ELICITING THE REAL PROBLEM

Mildred L. G. Shaw & Brian R. Gaines

Department of Computer Science, York University,
4700 Keele Street, Downsview, Ontario, Canada M3J 1P3.

ABSTRACT

Systems methodologies have become associated with increasing mathematical refinement and the use of computers to allow data acquisition, modelling, simulation and decision techniques of increasing complexity. However, the base level of all applications of any methodology is that of problem expression, of determining what the application is actually about, of setting up the rules of the game that will be played with the refined instruments available. In this paper we are concerned with methodologies for teasing out the base level problem and expressing it, and with eliciting the languages in which it, and relevant relationships to it, may be stated and discussed. We relate our work to the **epistemological hierarchy** of Klir, the **soft systems methodology** of Checkland, and the **personal construct psychology** of Kelly. We operationalize these through computer programs that elicit key terms relating to the problem being studied and a vocabulary through which these can be compared and contrasted.

KEYWORDS

Epistemology hierarchy; soft systems methodology; personal construct psychology; repertory grids; modelling; levels; personal computer.

INTRODUCTION

Systems methodologies have become associated with increasing mathematical refinement and the use of computers to allow data acquisition, modelling, simulation and decision techniques of increasing complexity. However, the base level of all applications of any methodology is that of problem expression, of determining what the application is actually about, of setting up the rules of the game that will be played with the refined instruments available. This base level is often taken to be extra-methodological in that the system to be identified, optimized, or controlled, is somehow 'given', as is the language in which statements about it are to be made, and as are the procedures whereby valid statements about it are determined. This is legitimate for theoretical developments or refinement of the techniques available to study already well-defined problems within the existing framework. However, in practical applications it is often the absence of any expression of a problem or, worse, the expression of a problem in such a way as to preclude its acceptable solution that is the source of the 'problem' itself.

The significance of the base level can be seen in such overall structures for methodologies as George Klir's (1976) **epistemological hierarchy** shown in Fig.1. The lowest level is one of **source systems**, effectively one of data terminology definition whereby the way in which any observed behaviour of a system about which knowledge is to be acquired is defined and agreed. The next level is one of **data systems**, effectively one of systems observation whereby the actual behaviour of some system is described in terms of the agreed terminology of the lowest level.

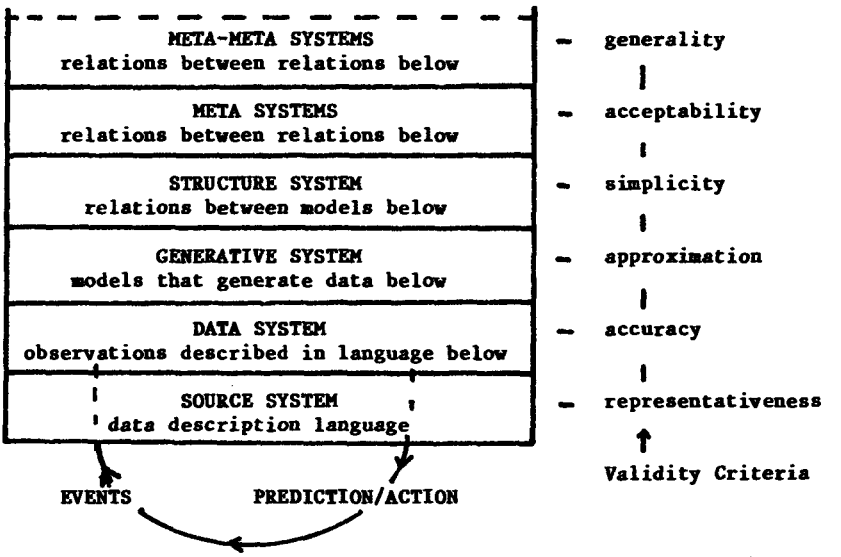


Fig. 1. Epistemological hierarchy, personal scientist and validity criteria

Levels above these are concerned with models of data and their inter-relationships but all of these upper levels, where refined modelling techniques may be applied, derive their significance, if any, only from the significance of the lower levels. No amount of technique at the upper levels can compensate for lack of significant information expression at the lower levels. However, our appreciation of what are the fundamental problems of knowledge acquisition and modelling is dominated by the relationships between these upper levels (Gaines 1977). In particular, our notions of model validity have to be appropriate to each level, and this is indicated on the right hand side of Fig.1. For example, at the source level **representativeness** is an appropriate criterion of validity since we are concerned with the adequacy of the language at this level to represent data. At higher levels different concepts of validity are appropriate and the **adequacy** and **realism** of any modelling system depends on all these criteria being satisfied.

