

REVISITING THE INTERROGATIVE PRONOUNS AND ADVERBS IN THE DESIGN OF INFORMATION SYSTEMS

Tony Hookins

Abstract

This paper is about asking questions as part of the design of an information system. It is thought that for this to be undertaken in a systematic manner the questions themselves need some prior consideration. The most common prompt for creating questions in the English language is the interrogative pronouns and adverbs, more commonly known as Kipling's Six Serving Men. This paper re-visits these pronouns and adverbs drawing on a wide range of literatures to establish them into a coherent frame for designing and implementing two large-scale IS projects in an Australian scientific research institution. As an action research project it draws on the structure of Checkland's LUMAS to sense-make. It concludes that as the pronouns and adverbs as formulated here is worthy of further research and application.

Keywords: IS design, interrogative pronouns, action research, service agreements.

PROBLEM STATEMENT

That questions are important does not seem to have been missed in the theory of knowledge literature. Crosswhite (1996) summarises this by pointing out that Heidegger, Gadamer, Foucault and Meyer all agree that "questioning is in every way prior to other ways of acting". Foucault writes of the "serious play of questions and answers" and how "a whole morality is at stake, the morality that concerns the search for the truth..." It seems very symbolic that God asks the first question in the Bible while the Socratic method is a questioning methodology. The European philosopher, Meyer (1988), has undertaken that most symbolic of human activities - naming a new area of study centred on questioning, called problematology. He thinks there has been an oversight by philosophers to appreciate the centrality of questions for problem solving. Crosswhite adds to this debate by highlighting the recursion between questions and answers. Not only should questions be encouraged but also previously accepted answers have to be constantly re-questioned. However, these writers do not explain where questions come from or suggest a system for generating questions.

One obvious system for generating questions is the interrogative pronouns and adverbs, conflated to 'pronouns,' also known as Kipling's six serving men, namely, What, Where, When, Who, Why, and How. The most complete application of these being perhaps in Grinder and Bandler's (1975) Meta Model, but many other authors have taken an interest in exploring the pronouns as a questioning system. This paper will look at the background of the interrogative pronouns as a starting point to considering how exactly they could be applied to the design of complex socio-technical systems. It uses an action research approach to incorporate the experience of actually trying to utilise these pronouns both to inform designers and to clarify them

as a system for thinking. It concludes with a more informed understanding of the interrogative pronouns, believing them to be worthy of a lot of further research and systematic application by systems designers.

Action Research

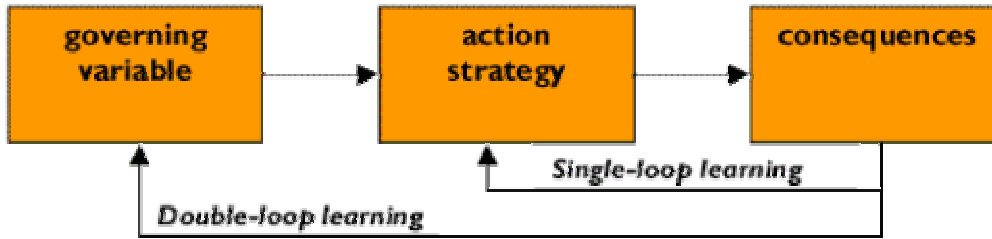
Because an action research methodology has been used, the structure of this paper is a little unusual. It uses the nodes in Checkland's LUMAS model (2000) as section headings, starting with the model User (U). However, before that the use of action research will be justified.

The stream of action research used here aims to produce research findings that are practical yet theoretically driven. The findings are intended to be the result of a process grounded in the perspectives and interests of all those immediately involved rather than merely the interests of the researcher (Baskerville, 1996). Action research is also seen as pragmatic in the philosophical sense, based on the premise that you have to do something before you fully understand it. Action informs explanation (theory) which is driven from some frame of reference. The research teaches those involved about both their frame of reference and the action. Moreover, in line with Jamesian pragmatism, it assumes explanations of purposeful human behaviour cannot be 'proved' only contextualised through dialectic argument (Rorty, 1989).

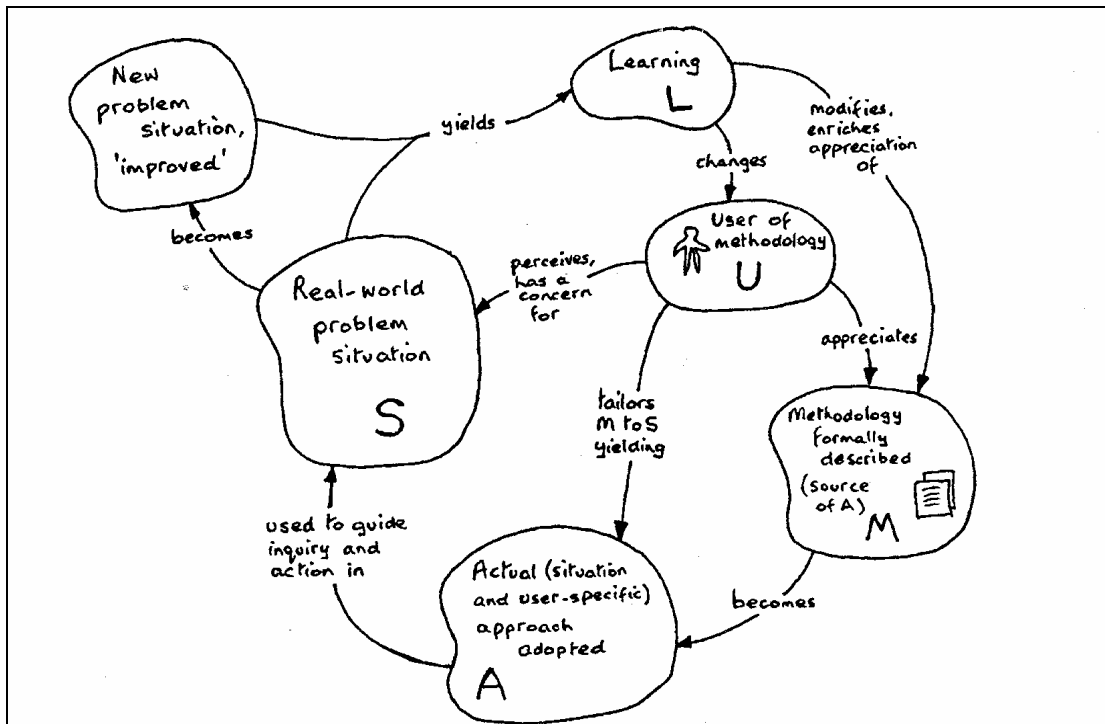
Checkland (2000) has been developing this action research approach to organisational change over a significant number of years. He emphasises action research as a cycle of continuous inquiry where the intellectual frame (methodology) interacts with practice. Baskerville (1996) also argues that as a research method into the study of purposeful human activity, action research is the most legitimate approach available, one of the few valid research approaches that researchers can legitimately employ to study the effects of specific alterations in socio-technical systems design. It is empirical, yet interpretive. It is experimental, yet multivariate. It is observational, yet interventionist.

