power as a modelling tool. Moreover, since a theoretical basis is provided, models can be both validated and challenged. This enables a positive contribution to the area of application.

Secondly, Soft Systems Methodology is repeatedly criticised for its relativistic stance. SSM relativism means that any position, no matter how detrimental to people, is included and there are no standards by which one can judge such a position as undesirable. The Arvidsjar Method acknowledges that there are standards for human conduct and attempts to meet this criticism towards SSM by including the modality framework as a standard. We get a frame of reference for appreciating the different perspectives which is explicit, based on human considerations, open for discussion and for everyone to learn. We, thus, are not purely dependent on the individual’s interpretations but also include an external source of knowledge.

Thirdly, although SSM has tried to dislodge itself from a mechanistic view of the world, there are still important elements in its modelling approach that are machine-based. The Arvidsjar Method, because of its non-mechanistic foundation, attempts to strengthen the humane dimension in modelling. Such models provide more insight for social systems analysis and design, that is, more learning, than mechanistic models.

Fourthly and last, learning in SSM is inadequate. Besides not giving any directions for learning, SSM's guidance is inconsistent, at times reductionistic, and relativistic. Moreover, because it includes only the knowledge of the participants, its learning is rather limited to the exchange of knowledge of the group. The Arvidsjar Method adds external sources of knowledge which give directions for learning and which are consistently used throughout the approach. These sources offer standards to which we can relate. We are therefore supported in gaining a non-reductionistic understanding of human life, and are also assisted in appreciating different perspectives and making appropriate choices.
Finally, SSM has made an outstanding contribution to the application of systems ideas to real-world problems. This research aims to build on to this tradition, but also to extend the approach towards including necessary tools and techniques for addressing human needs in society. This study has identified some problems in SSM for achieving this purpose. It has, however, also identified some ways to mitigate these problems. Therefore I believe that there are clear benefits to build on in this first attempt of a multi-modal systems extension to SSM.
CHAPTER 14:

CONCLUSION

It has been my main argument throughout that human aspects need to be re-incorporated into systems design since these have been increasingly neglected in modern organisations. It is economic concerns measured in profits that define the mission of an increasing number of organisations, including schools, hospitals and other kinds of organisations not traditionally identified as businesses. The economic aspect is allowed to dominate at the expense of others such as the social, emotional, ethical, and historical aspects of organisations that in the past have been considered as important as economic gain. We have designed fewer and fewer humane systems in our modern societies. It is toward dealing with this crisis that this study has been directed. I have attempted to develop a non-reductionistic tool for the analysis and design of systems that incorporates other dimensions in addition to mere economics.

The argument began with the recognition that Soft Systems Methodology (SSM) has made an important contribution to management and information systems and has incorporated a humane concern. However, Chapters 2 to 6 of this thesis exposed a relativistic slant that limited its effectiveness in dealing with human concerns. It was the aim of my research to overcome this limitation by combining SSM with aspects of Multi-modal Systems Thinking (MST), an overview of which is provided in Chapter 7. MST rests upon a framework of dimensions of life and thought that complements SSM and furthers its development. MST also incorporates a systems management model that is helpful in design.

The combination of these two systems approaches was discussed in Chapters 8 to 10. It emerged into a new design approach, which I termed the Arvidsjaur method – short for Multi-modal Soft Systems Methodology.
Conclusion

Next, SSM and the new method were applied in Arvidsjaur to an unemployed youth project that helps young people to make decisions about their future and become self-reliant. The two methods of modelling were applied and an evaluation was made of their modelling power in terms of their ability to set standards, to adequately represent human situations and facilitate learning. The conclusions reached from this research are summarised below.

14.1: Conclusions

In my critical review of the soft systems approach I found that, although modelling from different perspectives is useful for gaining insight into situations, it also has problems. Firstly, there is no theory that supports, explains and puts the modelling techniques into a context. There is a need for a coherent theory to guide the choice of which elements should be included in the model. The theory should also validate the models that have been designed.

The second problem is linked to SSM’s pluralistic and subjective nature. SSM does not make it clear what kind of representations of the world we should seek. There is a need for a clearer specification of how to strengthen the validity and reliability of data gathering and analyses. Furthermore, the social, cultural and political contexts of systems, which are so crucial to the success of design, needs to be addressed.

Thirdly, although SSM has dislodged itself from a mechanistic world view, some modelling elements still do not fit the multi-dimensional character of human life and hinder our ability to learn about social systems. Therefore, I see a need to include the multi-dimensionality of humanity in modelling. Such an inclusion would also make modelling more coherent with the richness of the world that we meet in the first and third methodological phases of SSM.

Finally, SSM provides a strategy to illustrate different understandings of the world, but the methodology does not give any direction for learning. For instance, SSM gives no advice on judging the competence, relevancy and validity of models, which means that any interpretation is accepted. Thus, although SSM claims wholeness, there is nothing to prevent learning from being reductionistic.
Conclusion

These deficiencies can, however, be surmounted by drawing from other systems approaches such as Multi-modal systems thinking. This offers a new and challenging way of thinking through its concept of interrelated dimensions. Furthermore, its inclusion of the viable systems model as a managerial component compensates for the lack of managerial orientation in SSM. This is essential if one is to have an impact on mismanaged systems. The Arvidsjaurs Method’s incorporation of interrelated dimensions and the managerial component into the SSM phases, provided for a more non-reductionistic data gathering. It also enabled discerning reductionistic views about life from more holistic ones.

The study also showed that SSM does not recognise the different levels of competence that is found in those who model. How does one weigh a model developed by a person of very low competence with one drawn by a highly competent professional? There are also deficiencies in the choice of elements to be modelled, evaluation and evaluation measures. Incorporating the management model of MST added considerable strength by allowing us to select appropriate systemic elements. In addition the framework of interrelated dimensions helped to identify the criteria for evaluating the systems’ achievements.

Although soft systems methodology has played an important role in the departure from the mechanic approaches to design, by itself it is not sufficient. The main problem seems to be that, by abandoning the mechanical view of the world, soft systems falls into a relativistic view where there are no standards for human conduct and therefore no stated standards to guide the exercise of justice and fairness in the task of design. The Arvidsjaurs Method provides the necessary extension to make this a more effective tool in four ways. First, it alleviated the criticism regarding SSM’s relativistic stance. Second, it enhanced philosophical consistency in the complete design process. Third, it provided a managerial design structure and, fourth, it offered a potential for designing systems which support a holistic, complete and dignified human life. Such an approach is also likely to assist us in appreciating different perspectives of our post-modern society and in making appropriate choices.
14.2: Further Studies

Multi-modal Systems Thinking is a new development in systems thought, and each school has contributed valuable insights and assisted the progress of systems science. Identifying these insights has been an objective of this research programme. From it several steps lie ahead in this research:

1. There is need for further longitudinal empirical research on actual groups. In an extended period of time one can evaluate the consequences of interventions guided by our Arvidsjaur Method.

2. The consequences of the lack of managerial functions in Soft Systems Methodology and their inclusion in the Arvidsjaur Method need to be further explored.

3. Organisations such as CYA are built upon the utilitarian/technological creed of industry, that is, the belief that industrial development will eventually solve the problems of unemployment, and by that, also other problems in society. This has failed. There is a need to reconsider the credal basis of these and other social systems and how to incorporate new vision into their activities.

4. Participation failed in this experiment. Future research on the Arvidsjaur Method will therefore focus on how one can re-design participation so that it works.

5. There is a need to introduce in the design process the fact that some people are more professionally qualified than others, and therefore that their “pictures” are more valid than others. Anti-professionalism is demolishing these differences in the design process, and when participation egalitarianism is taken to an extreme, the benefits to the whole system may be significantly diminished. Learning cannot take place without teaching.

6. There is a need, to address the problems of contemporary society, to extend design methods beyond the pure design of systems to the design of interaction between diverse systems.

Systems science has much to contribute, and although there is still resistance among decision makers – such as in the Arvidsjaur Municipal authorities – to think and decide systemically, I hope that in the future this resistance will be overcome.
Systemic thinking and decision making will be of enormous benefit to the young people at CYA by enabling them to seek a meaning in life and to make a positive contribution to their community.
BIBLIOGRAPHY


Bibliography


APPENDIX A:

MULTI-MODAL THINKING IN SOFT SYSTEMS METHODOLOGY'S RICH PICTURES

BIRGITTA BERGVALL-KÅREBORN AND ANITA GRAHN


APPENDIX B:

EXPANDING THE FRAMEWORK FOR MONITOR AND CONTROL IN SOFT SYSTEMS METHODOLOGY

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APPENDIX A:

MULTI-MODAL THINKING IN SOFT SYSTEMS METHODOLOGY’S RICH PICTURES

BIRGITTA BERGVALL-KÅREBORN AND ANITA GRAHN

INTRODUCTION

There is a lot of attention in the field of systems analysis and design given to developing methodology. However, this attention has normally had its base in technological determinism and economic reductionism, which, although dominating our modern lives, does not seem to be able to 'solve' the problems of today. Ironically, some of these problems, like those caused by unemployment, have their base in technological development and economic failures. Because of these failures we see a need to broaden the scope of our thinking and to include more normative aspects in systems analysis and design, in addition to technological and economic concerns.

The aim of this paper is to explore how a framework consisting of interrelated dimensions in thinking can enrich the appreciation of the problem situation in the systems analysis phase. We base our research on Soft Systems Methodology, SSM, as mainly developed by Checkland and his research team (Checkland, 1981; Checkland and Scholes, 1990; Checkland, and Holwell, 1993; Checkland and Haynes, 1994; Wilson, 1990) and incorporate a framework based on Multi-modal thinking (de Raadt, 1989; de Raadt, 1991; de Raadt, 1994; Strijbos, 1994). This framework is developed by a Dutch philosopher, Herman Dooyeweerd (Dooyeweerd, 1953; Kalsbeek, 1975), and captures a wide variety of human thought, perhaps not the complete variety, but the best we have found so far.
Soft Systems Methodology has raised a lot of interest. There is a vast amount of literature about the use of Soft Systems Methodology. There is also extensive literature on theoretical developments based on its use. Other work aims at incorporating SSM or parts of it to complement other methodologies. Further, there is also research on practitioners' experience of using SSM (Kreher, 1994; Mingers and Taylor, 1992) and research with the aim of strengthening, supporting and developing the techniques of SSM, e.g. (Avison, Golder and Shah, 1992). Our work aims at this last point; to further develop the techniques of SSM. In previous work (Bergvall and Grahn 1994; Grahn and Bergvall, 1994) we have developed a theoretical framework for evaluating normative aspects in systems design. This framework has been incorporated into SSM's system thinking phase in order to expand the measures of performance of conceptual models. Next, to study the practical implications, an empirical work has been outlined (Bergvall and Grahn, 1995) and this paper will report on the findings made so far.

