Implications from Decision Science for the Systems Development Life Cycle in Information Systems.

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Abstract. Nomology, a decision science approach to structuring qualitative decisions, is used to show that the Systems Development Life Cycle (SDLC) corresponds to a generic structure based on a Convincing process embedded within a Committing process, both of which were formalised originally by Kant as dialectical processes. The key decision issue in the SDLC is shown to be that of ownership of the process by the decision-maker. Consequently the decision when to move from one stage of development to the next should be determined 'subjectively' by the decision-maker or organisation. Comparing the SDLC with other similarly structured systems suggests that each stage of the SDLC is best implemented 'objectively' as an Adjusting process in which balance should be retained with regard to three issues, what should be done, where should it be done, and which way should it be done. Also, the generic nature of the structure suggests that practitioners could borrow from similar decision processes in other fields, including hierarchies of activities, types of thinking and Oriental philosophy.
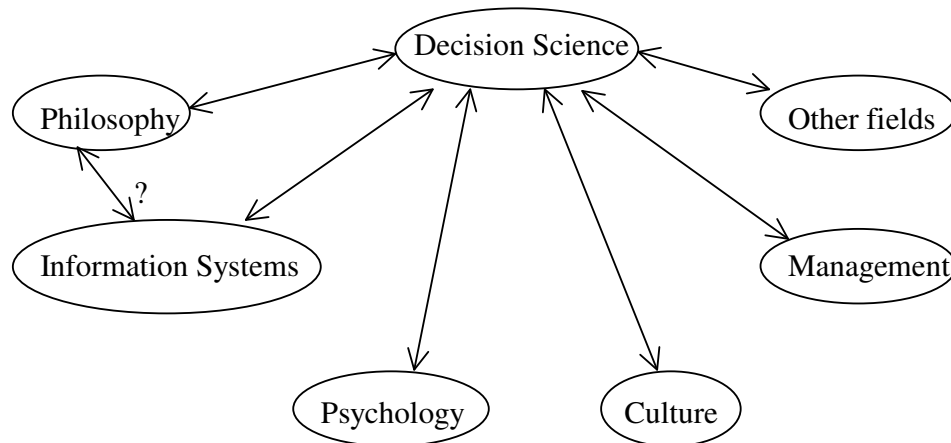
INTRODUCTION

In the call for papers for this special issue the editors expressed the belief that we have "hardly begun to tap the potential of philosophical reasoning in our work, especially in developing a more robust, and academically respectable, foundation for what we do". Most of the papers in this issue consider the implications for IS theory and practice of various contributions from philosophy. The word philosophy comes from the Greek words for friend and wisdom. To be wise implies to be sensible and prudent amongst other things. It is fair to suggest that the editors were hoping for more than just sensible and prudent suggestions for IS practice, although they wanted these also. By associating the word "reasoning" with "philosophical", the editors were alluding to a secondary role of philosophy, that of revealing the logical structures that are inherent in decision making. By using the phrase "more robust … foundation" they imply a questioning of traditional philosophical exegesis. This paper takes the radical view of doubting the capabilities of philosophy to provide on its own a robust foundation for reasoning in IS, and suggests that it could benefit from a contribution from decision science. Obviously philosophers have always to concern themselves with decision structures as they develop the foundations of their contributions. On the other hand many philosophers are introverted and insufficiently eclectic to get a comprehensive view of decision structures. Figure 1 illustrates the strength of decision science as receiving from and giving to many fields in order to discover and use the decision structures that (objectively) provide a framework for how people actually think in general. That such a framework exists is not generally accepted in IS; a purpose of this paper is

to demonstrate the value to IS of this framework. In it we will distinguish decision science from philosophy. We hope that this may also help the latter to reassert its older more subjective role of offering wisdom.