Action research's interpretive characteristic is reflected in its attitude to researcher intervention or participant observer. Walsham (1995) identifies two different researcher roles: outside observer and participant observer. He suggests that neither of these roles should be considered as an objective reporter since the collection and analysis of data involves the researcher's own subjectivity in the interpretation, a process Giddens (1984) refers to as 'double hermeneutic'. There are potential advantages and disadvantages of being a participant observer over just being an observer. The advantage is the researcher gets an inside feel for the problem domain that could yield extra insight. On the other hand, the observer participant may have problems separating their role as a researcher from that of a project manager, risking a reduction in insight. A balance needs to be sought.

The learning loops inherent in the stream of action research used here clearly has its origins in the double loop learning ideas of Argyris and Schon (1978) where what they call 'the governing variable' has variously been called theory, frame and methodology.



Susman (1978) reflects this by diagramming action research as a five-stage looping process: diagnosing, action planning, action taking, evaluating and specifying learning. She seems influenced by Checkland's (2000) summary of his soft systems ideas, which he calls the LUMAS model.



The boxes and arrows of Argyris and Schon's diagram seem easily mapped onto LUMAS. However, LUMAS provides a little more detail and a language more familiar to project managers. The word situation (S) replaced "problem domain" and the word "methodology" (M) is used where others may have used theory or frame. Neither is uninfluenced by practical project imperatives as shown in A, the actual approach adopted.

It is useful to start looping around LUMAS from the user (U) node, which is what is done in this paper as it adopts the language and structure of the LUMAS model. This aligns with Dewey's (1910) advice that the method of communication in a human inquiry should also be a method of science.

This paper will therefore first introduce the user, the lead author. It will then describe the situation, which starts with the development of service agreements with staff at CSIRO, an Australian

federal scientific research institution. Conceptually in parallel, but on paper next, the thinking methodology will be developed. This provides background to the interrogative pronouns. Then the application of this method to the situation is described, including what happened when the pronouns were used to assist with service agreement negotiations. Last, the learning node is visited. This is an attempt to reflect and generalise on what has been learnt about the pronouns.

U: THE MODEL USER (AUTHOR)

The person making the interpretations on the two projects is the lead author, who is a mid-career, MBA and PhD qualified, IT manager employed as the Divisional IT Manager of CSIRO Land and Water for the duration of this research project. He has some twenty years experience in the IT industry in a variety of engineering and management roles, as both the client and the vendor, having studied the problems of IT Service Delivery from a variety of perspectives. Reporting to the CIO as a member of the case study CSIRO IT Executive Management Team, this researcher was responsible for the leadership of the Enterprise Services Centre that is part of the corporate IT service delivery function. The Centre consists of Service Management, Service Support, and the Enterprise Service Desk. These are central to the two service delivery projects outlined in the next section. His worldview on IS system design is perhaps revealed in his believing IT Service Delivery is best defined as a socio-technical issue. The second author is a Management Information Systems academic interested in the design of questioning systems. He did not participate in the CSIRO projects.

S: THE REAL WORLD SITUATION

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is Australia's scientific research and development organisation, a Federal Government agency that has been delivering science for over 75 years, in fields of economic, social, and environmental importance including: agriculture, communications and information technology, health, manufacturing and construction, minerals and energy services, the environment, and transport and infrastructure.

CSIRO ranks in the top 1 per cent of world scientific institutions in 11 of 22 research fields based on total citations of publications. It transfers its knowledge through over 3,000 scientific publications, and 9,000 client reports annually. CSIRO has been reported to rank third in the world for environment/ecology and fourth in agricultural science. It is Australia's leading patenting enterprise, holding over 3,500 granted or pending patents. More than 70 spin-off companies are based on CSIRO-generated intellectual property and expertise. CSIRO has total revenue per annum in excess of \$900 million including Parliamentary appropriation funding of \$612 million in 2001/02. It generates close to \$300 million annually in external earnings for research, specialised consultancy and other services, derived from Australia's private sector, Federal and State governments, the Rural R&D Corporations and international companies and organisations. CSIRO is in the knowledge business with over 6,300 staff located at 60 sites throughout Australia and overseas; of those staff 60 per cent hold university degrees, including more than 1,800 doctorates and 430 masters. In partnership with university colleagues, CSIRO staff supervise or co-supervise more than 600 postgraduate research students annually.

CSIRO Division of Land and Water

CSIRO Land and Water (CLW) division is CSIRO's second largest, being dedicated to seeking solutions to complex land and water management problems. Their focus is on the delivery of innovative strategies and tools to meet Australia's natural resource management (NRM) challenges. CLW's vision is to develop options for land and water management, which are economic, socially acceptable and benign to the environment. To achieve significant outcomes in the critical issues that CLW addresses, synergistic and collaborative partnerships exist between the division and some thirty Cooperative Research Centres (CRCs). To further promote adoption of the research outcomes, CLW has developed strategic links to environmental policy bodies, government agencies, industries, water corporations, agribusiness, primary producers, land managers and catchment groups. With more than 500 staff in 11 locations around Australia, CLW has a budget of around \$60 million a year, more than a third of which is derived from external and private sector sources.

Two CLW IT based projects form the basis of this research. They are: a) establishing appropriate IT service delivery agreements between the IT services group and the various research groups; and b) developing a divisional-wide integrated web-based communications system to improve knowledge management.

The CLW's research grouping that would be serviced by these projects consists of highly educated researchers with a high degree of computer literacy and need. Most staff are more than capable of coping with the steep learning curves required to learn and leverage a range of new ITS technologies. They actively sought the technology. It is reasonable to suggest that the majority of staff fall into the power user category. As a result of the many advances in a range of alternative technologies and the often unique demands of the research environment there are several trends emerging from a user perspective including mobile computing, telecommuting and interactive use of the Internet which needs to be fully considered in these two projects.

The IT Support Group currently consists of seventeen ITS professionals geographically distributed in Perth, Adelaide, Griffith, Canberra and Townsville, plus the group remotely servicing Atherton, Brisbane, Mildura and Albury Wodonga.