In the following we will give a brief introduction to the theories we base our research upon, i.e. Soft Systems Methodology and Multi-modal thinking, with a focus on appreciating the problem situation, and the framework of dimensions in human thought. Then we will present our empirical work, conclude with the findings we have done so far and finish with the issues for further research.

**SOFTWARE SYSTEMS METHODOLOGY AND RICH PICTURE BUILDING**

Soft Systems Methodology, SSM, is by now well established within our field. Its basic shape can best be illustrated with the figure below, Figure 1. The SSM process usually starts because someone perceives a real-world situation as problematic. In order to get a better understanding of the situation, relevant issues are illustrated in activity models, which are based on system concepts. These models illustrate different interpretations of the real-world situation under study and represent activities that logically need to be performed in order to reach a certain purpose. The models are then compared with what is perceived, i.e. the actual perception of the situation. Through the comparison, new insights are revealed which will lead to actions to improve the situation.
A real-world situation of concern

yields choices of

Action to improve the situation

Compare

Cultural analysis

Relevant models of purposeful activity

Figure 1. The basic shape of SSM (after Checkland and Scholes, 1990; Checkland, and Holwell, 1993).

In the process of identifying relevant issues, the SSM practitioner gathers information about the problem situation itself and represents that information. This representation is termed "Rich Pictures" (Checkland, 1981: p. 317; Checkland and Scholes, 1990: p. 45). However, it is important to note that the term "Rich Picture" does not only include the pictorial representation itself but the whole process of appreciating the situation (Lewis, 1992). There is no formal technique for representing the problem situation except the recommendation to look for "elements of slow-to-change structure" and "elements of continuously-changing process" and how these elements relate to each other within the situation climate (Checkland, 1981: p. 164). The notion of climate has, in later versions of SSM, been further developed and is now guided by exploring the situation through analysis of the intervention, social system analysis, and political system analysis, i.e. SSM's Analysis One, Two, and Three (Checkland and Scholes, 1990: p. 47ff). However, as is typical in systems work, the emphasis is on representing relationships and connections and therefore a diagrammatic representation has proved more powerful in expressing these relationships than expressing it in linear text. Therefore the Rich Picture has come to be associated with this diagram, but as discussed in the above, the diagram is rather "a by-product of the process of investigation of the problem situation" (Lewis, 1992).
In a study of the use of SSM among non-academics (Mingers and Taylor, 1992) the findings were that the majority of the people chose SSM to develop an understanding of the situation and not to bring about change. This was surprising since traditionally SSM is viewed as a problem solving methodology with the aim of intervening in situations to facilitate change. However, the learning process of SSM is also emphasised. One skilful definition is presented by von Bulow: "SSM is a methodology that aims to bring about improvements in areas of social concern by activating in the people involved in the situation a learning cycle which is ideally never-ending" (Checkland and Scholes, 1990). Consequently, in Mingers' and Taylor's study (Mingers and Taylor, 1992), and in coherence with developing an understanding of the situation, the techniques of SSM that were almost always used were the rich picture and the central modelling activities - relevant systems, root definition and conceptual model - while the comparison activities - the base for debating about changes - were less used. Concerning modifications to the methodology the authors found that they were mainly centred around the rich picture stage. Some were replacements, e.g. personal constructs, while others were complements to SSM's original technique.

In another study on the teaching of SSM (Woodburn, 1991) the learning that is involved in a systems study is analysed and nine internal learning processes together with their external stimuli are presented. The learning processes involved are: reception - attending to new information; expectancy - appreciating the link between improved performance and new information; retrieval to Working Memory - retrieving past information from Long Term Memory to Working Memory; selective perception - prioritising new information; semantic encoding - coding new information for Long Term Memory storage and retrieval; responding - demonstrating awareness of new information; reinforcement - appreciating the value of new information; retrieval and reinforcement - demonstrating the impact of new information; and retrieval and generalisation - broadening the impact of new information. The corresponding external stimuli to trigger learning are then: gaining attention; communicating learning goals; stimulating recall of past information; presenting information; providing meaningful frameworks; eliciting performance;
providing feedback; assessing performance; and enhancing retention. These learning processes take part in five domains: motor skills, i.e. use of muscles; intellectual skills, i.e. use of symbols; verbal information, i.e. use of ideas, or combining symbols; cognitive strategies, i.e. use of learning strategies, or combining ideas; and attitudes, i.e. personal choices. Woodburn relates the above mentioned processes and stimuli to instructional events and gives suggestions for teaching SSM so that most of the domains of learning will be stimulated. However, one of the most important conditions for learning according to Jean Piaget's theories on intelligence, namely the ability to assimilate or accommodate new information with past information (Hård af Segerstad, 1982) is not argued. This aspect can be found in several of the nine internal learning processes, e.g. retrieval to working memory, semantic encoding, reinforcement etc. but is not explicitly discussed.

The characteristics for rich pictures is in expressing the problem situation by representing relationships in structures, processes and climate. Its main aim has, in surveys, shown to be in getting an understanding of the situation. To achieve this understanding the authors have pointed at the importance of consistency in learning, and the predicament of being able to assimilate or accommodate new knowledge with existing and past experience. To facilitate this learning we present a framework to be incorporated in SSM's systemic concept which, for the purpose of this paper, is in the rich picture building.

MULTI-MODAL THINKING AND ITS FRAMEWORK OF DIMENSIONS

There are scholars who have taken an interest in introducing additional aspects into systems analysis and design, besides logics and economics, e.g. (Ehn, 1994; Flood and Jackson, 1991a; Ivanov, 1991). However, none of them that we have found so far has based their studies on such a complete and holistic work as Dooyeweerd's (1953) see Figure 2.

Dooyeweerd identified 15 dimensions, or modalities, related to human experience and thought and ranged them from more determinative, e.g. numerical, spatial and kinematic, to more normative, e.g. aesthetical, juridical, ethical and credal
according to the figure. The modalities are best illustrated by an example, and, for that purpose we illustrate their application to an industrial plant. The numerical aspect can immediately be discovered by counting the members of the work force, the number of machines, the units produced per day, etc. The spatial dimension refers to, for example, the amount of space that the plant, machinery, workers, products for storage, etc. occupy. Within the plant building there is a constant movement of people, material, goods etc. which point to the kinematic dimension. Both living creatures and machinery need energy in order to function (the physical modality).

![Diagram of modalities]

Figure 2. The different modalities and their interrelation

The organic phenomena of life represented by the biotic modality can be viewed in the workers' need for food, water, and air to breathe. The sensitive aspect is illustrated in the display of emotions between the members of the work force and the managers when, for example, negotiating about wages. The logical dimension is present in production plans and work schedules, which are formulated on the basis of past experience, the historical dimension. Orders and instructions are then mediated to those concerned either through direct communication or in writing, both of them operating in the informatory modality.
The plant is in itself a social system, and is also part of a social community. For most people their employment is a major part of their social life; for some it may even be their only possibility to socialise. This is something worth remembering when designing our systems. The economic modality dominates today's business world, usually at the expense of the other modalities. The aesthetic dimension is hardly visible in an industrial plant at all. Perhaps this lack of aesthetic dimension, together with the general picture of industrial plants as places of loud noise and dirt, is one reason why people of today are not interested in this kind of employment. This is a problem that has been addressed by, among others, big industrial corporations like ABB, Sweden.

The juridical dimension is noticeable for instance, in the laws that regulate relations in the labour market, and in acts of parliament; for example the Companies Act. The ethical dimension is visible in discussions on topics like environmental pollution caused by the plant versus employment opportunities. Finally, the credal modality can be traced to the strong belief in industry as the engine of society. Furthermore, trust in the company by customers, share holders, finance institutions etc. is another example of the importance of this modality.

It is important to note that the distinctions between the modalities are made for purely analytical reasons. In human life and experience they are bounded together as a whole and one dimension cannot replace another. Further, the ordering of the modalities are not haphazard; on the contrary there are interrelationships between the modalities which define their position. Thus, the aesthetic modality is dependent on the economic, the economic on the social, the social on the informatory and so on, and no one can be reduced or replaced by any of the others. Further, one modality cannot be defined by concepts from within, e.g. the social modality does not get explained by the words 'being social' or 'having social intercourse'. Instead the informatory modality is inherent to the understanding of the social modality; and the historical is inherent in the understanding of the informatory modality.

Each modality is given its meaning through its kernel, or nucleus, and has its own order, or set of laws, by which it is governed. Thus, the numeric modality is guided by its kernel, discrete quantity, which is different from symbolic
representation, the kernel of the informatory modality. However, although the modalities have their own, specific set of laws, these laws are homomorphic so that the order of one modality can be transduced to the order of another (de Raadt, 1991). For instance, in the example of the industrial plant, the numerical modality, governed by mathematical laws, is used to represent aspects in the economical modality, the informatory modality, which is guided by the laws of symbolic representation, is used to communicate laws, agreements, etc. and so on.

Just as each modality has a nucleus which guides and gives meaning to it, every system should be defined by a core modality which guides and gives meaning to the system's purpose. This modality, including its laws and nucleus, defines the core purpose of the system and is termed the system's "sphere of sovereignty" (de Raadt, 1991: p. 110). While a certain nucleus is linked to a certain modality a system's sphere of sovereignty has to be chosen. The modality that is chosen as the sphere of sovereignty will affect the activities and the decisions of the whole system. For example, if a hospital's sphere of sovereignty is stated in the biotic modality, the purpose is focused on preserving biological life. If instead the ethical modality is chosen as the sphere of sovereignty, the hospitals purpose shifts to provide love and care in a respectful and dignified way. To keep the biological functions in the human body alive with the help of machines while the actual person is 'dead' is sometimes neither caring nor showing respect for the patient or her family. Thus, one modality might violate one or more of the others and in this light choosing one of the modalities as the system's sphere of sovereignty is very important for the nature of the whole system, because the characteristics of this modality has the final 'say' in determining how the system should act. However, it is not a straight forward task to determine the system's sphere of sovereignty. Therefore, exploring different alternatives and revealing the consequences that follow is often a necessary approach in order to choose the modalities most suitable to guide the system. The modality that is finally chosen as the sphere of sovereignty from this group is something that the people involved in the situation must decide upon.