Figure 1
Relationship of Decision Science to Other Fields

DECISION SCIENCE STRUCTURES

The common factor that all systems and models have is that they involve abstractions. Abstracting involves clustering ideas and forming language. Such systems can be used to consider relationships between objects, which may then be tested empirically. Any system that is used as a testing framework to evaluate research done in a variety of other systems must be able to operate at a very high level of abstraction. Such testing need not always be done on empirical data. Usually it is done indirectly by evaluating how well the findings of other people's research and discussions fit some meta-system. Such will be the case in this paper's consideration of the Systems Development Life Cycle (SDLC). However, it raises a chicken-and-egg problem. How does one know that one has a good meta-system? Good research can lead to a good system, which can then help to evaluate further research. A bad system could distort the findings of good research.

An underlying principle of philosophical studies of all sorts is that there exist regularities in human behaviour or societal processes that are common to all fields of decision. To discover these regularities it is necessary to explore deep structure within decision-making. Synthesising and formalising the results of such an exploration requires some kind of framework or meta-system. It would help if such a meta-system had support from empirical research in a variety of fields, not just in IS. Critical Realism (CR) (Bhaskar, 1978) is a formal method for investigating deep structure that distinguishes between three layers of the world of research. These are the *empirical* in which conclusions are drawn from research data, the *actual* which is bound by the context of its own situation, and the *real* which is the important layer that drives the other two. The real layer contains regularities in the behaviour of systems that operate as tendencies at a deep level. Mearman (1999) has reviewed the elements of CR research into these regularities and suggests that they comprise observation, abstraction, retroduction, elaboration of abstractions, scrutinisation of theories, and elimination of explanations. C.S. Pierce (1867) who

described it as "studying facts and devising a theory to explain them" originally called retroduction *abduction*. The "retro" aspect implies that the output of quality research is partial or incomplete "regularities" that, when combined with others, help to discover the underlying dynamics that have influenced the formation of some system. The "abstraction" aspect indicates that the research should be viewed as relating to levels that are deeper than the empirical and the actual. Two extensions of this abstraction concept are incorporated in Nomology, the study of the decision-making processes of the mind named by Hamilton (1877) after the Greek word for law. One extension is to explore how these regularities go beyond that of the particular field of study, in this case IS, into general decision-making by combining them with similar regularities found in other fields. The other extension is to extract these regularities into specific dis-aggregated axioms and principles.

Nomology is based on the premise that intelligent beings' choices tend to follow a common set of simple decision rules. Thus if several different fields of human activity have similar categorisations of some type of behaviour, then it is more likely than not that they emerge from the same common decision structure. This follows from Ockam's Razor that, if there are two plausible explanations for something, the simpler explanation is more likely to be the correct one (William of Ockam, 1993). Along with introducing Nomology, Hamilton (1877) defined the terms cognition, affect and conation as a triad of mental activities corresponding to knowing, feeling and willing, which operate as levels which he called *somatic, psychic* and *pneumatic*. He credited Kant (1987) with having formulated these ideas and specifically with proving the existence of the feeling level between knowing and willing. Thus Kant should be considered to be the "father" of Nomology. Recently Brugha (1998a, b & c) has formalised the rules of Nomology and shown that this triad corresponds to three stages or levels of a committing process.

Kant was not only responsible for discovering the foundations of the committing process; his exploration of the dialectic in Critique of Pure Reason (1985) discovered the three stages or levels in a parallel convincing process. Brugha (1998c) has formalised the rules for this also and shown that its levels start with *technical* or self-orientated issues, then relates to the *context* of the problem as indicated by the perceptions of other people, and finally takes account of *situations*.