Stage 1: The Problem Situation - Unstructured

Stage 2: The Problem Situation - Expressed

Stage 3: Root Definitions of Relevant Systems (CATWOE)

Stage 4: Making and Testing Conceptual Models

Stage 5: Comparing Conceptual Models with Reality

Stage 6: Determining Feasible, Desirable Changes

Stage 7: Action to Improve the Problem Situation

Fig. 2. Stages in soft systems methodology

The **soft systems** methodology of Peter Checkland (1981) is distinguished by its emphasis not just on the source systems but on the even lower level activity of

determining how these should be arrived at. It takes as its starting point the unrepresented problem, the feeling of disquiet that as yet has no specific referent, and is concerned with approaches that enable the problem to be elicited. This is shown in Fig.2 giving the seven stages of Checkland's methodology from the unstructured problem situation through to action to improve it. This methodology emphasizes **pluralism** through the recognition that there may be a number of distinct problems, and also through what Kelly (1955) termed **constructive alternativism**, in that these problems appear different from differing viewpoints. However, the soft systems methodology only draws attention to the key significance of problem elicitation and representation, and illustrates this through many case histories. As yet it lacks generally applicable techniques for the processes of elicitation and representation. Indeed it is of the essence of this methodology that it is wary of 'techniques' at these base levels since any technique can itself become the rigid cage that generates the frameworks inappropriate to some problems.

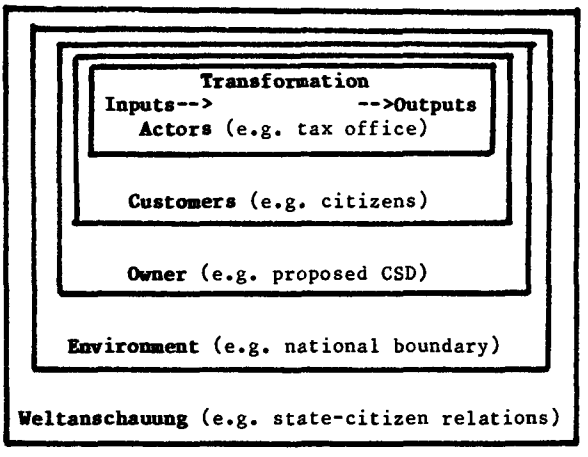


Fig. 3. Root Definitions of relevant systems - CATWOE

The part of Checkland's methodology that most interests us in this paper is Stage 3, the determination of **root definitions** of relevant systems. He has given the terms at this stage the mnemonic **CATWOE** and Fig.3 shows how this arises: the system is defined through a **Transformation** carried out by people who are the **Actors** within it; the system affects beneficially or adversely other people who are its **Customers** and there is some agency with power of existence over it who is its **Owner**; the system has to exist within a outside constraints forming its **Environment** and the whole activity of system definition takes place within an ethos or **Weltanschauung** that affects our views of it. **CATWOE** is a reminder to search for each of these components and make them explicit when determining what system it is that we are taking action about.

In this paper we are concerned with a methodology applicable between Stages 2 and 3 of problem definition for teasing out the base level problem and expressing it, and with techniques for eliciting the languages in which it, and relevant relationships to it, may be stated and discussed. We seek to avoid the dangers of rigidity in technique by emphasizing that the techniques themselves may be used in many different ways from many different viewpoints. At the base level any adequate methodology must also be its own meta-methodology that can be applied to itself and its users so as to distance themselves from it and comprehend the frameworks that its applications to date have erected. At the base level any adequate methodology must carry within it the seeds of its own destruction and its own resurrection.

The methodology we present is based on George Kelly's (1955) **personal construct psychology** operationalized through computer programs to elicit and analyse **repertory grids.** The methodology emphasizes the phenomenon of the **personal scientist:** that our personal views of the world are formed through a cycle of **events** leading to **modelling** leading to **prediction and action** leading to further events (Shaw 1980). This cycle is shown at the base of Klir's modelling hierarchy in Fig.1 and is the **same process for the individual person as for the community of science** (Shaw & Gaines 1981). This is particularly apposite to the theme of this book in that it emphasizes the individual aspects of **'reality'** and its variety of alternative, and equally legitimate, forms. It is also apposite to the methodological framework that has been established for this book whereby proponents of a variety of different methodologies have been asked to compare and contrast them through their application to a common set of problems. We note that our starting position is prior to the problem statements as framed by the book organizers: the very language of such statements imports a wealth of preconceptions that differ widely between individuals. We seek methods whereby these preconceptions themselves can be made more open, both to the individual having them, and to the community with which he is interacting.

THE PERSONAL SCIENTIST

George Kelly commenced his studies as an engineer but moved into clinical psychology and developed a radically different approach to the subject that emphasized the questing nature of the individual and the idiosyncratic content of our models of the world. Kelly put forward the idea of an individual as what Shaw (1980) terms a **personal scientist** using **personal constructs** as filters through which he perceives events:

> "we look at the undifferentiated stream of circumstance flowing past us, and we try to find something about it that repeats itself. Once we have abstracted that property, we have a basis for slicing off chunks of time and reality and holding them up for inspection one at a time...this is done by construing" (Kelly 1955 p.120)

He emphasizes the role of these constructs in our predicting and controlling the world and their status as personal conjectures rather than reality-derived absolutes:

> "When one abstracts replicated properties in the events he has already experienced, it becomes possible for him to chart events to come in terms of these same properties. ... What one predicts is not a fully fleshed-out event, but simply the common intersect of a set of properties. If an event comes along in which all the properties intersect in the prescribed way, one identifies it as the event he expected. (Kelly 1955 p.121)

Thus, making explicit the construct structures in use is a key process in understanding our different approaches to the same world. In psychiatry the assumption is that problems may often be related to the construct system through which the patient is viewing the world. In general we may expect many problems of knowledge, decision and action, both fundamental as in science and applied as in management, to be similarly related to the construct systems in use. In the context of this conference different methodologies will differ not just in their formal power, depth of analysis, and focus of emphasis, but also in the construct system, often implicit, which is used in analysing problems.