Dooyeweerd's dimensions can also be found in our sciences, e.g. the numerical dimension is researched in Mathematics, the spatial in Geometry, the kinematic in
Chemistry, while the aesthetical dimension is researched in Arts, the juridical in Law, the ethical in Ethics and the credal in Theology. This scientific distinction promotes the possibility to further our understanding of each dimension as well as, when acting as systems scientists, to identify their homomorphism and their relations.

Since the dimensions are present in human experience they are also present in organisations and should therefore be represented in the systems we design for organisations. Consequently, these dimensions should also be looked for in the process of appreciating the situation. Further, from a learning point of view, since the dimensions in themselves are not new knowledge, but rather provide a framework for incorporating both past and new knowledge, this framework supports the process of assimilation and accommodation which, as pointed out in the above, are the pre-requisites for understanding the situation. Next we will illustrate with a case from a real world situation how Multi-modal thinking can support the collection of information for appreciating the situation, and thereby enrich SSM's rich picture.

**EMPIRICAL STUDY OF THE YOUTH SITUATION IN ARVIDSJÄUR**

Our case is based on data concerning the situation among youth in a small municipality in the north of Sweden called Arvidsjaur. Arvidsjaur is situated inland and is surrounded by forests, mountains and about 4000 lakes and rivers. The number of lakes can be compared with the number of inhabitants which is around 8000. The big employers are the state and the municipality, especially the army, medical centres and the forestry industry. Due to cuts in governmental expenses Arvidsjaur has experienced a growing rate of unemployment. In these respects Arvidsjaur's situation is no different from many other inland municipalities in the north of Sweden, i.e., they are sparsely inhabited, have a higher unemployment rate than usual and are very dependent upon the government for employment. What makes Arvidsjaur interesting is its strategy to develop work opportunities based in information technology. In order to manage this in the long term an important issue arises, namely how to keep the young people from leaving the municipality for a
bigger city, and how to influence the people who leave Arvidsjaur for higher education, to come back.

Because of this a survey was conducted in order to establish the conditions for young people in Arvidsjaur. The survey include 2 questionnaires with open ended questions and it is the data from the first one that forms the basis of our empirical work. This questionnaire was given to and answered by 46 people of which the majority were between the ages of 15 to 25. It covers 7 topics, starting with a general question about what is perceived as good and bad about being a youth in Arvidsjaur. It then continues with more specific questions concerning living conditions, cultural activities and leisure time, education, work opportunities, power perceptions, and finally, visions for the future concerning themselves and the municipality. Most of these questions were stated in the form 'what would you like to change concerning ...' followed by questions on how these changes ought to be brought about. Consequently most answers focus on matters that are perceived as problematic in some way.

When organising the data, and thus beginning to diagramatically illustrate the rich picture, we chose to structure it according to the framework of multi-modal thinking presented earlier. Although we do not analyse or design 'systems', we use the concept of the sphere of sovereignty in order to achieve a focus for each issue. For each question we have, in most cases, picked a sphere of sovereignty which is consistent with the topic of the question or, for the general questions, the answers. In some cases we have, however, chosen to explore different alternatives instead, to illustrate that for certain topics a group of modalities are seen as equally important and therefore equally suitable to guide the topic. In these latter cases the decision about which sphere of sovereignty is left for later work.

In order to see what aspects and issues the respondents have given priority to, we start our rich picture (Figure 3) by clustering the answers from question one and labelling them with the modality/modalities we found most appropriate. In the picture we also include the above mentioned pre-conditions of Arvidsjaur since we believe they are of interest when analysing the answers and also because they make the picture richer.
Figure 3. A first attempt at building a rich picture.

The preconditions are represented in the form of square boxes in the figure above. The municipality’s size and the number of inhabitants are linked to the numerical modality; the fact that Arvidsjaur occupies space in the north inland of Sweden is related to the spatial dimension and the contract of employment between the inhabitants and the state is foremost a juridical matter.

The circles in the figure (which should be seen as suns) represent the answers on what is good about Arvidsjaur while the clouds illustrate what is perceived as bad. The arrows represent relations between different issues. Starting with the former, the circle in the lower left-hand corner communicates the most normative aspect mentioned, namely the juridical, in the form of little violence and drugs. (In the word drugs, alcohol is not included.) The circle at the top of the figure shows that there is a good community spirit and fellowship in the municipality. Some people related this to the fact that Arvidsjaur was small, and because of that everybody knew everybody. There is also a possible relation between this and the fact that there is little violence in Arvidsjaur. The third positive thing about Arvidsjaur is that there are excellent conditions for sport activities and outdoor life. For some people sports are a way to meet new people and to socialise while for others the main attraction is sensitive; it clears the mind and is both stimulating and relaxing. The same goes for most outdoor activities. Of course, for most of us it is not either or; sometimes the social aspect is
more important while at other times it is the sensitive that takes over. This is also the reason why we have chosen to relate this issue to both the social and the sensitive dimension. As can be seen in the figure, there is a relation between this issue, especially concerning outdoor life, and the spatial modality. Because Arvidsjaur is situated in a place surrounded by fresh air and clean nature in the form of forests, mountains, rivers and lakes the conditions for outdoor activities are good. The last circle depicts the perception of good elementary schools in the municipality.

The two main clouds that appeared in the answers regarding negative conditions for youth in Arvidsjaur was the limited entertainment possibilities and high unemployment. The former is a cluster of opinions regarding not enough dances, discos, pubs, cinemas, theatre, concerts, cafés, etc. This can be related to both the numerical and the spatial aspects mentioned, i.e. it is not very common that a small municipality in the Nordic inland of Sweden can offer broad and big entertainment possibilities. This by no means indicates that one cannot or should not try to enhance the supply. The second cloud, unemployment, is foremost an economical and a social problem. The problems experienced at first with being unemployed is perhaps economical, but work also has a important social aspect. One can, of course, also say that work has a sensitive purpose, we need to fulfil ourselves and one way to do this is through our work. However in this context we chose to focus on the economical and social.

We then complement the first rich picture, Figure 3, with the answers related to the other topics; see Figure 4 below. The rich picture below illustrates the answers from the 7 topics in the questionnaire and is focused on matters which were perceived as problematic. Beginning in the lower right-hand corner the kinematic aspect was visible in answers relating to several questions. It was perceived that communication services were insufficient and needed to be developed. Continuing in the figure anti-clockwise, from more determinative to more normative dimensions, we come to the informatory modality. This dimension relates to questions about education, and the answers mainly addressed the issue of limited possibilities for higher studies. The fact that the elementary school is perceived as good while there is a dissatisfaction concerning higher education can be explained by a prime difference between the two
Appendix A – Multi-modal Thinking in Soft Systems

educational levels; elementary school is quite standardised while higher education is more specialised. Relating to the numerical and spatial dimensions again, it can be hard for a small municipality to offer a wide variety of education.

Figure 4. Rich picture of the youth situation in Arvidsjaur

When asked specifically about culture and leisure time it was consistently mentioned that the entertainment possibilities were too narrow and too few. The answers also showed that the cultural activities, which we relate to the aesthetic dimension, were perceived as inadequate. The question about work opportunities revealed similar answers as the ones related to the first topic concerning good and bad conditions for young people in Arvidsjaur. The labour market was perceived to be too narrow and the unemployment rate too high. The question regarding living conditions yielded answers which all pointed in the same direction, namely to the economical modality and to the fact that Arvidsjaur’s living conditions are too expensive.
The next topic relates to power perceptions, which we link to the juridical dimension. What was apparent when analysing these answers was that young people felt left out; they felt that no one listened to them or took them seriously; they felt they had no influence on the decisions taken concerning their own and the municipality's future. The last question deals with the respondents' visions for themselves as well as for the municipality, and relates to the credal dimension. One thing that the answers make plain is that there is a big difference between the respondents' visions for the municipality and for themselves. The visions of the municipality tend to be almost unrealistic dreams; e.g. Arvidsjaur is seen as a conglomerate to which big companies are drawn and where culture is flourishing and entertainment possibilities are endless. Compared to this, the respondents' visions for themselves is much more modest and mundane; they hope to have a job; a family; a house, a car etc. The reasons for this difference can be left for future studies.

A common theme which mirror a segregation between adults and youth was noticed in all answers. This segregation is visible in the different perspectives on authority and responsibility. Adults usually perceive these concepts as two sides on the same coin, while the young people tend to ask for authority without recognising its companion, responsibility. For instance, when asked how to improve the different problem situations the common answer was 'fix it for us'; 'build cheaper apartments'; 'give us subsidies'; 'create work opportunities by arranging theatres, musicals etc.'; and so on. Nowhere in the answers could suggestions be found that mirrored youth responsibility for bringing about improvements of the problem situations. For example, to cope with the expensive living conditions young people could advertise for a room mate instead of asking the state to build smaller apartments; in order to expand the cultural activities in the municipality and perhaps create work opportunities they could organise a theatre association and give performances instead of asking the municipality to do this for them. To summarise, young people wanted authority but did not seem willing to take on the responsibility that goes with it.

By structuring the rich picture according to the framework of multi-modal thinking, we notice which dimensions seem to be especially important and which dominate the situation in this specific context. Consequently, the aspects given less
attention, or no attention at all, becomes visible. This structure for organising real-world situations is highly suitable for analytical purposes, while it also keeps a holistic view. As shown in the above, different issues can be analysed, differentiated and related to each other as the modalities are tied to human experience making the framework easy to understand and natural to most people. This facilitates an enriched understanding of the situation. The significance of this finding is perhaps best illustrated by the reaction of one of the youth social workers involved in the study. He could see things in our rich picture that had escaped not only him but the rest of the research team. The thing that astonished him most was that youth seemed to want authority but not the responsibility and social integration that usually follows. This episode supports Avison, Shah and Golder's statement that "rich picture diagrams are an excellent communication tool" (Avison, Shah and Golder, 1993).