Brugha's particular contribution has been to show parallels with similar structures that have emerged from research in fields such as management and psychology, and to synthesise them into a unified framework. He showed that the differences between the committing and convincing dialectics from Kant have parallels with Jung's (1971) introverted and extroverted orientations in psychology. Jung's particular contribution was to show that different levels on these two orientations can be combined into meaningful orienting functions such as intuiting, sensing, thinking and feeling. Thus the committing and convincing processes act as independent dimensions. Parallels with Maslow's (1987) hierarchy of needs confirmed the validity of this pattern and suggested that both his and Jung's systems could be formalised and filled out to the full Kantian two-way dialectical structure of nine aspects. Brugha (1998c) did this and showed that the levels of activity (Table 1) and types of thinking (Table 2) arise as each phase of commitment goes through a convincing process. A further extension was to show that the nine activities correspond to stages of a development process that have parallels with Elisabeth Kubler-Ross's (1969) Five Stages of Dying and the Systems Development Life Cycle (Table 3) (e.g. Whitten, Bentley and Barlow, 1989). See Brugha (1998c) for other applications of the same

procedure to several processes from religion, the Enneagram personality typing system and Checkland's (1981) Soft Systems Methodology. The wide variety of systems that fit into this structure should be visualised as facets of a broader reality. Each of the cells in Tables 1 to 3 should be viewed as coherent clusters of activities that are best explained via the corresponding facets. For example, trust could be described as a psychological state that relates to some situation; it operates on the emotional level of behaviour and is particularly relevant at the acquisition stage of the SDLC. Brugha (1999) has shown that the confluence of thinking types, levels and stages of the development process is also useful for explaining the antecedents of trust in relationship marketing.

Table 1

Hierarchy of Needs, Preferences and Values

Introverted Development - Committing Phases	Extroverted Development - Convincing Stages		
	Technical - Self	Contextual - Others	Situational - Business
Somatic – Needs	Physical	Political	Economic
Psychic – Preferences	Social	Cultural	Emotional
Pneumatic – Values	Artistic	Religious	Mystical

Table 2
Types of Thinking

Committing Phases	Convincing Stages		
	Technical -Involving	Contextual - Protecting	Situational - Observing
Somatic –Having	Intuiting	Recognising	Believing
Psychic – Doing	Sensing	Learning	Trusting
Pneumatic – Being	Experiencing	Understanding	Realising

Table 3
Systems Development Life Cycle Activities

Committing Phases	Convincing Stages		
	Technical	Contextual	Situational
Analysis	Survey project scope and feasibility	Study the current system	Define the end-user's requirements
Design	Select a feasible solution from candidate solutions	Design the new system	Acquire computer hardware and software
Implementation	Construct the new system	Deliver the new system	Maintain and improve the system

Extensive trawls of similar qualitative structures based on established systems or empirical evidence indicated that systems that did not fit into the above dialectical structure appeared to be based on balances between opposites or contrasts. Some of these were connected with culture, such as Hofstede's cross-cultural study (1980) which reported that cultures tended to differ on four main dimensions of uncertainty avoidance, individualism, power distance and masculinity.

Another was the eight *Trigrams* or archetypes of the *I Ching* from the *Yin-Yang*–based system of Ancient China (Secter, 1993, 1998). Brugha (1998b) has reported on such examples from management including Peters and Waterman's (1982) eight criteria of excellent companies, from which McKinsey's *Seven 'Ss'* (Waterman, 1982) were developed.

Brugha also had for many years been using a procedure called Priority-Pointing (1974, in press) for clustering responses by managers to open-ended questions about how to achieve defined development objectives. The clustering pattern was always the same. The highest clustering differentiated between the need for more *planning* and for more *putting* plans into effect. At the next level down the question addressed was whether or not the problem concerned mainly the *people* involved in the process. At the third level the issue was always about the best approach to use; whether it be *inter-personal* or not. Despite this structural stability each case was so different that it required its own set of descriptors and names for the individual clusters. At a generic level there were no readily recognisable names such as on the development side (Tables 1 and 2). To emphasise this generic aspect Brugha (1998a & b) used the initial letter "p" for these terms (Figure 2). From analysis of many such surveys it became clear that decision-makers were addressing the problem with the same approach based on asking questions that had dichotomous answers. The first question they addressed was "*what* kind of problem was it?"; had it more to do with uncertainty and consequently planning, or was it more about putting plans into effect? The second question was "*where* was the focus of the problem?"; was it more with the people involved or more with the "place" associated with the problem, i.e. the systems, structures, management, etc.? The third question was "*which way* should be used to solve the problem?"; should it be more of a personal approach or more one where the management use their own "position" to achieve their purposes? Combining the answers to these dichotomies led to the formalisation of eight principal adjustment activities (Figure 2) (Brugha, 1998b). It was described as an adjustment system because remedying the imbalances in the three dichotomies acted as a mechanism for reducing excessive emphasis on particular approaches to solving problems in organisations.