Certain historical problems with IT services have been identified:

External

1. A lack of meaningful dialogue between corporate centre and divisions.
2. A lack of change control from the corporate centre which did not inform CLW when infrastructure and wide area networking (WAN) changes occurred.
3. The need to clearly articulate the services delivered to explain costs.

Internal

1. Undue stress and resulting poor performance because IT staff were delivering the wrong services.
2. The IT team were working as five separate units. Despite efforts to coordinate there nevertheless remained duplication.
3. There was a lack of formal processes to support the business. A best practice IT service support processes framework was needed.

M: METHODOLOGY

INTERROGATIVE PRONOUNS

Continuing on around the LUMAS model, this section describes the construction of the frame or methodology that will be used to think about the two CLW IT projects. The interrogative pronouns, often known as Kipling's six serving men, are in constant use as a systematic method of questioning. It is simple enough to prompt thinking while not imposing the questioner's criteria on the recipient. The origins of the pronouns can be traced back to Aristotle who makes mention of eight circumstances of an act:¹ *quis, quid, ubi, quibus auxiliis, cur, quomodo, quando, circa quid*. These acts are connected, first, with their causes, secondly with its circumstances and thirdly the effect or results of the act, viz:

Cause of the Act

- (a) Why did it happen?
- (b) What made it happen?
- (c) Who made it happen?
- (d) With what instruments?

Circumstances of the Act

- (e) When did it happen?
- (f) Where did it happen?
- (g) How did it happen, in what manner?

Result of the Act

- (h) What Happened?

Quoted from Aristotle *Nicomachean Ethics*, book 3 section 1:

*A man may be ignorant, then, of
who he is,
what he is doing,
what or whom he is acting on, and sometimes also
what (e.g. what instrument) he is doing it with, and
to what end (e.g. he may think his act will conduce to someone's safety), and
how he is doing it (e.g. whether gently or violently).*

The pronouns were further developed by the 13th century Danish theologian Augustine of Dacia, for use as a meditation to analyse the deviation of the soul from the path of righteousness². However, possibly the best-known reference to the interrogative pronouns comes from literary Nobel Prize winner, Rudyard Kipling's poem (1902) from *'The Elephant's Child'* in *Just So Stories*:

¹ Aristotle *Nicomachean Ethics* book 3 section 1.

² Walther, H. *Proverbia sententiaeque Latinitatis Medii Aevi: Lateinische Sprichwörter und Sentenzen des Mittelalters in alphabetischer Anordnung*. 6 vols. Göttingen: Vandenhoeck & Ruprecht, 1963. Entry 25432, variants at 25428–25432.

I Keep Six Honest Serving Men.

*I keep six honest serving-men (They taught me all I knew);
Their names are What and Why and When, and How and Where and Who.
I send them over land and sea, I send them east and west;
But after they have worked for me, I give them all a rest.
I let them rest from nine till five, for I am busy then.
As well as breakfast, lunch and tea, for they are hungry men.
But different folk have different views; I know a person small –
She keeps ten million serving men, who get no rest at all!
She sends 'em abroad on her own affairs,
from the second she opens her eyes –
On million Hows, two million Wheres, and seven million Whys!*

(1902)

There seem to be far more cases of these interrogative pronouns being recommended than researched. Yet these applications do span many different disciplines, perhaps illustrating the versatility and generalisability of such a simple scheme. A typical example is Purcell (2000), who writes about Value Engineering, which is a method of determining how to perform a function at the least cost possible, and who suggests the use of Kipling's six honest men when evaluating cost/function relationships, citing an example of designing an advanced transponder in an aircraft. Purcell suggests that once the cost/function relationship is established the contractor then tries to develop ways in which to perform the same function at the lowest possible cost without loss of reliability. The principle tools in this activity are the questions: What is it? Why is it needed? Where is it used? Who or what uses it? How is it used? How often is it used? Who is responsible for maintaining it? What does it do that something off the shelf wouldn't do as well? What materials is it made of, and are there cheaper materials that would do the same thing? etc. ...

Bowles (1995) suggests using the interrogative pronouns as a starting point in an auditing exercise. He believes the answers to the pronouns will give clues as to the right questions to ask during the audit; citing case studies such as KPMG, ANAO, DAS, etc. Mason (1994) outlines the use of the pronouns as a thinking tool in the preparation of a language course in a health care environment. Dawson (2000) suggests the use of the pronouns in the process of power negotiating. He notes that he likes the question 'why' even though it can easily be seen as accusatory: "Why did you do that?" Dawson suggests softening the question by rephrasing it using What? instead of Why?: "you probably had a good reason for doing that. What was it?" Watzlawick (1967) suggests a rule of thumb: where the why? If a behaviour remains obscure, the question what for? can still supply a similar answer. Dawson also suggests using the six honest men to find out what you need to know.

Whetten (1989) discusses the use of the interrogative pronouns when evaluating and reviewing journal papers for publication in the Academy of Management Review. Kepner and Tregoe (1997) use a process to create a problem statement in terms of deviation from normal behaviour. Once the problem is defined they use their problem analysis process to describe the problem in detail by specifying it in four dimensions, viz: What – the identity of the deviation; Where – the location of the deviation; When – the timing of the deviation; and Extent – the magnitude of the deviation. It seems the pronouns are also frequently used in the courtroom. Lisnek (2001) offers advice to trial lawyers on communication techniques for the courtroom. Carson (2003) suggests that a unifying systems model must clearly explain how, why, where, and when. Why is about values

and beliefs; how is about capabilities; what is about behaviour; and when/where is about boundaries.

Jensen (1978) is one of the few authors who tries to formalise the interrogative pronouns into a problem solving method called '*Dimension Analysis*'. It defines the pronouns in terms of five dimensions which it calls: Substantive Dimension; Spatial Dimension; Temporal Dimension; Quantitative Dimension; and Qualitative Dimension.

The Substantive Dimension. ('What?')

The substantive dimension questions are based on: commission or omission (doing something wrong, or failing to do something); attitude or deed (is it necessary to change attitudes or practices); ends or means (is the irritant we see the actual problem or merely a symptom of it); active or passive (active threat or source of irritation); visible or invisible (is the problem masked (e.g. covert human relations issues)).

The Spatial Dimension. ('Where?')

The spatial dimension questions are based on: local or distant (is it merely local or are there some remote influences); particular location(s) or within a location (recognise the exact area concerned); isolated or widespread (is the problem isolated or linked to several other problem areas).

The Temporal Dimension. ('When?')