**CONCLUSION**

We have presented the Multi-Modal framework which is related to a variety of dimensions in human thought, and which aims to support the systems analysis phase. In this specific research the framework has been incorporated in the rich picture building in Soft Systems Methodology and applied in an empirical study.

The core of rich picture building is mainly to gain an understanding of the situation and to facilitate the identification of relevant issues for further inquiries. Understanding is sought by illustrating different perceptions and relationships, something that our framework supports. The strength of the framework has been demonstrated in analysing, differentiating and relating different issues to each other. Further, the elements which are indicated in SSM's recommendations for Rich Pictures, e.g. structures and processes within the culture of the situation, becomes a richer analysis by incorporating the Multi-Modal framework. In addition, dimensions that are perceived as important are highlighted as well as dimensions that are lost or ignored. A further benefit is the relationship between our framework and existing sciences. Due to this relation different issues can be appropriately categorised and analysed with the help of individual sciences.

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It is hoped that further studies will concentrate on continuing to incorporate the framework of multi-modal thinking to the different phases of SSM as well as continuing empirical work by completing the SSM cycle. Another issue to attend to is the order within the modalities, their homomorphism and their relationships. Finally studies will be directed towards understanding the role that different dimensions play in information systems and their development.

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APPENDIX B:
EXPANDING THE FRAMEWORK FOR MONITOR AND CONTROL IN SOFT SYSTEMS METHODOLOGY

BIRGitta BERGVALL-KÅREBORN AND ANITA GRAHN

1. Introduction

The underlying purpose of this paper is to build upon the Lancaster developments of Soft Systems Methodology, SSM (Checkland 1972, 1981; Checkland & Griffin 1970; Checkland & Jenkins 1974; Checkland & Scholes 1990b; Wilson 1990), with a focus on systems design. However, SSM is stated to be, not a methodology for systems design, but a methodology for conceptualisation and design of changes. "Any design and implementation is, in general terms, the design and implementation of an agreed change rather than of a system. Design of a system emerges as a special case, appropriate when the problem definition is sufficiently sharp to enable objectives and measures of performance to be defined and hence to allow the thinking to be in terms of model building, simulating performance and optimising" (Checkland 1972). We disagree with the above narrow definition of systems design. Also we interpret this definition as inconsistent with Checkland's earlier typology of systems where he maps the universe into five possible systems classes: natural, designed physical, designed abstract, human activity and transcendental systems (1971). The authors agree with the latter, that the whole of Universe, including the process of enquiring about it, can be perceived as a system. Therefore, when interpreting the concept of systems in this broad sense, systems design does not emerge as a special case. Thus, we believe that, while Soft Systems Methodology is appropriate for systems design it has some weaknesses.
Guided by the critique offered by Critical Systems Thinking, CST (Flood & Jackson 1991a, 1991b; Flood & Ulrich 1990), this paper argues for the need of an 'objective' criteria for reflecting on the systems design. By 'objective' criteria is meant, not the positivistic view, but something similar to Bhaskar's "critical realism" (1978). That is, a standard which stands 'outside' ourselves and is based in theory which gives it meaning in a particular context.

Resolving this issue by using Multi-Modal Methodology, MMM, (de Raadt 1989, 1991, 1995; Strijbos 1995) as the theoretical framework is the main purpose for this paper. MMM rests on some well founded theories based on two different streams of thinking, the Philosophy of the Cosmonomic Idea (Dooyeweerd 1953), and Cybernetics (Shannon & Weaver 1949; Wiener 1948; Ashby 1976; Beer 1981). MMM was developed as a reaction toward the hard systems approaches, which are seen as being too narrow because of their common base in technological determinism and because of their way of dealing with human problems only as they affect productivity, profit or other economic variables. That there is more to life than just hard logic is realised by other authors as well (Ackoff 1981; Banathy 1989; Checkland & Scholes 1990b), but instead of incorporating "loosely defined dimensions" (de Raadt 1991), Multi-Modal Methodology is founded upon rigorously specified aspects of human life.

In the following, an overview of each approach will be given. We begin by discussing SSM from the systems design point of view, with a focus on the evaluation criteria. Then CST is briefly described, with attention to its critique of interpretivism. In the philosophy concerning MMM, and the philosophies behind it, the choice has been to focus on the structure of distinct dimensions in reality, while its operational aspects are not regarded. MMM has then been used in order to expand SSM's theoretical framework concerning performance indicators and has resulted in the development of a model. Finally, the model is discussed, and conclusions and implications for further research are provided.
2. **Soft Systems Methodology for Design of Changes**

Soft Systems Methodology grew out of the failures of traditional management science and has raised a lot of interest among people within our field. It's basic shape can best be illustrated with the figure below, Figure 1.

The SSM process usually starts because someone perceives a real-world situation as problematic and wants to do something about it. In order to get a better understanding of the situation of concern, relevant issues are illustrated in models of purposeful activity. These models illustrate different interpretations of the real-world situation under study and represent activities that logically need to be performed in order to reach a certain purpose. The models are then used in a comparison process, by being set against perceptions of the real-world situation, depicted in "rich pictures" (Checkland & Scholes 1990b, p. 45). The comparison will initiate a debate leading to a decision, which is enriched by knowledge from the cultural analysis, and to take actions, in order to improve the situation. In modelling purposeful activity the concept of systems thinking is used to interpret the 'real' world. In guiding the cultural analysis support is given by Analysis One, analysis of the intervention, Analysis Two, social aspects, and Analysis Three, political aspects (Checkland & Scholes 1990b, p. 44ff).
Appendix B – Framework for Monitor and Control in SSM

Figure 1. The basic shape of SSM (after Checkland & Scholes 1990b, p. 7, Checkland & Holwell 1993)

In the systems thinking part some 'precise' techniques have been developed, which consist of root definition, CATWOE, and conceptual models of activity systems. Root definition means naming, in a short statement, a system of purposeful activity. The formal rules for a well-formulated root definition is that it should contain the elements of the mnemonic word CATWOE (Smyth & Checkland 1976):

- **Customers:** The persons that would be beneficiaries or victims of the system;
- **Actors:** The persons who perform the transformation process;
- **Transformation:** An input-output process by which some entity is changed to some new form of that same entity;
- **Weltanschauung:** A world view which makes the transformation meaningful;
- **Owners:** The persons who can stop the transformation;
- **Environmental constraints:** Elements which affect the system but which cannot be controlled.

The conceptual model consists of a set of logically contingent activities, which express the transformation. It is of vital importance that the formulation of these three techniques are consistent with each other, "since credibility (and the participants' confidence in the process) can be diminished if some smart person in the situation points out a basic logical flaw in the model" (Checkland & Scholes 1990a).
In coherence with the systems idea of communication and control, a monitor and control system of the conceptual model is a necessity. The monitor and control system evaluates the activity system's performance against three, or if wider consideration seems relevant, five, measures of performance. They are normally referred to as the 3 (or 5) E's (Checkland, Forbes & Martin 1990):

- **E1 - Efficacy** - Does the means work; are these activities accomplishing the transformation;
- **E2 - Efficiency** - Are minimum resources used; could the transformation be accomplished better with a different technique, e.g. is it efficient to brush the pavement with a tooth-brush;
- **E3 - Effectiveness** - Is this the right thing to do; are we accomplishing our longer-term goals that are linked to our weltanschauung;
- **E4 - Ethics** - Is the transformation a morally correct thing to do;
- **E5 - Elegance** - Is the transformation aesthetically pleasing.

These measures of performance are defined as "indicator[s]" (Checkland 1981, p. 315) which signal progress or regress in pursuing purposes or trying to achieve objectives. The measures are not explicitly stated, neither in root definition, nor in CATWOE and some of them have no clear correspondence to the situation. It is not mentioned why these particular Es were chosen, except that the first three originate from the question "How could the system fail?" (Checkland 1989). Effectiveness answers the question, 'Are we doing the right thing?'; and relates to weltanschauung. Efficacy, asks if the means work and relates to the transformation process. Both are judgments based on one interpretation in the systems thinking phase. Efficiency, on the other hand, relates to economy of resource use. This consideration together with the remaining two, ethics and aesthetics, seems to be related to something 'outside' the system thinking phase.

The first three Es, that is efficacy, efficiency, and effectiveness "cover only the most basic idea of transformation. They can be supplemented with other considerations of a broader nature if it seems appropriate in a particular field." (Checkland and Scholes, 1990b, p. 42) Thus, ethics and aesthetics seem to be 'picked out of the air' and could be neglected, replaced or complemented by others of free choice. Subsequently, the use of the concept efficiency is not consistent with the
systems approach (Churchman 1968). 'Efficiency thinkers' are coloured by Taylor's theories on Scientific Management where there is one single way to perform a work efficiently. Costs are seen as equivalent to resource use, which is measured in dollars and cents, and the objective is to minimise costs. Efficiency is a concept which is always viewed in relation to a small portion of the organisation and therefore unsuitable for an holistic approach. As Churchman points out, if one is only interested in cost reductions as such the result can be quite the opposite to that which was intended. A decrease in costs of one part of a system can often lead to an increase in costs of the whole system.

One of the optional E's is however addressed as an issue of an ethical dimension in SSM. Atkinson (1989) points to the importance of identifying where moral judgments are implicit in systems design in general and in SSM in particular, and uses Seedhouse's 'Ethical Grid' (1988) to structure moral judgments. However, Atkinson's research on ethics in SSM does not cover ethics as a measure of performance for the transformation in conceptual models. He focuses on the question from a position where moral judgments are involved in the process of doing a systems study using SSM.

The problem we perceive, because of SSM's interpretivistic stance, is that the methodology gives no vision for the learning and the design. The systems design is evaluated in the light of the measures of performance, but these need to be looked at more closely and related to some theoretical framework.

3. Critical Systems Thinking as Initial GuideS for 'Objective' Criteria

Critical Systems Thinking, CST, as defined mainly by scholars at Hull University in the United Kingdom, evolved out of a critique of traditional management science as well as out of a critique of SSM. Traditional management science was criticised for being positivistic and because of that, inadequate in practical applicability, whereas SSM was criticised for its interpretivistic stance.
CST's critique towards SSM points to the lack of 'objective' standards for the interpretations. If we live in a 'perfect' world where everyone is concerned with improving the organisation as a whole, then the debate in SSM will be impartial to particular persons' or interest groups' own objectives. This is, however, not the case. Real-world situations are very much characterised by power and politics where persons and groups, regardless of the benefits for the organisation, aim at furthering their own ends. The characteristics of Soft Systems Methodology implies the intention not to "diminish the freedom" nor "to force it [real life] into a more rational form" (Checkland 1981, p.173, p. 181). Instead it wishes to portray itself as being open and participatory. But, "the kind of open, participative debate which is essential for the success of the Soft systems approach, and is the only justification for the results obtained, is impossible to obtain in problem situations where there is fundamental conflict between interest groups which have access to unequal power resources" (Jackson 1991).