… Insert Figure 2 Near Here …

This structure based on dichotomies raised the question of parallels with the *Yin-Yang* (either-or) system in oriental culture. The main question then was how generic and how extensively applicable was this adjustment system? A proper nomological test would be to compare it with similar systems that have arisen in totally different and unrelated contexts, for example in this case, Oriental culture. It emerged that descriptions of the eight activities correspond to those of the eight *Trigrams* or archetypes of the *I Ching*. The outer ring in Figure 2 and the phrases outside the circle come from the *Yin-Yang*–based system of Ancient China (Secter, 1993, 1998). The correspondence with the trigrams clearly arises because of the conjunction of three *Yin-Yang* dimensions. The term trigram comes from the construction of an archetype using three 0-1 choices. The inner circle gives a number associated with the binary number in the second circle from the centre, which corresponds to a trigram symbol in the next circle. Trigrams are read upwards so that the first digit corresponds with the lowest line; a broken line corresponds to *Yin,* is represented by a zero, and reflects openness or softness. Consequently the most "open" approach is policy-making because it reflects uncertainty and working with people in a personal way. The most "closed" approach is practice because it reflects certainty and working in one's place using one's position.

The *I Ching* and the Nomology adjustment system are not exact replicas of each other. Both systems use the same three independent dimensions. They differ on the issue of the order of importance of the three dimensions. The eight activities in Nomology arose out of a problem solving activity that required that the "what", "where", and "which way" questions be answered successively leading to the eight activities in Figure 2 having the order as shown. In the *I Ching* the order does not seem to be as important as the archetypes themselves. The *He Tu* – Former (Early) Heaven Diagram of the *I Ching* (Matthews, 1998) takes the questions in the order of the "what", "which way", and "where" questions, i.e. reversing the order of the second and third questions. This appears to reflects the "archetype" nature of the trigrams that gives a higher priority to the *approach* that a decision-maker will use to solve a problem, than to *where* the solution will be focused. In Figure 2 this leads to an interchange between the locations of Mountain / Mound with Water / Abyss on the right hand side of the diagram, and on the left between Fire / Light and Lake / Precipitation.

The other difference is the sequence used amongst the eight activities. The western approach is to go from Pounce to Practice, i.e. working around the clock in Figure 2 following a sequence of problem-solving activities. The Former Heaven sequence starts at the bottom right hand side of Figure 2 with Policy, and moves up to Pounce. Then it starts again at the bottom left hand side with Promotion, and moves up to Practice. Notice that planning / putting, people / place, and personal / positional are *yin / yang* activities, having 0 / 1 in *trigram* notation. Thus the Former Heaven sequence starts with the most open or "*Yin*" activity policy and ends with the most closed or "*Yang*" activity practice, as it were after a linear move from very *Yin* to very *Yang*.

One major question remains in this review of decision structures, one that is relevant to the discussion on the SDLC below. How do the development and adjustment systems interact? Do they combine in any way? It is clear that the SDLC is, at the highest level, about a process of commitment to a systems project; and at the next level it is about proceeding through each committing level in a convincing manner. Is it possible that contained within each cell of the SDLC in Table 3 is an adjustment process corresponding to a lower level of abstraction? If this were the case it could have implications for how the SDLC should be used in IS. The simplest solution would be that committing, convincing and adjusting are three dimensions that form an important generic model that occurs naturally.