A variety of approaches has been taken to the elicitation of personal construct systems. As well as theoretical foundations, Kelly (1955) also proposed a methodology for the elicitation of personal constructs using a **repertory grid.** He

assumed that constructs were bipolar and binary so that an element would be construed as being assigned to one or other of the poles of a construct; the grid obtained being essentially a binary matrix of elements against constructs. To elicit the constructs themselves Kelly used triads of elements and asked for some basis on which one element differed from the other pair in the triad, that is how could the elements in the triad be construed so that two were similar in some way and the other differed in that same way. An extension generally adopted is to allow multi-point rating scales to be used between the poles. Kelly notes that the repertory grid may be used and analysed in a number of ways, notably through some form of factoring that makes apparent relationships between constructs.

If we apply repertory grid methodology to the three problems specified for this conference then the first step is to determine the people whose construct systems relate to the problem. It is natural to start with the **problem owner**, or owners in Checkland's (1981) **CATWOE** terminology, that is someone who is responsible for the system. We would then add others who form part of the problem context, as **customers** benefiting from a system, or **actors** operating within it. As soon as we start to do this we realize that this selection process itself involves at least one person, oneself, and that our perception of the problem, its owners, customers and actors is mediated through a personal construct system. Thus there is a necessarily flexible and possibly changing framework from the start in the way we begin to analyse the problems. However, for the moment, let us assume that a number of individuals whose construct systems are relevant to the problem have been singled out. In the first problem we might take those who formulate the objectives of the mission, those responsible for engineering the system, and those responsible for operating the system at both ends as relevant people to the problem. In the second problem it might be those responsible for the policies and operations of the governmental and commercial operations affected by a person's change of location and the people themselves whose constructs are seen to be relevant.

Having selected people relevant to the problem then we proceed to elicit from them their construct systems within the framework of different aspects of the problem. Even for a single individual it is not just one set of constructs we elicit but those relevant to different aspects of the problem, the astronauts' perceptions of the organization in which they work, the ground staff, the equipment they use, the tasks they have to perform. The person changing location will have constructs relating to many aspects of the change and many of these aspects themselves may not be apparent to us in analysing the problem. We emphasize the need to interview the actual people who are, or will be, involved in the problem - it is all too easy to make assumptions about the viewpoints of such people but these are based on our own preconceptions which are unlikely to match those of the actual participants exactly. System analysis, if it is to lead to model realism, must minimize the importation of preconceptions and maximize its unfettered exploratory power.

Construct elicitation by people is time consuming and requires a high degree of skill to avoid the distortion of the interviewee's system by that of the interviewer. Fortunately **interactive computer systems** offer the possibility of automated construct elicitation (Shaw 1980, 1981). In the next section we describe such a system in operation in the context of the second problem example.

AUTOMATION OF CONSTRUCT ELICITATION - PEGASUS

To show how our methodology may be applied to the problem of the formation of a Citizens' Service Department (CSD) we have considered the attitudes of potential **Customers** to the **Actors** who currently carry out system activities related to the customer's address. Figure 4 shows a repertory grid elicited from a person

```
                    * 1   2   3   4   5   6   7   8   9
                  ****************************************
authority         1 * 1   5   1   1   1   4   1   1   3  informal
government        2 * 5   3   5   1   1   5   5   1   5  commercial
takes money       3 * 5   3   3   1   1   2   4   3   1  gives money
unwelcome         4 * 4   5   3   1   1   5   4   4   5  welcome
main employment   5 * 1   3   3   1   5   4   3   3   3  consultancy
long-standing     6 * 3   3   1   1   5   2   3   1   1  fairly new
personal          7 * 3   1   5   5   5   5   5   3   2  impersonal
right to know     8 * 2   5   4   1   1   5   5   1   5  let know
see personally    9 * 1   1   1   5   2   5   5   1   1  remote
interferes       10 * 4   5   4   1   1   4   3   1   4  interacts
annoying         11 * 5   5   3   1   1   5   3   3   3  stimulating
                    * * * * * * * * * * * * * * * * * *
                      *   *   *   *   *   *   *   *   *  automobile association
                      *   *   *   *   *   *   *   police
                      *   *   *   *   *   *   shareholdings
                      *   *   *   *   *   journals
                      *   *   *   *   vat authority
                      *   *   *   income tax authority
                      *   *   bank
                      *   friends
                      employer
```

Fig.4. Grid elicited by PEGASUS about "who to inform when I change address"

contemplating a change of address: the elements are different groups who should be notified and the constructs are significant distinctions between them. A '1' in the matrix indicates that the left-hand description on the row applies to the element on that column; a '5' that the right-hand description applies; and intermediate values that the element lies between the two descriptions. This grid was derived by the computer program PEGASUS (Program Elicits Grids And Sorts Using Similarities, Shaw 1980) which elicits a grid interactively from an individual, simultaneously acting as a psychological reflector for heightening his awareness and deepening his understanding of himself and his processes. This is done by continual commentary on related elements or constructs, together with the encouragement to differentiate between them.