The temporal dimension questions are based on: long-standing or recent (which parts are new and which are old); present or impending (is the problem happening or looks as though it may happen); constant or ebb-and-flow (is the problem always there, irregular or cyclic).

Quantitative ('How much?')

The quantitative dimension questions are based on: singular or multiple (is there a single cause or are there many); many or few people (how many people are affected by the problem); general or specific (is the problem applicable to a broad category or very specific sub-area); simple or complex (are there several elements to the problem with complex interactions); too much or too little (appears as a shortage or surplus).

Qualitative ('How serious?')

The qualitative dimension questions are based on: philosophical or surface (is it an issue with deep values or surface practicalities); survival or enrichment (is it a live-or-die issue, or one to do with managing quality); primary or secondary (what priority does the issue have [?], top or bottom); what values are being violated (to what degree are they being violated); proper or improper values (not all values should be honoured).

Interestingly this Dimensional Analysis version of the interrogative pronouns does not seem to explicitly include 'Why', which is a question often considered central to scientific research.

THE MATTER MODEL

Yardley (1995) developed what he calls the *Matter Model* while arguing that we are in danger of asking questions based on what we already know. To avoid imposing this on the subject, the Matter Model questions are designed to be asked of information the subject has already offered in an unstructured conversation. The questions can help to '*dimension*' a problem hoping to revealing insights from retrospection. The Matter Model suggests seven dimensions

When (a time based question, that reveals wants and desires);
Which (a space based question, that reveals relationships);
Who (a space based question, that reveals relationships);
Where (a space based question, that reveals relationships);
What (a question about what matters, that reveals values and beliefs);
How (a question about action, that reveals movement); and
Why (a question about balance, that reveals reasons).

Clearly also this is another attempt to more carefully define the interrogative pronouns.

Symbolic Logic Model

Another approach to the interrogative pronouns exists which expands the 'what' question. Carroll (1939) proposed that

Symbolic Logic will give you clearness of thought—the ability to see your way through a puzzle—the habit of arranging your ideas in an orderly and get-at-able form—and, more valuable than all, the power to detect fallacies, and to tear to pieces the flimsy illogical arguments, which you will continually encounter in books, in newspapers, in speeches, and even in sermons, and which so easily delude those who have never taken the trouble to master this fascinating Art.

The figure below shows his Symbolic Logic Table applied to a problem. We have a theorem that says “what would happen if we did?” where the linguistic operator “would” is symbolically represented by the letter A and the linguistic operator “did” is symbolically represented by the letter B. From this we can extrapolate the inverse, converse and non-mirror image reverse of the theorem, viz: “What would happen if you didn’t?”, “What wouldn’t happen if you did?” and “What wouldn’t happen if you didn’t?” respectively. These four questions offer some useful and powerful linguistic patterns. The theory of Cartesian logic asserts that if a theory (or an outcome) will hold true in all four questions, then the outcome is attainable. So not only is the negation form of the pronoun being used but also the converse.

Figure: Symbolic Logic (based on Hall (2001))

<p>Converse</p> <p>$\sim AB$</p> <p>Example: What wouldn't happen if you did?</p>	<p>Theorem</p> <p>$A=B$</p> <p>Example: What would happen if you did?</p>
<p>Non-Mirror Image Reverse</p> <p>$\sim A\sim B$</p> <p>Example: What wouldn't happen if you didn't?</p>	<p>Inverse</p> <p>$A\sim B$</p> <p>Example: What would happen if you didn't?</p>

Overduff (1996) uses the metaphor of a pair of gloves to describe symbolic logic: suggesting the gloves could be worn normally (theorem), one inside out worn on left hand (inverse theorem), and one inside out worn on the right hand (converse theorem). The non-mirror image reverse of the glove would include everything in existence other than the glove.

Personal vs Group Interrogation

One last take on the interrogative pronouns is worth mentioning. The pronouns have so far been blind about whether they are intended to be used for the questioner to understand the thinking of the questioned for his or her own ends. An alternative situation exists for psychoanalysis. In this situation, the aim is to get the patients to question themselves about their social construction of the world. The analyst's questions probe understanding of what the patient says to assist the patient think about themselves. In the mid 70s, the founders of Neuro-Linguistic Programming, John Grinder and Richard Bandler (1975) developed what they called the Meta Model of Language after observing the skills of family therapist Virginia Satir (1983) and Gestalt practitioner Fritz Perls (1973). Bandler and Grinder videotaped thousands of hours of Satir and Perl's work, finding that Satir in particular was very precise in her choice of language when trying to help patients interrogate their construction of their world.

The Meta Model consists of twelve patterns and twelve sets of questions that help the patient enquire about their own ill-formedness using the surface structure of their language. The interrogative pronouns are used to encourage the questioned person to restore the material that has been deleted, generalised, and/or distorted. These sets of questions are grouped under three headings: deletion, generalisation, distortion.

A) When information gathering, deletions can be sought with the 'what' pronoun; "what specifically?" and "compared to what?" Unspecified verbs can be recovered using 'how' questions; "how specifically?" Lack of referential index may be recovered using 'who says?' or "what object specifically?" Nominalisations (verbs) can be converted back to nouns using "What are you not doing?" or "how are you not doing?"

B) Limitations, which are often over generalisations, are identified from modal operators like 'must' or 'impossible'. They can be interrogated with 'why'; "why do you always do it this way?" or "why not". Generalisations can also be identified from universal quantifiers like always, only, everyone, everything. They can be challenged with how; that is, "how do you know that this is true in all cases?" or "what would happen if this were not the case?"

C) Distortions or semantically ill-formed ideas often reflect prior implicit assumptions. Mind reading attempts can be challenged with 'how' questions; that is, "how do you know that is what they mean?" Cause and effect assumptions can also be challenged with 'how' questions; that is, "how do you know that X causes Y?" Assumptions of equivalence, where two unrelated experiences are linked together so that they become equivalent, can again be challenged with 'how' questions; that is, "how is A related to B?" Lost performative statements contain evaluations such as; right, wrong, good or bad, that has become disconnected from the reasons why, or [of] who made the judgement in the first instance. To challenge the connections it can be useful to ask who questions; "according to whom?"

None of the Meta Model patterns is mutually exclusive; that is, in many cases several of the patterns can apply to the same statement. It is a matter of deciding what information the listener wishes to recover that determines which of the challenge questions is to be used.