If this were true then there should be evidence of such structures elsewhere. Brugha (1998d) has described such a combination as occurring in Galliers and Sutherland's revised 'stages of growth' model (Galliers & Sutherland, 1991; Galliers, 1991). He showed that the stages of growth in an IS organisation follow the development stages of Tables 1 to 3. Galliers uses McKinsey's *Seven 'Ss'* (Waterman, Peters and Phillips, 1980; Waterman, 1982; Peters and Waterman, 1991) as a basis for describing in greater detail what occurs *within* their 'stages of growth'. These Seven 'Ss' are style, skills, superordinate goals, strategy, staff, structure and systems, and correspond to adjustments that *should be carried out* within each stage of development. The adjusting process is about fine-tuning at a third or lower level. Thus, when an organisation wishes commit itself to working on a higher level of use of IS, it must develop through a process of fulfilling the requirements of that level convincingly. Because doing this in a major organisation is non-trivial matter each step requires adjusting to the new situation.

As might be expected, there are not many reported cases of the interaction of these three dimensions. Another one is from a very different case, a modern Chinese system for managing projects called *wuli-shili-renli* (WSR) (Gu and Zhu, 1995; Zhu, 1998, 2000). Brugha (1998e)

has shown how *wuli* translates as *adjusting*, *shili* as *convincing*, and *renli* as *committing*. WSR has a project cycle similar to the SDLC, the main difference between the two systems being that WSR includes an element of 'co-ordinating relations' that is linked to all the others and that seems to act in an adjusting role at each stage of the cycle. This lends support to a formalisation of an embedded version of WSR similar to the 'stages of growth' model described above, i.e. much adjusting within moderate amounts of convincing within an essentially committing process.

As within the adjustment process where the three dimensions are more important than any fixed process type relationship between them, the same applies between the committing, convincing and adjusting dimensions. The history of the development of WSR reveals the different emphases amongst these three dimensions between East and West. The genesis of WSR started in the early 1970s with a sense of dissatisfaction with Chinese systems practice that it was too mechanistic, in their terms too dependent on *wuli*. This led to the incorporation of *shili* in the early 1980s and then *renli* in the late 1980s. The nature of these dissatisfactions reveals something about the processes and their relationship with Oriental culture whose central differentiating feature appears to have been an excessive willingness in the past to adjust to new circumstances and leaders whether of governments or of company projects. (This is in keeping with an understanding of a society in which the *I Ching* used to play an important role as a tool for divination. Superstitious people believed in it and consequently followed its "pronouncements" which always proposed some adjustment to their activity. It is possible that political leaders may have encouraged its use as a way of discouraging independent thinking.) The developers of WSR saw themselves as redressing an imbalance by bringing in more subjective or *shili* aspects to do with the running of projects, and more commitment to caring or *renli* responsibilities to do with projects.

This imbalance also exists in India and Japan. It has contributed to a gulf of mutual misunderstanding between East and West because, by contrast, western culture is characterised by a strong sense of commitment and by a comparative slowness to adjust even when it appears objectively justified; some might associate this with a 'pioneering spirit'. In the context of this paper this would lend weight to the view that people using the SDLC would benefit from the inclusion of an adjustment aspect within each stage of the cycle.

If combinations of adjustment within development take place, as was shown in the cases above at the level of eight by nine activities, one should also expect more aggregated versions of the same structure. Brugha (1998d) has reviewed several such so-called 'twelve step' programmes that are based on four by three activities. One for personal growth (Peace Pilgrim, 1981) is based on developing commitment through three levels of preparation, purification, and relinquishment. It would appear to be established that each step of the SDLC is implemented most naturally as an adjustment process. At the very least it suggests a working hypothesis that is worth exploring in terms of its implications.