In order to manage situations characterised by conflicting interest groups and get a more democratic approach, Critical Systems Thinking suggests a philosophy which rests on three 'commitments'. These are commitments "to critique, to emancipation and to pluralism" (Schecter 1991).

The second 'commitment', emancipation, is of interest as an 'objective' criteria for systems design. Emancipation is considered by seeking to develop emancipatory systems approaches and methodologies to deal with problem situations in coercive contexts. Additionally, there is also a reference to Habermas' theory of human interests and his social theory. For all individuals Critical systems thinkers aim at achieving maximum development of their potential. This is said to be done by raising the quality of work and life in organisations and society. In the theory of human interests, Habermas (1972) argues that there exists three different kinds of knowledge interests, namely, a desire for technological control, a desire for understanding and a desire for emancipation. The desire for technological control is linked to hard systems methodologies, which aim at assisting material well-being by improving production and steering capacities. The desire to understand is connected to interpretive methodologies, which look at promoting and expanding mutual
understanding among individuals and groups. Finally, to serve emancipatory interests means to protect one domain of interest from being dominated by the other "by denouncing situations where the exercise of power, or other causes of distorted communication, are preventing the open and free discussion necessary for the success of interaction" (Jackson 1991).

CST's choice for 'measuring' the performance of a system is found in emancipation. Though we agree that we need a standard 'outside' ourselves for guiding the design, we do not agree with CST's measure of performance, "emancipation", as the solution since it is too narrow in scope. To measure a system only in terms of whether it sets its members free "especially from legal, political or moral restraint" (Hornby 1986, p. 281) cannot be a sufficient solution. If a bus driver decides to set himself free from the legal restraint of having to obey the traffic rules and decides not to respect the traffic light, the consequences can be fatal. The only emancipation that is likely to occur is liberation from life, something that may have not been requested by the victim(s). So, emancipation for one person may cause oppression for others. This leads to an important aspect which, to the authors' knowledge, has never been discussed among Critical systems thinkers; that is, freedom always implies responsibility. Hence, the performance of a system needs to be measured in more than the emancipatory aspect.

4. What Is Multi-Modal Thinking?

Multi-Modal Methodology, MMM, is rather new to the field of systems thinking, but rests on some well founded theories, the Philosophy of the Cosmonomic Idea, and Cybernetics. The Philosophy of the Cosmonomic Idea has its origin in the Netherlands and was founded by two Dutch professors at the Free University of Amsterdam, D.H.T Vollenhover and Herman Dooyeweerd. It is the work of Dooyeweerd (1953) that, among the philosophers of the Cosmonomic Idea, has had the greatest influence on Multi-Modal thinking.
The second stream of influence comes from cybernetic thinking, which has its origin in Shannon and Weaver's 'Information Theory' (1949) and Wiener's work (1948). Their ideas, further developed by Ashby (1976) and Beer (1981), are applied by de Raadt in Multi-Modal Methodology.

MMM criticises the narrowly focused, technological determinism used by the hard systems approaches in dealing with human problems, as well as the soft approaches where the assumption about reality is based on chaos and complexity. Instead, Multi-Modal Methodology influenced by Dooyeweerd, suggests that there is order within complexity. We believe that the philosophy of Multi-Modal thinking, focused on Dooyeweerd's dimensions of reality, offers a great contribution for guiding systems design.

Dooyeweerd began his task of developing the Philosophy of the Cosmonomic Idea through his position as an advisor of legal and politico-economic issues at the Kuyper Institute. He felt that to properly carry out this task, systematic theoretical work was required. Therefore he began to tackle the problem of politics, both historically and systematically, both theoretically and practically, and studied its application in the social, economic, political and legal spheres of life. This work convinced him that all questions in science are consciously or unconsciously answered in terms of underlying philosophical systems, i.e. the answers are formulated on the basis of a certain belief of about reality. As a result, Dooyeweerd sought for the structure of temporal reality through reflecting on human experience and thought. Gradually distinct dimensions were identified, analysed and discussed. Dooyeweerd's work resulted in fifteen irreducible aspects, but he constantly emphasised that his analysis is open to correction and elaboration.

The aspects, or modalities, Dooyeweerd identified are numeric, spatial, kinematic, physical, biotic, sensitive, logical, historic, informatory, social, economic, aesthetic, juridical, ethical and credal, see Figure 2.
Figure 2. The different modalities and their interrelation

The distinctions between these modalities are made for purely analytical reasons with the purpose of disentangling the concepts and thereby obtaining a clearer picture of the situation. In human experience and thought, however, they are bonded together as a whole. The modalities are best illustrated by an example, and we have chosen to apply them to an industrial plant. The numerical aspect can immediately be discovered by counting the members of the work force, the number of machines, the units produced per day, etc. The spatial dimension refers to, for example, the amount of space that the plant, machinery, workers, products for storage, etc. occupy. Within the plant building there is a constant movement of people, material, goods etc. which point to the kinematic dimension. Both living creatures and machinery need energy in order to function (the physical modality).

The organic phenomena of life represented by the biotic modality can be viewed in the workers' need for food, water, and air to breathe. The sensitive aspect is illustrated in the display of emotions between the members of the work force and the managers when, for example, negotiating about wages. The logical dimension is present in production plans and work schedules, which are formulated on the basis of past experience, the historical dimension. Orders and instructions are then mediated
to those concerned either through direct communication or in writing, both of them operating in the informatory modality.

The plant is in itself a social system, and is also part of a social community. For most people their employment is a major part of their social life; for some it may even be their only possibility to socialise. This is something worth remembering when designing our systems. The economic modality dominates today's business world, usually at the expense of the other modalities. The aesthetic dimension is hardly visible in an industrial plant at all. Perhaps this lack of aesthetic dimensions, together with the general picture of industrial plants as places of loud noise and dirt, is one reason why people of today are not interested in this kind of employment. This is a problem that has been addressed by, among others, big industrial corporations like ABB, Sweden.

The juridical dimension is noticeable for instance, in the laws that regulate relations in the labour market, and in acts of parliament; for example the Companies act. The ethical dimension is visible in discussions on topics like environmental pollution caused by the plant versus employment opportunities. Finally, the credal modality can be traced to the strong belief in industry as the engine of society. Furthermore, trust in the company by customers, share holders, finance institutions etc. is another example of the importance of this modality.

Each modality is given its meaning through its kernel, or nucleus; see Figure 3 below. Each has its own order, or set of laws, by which it is governed. Thus, the numeric modality is guided by its kernel, discrete quantity, which is different from symbolic representation, the kernel of the informatory modality. In the hard modalities, such as the numerical and spatial, and their equivalents in scientific disciplines, mathematics and geometry, the orders, or set of laws, that govern these modalities are more determinative, the laws of which "always exerts its own fulfilment" (de Raadt 1991). But in the soft modalities, such as the ethical and juridical, the laws are more normative. Their fulfilment is contingent on people's inclination to follow these laws. That does not mean that the softer modalities are indefinite or 'fuzzy'. They have their own set of laws, although they cannot be described through the harder modalities' determinative rules.
Figure 3. The different modalities related to its nucleus (after de Raadt 1995)

The ordering of the modalities are not haphazard; on the contrary their arrangements are in accordance with Dooyeweerd's perception of the order of creation or the development of the earth. This order also shows the interrelationships between the modalities. Thus, each lower modality (see Figure 3) forms the foundation for the one immediately above, e.g. organic life, the biotic modality, rests upon processes within the physical, which rests upon processes within the kinematic, which rests upon the spatial, and so on. These foundational aspects constitute basic conditions for all organic life.

Further, one modality cannot be defined by concepts from within, e.g. the social modality does not get explained by the words 'being social' or 'having social intercourse'. Instead the informatory modality is inherent to the understanding of the social modality; and the historical is inherent in the understanding of the informatory modality.

de Raadt suggests that when designing systems for humans, especially information systems, there is a need to incorporate all aspects of life, and keep a
balance between them, so that "human life may be defined as one that displays a modal ecology very similar to the biological ecology found in the rain forest" (de Raadt, 1989). Kant, Weber and Habermas also recognise the need to incorporate several dimensions of knowledge, like ethics and aesthetics, and not just pure logics (Stolterman 1991). In designing systems, hard systems methodologies have already devoted attention to the more determinative aspects of systems design. The normative dimensions have been left unconsidered; in the following we will therefore give our attention to them. We argue that by analysing the system in different modalities and in several layers, new insights are discovered. We also expand our knowledge of the more normative aspects, often called soft and fuzzy, in real life, and develop a vocabulary that makes it easier to form and express our thoughts about these dimensions.

5. Multi-Modal Thinking as a Complementary Framework for SSM

Soft systems thinking as a methodology aims at learning and motivating for changes, and is, according to Checkland, not to be seen as a methodology for systems design. But, as argued above, this separation is not possible since they are each other's presuppositions. However, in a design situation, regardless of the design of changes or of the systems, we need, as stated before, some kind of guidance. If the guidance is based on different individuals' interpretations, as in SSM, one interpretation is as good as another. In a situation, with conflicting interpretations, there is no point in discussing because no argument will be seen as more valid. The debate becomes meaningless. To navigate around the problem, SSM suggests the systems thinking phase. There, different interpretations are illustrated in root definitions, CATWOE, and conceptual models which are validated through the measures of performance, i.e. the five Es: efficacy, efficiency, effectiveness, ethics and elegance.