Before choosing his elements the user is asked to think about his purpose for eliciting the grid. Here it was stated to be "who to inform when I change address". This is of great importance for the interaction which is to follow, as it enables him to choose elements which are dependent on the purpose and then to distinguish between them through constructs which are relevant and representative of the topic area.

The PEGASUS program uses a standard triadic elicitation method to obtain the first few constructs as shown in the following dialogue:

```
TRIAD FOR ELICITATION OF CONSTRUCT 1
 1 employer
 2 friends
 3 bank

CAN YOU CHOOSE TWO OF THIS TRIAD OF ELEMENTS WHICH ARE
IN SOME WAY ALIKE AND DIFFERENT FROM THE OTHER ONE

WHAT IS THE NUMBER OF THE ONE WHICH IS DIFFERENT?2
```

```
NOW I WANT YOU TO THINK ABOUT WHAT YOU HAVE IN MIND
WHEN YOU SEPARATE THE PAIR FROM THE OTHER ONE.
HOW CAN YOU DESCRIBE THE TWO ENDS OR POLES OF THE
SCALE WHICH DISCRIMINATE employer AND bank ON THE
LEFT POLE FROM friends ON THE RIGHT POLE.

JUST TYPE ONE OR TWO WORDS FOR EACH POLE TO REMIND YOU WHAT
YOU ARE THINKING OR FEELING WHEN YOU USE THIS CONSTRUCT.

LEFT POLE RATED 1 -- ?authority
RIGHT POLE RATED 5 -- ?informal

NOW ASSUME THAT employer AND bank ARE ASSIGNED THE VALUE 1
AND friends IS ASSIGNED THE VALUE 5.

ACCORDING TO HOW YOU FEEL ABOUT THEM PLEASE ASSIGN TO EACH
OF THE OTHER ELEMENTS IN TURN A PROVISIONAL VALUE FROM 1 TO 5

 1 employer              1
 3 bank                  1
 2 friends               5
 4 income tax authority  ?1
 5 vat authority         ?1
 6 journals              ?4

POLE 1 --authority

 1 employer              1
 3 bank                  1
 4 income tax authority  1
 5 vat authority         1

 6 journals              4

 2 friends               5

POLE 5 --informal

DO YOU WANT TO CHANGE ANY OF THESE VALUES ? no
DO YOU WANT TO CHANGE THE POLE NAMES ?no
```

The **Construct Match** section of PEGASUS provides feedback when two constructs are highly related. The user is first asked to add an element which is either at pole 1 on the first construct and pole 5 on the second or vice versa. If he can add a new element it must be rated on all the constructs so far elicited, but if he cannot split the two constructs this way he is asked if he would like to delete a construct, combine two constructs into one, or just carry on. Feedback from a construct match is shown in the following dialogue:

```
THE TWO CONSTRUCTS YOU CALLED
 4 unwelcome--welcome
 10 interferes--interacts
ARE MATCHED AT THE 78 PERCENT LEVEL

THIS MEANS THAT MOST OF THE TIME YOU ARE SAYING unwelcome
YOU ARE ALSO SAYING interferes AND MOST OF THE TIME YOU ARE
SAYING welcome YOU ARE ALSO SAYING interacts
```

```
THINK OF ANOTHER ELEMENT WHICH IS EITHER
unwelcome AND interacts
OR interferes AND welcome

IF YOU REALLY CANNOT DO THIS THEN JUST PRESS RETURN AFTER
THE FIRST QUESTION MARK BUT PLEASE TRY.

THEN YOU MUST GIVE THIS ELEMENT A RATING VALUE ON EACH CONSTRUCT
IN TURN. AFTER EACH QUESTION MARK TYPE A VALUE FROM 1 TO 5
WHAT IS YOUR ELEMENT ?police

TYPE IN THE RATINGS FOR THIS ELEMENT ON EACH CONSTRUCT

LEFT POLE RATED 1, RIGHT POLE RATED 5

authority--informal ?1
government--commercial ?1
takes money--gives money ?3
unwelcome--welcome ?4
main employment--consultancy ?3
long-standing--fairly new ?1
personal--impersonal ?3
right to know--let know ?1
see personally--remote ?1
interferes--interacts ?1

DO YOU WANT TO CHANGE ANY OF THESE VALUES ?no
```