PHILOSOPHICAL IMPLICATIONS

The previous section took a descriptive approach to qualitative structures in decision-making. It demonstrated the existence of a relatively simple system of structuring that seems to occur in different fields. The dimensions appear to be universal. Processes based on these dimensions can differ occasionally. For instance, within adjustment we saw that Priority-Pointing followed a

different cycle to the *I Ching* although both were based on the "what", "where" and "which way" dichotomies. Likewise the committing, convincing and adjusting dimensions should be seen as themes or issues. Although they have an embedded aspect in the process of the SDLC, it is more important to see them as three dimensions that act together on any problem. In particular, the impact of any external event on the SDLC should be considered in the context of how it affects all three dimensions.

We now consider the implications for philosophical advice of some of the decisions that underpin these structures. We start by considering the fundamentals of problem solving in an open or meta-physical situation that give rise to the structures described in the previous section.

The basis of Nomology is that decision-makers tend to analyse not previously structured *problems* that involve qualitative distinctions by breaking them into activities, or categories of behaviour, that are each important in themselves and that follow natural sequences. This is done using a balancing approach that defines differences on the basis of dichotomies such as *Yin* and *Yang* in Oriental culture. For general problem solving the most fundamental dichotomies in Nomology are firstly *planning* versus *putting*, which reflects answers to a question about what is the nature of the problem, and secondly *people* versus *place*, which reflects answers about where is the focus of the problem. These two dichotomies produce a generic set of four adjustment phases (Figure 2). The first phase is called *proposition* and describes planning in the decision-maker's place. Here the person considers a response to the problem without much concern for what people think about it. If this fails to solve the problem the person moves into the second phase which is called *perception* and describes planning amongst people. Here finding the views of people is considered important to developing a viable plan. The third phase is called *pull* and describes the process of putting whatever plan there is into effect amongst people. The last phase is called *push* and describes putting in place whatever remaining changes are necessary, to and within systems and structures. Thus a nomological problem solving process involves developing a proposition, then a perception, next pulling people along, and finally a push to complete it. Brugha (1998a) has described numerous examples of these particularly in management. Table 4 gives two from strategy (Johnsen, 1993) and IS (Woolfe, 1993).

Table 4

Examples of Adjustment Phases

Generic	**Strategy**	**IT Impact (Woolfe)**
Proposition	Coalition	Functional Automation
Perception	Mission	Cross-Functional Integration
Pull	Vision	Process Automation
Push	Strategy	Process Transformation

The most important theoretical question in Nomology addressed by Brugha (1998a) was what caused the difference between adjustment, with its four activities, and development with its two sets of three activities. Kant (1985, p.417) considered the emergence of triads out of dichotomies as a process of interaction between a thesis and an antithesis, either of which could be argued objectively. How the third part of the triad, the synthesis, was arrived at then became the subject of lengthy consideration, most of all by Hegel (Inwood, 1983). They had several difficulties that hampered the clarification of their thought. They used an Aristotelian dialogical approach that argues upwards from thesis and antithesis to a higher level synthesis. We will show below, from Brugha (1998a), that one can start with the four main adjustment categories and drop down to

three. They worked from a very limited empirical base compared to the vast amount of empirical research that is now reported in journals, particularly using IT. Much of their casework was based on slow-moving territories such as philosophy, literature and history. We have the advantage of numerous cases in management, most particularly in IS where the lessons from success and failure can be learned within months. Finally, because the dialectic can appear either as committing or convincing, efforts by the early authors to explain it as one combined dynamic led to some confusion.