While the Meta Model is an interesting application of the interrogative pronouns it needs to be remembered that it is for situations where the questioned is being encouraged to think about their own thinking and language. The situation in this present paper is one where the service provider is not really in a position to engage in one-on-one investigation of the thinking of the users from their surface language. The service providers can only use the interrogative pronouns as a thinking system to ensure their own questions are well structured and comprehensive for their one take. This point was driven home to the authors when they tried to use the Meta Model to design a survey. A survey is not a one-on-one conversation aimed at helping the respondents improve their own thinking. A brainstorming session involving several people was also found not to be intimate enough. In group-thinking situations, it was learnt to use the interrogative pronouns directly to design a handful of questions intended merely to encourage insightful group discussion.

In Summation

The various forms of interpreting the interrogative pronouns, considered to be the most relevant to the CIRSO service delivery projects, have been synthesised on to the table below by the authors.

Interrogative Pronoun	Dimension Analysis	Aristotle	Matter Model	Our Summary
Why Why Not		Cause of an Action	A question about balance, that reveals reasons, explanations, theory, viewpoint.	Philosophical
Where Where Not	Spatial	Circumstances of an Action	A space based question, that reveals relationships	Spatial
Who Who Not		Cause of an Action	A space based question, that reveals relationships	Identify
When When Not	Temporal	Circumstances of an Action	A time based question, that reveals wants and desires	Temporal
How Serious	Qualitative	Circumstances of an Action	A question about action, that reveals movement	Qualitative action
How Much	Quantitative	Circumstances of an Action		Quantitative action
Which			A space based question, that reveals relationships	See: Who or what
What To What End? What happened?	Substantive	Cause of an Action, or Result of an Action	A question about what matters, that reveals values and beliefs	Behavioural
What if A=B What would happen if you did?				Interpretive
What if ~AB What wouldn't happen if you did?				Converse Interpretive
What if A~B What wouldn't happen if you did?				Inverse Interpretive
What if ~A~B What wouldn't happen if you didn't?				Reverse Mirror Image Interpretive

ACTUAL APPROACH ADOPTED (A)

The next node on the LUMAS model being presented is that of the Actual Approach Adopted (A). This is where the situation is synthesised with the frame (methodology) in a purposeful human activity, the IT projects.

Project 1: The ITS Service Delivery Project

Initial Meeting

Early in this project, which was aimed at appreciating and improving IT services at CLW, it was thought necessary to catalogue the services currently being delivered. Therefore, all site IT managers were requested to:

“Please provide a catalogue of the IT services you provide.”

Perhaps predictably, they submitted descriptions of technology maintenance requirements rather than service offerings. This highlighted the communication problems that can hamper this sort of project. In response, a meeting was called, an informal brainstorming session, with the IT managers. As part of designing this meeting, it was decided to use the interrogative pronouns table produced in the summary of the Methodology section. This was simply intended as a guide that needed to be synthesised with the situation. Consequently, the meeting was therefore organised around seeking answers to the following questions frame.

Generic	Explanation	Actual Question
Why	Philosophical	Why does the service exist?
What	Behavioural	What services are offered?
Where	Spatial	Where are the services to be delivered?
Who	Identify	Who were the stakeholders?
When	Temporal	When was the service required?
How Serious	Qualitative action	How was the service to be delivered?
How Much	Quantitative action	How was the service to be measured?
What if	Theorem $A=B$	What would happen if you offered the service?
What if	Converse $\sim AB$	What wouldn't happen if you offered the service?
What if	Inverse $A\sim B$	What would happen if you didn't offer the service?
What if	Reverse Mirror Image $\sim A\sim B$	What wouldn't happen if you didn't offer the service?

The usefulness in terms of participants' responses will be discussed in the next section/node called Learnings (L). Here the intention is merely to show how the pronouns were used in action.

Survey

The next task was agreed as asking the users at CLW about their satisfaction with the IT services. Given that they consist of over 600 people geographically distributed across Australia, the decision was made to use a qualitative survey asking for detailed comments, posted on the web. It has been mentioned above that the first attempt at the survey used the Meta Model and an interactive conversation between the lead author and a consultant familiar with this and other linguistic models. This proved to generate questions that were confusing to the recipients. The interrogative pronoun table was therefore tried. This resulted in the table below which, as it turned out provides the ideal viewpoint this survey was trying to capture. However, given the number of services offered and the ways they are offered, this ideal was seriously compromised. It had to be reduced to mainly the 'what' and 'how' questions. The way in which services are offered varies depending on whether or not the staff are in a main office, a regional office, travelling in Australia, overseas, or working from home.

Generic	Explanation	Actual Question
Why	Philosophical	Why are you (not) happy with the IT service?
What	Behavioural	What is wrong/right?
Where	Spatial	Where is the service failing/succeeding?
Who	Identify	Who is responsible?
When	Temporal	When were you (un)happy?
How (qualitative)	Qualitative action	How can the problem/good service be changed?
How (quantitative)	Quantitative action	How often did the problem/good service occur?
What if	Theorem $A=B$	What would happen if we...?
What if	Converse Theorem $\sim AB$	What wouldn't happen if we...?
What if	Inverse Theorem $A\sim B$	What would happen if we didn't...?
What if	Reverse Mirror Image Theorem $\sim A\sim B$	What wouldn't happen if we didn't...?

There were 142 respondents, which is about 25 per cent of the population, but the number of questions responded to with comments was 1,156, which does suggest some effort was invested by the staff. Previous poorly worded and structured qualitative questionnaires used in CSIRO had a much lower response rate.