However, when examining these measures - the five Es - more closely they become more and more nebulous in several aspects. It is not mentioned, nor clearly stated, why these particular Es were chosen, how they should be used, what they exactly mean, what they should relate to and how one knows if they are achieved.
While two of them, efficacy and effectiveness, are interpretativistic, the remaining three look 'outside' for reference. Efficacy and effectiveness are related to transformation and weltanschauung respectively, i.e. they are internal judgments based on one interpretation. Efficiency, on the other hand, is related to minimising costs, which has nothing to do with the root definition or CATWOE. Ethics and elegance (also referred to as aesthetics in the following) as measures of performance have not been clearly stated. However, we interpret that SSM's intention in using these measures is to look beyond mere interpretation. If this is not the case, if ethics and aesthetics are subjectively interpreted, we see no meaning in explicating them, since they then could be found as a part of the weltanschauung, and thus related to effectiveness. This is a clear indication that SSM's measures of performance would benefit from an expansion of its theoretical framework to address these sorts of problems.

Multi-Modal Methodology captures a wide variety of human thought, perhaps not the complete variety, but the best we have found so far to elucidate us. The framework relies on extensive research where the dimensions have been uncovered and arranged in their specific order. There is an interrelation between the modalities so that one builds on another and therefore no dimension can be ignored. A further benefit with the structure is that most people, if not all, recognise the dimensions as natural aspects of their own life. Systems we design should therefore reflect these dimensions. Further, since these modalities are drawn out of the sciences knowledge about each can be found by inquiring into the different disciplines.

Because our aim is to concentrate on the normative aspects of systems design we find some relationship between SSM's evaluation of the models' performance, E1 - E5 and the normative aspects of the Multi-Modal framework. Dooyeweerd's structure is also discernible in the SSM process. See Table I below.
Appendix B – Framework for Monitor and Control in SSM

<table>
<thead>
<tr>
<th>MODALITIES</th>
<th>MODALITIES</th>
<th>MODALITIES</th>
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</thead>
<tbody>
<tr>
<td>MULTI-MODAL METH.</td>
<td>MULTI-MODAL METH.</td>
<td>SOFT SYSTEMS METH.</td>
</tr>
<tr>
<td>NUCLEUS</td>
<td>MEASURES AND CONCEPTS</td>
<td></td>
</tr>
<tr>
<td>Credal</td>
<td>Faith</td>
<td>E3 – effectiveness</td>
</tr>
<tr>
<td>Ethical</td>
<td>Love</td>
<td>E4 – ethics</td>
</tr>
<tr>
<td>Aesthetic</td>
<td>Harmony</td>
<td>E5 – elegance</td>
</tr>
<tr>
<td>Economic</td>
<td>Frugality</td>
<td>E2 – efficiency</td>
</tr>
<tr>
<td>Social</td>
<td>Social intercourse</td>
<td>Analysis of social aspects</td>
</tr>
<tr>
<td>Informatory</td>
<td>Symbolic representation</td>
<td>Root Definition</td>
</tr>
<tr>
<td>Historical</td>
<td>Formative power</td>
<td>The problem situation itself</td>
</tr>
<tr>
<td>Logical</td>
<td>Distinction</td>
<td>E1 – efficacy</td>
</tr>
</tbody>
</table>

Table I. The modalities, with their nuclei, related to SSM's measures of performance and the SSM process.

As a result of the relationship between SSM and MMM seen in Table I we can see the following. The credal modality is linked to E3 - effectiveness through the chosen weltanschauung for the system ('W' of CATWOE). Effectiveness relates to the system's outcome, in relation to W, not to the effectiveness of the weltanschauung. The ethical modality is related to the measure of performance, E4. The aesthetic modality corresponds to SSM's measure E5. The economic modality refers to resource use and corresponds to SSM's measure E2. The social modality's nucleus, social intercourse, is represented by SSM's intrinsic dialogue guided by respect, consideration, observance of conventions, etc. This dimension is also explicitly considered through SSM's cultural analysis of social aspects, termed Analysis Two. The informative modality permeates the whole process. In SSM specifics the formulation of the root definition is an example of symbolic representation being clearly visible. The historical modality predomnates the design through its formative power, "today's problems comes from yesterday's 'solutions' " (Senge 1990, p. 57), and is also a prerequisite for future changes. Finally, the logical modality coincides with measure E1 - efficacy. The concept of logic and the concept of efficacy is, in everyday language, usually perceived as each other's presupposition. If one is logical one is also considered to be efficacious, and if one acts efficaciously the actions are presumed to follow a logical flow. As a consequence, if one wants to make a task more efficacious, this is usually done by looking at the present flow of activities which
make up this task and then this flow is evaluated, in terms of logics, to find the best solution.

As shown in Table I, the modality framework is in coherence with SSM and hence implies its potential as an analytical framework for measuring the performance of the system. Since most of the dimensions are recognisable in some way or another we believe that Dooyeweerd's theory is a suitable framework of analysis for SSM. By expanding SSM's theoretical framework with the normative aspects of Multi-Modal thinking, we improve the design guidance. Our belief is that by designing systems according to the modalities and their guiding nucleus, the system regulates itself in each dimension. Further, our hypothesis is that by adhering to the interrelation between the modalities, the system will be balanced in a harmonious manner. Taken together this results in the design of systems with a focus on human needs where also emancipation can be achieved when needed. Therefore we suggest that SSM's measures of performance can be complemented by Multi-Modal Methodology's framework.

The notion 'measures of performance' is normally linked to something measurable, in digits. However the present authors believe that the criteria which measure the performance of a system should not be limited to quantifiable indicators. We believe that it is also important to include judgmental standards, i.e. qualitative aspects. Additionally, some elements are not meaningful to measure, but should instead be seen as instruments for guiding the design.

Because of the inherent, quantifiable aspect of the expression 'measure of performance', we suggest that the word 'measure' should be replaced by 'indicator'. This term is already used in the glossary (Checkland 1981, p. 115) and covers both the qualitative as well as the quantitative aspects in a more comprehensive way. Therefore in Table II when referring to the model of SSM's expanded measure of performance, the synonym 'performance indicators' or PI will be used.
### Table II. Definition of the performance indicators to be used in SSM's systems thinking phase (*Source: Checkland, Forbes & Martin 1990*)

<table>
<thead>
<tr>
<th>PERFORMANCE INDICATOR</th>
<th>NUCLEUS</th>
<th>CLARIFYING QUESTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credal</td>
<td>Faith</td>
<td>&quot;Is the right thing being done?&quot;</td>
</tr>
<tr>
<td>Ethical</td>
<td>Love</td>
<td>&quot;Is the transformation morally correct?&quot;</td>
</tr>
<tr>
<td>Juridical</td>
<td>Justice</td>
<td>Is the transformation just?</td>
</tr>
<tr>
<td>Aesthetic</td>
<td>Harmony</td>
<td>&quot;Is it aesthetically satisfying?&quot;</td>
</tr>
<tr>
<td>Economic</td>
<td>Frugality</td>
<td>&quot;Is resource use minimum?&quot;</td>
</tr>
<tr>
<td>Social</td>
<td>Social intercourse</td>
<td>Is the social need accounted for?</td>
</tr>
<tr>
<td>Informatory</td>
<td>Symbolic</td>
<td>Is the communicative aspect considered?</td>
</tr>
<tr>
<td>Historical</td>
<td>Formative power</td>
<td>Can we derive lessons from history about similar transformations?</td>
</tr>
<tr>
<td>Logical</td>
<td>Distinction</td>
<td>&quot;Does the means work?&quot;</td>
</tr>
</tbody>
</table>

The performance indicators judge the design of the system in coherence with SSM's techniques in the systems thinking phase. The core of the systems thinking phase is the transformation (‘T’ of CATWOE), in the light of its weltanschauung. The transformation process should not be judged solely in itself, but in a wider perspective where considerations of what makes the transformation possible are included.

In Table II above, a presentation of each performance indicator is given. It starts with the credal and proceeds towards the logical. The left hand column of the table lists each performance indicator; the centre column links each indicator to its nucleus, the purpose of which is to guide and give meaning to the indicator. Finally, the right hand column states a question which aims to seek information and knowledge about the indicator in a particular situation.

The *credal* indicator is linked to the chosen weltanschauung for the system. Checkland and Davies (1986) clarifies the use of the term weltanschauung by distinguishing three categories, W1, W2 and W3. W1 is a taken-as-given set of assumptions which makes a particular root definition meaningful and is there only to help in model building. W2 is related to a version of the problem situation, and thus, related to the taken-as-given assumptions in W1 in the sense that W2 makes W1 relevant. Finally, W3 is of wider concerns and related to the social reality in which the problem situation is embedded. W3 is linked to our beliefs and assumptions about
Appendix B – Framework for Monitor and Control in SSM

reality and makes us understand social situations. The techniques developed for SSM do not include evaluation of W3 or W2, but concentrate on the evaluation of W1. By asking 'is the right thing being done?' the effectiveness of the transformation, in the light of the W, i.e. W1, is checked. We agree that it is important to evaluate the system from this perspective, but argue that this is not enough. Evaluation of a broader notion of Weltanschauung is needed, which is found in the credal modality. This modality equals W3, which W2 is a part of, and which, in turn, W1 reflects. Subsequently, this performance indicator evaluates if W1 is reached by the transformation but also discusses the soundness of W3. W2 is not explicitly considered in the evaluation process.

The ethical modality is represented through SSM's ethical measure or E4. When judging the ethical performance of the system, SSM reviews whether the transformation is morally correct. Ethics is normally seen as the study of right and wrong, and because of the close connection between right and just, the distinction between ethics and juridics becomes a bit blurred. However, in Dooyeweerd's conceptualisation the ethical dimension is based in charity, i.e. in the willingness to judge other persons with kindness, and its core is "humanitarian love for one's neighbour" (Kalsbeek 1975, p. 102). This is also our definition of the ethical performance indicator.

The juridical modality is neither explicitly, nor implicitly, represented in SSM; therefore to follow Dooyeweerd's structure it needs to be added. The aspect concerns the justice of the system and how it is affected by juridical laws. These laws should be balancing different interests, and their function should be twofold, conducting actions, and guiding sanctions in order to maintain and restore the respect for law. It is however important to remember that this aspect should reflect the justice of the system and thus should not be limited to the juridical laws.