The **Element Match** section of PEGASUS provides feedback when two elements are highly related. The first choice offered is to add a new construct on which the two elements are placed at opposite poles, and then all the elements must be rated in the usual way. Alternatively an element may be deleted, or no action may be taken. Feedback from a element match is shown in the following dialogue with PEGASUS:

```
THE TWO ELEMENTS 2 friends AND 6 journals ARE MATCHED AT THE 75
PERCENT LEVEL.

THIS MEANS THAT SO FAR YOU HAVE NOT DISTINGUISHED BETWEEN friends
AND journals

DO YOU WANT TO SPLIT THESE ?yes

THINK OF A CONSTRUCT WHICH SEPARATES THESE TWO ELEMENTS WITH
friends ON THE LEFT POLE AND journals ON THE RIGHT POLE

LEFT POLE RATED 1 -- ?personal
RIGHT POLE RATED 5 -- ?impersonal

ACCORDING TO HOW YOU FEEL ABOUT THEM PLEASE ASSIGN TO EACH
OF THE OTHER ELEMENTS IN TURN A PROVISIONAL VALUE FROM 1 TO 5

 2 friends               1
 6 journals              5
 1 employer              ?3
 3 bank                  ?2
 4 income tax authority  ?5
 5 vat authority         ?1
```

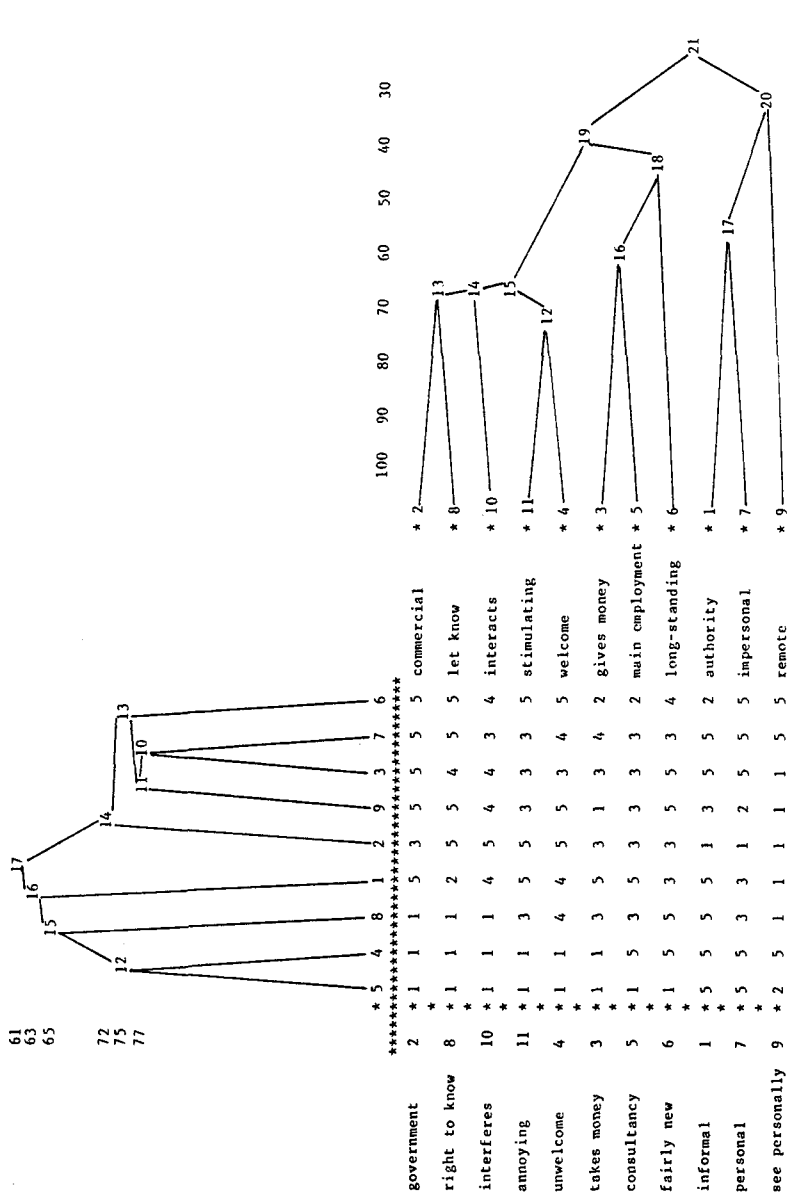


Fig.5. Repertory grid of Figure 4 sorted and clustered by FOCUS

When the grid reaches the maximum size allowed, or if the user chooses to finish before that, the results are analysed using the FOCUS procedure as shown in Fig.5. This is a two-way hierarchical cluster analytic technique which systematically reorders the rows of constructs and columns of elements to produce a focused grid which shows the least variation between adjacent constructs and adjacent elements. The printout shows the trees of the elements and constructs as well as the focused grid with the element and construct labels. It can be seen from the element tree above the grid that the elements 'bank' and 'shareholdings' are seen as fairly similar despite the fact that this match appeared earlier in the interaction and the construct 'see personally -- remote' was added to separate them. Also 'income tax authority' and 'vat authority' are seen to have similar characteristics. Looking at the construct tree on the right side of the grid three main clusters can be seen. Constructs 2, 8, 10, 11 and 4 form a related cluster with 3, 5 and 6 less tightly linked, and 1, 7 and 9 even more loosely grouped together. Since the PEGASUS feedback encourages the separation of constructs very close matches are rare.

As a PEGASUS elicitation proceeds this FOCUS algorithm is used to offer to the user a possible explanation and interpretation of his meaning system in the terms of the similar patterns he uses in supposedly different circumstances. Cross-references are mapped across the grid and exhibited to the user in such a way as to offer him the facility to reconsider and change anything he feels to be inappropriate, which in turn enables him to be more aware of the links he is implicitly holding in his cognitive model.