Service Desk Design

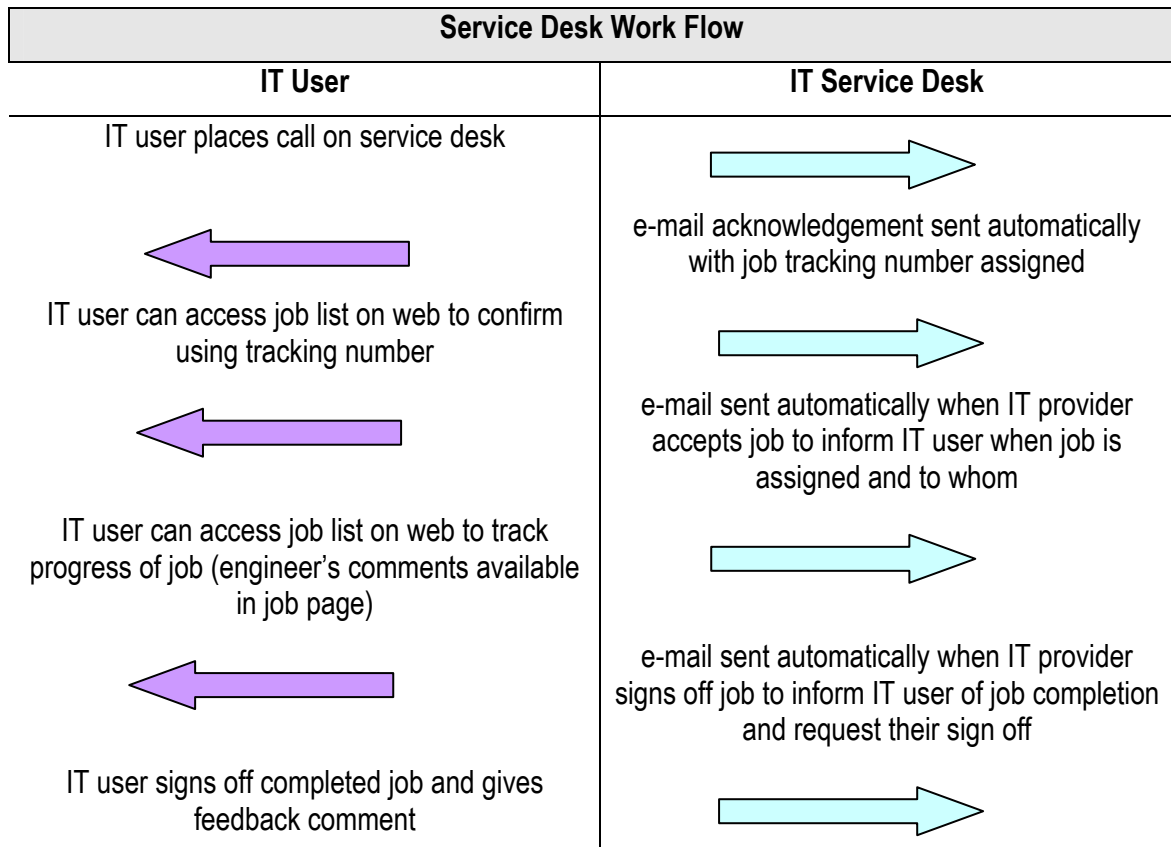
The responses had focused the project on re-designing the service desk. Again, the pronouns table was used to help with defining the service desk. This resulted in the following document being used by the IT managers to think about how the desk might be re-designed.

Why	IT Service desk is a necessary part of providing a quality IT service. Interactions with the IT Service Desk help form the IT user's perception of quality of service. It is the source of customer satisfaction.
What	IT Service Desk represents the single point of contact for the IT users to interact with the IT providers. It is the first port of call for reporting incidents, requesting assistance and making complaints.
When	IT Service Desk availability is seven days a week and twenty four hours a day. Calls are responded to during normal business hours, and best effort is made after normal hours. An escalation procedure exists for emergencies.
Where	IT Service Desk is Web based and is permanently online. Each regional laboratory has its own service desk that is visible to the other sites and jobs can be serviced from other centres. The user id requested at login determines the location of the user via the active directory service and IP address. The service desk automatically presents the user with the correct interface for their specific location and logs the user's details directly from the active directory service into the IT Service Desk database.
Who	IT Service Desk is provided for all CSIRO Land and Water staff, collaborators, students, and visitors. The IT user controls the process because the job cannot be signed off until the IT user is satisfied with the outcome of the call. Members of the IT providers group can access other sites and pick up service requests. This means for example an IT user in Perth could be serviced by an IT provider in Townsville.
How	IT Users and IT providers can access the Service Desk from any PC with network access and an internet browser. For example this means that travellers can interact with the IT providers from remote locations to gain assistance even over low bandwidth telephone lines from the hotel room in a third world country, or an IT provider can provide service from any remote site or even when travelling using their PDA via the WAP service on their mobile phone.

What would happen if the IT user did sign off the service request?	<ul style="list-style-type: none"> • User would have a sense of control • User would feel satisfied • Incomplete jobs would not be lost in the system • User would have a feedback mechanism that is transparent
What wouldn't happen if the IT user did sign off the service request?	<ul style="list-style-type: none"> • IT providers would not accidentally sign off incomplete jobs • There would not be misunderstanding between IT user and IT provider as to IT users' requirements
What would happen if the IT user didn't sign off the service request?	<ul style="list-style-type: none"> • User would not have a sense of control • User would not feel satisfied • Incomplete jobs could be lost in the system • User would not have a feedback mechanism
What wouldn't happen if the IT user didn't sign off the service	<ul style="list-style-type: none"> • IT provider would not have confirmation that the IT users needs were truly met • IT user would be uncertain that the job was completed

request?	satisfactorily
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This lead [led?] to the design of an interactive web based service desk, which enabled users to track their jobs, and then signed off when they thought their job was complete. The work flow diagram below summarises the thinking behind the service desk system.



Project 2: The ITS Strategy Development Project

The second project also used and developed the interrogative pronouns table. Called the ITS Strategy Development Project, its desired outcome was a Divisional-wide web based communication system that enabled IT strategy development and implementation including ensuring the alignment of IT with the business activity (scientific research).

At the outset it was important to confirm the dependency of CSIRO staff on the internet for web based communication and collaboration. A second survey on web related topics was therefore designed again using the interrogative pronouns table. It ran for four weeks, had twenty-three questions and produced 1026 responses from ninety-seven participants. Examples of the questions include:

"What is important about the Internet to your work"

"How long could you do without Internet access?"

At the same time, in line with the first project the pronouns table was used to define the project more carefully. This came out in the form:

Problem Definition	
Why	In order to create and communicate useful and actionable knowledge, the CSIRO knowledge workers must have transparent methods of communication and collaboration
What	<p>Communication model must:</p> <ul style="list-style-type: none"> • Consider the need for broadcast of information and must also cater for communities of knowing. • Allow for secure interaction and exchange of data, information and knowledge whilst protecting intellectual property rights and protecting the CSIRO branding. • Accommodate workflow applications within CSIRO including distributed authorship and publishing cycle. • Accommodate automatic data collection from remote sensing devices.
When	Services must be available 7x24 to allow global access.
Where	<ul style="list-style-type: none"> • Must have global reach. • Must be able to communicate securely both inside CSIRO and through secure connections to outside world. • Must be able to communicate with remote field sites.
Who	<p>CSIRO knowledge workers must be able to interact with:</p> <ul style="list-style-type: none"> • Other CSIRO knowledge workers in their work groups, divisional peer groups, organisational peer groups. • National and international collaborators in academic institutions, government agencies, and corporate bodies. <p>CSIRO must communicate its knowledge to:</p> <ul style="list-style-type: none"> • Government, academia, corporate clients, and general public including students, NRM stakeholders and special interest groups.
How	CSIRO knowledge workers, collaborators, stakeholders and general public must be able to utilise user friendly, platform independent technology to communicate with and within CSIRO from any location globally over slow communication lines.