Kant (1985) explored various versions of combinations of four and three categories. C. West Churchman (1979) interpreted Kant and contrasted him with his contemporary Bentham who is best known for the *Panoptican*, a prison where every prisoner is always on view and subject to control via the administration of pain and pleasure, and for *Deontology*, the science of duty. In doing this Churchman associated Bentham with a society that is run using an objective law and external control, and Kant with relying on a subjective approach and the 'good will' of the individual. "In Kant's ideal, on matters of moral duty, the client, the decision-maker, and the planner are one. The purposes and measures of performance disappear (there is no 'trade-off' for immoral acts)." (Churchman, 1979, p. 123) Nomology takes Kant's 'moral duty' to a more general level and says that, if the decision-maker owns the problem, in the sense of not being accountable for the results to anyone else, then his or her involvement will be subjective. In that case the person will not be able to self-impose a feeling of guilt about not dealing with the problem. Consequently, of the four generic activities, the pull activity will become irrelevant and the four phases become three levels of a development process. This is summarised in Table 5 (from Brugha 1998a) that links the four phases to major feelings and appropriate responses.

Table 5
Feelings and Responses Associated with Adjustment Phases

Generic	Feeling	Responses
Proposition	Fear	Faith
Perception	Anxiety	Hope
Pull	*Guilt*	*Righteousness*
Push	Resentment	Love

Thus, at one extreme the world follows a Kantian approach in which everyone is good and there is no need for outside decision owners to tell people what to do. At the other extreme every member of society has a sense of "Big Brother" likely to make them feel guilty if they do not do what they think is expected of them. In Nomology this is about the balance between development and adjustment decision-making. For every open decision this choice is determined after the first two questions "what kind of problem is this?" and "where is this problem?" have been answered. The next question is "who owns this problem?". If I own the problem then I cannot attach any guilt to my decisions and a development structure emerges. If there is an outside owner then an adjustment structure applies.

In Nomology there are two kinds of development processes, both of which are dialectical and follow the same pattern: proposition, perception and push. One sort is introverted and about committing, and associated with constructivism. The other is extroverted and about convincing (Brugha, 1998c) and associated with dialectical critique. This subjective / objective distinction is carried into the difference between development and adjustment decision making.

A most important implication of this difference is ethical. Brugha (1998f) has considered this in the context of a 'stages of growth' model (Galliers & Sutherland, 1991; Galliers, 1991) of systems development. The main consequence is that decisions about when to move from one stage of a development to the next should, by virtue of the subjective nature of the system, be made freely by the decision owner when the person feels it is appropriate. Attempts to jump stages appear not to work; failure to deal with a stage weakens the foundation on which the next is built. In an organisational context the decision 'owner' is the group responsible for the development. Disagreements within a decision-making group should be resolved before proceeding because of the key development issue of 'ownership'. For example, failure to resolve political differences weakens the process at the second stage or level (Table 1). A Benthamite or "deontological" approach would suggest that it is one's duty to pass from one stage to another by a certain time, whether or not one was ready, for instance because of a commitment to an externally imposed schedule. This introduces a sense of guilt and consequently changes the process from development into adjustment. The key idea is that one feels that there is someone looking over one's shoulder to whom the decision-maker is responsible.

Within each stage of development, on the other hand, the embedded adjustment processes that are carried out do have an objective character. Thus there is a "right way" of carrying out each stage. The implication for nine stage development models is that inter-stage decisions about when to move from one stage to the next should follow a subjective approach, whereas intra-stage decisions should follow an objective approach. Thus it is the situation that determines whether one should apply Kantian or Benthamite thinking.

Recently Werner Ulrich (1983) has reviewed the contributions of various philosophers to social planning. He distinguishes two opposing philosophical camps, the scientists including Karl Popper, and their opponents including Jürgen Habermas. He is against the 'decisionism' of Popper that divides theory from practice as being too rigid and value free. In a nomological context 'decisionism' seems to be confined to the adjustment or 'objective' decision-making dimension, and within it to the "Place" aspect. In other words it avoids involving people in the decision because (sic) that would make it 'unscientific'. Ulrich appears to place Habermas within the "People" orientated zone, and yet also within the adjustment frame. Thus Habermas would be associated with the lower half of Figure 2 and Popper with the upper half. Hence, although Habermas is more concerned with people than is Popper, he is still concerned with abstract or 'objective' philosophy. In his section on "Application" Ulrich (1983) rejects Habermas as insufficiently radical and not having real practical concerns with society. The subjective nature of Ulrich's language suggests that he has made a jump out of "adjustmentism" into "developmentalism". This is confirmed by his emphasis on local ownership of its development problems in Latin America, and with working up the hierarchy of levels. The emphasis is very much on the political level and on using democratisation and decentralisation in societies to empower people with regard to their own development. The critical concern is about ownership of the decision-making process. Looking at the context column in Table 1 it follows that avoiding political interference can be extended to including respect for local culture and religious freedom.