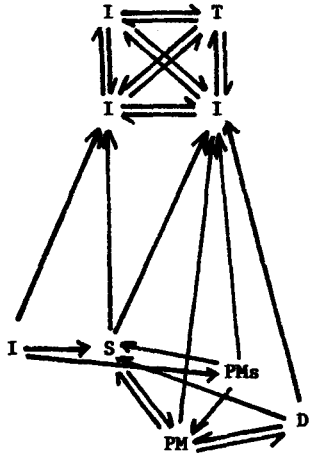
GROUP CONSTRUCTS AND RELATIONSHIPS IN THE COMMUNITY - SOCIOGRIDS

As we begin to examine multiple construct systems, the duality becomes apparent between Kelly's extremely individualistic model of personal reality and our social stereotype of a common world shared through common ideas and language. In a recent paper (Shaw & Gaines 1981) we have put forward a detailed model of how individual construct systems interact to form social construct systems, and how in doing this the individual systems are themselves changed in a way that models normative social influences. This goes a long way towards bridging the gap between the abstract epistemological hierarchy analysed by Klir and the pragmatic soft systems methodology of Checkland. Again the methodology we propose has been at least partially operationalized through the program SOCIOGRIDS (Shaw 1980, 1981) which produces a set of **socionets** showing the capability of one person in a group to comprehend the constructions of the others when they have all construed the same elements. It also extracts from the group a set of **mode constructs** which are shared and hence form the basis of communication, consensual cognition and action amongst members of the group.

SOCIOGRIDS has been applied in industrial studies of managers' evaluations of their subordinates and of the construct system of a quality control division in garment manufacture (Shaw 1980). Figure 6 shows a socionet produced by plotting the three strongest links between individuals from the quality control group study. On the right hand side is shown the divisional organization and it is of interest to note that the cluster analysis of FOCUS reproduced this hierarchy when analysing the joint grid generated by each individual deciding what they considered to be the most important faults from their own perspective.

APPLYING THE PERSONAL CONSTRUCT METHODOLOGY

What have we achieved through the interaction of an individual with the PEGASUS program described in this paper? From the starting position of stating the context as merely "who to inform when I change address" we have come to a second stage



THE ORGANIZATIONAL STRUCTURE

Divisional Manager (D)

↑

Production Manager (PM)

↑

Production Manageress (PMs)

↑

Supervisor (S)

↑ ↑ ↑ ↑

Final Inspectors (I)

Trainee Production Technologist (T)

Fig. 6 Socionet from SOCIOGRIDS analysis of grids from quality control staff

where we have elicited: firstly a set of organizations which are thought of as having to be informed; and secondly a set of constructs that this person uses in thinking about these organizations. We have done this in such a way that the person is stimulated to think about the variety of different organizations and the variety of ways he thinks about them. We have an **exploratory** program that itself has **no preconceptions** about the situation being explored - that is one that begins to elicit the **whole** truth and **nothing but** the truth within that person's reality.

Even without any further analysis we have derived from the initial starting position a set of relevant aspects and ways of thinking about the problem. The clustering of the grid through FOCUS begins to give us **taxonomies** for these relevant features of the problem. By eliciting constructs from a wide range of individuals we can build up a fairly exhaustive repertoire of material on which to base our systems analysis. In the context of the second problem we might look at the similarities and differences between the construct systems of people in different sections of society using SOCIOGRIDS. Figure 7 shows the role of the

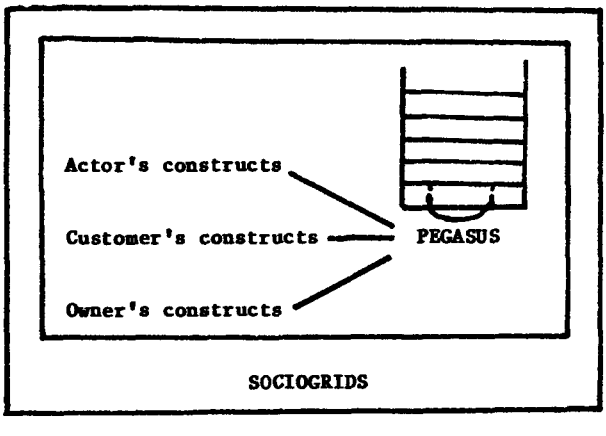


Fig.7. Eliciting the real problem

programs in relation to the problem representation for each of those playing roles in the root system and for the relationships between their construct systems. Note that Checkland's classification brsing into play a further superordinate construct system based on the classification we use of people in society, and this classification can itself be explored using PEGASUS and FOCUS. Thus the methodology is truly **reflexive** and gives us the means to model ourselves and others exploring the means to model ourselves, themselves, and others.