In Summation

It was hoped in this section to show how the same pronouns table was interpreted into action depending on the situation, or the need. It provided a means for seeing the problem, and was not a solution. It was hoped in the space available to provide a glimpse of how the pronouns table still provided considerable flexibility of work but with a frame that became more comfortable with use. In Weick's (1995) language it helped 'sense-make' the very complex situation in a manner that

acted to co-ordinate everyone's thinking. Not only was some focus on the project possible but the frame used to do this sense making was also better appreciated. Of course, numerous other frames could, and should, be used. This research is only reporting what happened when this one was used. It is not intended to replace, but rather augment, other frames.

L: LEARNINGS

The next LUMAS node is called Learning's (L), which appears to be a similar concept to reflection, critique and generalization. This node represents an important part of action (double loop) learning. The actions and the frame need to be reflected upon, and the lessons learnt noted as per a post mortem.

Reflections on Action

The intention to use the interrogative pronouns as a frame (methodology) for thinking about the IT services and the web based communication planning was made very explicit to those involved. The authors' impression was that it provides a satisfactory enough frame. Of course, proving it worked or that it was better than some other frame is thought a very extensive exercise, perhaps even futile. The pronouns exist in our language, this research has merely revisited them and is now reflecting upon this attempt to set them in a more expansive and rigorous manner. The reactions of those involved in the first brainstorming session were sought. They are presented in an edited format.

- Good to have the frame work to prompt us.
- Can help prioritise conflicting issues.
- Could get bogged down in detail.
- Can we work with this process – yes.
- Messy – would benefit from having a vertical axis.
- Dug up lots of issues.
- White space is informative.
- Can we tackle some of these themes – yes.
- 'Why' and 'How' work well as rows.
- Not so important to distinguish 'what' and 'how'.
- 'Who' is good to capture ideas.
- Pretty easy to digest as an overview.
- 'Where' can help show where action is taking place, but 'Who' is quite similar – second dimension brings order.
- 'Who' helps determine who to contact, clarifying roles, gaps and overlaps.

At least two things can be drawn from these comments. First, the participants seemed happy to have an explicit thinking frame, in particular one with which they were familiar. One advantage of the pronouns as a frame is that it does not appear to be as restrictive or academic as trying to get the audience to stick to say, evolution theory as the frame.

Second, the participants' remarks suggest they are starting to engage and critique the frame. This suggests acceptance and learning. This aligns with the aim of action research in terms of being research into both the thinking frame, the problem and how they interact. So for example, the 'who' pronoun seems to have attracted a disproportionate interest. A scientific institution might be expected to take an interest in 'why,' explanations. Perhaps the interest in 'who' reflects an

appreciation that a service needs to focus on the client and clear allocations of responsibility for those delivering the service.

Reflection on the Pronouns

Moving on to reflection on the pronouns, rather than participants' interactions with the process, the authors now feel that the order in which the pronouns are presented may be worth more consideration than was used in this research. The interaction of pronouns may be an interesting topic for future research. There are consulting methods that place the pronouns on separate cards and are particular about the order in which they are asked. They claim that starting with the 'why' pronoun can encourage a strategic level of deep thinking, interpretations. Starting with 'where' or 'when,' on the other hand, may encourage a level of thinking and subsequent conversation more attuned to providing eye-witness reports. It may be inappropriate to treat the pronouns as mutually exclusive.

In summary the authors now think the pronoun 'which' seemed to be the least useful, as it immediately led to 'who' or 'what'; which person or which thing. It was not included in the service or communication projects questions and there was little evidence that it was missed. Further research targeted at this pronoun may be required.

The temporal pronoun, 'when' seems to have a clear role of introducing the universal concept of time into the discussions. Time co-ordinates the world's activities, we need it to integrate one task with another. Humans have a strong sense of time as it underlines their very existence on earth. 'When' therefore seemed very relevant to those focused on operational activities.

The special pronoun 'where' has some similarities with when, it also has a role of connecting the task to another universal, that of geographical location. It is used to co-locate all activities relative to others. Again those interested in operation activities will be interested in 'where.'

The identity pronoun 'who' seems powerful in subjectifying human activity. Metcalfe (2001) and Landy (1995) have argued that this can open up problem solving thinking from a merely objective view. Stating that a task will be done, and then asking 'by whom', changes it from being a 'thing' to being connected to a person. This is a perspectival shift, and the problem is seen anew, which is usually a good thing. Those familiar with responsibility management will see the attraction of the 'who' question.

The action pronoun, 'how' quickly needs to be distinguished between 'how serious' (qualitative), and 'how much' (quantitative). The former places activities in order of priority and the latter compares it to another universal, numbers. It is a very attractive pronoun for the functionally minded, the doers. Action research, and pragmatism are particularly attracted to this pronoun. How does action tell you what you know?

The philosophical pronoun 'why' is a powerful and perhaps rather different question. It demands interpretation, explanation, and purpose. Furthermore, it is the basis of scientific inquiry, theory and moves the respondent from merely repeating sensory input (seen, etc.) to interpreting that input with reasoning and insight. Being only an eyewitness cannot answer this question. Recording equipment may answer many of the other pronouns but not this one.

The behavioural pronoun 'what' appears the most expansive of the pronouns. As Aristotle notes, you can have, 'to what ends' (cause) or you can have 'what happened' (result), both are about

action or behaviour. The pronoun has been picked up by logicians in the form, 'what if'. This has converse as well as negative converse (mirror image) forms (what would not happen if you did/did not). In all but the basic form of 'what happened', this pronoun also requires some interpretation. It also has the potential to be a perspective-buster as it demands falsification rather than only confirmation thinking, something that the human brain can easily forget unless prompted by questions.

The negative form of the other pronouns was expected and found to be useful. Questions like 'why not' do not always solicit a directly matched negative response to the question 'why'. As with the negative forms of 'what if' it can be a perspective shifter, which seems like a useful attribute of questions. It may be that there is some opportunity to do more research about the converse of pronouns.

Last, the number of the pronouns fits close enough to Miller's magic number five (1956). The whole complex situation domain is 'chunked' into about 5 overall questions. This seems to be very appropriate, and a flexibility that makes the pronouns an attractive questioning system.