The aesthetical modality is represented through SSM's measure E5 - elegance, and checks the beauty of the system by asking if the transformation is aesthetically satisfying. This aspect needs to be further expanded, both in understanding its nature and its role as a SSM measure of performance.
When considering the *economic* performance of the model, SSM asks if the use of its resources is minimum through its measure E2 - efficiency. Because of the fact that we do have limited resources, which should be used sparingly, this is an important question. But, due to the word 'efficiency' the question can easily be associated with minimising costs in order to maximise profit. To minimise costs is nothing wrong in itself. The problem occurs when short term reasoning is taken too far and costs are minimised in order to maximise profit with disastrous long term consequences. A decrease in costs viewed only from a short term basis can often lead to an increase in costs of the whole system, especially seen in a wider perspective. The economic modality's nucleus, frugality, suggests a different approach to efficiency. The word economy has its origin in the Greek word 'oikonomous' which means household, and to keep a household means to manage within given resources. Frugality proposes the sparing use of scare resources "whereby our needs are fulfilled while at the same time sufficient is kept for other people and also for nature" (de Raadt 1991, p. 27). In order to stress minimum resource use, it would be of benefit to change the name of this measure from *efficiency* to *economic* and thereby emphasise the nucleus frugality.

In the cultural enquiry of SSM the *social* aspect is discussed in the analysis of roles, norms and values. The analysis concentrates on a present situation which has been formed by its history. Thus, even though SSM recognises the importance of analysing the social dimension from a historical perspective, it does not evaluate it in the design. Hence, this dimension, which was so important in understanding the situation, is likely to be neglected or overlooked. The social aspect also needs to be stressed from a future perspective since SSM's conceptual model is a basis for future changes, which will affect people in their social situation. In the question 'are social needs accounted for?' lies considerations such as, does the model improve or worsen the possibility for social interchange; to what extent is social competence needed; how does the change affect established roles, norms and values; etc.

Symbolic representation is present in all human activity systems, and is considered in SSM particularly in terms of the consistency between root definition, CATWOE and conceptual model. This consistency, that is, that the model be
technically defensible, is most important for the credibility of the model which will affect the participants' confidence in SSM. However, this discussion is kept on a meta-level and mainly concerns the semantic of language, i.e. it checks that SSM is done 'properly'. It does not evaluate the \textit{informatory} aspect in relation to the modelled activity system.

When considering the informatory aspect as a measure in itself we concentrate on the idea of a feedback loop between the meta-system and the operational system (Beer 1985). The meta-system feeds information to the operational system, which through its operations, transforms input to output. The output that is generated is then compared to standards, and deviations are reported back to the meta-system. Based on this feedback information the meta-system decides on the course of action, which then is fed back to the operational system, and so the loop continues. In this context questions arise like: which data is relevant to collect; which information is relevant to feed into the operational system; which information is relevant to feed back to the meta-system and what should be filtered out; with what frequency should the status of the measures be checked; which are the appropriate channels for the information; etc. This indicator has the potential to become the bridge between SSM and information systems design.

The \textit{historical} aspect is not explicitly considered in SSM's measures of performance, but can be seen implicitly as a part of the cultural analysis. Consequently, the historical aspect is not considered when evaluating the models, only in a later stage when the models are being compared with perceptions of the real world. The outcome of this phase should lead to suggestions for culturally feasible changes. We argue that it is a benefit to consider the historical aspect already in the design process and not leave it to the debate about what is culturally feasible to implement. By considering history already in the design stage previous experiences will be discussed explicitly and put in relation to relevant models. In this way the importance of history is evaluated one step earlier in the process, which should lead to refined models and thereby an improved tool for the debate. Finally, and most important, "it will always be essential to learn and reflect upon ... history if we are to learn from the relative failure of [e.g.] classical management sciences, since that is
surely due to its attempt to be ahistorical" (Checkland & Scholes 1990b, p. 28). Considering the historical aspect with its formative power, already in the design of conceptual models, our attention is drawn to the learning that yields from history.

The concept of logic and the concept of efficacy, SSM's measure E1, is, in everyday language, usually perceived as each other's presupposition. However, the nucleus of Logic is distinction and this implies that to model the system one has to be able to distinguish between the different activities that together make up the system as a whole. The logical indicator checks whether the distinctions are made properly and whether the distinguished activities make it possible to achieve the intended transformation. Instead of naming the measure efficacy, it would be more appropriate in this context to name it logical, since it is the logic of the system that is evaluated. Further, though the meaning of the term efficacy is different from effectiveness in Checkland's definition (1989, p. 90; 1990, p. 39), the words are synonymous in everyday language (Hornby 1986). Therefore, by changing the name of the measure from efficacy to logical one will gain in clarity.

When applying the above performance indicators, each needs to be analysed through its nucleus and, when taken together, kept in balance in such a way that no modality is allowed to dominate. Our belief is that if one follows the guidance of the nucleus and keeps the modalities in balance with each other the chance of achieving 'good' systems is improved. This hypothesis will be tested in further studies.

The main contributions of our model in Table II is that we expand the measure of performance according to a well researched framework. Although most indicators are noticeable in different parts of the SSM process, for instance in modelling relevant systems and in selecting systematically desirable and culturally feasible changes, they are not clear and visible. Our model distinguishes between them and structures them in order to make them apparent and assure that none of them is ignored or lost from neglect.

The spirit of the model is harmony. Therefore no performance indicator is allowed to be ignored, but depending on the situation some aspects are more important than others. However, if one allows an indicator to dominate over the
others this must be a conscious choice, which is consistent, and not in conflict, with all of the nuclei. What is, for example, morally correct and aesthetically satisfying, is a judgment based upon the nucleus and the laws and orders which govern each modality. Our firm belief is that by considering all the different performance indicators together in a harmonious way the soundness of the transformation is improved.

6. illustration of the Performance Indicators

To clarify our contribution to SSM's monitor and control activities, let us consider a real world situation, the Estonia catastrophe. On the night to 28th September, 1994, the ferry Estonia sank into the Baltic Sea on its way from Tallinn to Stockholm, carrying over 1000 people. Only 137 people survived; about 900 died in what is considered to be the worst shipping catastrophe in Europe since the Second World War. This calamity has left no one unaffected and the recurrent question is how something like this could happen. In the following, touched by the Estonia accident, we develop a conceptual model of an activity system for obtaining safe ferry transportation and discuss our suggested model for performance indicators. Below, in Figure 4, we present one version of how the disaster could be conceptualised. The top of the figure shows the root definition and continues with the CATWOE-test. Beneath follows the activity system of the stated transformation, with its monitor and control activities.

The figure represents a transformation, with the aim of obtaining safe ferry transportation in order to reduce emergency situations in contemporary shipping business. The activities in Figure 4 are the minimum necessary to meet the requirements of the root definition and CATWOE. The model shows the operational system, activities 1-6, and the monitor and control system (or meta-system), activity 7-9. In accordance with the purpose of our paper we will concentrate on the measures
Root Definition:

A system, shipping company owned and staff operated, that runs on existing ferries and in existing weather, in order to obtain safe ferry transportation and thus, reduce emergency situations.

CATWOE

C - passenger; staff
A - staff
T - need for safe ferry transportation  that need met
W - reduce emergency situations
O - shipping company
E - existing ferries; weather

Figure 4. A SSM-representation of a system to obtain safe ferry transportation.

used in the monitor and control activities. To clarify the contribution of our model we will discuss each performance indicator in relation to Figure 4. We start by looking more closely at the logical performance indicator and proceed upwards in accordance with our model, Table II. The examples and illustrations that we give are based on
information by the press and may include mere speculations and flaws. Since our aim is to illustrate the performance indicators, and not to investigate the Estonia accident, we do not consider this as affecting the quality of our example.

In evaluating the logic of the above system the question 'does the means work?' (Table II) checks whether the activities distinguished in the system produce the desired output. In order to reflect on the above question we have to analyse our notional system by distinguishing between the different activities and their order, and finally, check that the activities taken together can be counted as safe ferry transportation. It is also important to distinguish between different levels of safety, because checking that the chairs are not damaged and that stairs and floors are not slippery do not alone vouch for safe ferry transportation. In the Estonia example, early in their investigations experts were quite sure that the accident happened because huge amounts of water entered the car deck. Before Estonia left the harbour in Tallinn the ferry was checked by two Swedish Maritime inspectors who were in Tallinn for in-service training. They had made a minor remark about the inadequacy of the inner door seals but also said, when interviewed, that this alone could not have caused the disaster. Other experts thought that the hydraulic system that regulated the locking of the bow doors had not been in order; something the inspectors did not check.

When regarding the historical impact in the model in Figure 4 the question that should be asked is 'can we derive lessons from history about similar transformations?'. By studying events that have occurred in the past and which have been repeated, lessons can be learnt. More specifically, the impact of the historical dimension can be seen in ferry construction, i.e. the design of safer ferries and not more profitable ferries. The use today of ro-ro ferries (roll-on roll-off) is a case in point. Previously the construction was U-shaped with both entrance and exit in the stern. This has been replaced by the more efficient ro-ro design where the cars enter the stern and then exit through the stem. The design necessary for this type of economy means that they are vulnerable for easy filling up and capsizing. Besides the Estonia the British ferry "Herald of Free Enterprise", which capsized outside Zeebrugge in 1987 is another example of this problem. History, in the form of statistics, will also tell us that ro-ro
ferries are more vulnerable than their precursors, so vulnerable that the Royal
Institute of Naval Architects states that they are "unacceptably sensitive" to damages.
Also, according to Lloyd's Register of Shipping, statistically there will be one severe
accident involving ro-ro ferries every fifth to seventh year.

The informative aspect mainly concerns feedback information, understood in
its full context, as well as data collection and generation. In regard to the informative
aspect in our example, questions could be raised such as: which are the appropriate
information systems; what information is needed; how should that information be
channelled and fed back; are key concepts, criteria, and decisions clearly stated and
clearly communicated; etc. In reference to Estonia, were decisions taken about safety
routines clearly communicated to the staff; were incidents reported and fed back to
decision takers; were monitor and control systems in order, appropriate and active;
etc. There are speculations that the information systems, monitoring the vehicle deck,
were turned off for the night so they would not disturb the staff. If this is the case the
consequence would be a delay in discovering that water was entering the car deck
and thereby there was a delay in taking appropriate actions as well as in alarming
staff, passengers and emergency centres.

In regard to the social indicator our conceptual model requires the possibility
for social interchange, the necessity for social competence, and the consideration of
established roles. More specifically, when designing the actions which comprise
activity 6, strategies like the following needs to be discussed: should operations be
performed manually or computerised; should they involve several people or be carried
out by individual persons; should the emphasis be on diversity or specialisation;
should the tasks be attached to a bigger whole or carried out in isolation; etc. The
choice of strategy will most certainly affect the social aspect in the design of work.