At a very practical level one can envision that the need for a CSD will be explored through public opinion polls and questionnaires. However, the questions asked are clearly critical to the domain to be explored and, if they are to fully cover possible issues, they must be generated through processes such as those we have described in this paper. No one group from a particular section of society, nor any combination of groups, can be expected to be able to generate the relevant questions. When one embarks on a novel enterprise then it is the very novelty itself from which problems will arise -- we must expect to be surprised. The only possibility for reducing such surprise is a thorough, and completely unbiassed exploratory analysis of the potential problem domain. Nowadays the low-cost personal computer makes it possible for such studies to be carried out economically with the computer taking the role of a patient, supportive but questioning interviewer. In future we may expect to see interactive cable television and videotex systems used increasingly for such purposes.

Thus, in conclusion, we believe that personal construct psychology operationalized through interactive computer programs provides an applicable and effective methodology for the initial stages of soft systems analysis. In terms of **model realism** we make the philosophical remark that this is a relative term requiring pluralism rather than absolutism, and we make the practical remark that the programs described here allow one to access the reality of the system being studied with the minimal, and controlled, imposition of the reality of the system studying it.

REFERENCES

Checkland, P. (1981). **Systems Thinking, Systems Practice.** Wiley, Chichester, U.K.

Gaines, B.R. (1977). System identification, approximation and complexity. **International General Systems** 3: 145-174.

Kelly, G.A. (1955). **The Psychology of Personal Constructs.** Norton, New York.

Klir, G.J. (1976). Identification of generative structures in empirical data. **International Journal of General Systems** 3: 89-104.

Shaw, M.L.G. (1980). **On Becoming a Personal Scientist.** Academic Press, London.

Shaw, M.L.G. (1981). **Recent Advances in Personal Construct Technology.** Academic Press, London.

Shaw, M.L.G. & Gaines, B.R. (1981). The personal scientist in the community of science. **General Systems Research and Design: Precursors and Futures.** Society for General Systems Research, 59-68.

COMMENTS ON SHAW'S & GAINES' PAPER

by Gerard de Zeeuw

Institute for Andragology, Grote Bickersstraat 72
1013 KS Amsterdam, Netherlands

KNOWLEDGEABLE PEOPLE AND CHANGE

It is a standard insight that people's experience with their environment - expressible as rules, biases, insights, subjective theories, etc. - constitutes knowledge, albeit of a pre-scientific nature. The only thing that is taken to be lacking to make such experience 'really' scientific, is its depersonalization: to find what is common, nonbiased, objective. The most important contribution of the paper under discussion, it seems to me, is its stress on the idea that the latter step is actually not necessary, and sometimes even in principle nonsensical, for still making such individualistic experience scientific. Individual experience may already be objective, be it only from an individual's point of view. But that is not the point: such objectivity is in a sense even irrelevant (see Kelly, as cited in the paper). What matters is whether such experience can be usefully employed, in a systematic way, for people to learn to change what they can do with what other people or groups of people do (which is what problem study 2 is about: reorganization in a Socio-technical System).

It is exactly this change of emphasis however which (re-)introduces a problem that is usually taken as more or less solved in the standard formulation. That is the problem of quality. Experiential statements usually are taken to have (scientific) quality when it can be shown that they relate to what is shared, and are unbiased, correct in some sense, valid, or 'verisimilar'. This type of quality criterion no longer applies when it is accepted that personal experience can form the basis of the science of the personal scientist. A criterion like validity becomes ambiguous, for example: statements may be valid not (only) in terms of some (personal) reality, but also in terms of their power to make people aware of certain options, or to help formulate alternative actions.

My main criticism of the paper is that it is mainly silent, or at most seems only to whisper, about this problem of quality. It seems to be assumed that personal scientists become more knowledgeable, just by becoming more aware of their experience, or by putting such experience under some kind of rational discipline (as in PEGASUS: coherence, etc.). That seems to have to suffice, to improve action (in a socio-technical system, as it is suggested here). But surely more is possible: checks can be built in to find out about quality. Does awareness actually help, what are its side-effects, what is the effect of one actor changing actions on other actors, what is the effect of experience elicitation itself? Even though in the end the methodology proposed in the paper may turn out to be sound - as it deserves - questions like these must be tackled, were such soundness to appear more clearly at all.

To make the above a little bit more specific I will now introduce the following distinctions. First there will be a *goalgroup* for the researcher: the group of people, (self-)chosen to experience a quality increase in what they can do in relation to some (socio-technical) system, in terms of their own criteria, via the researcher's actions. Second, there will be an *addressgroup*: people, or sub-

systems of organizations, to whom the results of the research should be addressed; their use of them should be instrumental to realize the desired effects for the goalgroup. Third, there is the *sourcegroup*: those people whose experience will be tapped (i.e. construct-elicited), or those organizations which can supply information on such experience. A second distinction concerns the concept of knowledge. I will call all constructs, philosophies, rules as they are present in a certain situation, and as they have been developed over time and exist in the form of each person's experience, *present knowledge*. Research may add *additional knowledge*. Such additional knowledge may have many different *qualities*. It may imply an increase of awareness of what is in the body of present knowledge. Or it may imply a reorganization of this body (elimination of contradictions, etc.). Or it may imply the addition of one or more useful metaphors, to be used for ordering actions - useful for one actor or even for many.