Meta Model

Trying to apply the Meta Model provided an early learning experience, as mentioned in the Methodology section. Using the pronouns to generate questions that make people think may be different in a group situation and/or one where the questioner is not in a position of power to dominate the conversation. In these situations, detailed clarification of what has been said is not practical. This alters the whole format of any interrogation and of how the pronouns are applied. In group situations, the pronouns may be more useful as simply a means of chunking a complex situation into an appropriate number of parts. In one-on-one situations there is expected to be more opportunity for careful self-analysis.

Generalising

It is believed that the knowledge claim that the pronouns as presented here make a useful questioning system needs to be justified and be applicable to number of situations, that is, made generalisable. However it is recognised that generalisation is defined differently by each epistemology (Walsham, 1995). In some forms of postmodern epistemology, it is irrelevant. In positive science, it is determined in terms of the degree of universality of measurements. The Theory of Relativity applies to all macroscopic realms. Quantum Mechanics theory applies to all microscopic realms. In interpretive research, interpretations (explanations) are required to cover more than one situation (Metcalf, 1995; 2005). As it felt that one researcher cannot anticipate how useful their findings are in another location, the language used is that of the 'transferability' of an interpretation. New researchers are the only ones who can decide if the interpretation covers some insight in their situation. In Jamesian Pragmatism a knowledge claim is true in differing situations, that is, it is general if it can be contextualised into what is already known (James, 1907/1910). In philosophy, the aim is to clarify concepts. Action research is pragmatic; it aims to justify concepts through and for human action. This research can therefore be thought of as theory development or as clarifying a frame through action.

The aim of this paper was therefore not to prove universally that the interrogative pronouns as presented here provide a useful system for thinking for IS design. Rather it wanted to clarify what the pronouns were, how they might be used, who would use them, for what reason? and when in

the context of real design situation. Importantly this clarification needed to include experiences of IS design that other designers might recognise and be able to fit into the overall context of their worldview; see how they might work for them. It was hoped to convince readers that the pronouns are worthy of more rigorous further research, application and consideration for Information Systems design. Whether they are transferable in the form presented here is for the reader to decide.

References

- Argyris, C. and D. A. Schon (1978). *Theory In Practice*. San Francisco, Jossey-Bass.
- Baskerville, R. and A. T. Wood-Harper (1996). A Critical Perspective on Action Research as a Method for Information Systems Research. *Journal of Information Technology* 11: 235–246.
- Bowles, F. E., & Parkinson, M.J.A. (1995). Measuring Audit Performance: Are The Instruments Fine Enough. *Computer Audit Journal*, 3: pp.20–28.
- Carroll, L. (1939). *The Complete Works of Lewis Carroll*. London, The Nonesuch Press.
- Carson, L. J. (2003). Understanding Dialogue: To A Unified Field Part I. *Anchor Point*, 17 (No 11).
- Checkland, P. (2000). Soft Systems Methodology: A Thirty Year Retrospective. *Systems Research and Behavioural Science* 17(1): S11-S58.
- Crosswhite, J. (1996). *The Rhetoric of Reason*. Madison, University of Wisconsin Press.
- Dawson, R. (2000). *Power Negotiating for Salespeople: Inside Secrets From a Master Negotiator*, Career Press.
- Dewey, J. (1910). *How We Think*. NY, Dover.
- Giddens, A. (1984). *The Constitution of Society*. Los Angeles, University of California Press.
- Grinder, J., & Bandler, R. (1975). *The Structure of Magic I : A Book About Language and Therapy*. Palo Alto, California:, Science and Behaviour Books.
- Hall, L. M., & Belnap, B.P. (2001). *The Sourcebook of Magic: A Comprehensive Guide to the Technology of NLP*. Wales, UK, Crown House.
- James W. (1907/1910). *Pragmatism*. Cleveland, World Publishing (Meridian).
- Jensen, J. V. (1978). A Heuristic for the Analysis of the Nature and Extent of a Problem. *Journal of Creative Behaviour*, 12(3): pp 169–181.
- Kepner, C., & Tregoe, B. (1997). *The New Rational Manager: An Updated Edition For A New World*. Princeton, New Jersey, Princeton Research Press.
- Kipling, R. (1902). The Elephant's Child in: Just So Stories.
- Landry, M. (1995). A Note on the Concept of Problem. *Organizational Studies* 16(2): 315–327.
- Lisnek, P., & Oliver, E. (2001). *Courtroom Power: Communication Strategies for Trial Lawyers*, Pesi Law Publications.
- Mason, D. (1994). Planning an English Course for Students of Health Care. http://exchanges.state.gov/forum/vols/vol32/no2/#special_ret_41 , 32(2) April–June, pp. 18.
- Metcalfe, M. (2005). Generalisation: Learning Across Epistemologies. *FQS* 6(1).
- Metcalfe, M. and E. Hobson (2001). Concern Solving for ISD. ACIS Conference, Coffs Harbour.
- Meyer, M. (1988). Kafka or the Existentiality of Questioning. *Questions and Questioning*. M. Meyer. Berlin, Walter de Gruyter & Co.
- Miller, G. A. (1956). The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information. *The Psychological Review*, 63: pp. 81–97.
- Overduff, J., & Silverhorn, J. (1996). Beyond Words: Languaging Change Through the Quantum Field. Audio Tapes: PA, Neuro-Energetics.

- Perls, F. (1973). *The Gestalt Approach and Eye Witness to Therapy*. Palo Alto, California, Science & Behaviour Books.
- Purcell, F. J. B. (2000). *Value Engineering: A Tool for Our Times*. Purcell Associates, Boynton Beach, FL.
- Rorty, R. (1989). *Contingency, Irony and Solidarity*. Cambridge, Cambridge University Press.
- Satir, V. (1983). *Conjoint Family Therapy*. Palo Alto, California, Science & Behavior Books.
- Susman, G. I., & R.D. Evered (1978). Assessment of the Scientific Merits of Action Research. *Administrative Science Quarterly*, 23: pp 582–603.
- Walsham, G. (1995). Interpretive Case Studies in IS Research. *European Journal of Information Systems* 4: 74–81.
- Watzlawick, P., Bavelas, J.B., & Jackson, D.D. (1967). *Pragmatics of Human Communication: A Study of Interactional Patterns, Pathologies and Paradoxes*. New York, W.W.Norton & Company.
- Weick, K. E. (1995). *Sensemaking in Organizations*. Thousand Oaks CA, Sage.
- Whetten, D. A. (1989). What Constitutes a Theoretical Contribution. *Academy of Management Review*, 14(4): 490-495.
- Yardley, G., & Kelly, J. (1995). *NLP Practitioners Handbook*. Singapore, Southern Lands NLP.