The economical performance indicator, in reference to our model, concerns the
use of resources in relation to the outcome and can lead to discussions such as: which
constraining elements should be considered; how many current ferry transformation
systems should be evaluated; which are the key concepts that need to be framed; how
many levels of monitor and control systems are needed; etc. There is a point when it
is no longer economic to 'frame' yet another 'concept', to 'evaluate' one more 'ferry
transportation system', and so on. This situation occurs when the costs are higher than the value it generates. In relation to Estonia, the owners cut costs by hiring cheap staff that did not have sufficient education, and by this they also decreased the value of the outcome. Because of this there has been speculations that the shipping company traded security for economical reasons. At hindsight, if this is a fact, it might have been more economic for the company to hire more qualified staff and by that perhaps avoid the catastrophe from happening or at least reduce the severance of it.

In regard to the aesthetic dimension SSM checks the elegance of the system by asking if the transformation is aesthetically satisfying. To illustrate the importance of the aesthetic dimension consider a helmet, or any other safety equipment, that would make the staff look ridiculous. Since the staff are not different from other people they will most certainly not enjoy being laughed at. Therefore it is imperative that we design a helmet that staff are not ashamed to wear and is therefore aesthetically pleasing, and at the same time has the safety of its crew upper most.

When evaluating the juridical aspect in our example the focus is on how the process and the output are affected by the laws of justice. Sea traffic is regulated in national laws and orders which are based on international agreements; for instance, the International Safety Management Code initiated by the United Nation's International Maritime Organisation. In theory most nations have homogeneous rules for sea traffic. What differs between them is to what degree these rules are observed. Different shipping companies give different attention to these regulations, and different countries have different sanctions for ensuring that the laws are obeyed. In activity 5 in our example, when deciding appropriate activities for obtaining safe ferry transportation, these regulations must be taken into consideration.

The juridical situation can be very complicated, as in the case of the Estonia, where three different countries, Sweden, Estonia and Cyprus are involved. The ferry traffic between Estonia and Sweden is run by Estline Ltd. which is registered in Sweden. At the time of the accident Estline Ltd. was owned both by Estonian Shipping, an Estonian state company, and the Swedish shipping company Nordström & Tuhlin. Estonian Shipping and Nordström & Tuhlin also own the company Estline Marine Ltd. which is registered in Cyprus. This company owned the Estonia and
leased the ferry, without crew, to Estonian Shipping. Estonian Shipping, in turn, leased the ferry, now with crew, to Estline Ltd. To open the shipping route between Tallinn and Stockholm Estline had to buy a ferry and therefore needed a bank loan. However, Estline wanted an Estonian crew and therefore planned to register the ferry in Estonia, but the bank involved required that the future owner of the ferry was registered in a western country. Therefore Estline Marine Ltd. was created and registered in Cyprus. This company applied for the loan and bought the ferry, and the ferry was registered in both Cyprus and Estonia. The advantage for the company to register in Cyprus was that, besides being a western country, Cyprus did not, contrary to most western countries, object to the ferry being registered in several nations. Nor did they demand, also contrary to most western nations, to staff the ferry with a crew from its own country. Consequently, in the case of the Estonia, laws and interpretations from three different nations, concerning sea traffic, were needed to be considered.

The ethical dimension raises a lot of interesting issues for discussion and the Estonia catastrophe has given us many examples of the consideration of man for his brother even to the point of self-sacrificing action. When one of the shipwrecked was lifted by a winch from the raft to a rescue helicopter, he was so tired out that he fell through the harness. One man from the rescue crew then jumped from the helicopter into the water and managed to get hold of the man despite the huge waves. He swam back to the raft with the man and managed to save both him and himself. One would think that those who were saved, especially under such dramatic circumstances, felt lucky, but many of the shipwrecked people that survived felt mainly guilt. They asked themselves how they could be happy in such a tragic situation, and if they had survived at the expense of others; and if they could have done more to save their friends and fellow passengers. In our activity system, when deciding criteria and acceptable values for safe ferry transportation, ethical considerations play a big role.

Finally, to evaluate the credal aspect in our example the following needs to be considered. First, by asking whether our longer term goals are reached or not, the T (transformation) is checked in relation to W1 (weltanschauung). More specifically the question asks if meeting the need for obtaining safe ferry transportation will lead to
reduced emergency situations. Second, by asking whether our longer term goals ought to be strove for or not, our beliefs and assumptions about reality, that is W3, are critically examined. These reflections will then generate new questions which will further inquire our beliefs and assumptions. Reducing emergency situations may be important for the shipping company since emergencies cost money and create chaos. Another reason why reducing emergency situations is important to strive for is the belief that life has an intrinsic value of its own that needs to be respected.

As the above indicates, when inquiring into the W of the model, different underlying assumptions and beliefs on higher recursive levels can be found, which makes that particular W meaningful. The effects of the Estonia catastrophe has shown us what an important part faith plays in our lives and in our decisions. After this calamity people lost their faith in ferries as a transportation means and were afraid to travel by sea. Consequently, the shipping companies in and around Sweden lost 30% of their passengers. Shipping companies did almost anything to restore people's faith in them. They welded the bow doors on the ferry while claiming that this was not really necessary, since the construction of bow doors were safe. They even gave free tickets away to increase the number of passengers and thereby increase their business. The underlying assumption about people's behaviour was, in agreement with positive feedback, that when more and more people started to travel by sea again this would restore faith among both travellers and in society in general.

In Figure 5 below, based on Figure 4, we state short questions to consider for evaluating the performance of the system, and summarise our model of a safe ferry transportation system.

The clarifying questions for each performance indicator are adjusted to our example of a system to obtain safe ferry transportation and are ranged in accordance with our model presented in the previous section of this paper. Benefits achieved by complementing SSM with further evaluation aspects are illustrated and argued in the above. As our example has shown, important aspects such as lessons from history, social implications and juridical connotations, were easily lost when the concentration
Frame the key concepts: safe ferry transportation - emergency situation etc.

3. Decide criteria and acceptable values for 'measuring' safe ferry transportation

4. Evaluate current ferry transportation systems and their impact on safety

5. Decide appropriate activities for obtaining safe ferry transportation

6. Perform these activities

Log. - does this count as safe ferry transportation?
Hist. - what can be learned from one's own and other's experiences
Inf. - are concepts and decisions lucidly stated and communicated
Soc. - are social needs respected?
Ec. - are minimum resources used?
Aest. - is aesthetics considered?
Jur. - how is the system affected by laws of justice?
Eth. - how do ethical considerations influence the system?
Cre. - are the longer term aims reached and ought they be strives

Figure 5. The performance indicators defined for the system to obtain safe ferry transportation.

was focused on the logical dimension of conceptual models, and the related three measures of performance of how the system could fail. By considering additional dimensions such as history, sociology and law greater insight into the future notional situation was achieved.

7. Summary and Implications for Further Research

The main aim of this paper was to build upon the Lancaster developments of Soft Systems Methodology, the base of which is in guiding interventions in situations where change and improvement feels needed. SSM claims to be a methodology for learning, not primarily a methodology of systems design in the traditional sense. However, as discussed earlier, we believe that learning and the design of concepts
cannot be separated since the one implies the other. The problem we perceive is that, because of its interpretivist stance, SSM gives no vision for the learning and the design.

Hence, we argued that Critical Systems Thinking fairly criticises SSM regarding the 'danger' of interpretivism. We agree that we need a measure of performance, grounded in theory, which 'stands outside' ourselves, for guiding the design. However, we do not agree with CST's measure of performance, emancipation, as the solution since it is too narrow in scope and cannot hold for all dimensions of life.

Multi-Modal Methodology suggests that there is a distinct order in reality displayed in fifteen different dimensions. This new and challenging way of thinking is explicated in a model of the dimensions, their nuclei, and their interrelationships. In this paper the MMM-model was used as a theoretical framework for expounding and justifying the measures of performance of the systems design. In order to differentiate between 'original' measures of performance and our suggested expansion, we introduced the term "performance indicators". This was also done because of the inherent interpretation in everyday language of the word measure, meaning something quantifiable.

Our developed framework is in itself fairly general and is to be used as an instrument for structuring and guiding the discussion about the design. We consider that it is not only hard logic and technical aspects that need to be considered when designing systems, even though these tend to predominate during the actual development phase. By concentrating on logical and technical aspects we argued that other important dimensions were lost. Under these circumstances it is not surprising if impacts other than the predicted accrue. By considering additional dimensions, as was done in our model, we conclude that unpredictable disadvantages, as well as unpredictable advantages, can come to light and thereby be anticipated. Furthermore, our model is based on a well-founded ontology, is comprehensive and easy to apply. This makes it possible for the designers of a system to conceive the aspects of the model and take them into account when developing systems for real world use. Most performance indicators in our model are not new to SSM and can be recognised in different parts of the process. Our contribution in this paper was to make them
explicit and to link them to a theoretical body of knowledge. The performance indicators are credal, ethical, juridical, aesthetical, economical, social, informatory, historical and logical. They are interrelated and build on each other. By considering all the above performance indicators in a harmonious way, guided by their different nuclei, systems design will be enhanced.

As the development of our model of performance indicators has emerged, new insights for further research have evolved. Each performance indicator needs to be elaborated in greater depth, both in its nature and in its role as a performance indicator for the design. The model also needs to be studied in a practical application.

Additionally, in the paper we have argued that the concept of learning and the concept of design presuppose each other. For the performance indicators to be meaningful from a learning perspective, they must be considered when analysing the problem situation, i.e. the rich picture. Previous knowledge of the situation is visualised in SSM's rich picture; the only guidance of which is the analysis of the intervention, the analysis of the 'social system' and the analysis of the 'political system'. From a learning perspective it is a weakness that the rich picture is not consistent with the conceptual model. For instance, the ethical and aesthetical criteria for measuring the performance of the conceptual models are nowhere to be found in the rich picture. Hence, two new aspects of evaluation, which have not been considered in analysing the problem situation, are 'suddenly' introduced to the conceptual model. Therefore the framework that we have developed will in future research supplement SSM's concept of rich pictures, and the performance indicators will be subsequently expanded.

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