It seems to me that these concepts may help in clarifying what is the problem of quality, as implied by the text in the paper. Pointwise:
I. The proposed procedures can be of help in tapping people's experience, and to represent these as transitions from elements to constructs (see the paper). The formulation of these transitions is interpreted by the authors as a kind of additional knowledge, in my term. Its quality seems to be that it represents experience related to 'who to inform when I change address'. Unfortunately there is no systematic effort to check on this quality: is all such experience tapped, does the person become also aware of problems when experience is deficient?
II. The person(s) (to be) interviewed apparently form the sourcegroup. No addressgroup is defined - unless implicitly, as being identical to the sourcegroup: the interviewees may use their experience instrumentally, and act differently. But that does not imply that the problem of Problem Study 2 is solved, or solvable. For indeed, such an instrumental use may still harm others, or lead to 'free rider' problems, etc. No argument or check on this type of generalization is available.
III. Suppose that indeed the addressgroup coincides with the goalgroup, as seems to be assumed in the paper. That means that people should be provided with the tools to answer a question of Problem Study 2 themselves: they may be stimulated via the use of PEGASUS to create different types of procedures to inform their friends about their movements, or their journals. But what check is there on the quality of these procedures? Will they lead to a reduction of costs, or to more enjoyment? What effects may there be on the system (e.g. smaller mailings of changes of address may enforce price increases for the mailservice)? How can what is a useful procedure for one person become useful for another?

To conclude: interactive computer modelling may be(come) a very fruitful device for tackling problems. The authors make a marked contribution here. Studying it should imply however tackling the problem of quality as well.

REFERENCES

Zeeuw, G. de (1981). Is there really something better? *J. of Man. & Applied Cyb.* 10/2-3, 67-87.
Zeeuw, G. de (1981). Philosophy of change. In R. Trapple (Ed.), *Proceedings Vth EMCSR*. Hemisphere, New York.

Comments on the paper "eliciting the real problem" by M. Shaw and B. Gaines

Walter J.M. Kickert
Institute for Political Science, Nijmegen University
van Schaeck Mathonsingel 4, 6512 AN NIJMEGEN, Netherlands.

The main message of this paper has my complete approval and full support. The authors state that systems methodologies and models have more and more focussed on mathematical refinements, high brow techniques and complex computations, but that these maybe very interesting subjects are not the real problem. The real problem with systems representations and models is: what is the problem to deal with. In other words, firstly how to find the problem that should be tackled and secondly how to represent that problem in a modellanguage. The authors speak of "the key significance of problem elicitation and representation". Without saying so, the authors in fact adress the well-known dilemma between the degree of mathematics in a model and the practical relevance for problem-solution of a model. In other words, the realism of models. The paper suits the conference title very well.

After this very important statement the authors proceed to show why problem finding and problem representation is such a problem. The main reason herefore is that there is no such thing as "reality". Reality does not exist, only perceptions of reality exist, perceptions by observers through spectacles. Observations of reality have always passed an observation system which acts as a filter. And the observation filter of people consists of a value and norm pattern which consciously or unconsciously tells them what to look at, how to look, where to pay attention to, etc. Modern handbooks on the methodology of science are full of this subject.
And because a problem is defined as the difference between factual situation and desired situation, one can imagine what the implications are of the above-mentioned troubles with "facts" for problem eliciting.

In view of the fact that the majority of the other papers for this model realism conference prefer to bother about mathematics and computers I was positively struck that at least these two authors finally adress the real problems of model realism.
My enthousiasm gradually fainted when I went on reading.
Shaw and Gaines elaborate on the subject of observations, perceptions and the filtering systems of "reality". They call this the "construct system" through which the world is viewed. But instead of dwelling upon the problems arising from these "constructs" (reality does not exist, is always filtered, depends on values, norms etc., say "constructs", these norms and patterns change in time, norms can be conflicting, ambiguous, vague, in short the whole discussion about goals, values, rationality etc. which implies serious constraints to the usual rational models of decision-making and problem-solving) the authors prefer to invent a computer program in order to find and determine these "constructs". And so two third of the paper still deals with a computer program.

Let me mention some important problems which are not dealt with.
First one might doubt whether it is possible to validly measure the "constructs". The measurement trick to find the poles of constructs by presenting a triad and asking to divide it into a pair and a singleton has measurement-theoretical advantages and disadvantages. No doubt psychology has a lot to tell us here about the usual aspects of validity, accuracy, reliability.
Second, the problem of changes in time in the construct system is not dealt with. This particularly raises problems as to the applicability of the determination of constructs for future predictions and actual behaviour. What to predict

if the constructs have changed in the meantime.
Third, this prediction and applicability issues bring me to a crucial shortcoming: the measurement of constructs can not serve to predict, for that would be a vicious circle. This is the same classic vicious circle scientists jumped on some decennia ago when they tried to predict rational behaviour by first trying to find the utility function of the rational "homo economicus"; the utility function was reconstructed from actual behaviour, and predicting actual behaviour therefore forms a vicious circle.
In short I cannot understand what the relevance is of retrieving constructs; are they applied for prediction, or for something else? Last but not least, what are the implications of this construct retrieval method for the original problem, that is, the determination of what the real problems are and how they should be represented in some systems language.

To summarize my comments in the very terms of the authors: I think they elicited the right problems but used the wrong representation.