Ulrich contributes to the discussion in this paper by addressing the philosophical issues behind two major alternative approaches to social planning, Rational Discourse and Critical Heuristics. Nomology would associate rational discourse with objective or adjustment decision-making, and would associate critical heuristics with the convincing aspect of development decision-making.

This association appears to be validated by the following coincidences. Ulrich makes the same distinction between these two approaches as does Nomology, i.e. on the basis of ownership of the process. A small criticism would be that, in describing the developmental approach as heuristical, he is in danger of implying that it is less properly founded than adjustment, and thus making it vulnerable to attack (e.g. see Churchman, 1979). Another correlation between Ulrich and Nomology is the placing of Kant as the central figure giving foundation to the theory underpinning development.

Foucault has also contributed to the discussion by taking Bentham's idea of the *Panoptican* in which pleasure and pain are used to 'pull' people in whatever direction is decided to be 'good for them'. He used this image of institutional power in order to develop a critique of bodies of knowledge in society, and of social and institutional mechanisms of power. Within this adjustment system he appears to have been exploring the development dimension. The focus of his ideas changed in his writings from emphasis on somatic aspects of power in Discipline and Punish (1979) to psychic aspects in The History of Sexuality (1980). Corresponding to this change was a move away from treating people as objects to one where people themselves adjusted in response to an internally perceived external power.

Nomology's highlighting of the importance of the difference between development and adjustment has implications for epistemology and ontology. It shows that there are parallel forms of knowledge: subjective such as believing and sensing, and objective such as perceiving. These can be explored in the context of subjective versus objective learning theories. Subjective learning can be broad and correspond to one's personal growth through the hierarchy of activities, or it can be narrow within a cultural context (Table 1). Similarly objective learning can be seen as a broad adjustment process or more focussed on one sector. Brugha (1998b) has shown that two of Honey and Mumford's (1986) four learning styles of the *activist* and the *pragmatist* correspond to the *pounce* activity, the other two, the *reflector* and the *theorist*, to the *procedure* activity (Figure 2). This adjustment-development difference also has implications for relationships with different fields of activity. For instance, it helps to distinguish an economics (subjective) point of view to do with one's needs from the price or (objective) value of something. Being able to make such distinctions could contribute very considerably to the elucidation of philosophical positions.

It would appear that there exist two parallel epistemologies, each with its own cycle. Of the three dimensions only committing relates directly to ontology. The stages of committing start with getting what one needs for a project, continue with deciding what one would like to do, and finish with bringing it into being. Adding in the convincing dimension justifies each commitment and converts it into a development. However, being committed and convinced do not, on their own, bring some entity into existence. They must also be applied to some objective reality, i.e. must carry out some adjustment. The reverse is also true, an adjustment about which there is no commitment or conviction is not likely to create anything lasting. This suggests the following ontological statement. A metaphysical entity exists in a three-dimensional world of committing, convincing and adjusting. A corresponding ontological extension of the discussion on learning theory above would be into the area of personal growth and formation.

IMPLICATIONS FOR INFORMATION SYSTEMS MANAGEMENT

The SDLC is a process for developing individual projects. It suited early IS developments where projects 'stood alone'. Nowadays IS organisations typically have many projects at different stages, that may also be interacting with each other, making it more difficult to reap the benefits of understanding the SDLC process. The SDLC is now viewed as inflexible and out-of-date. Avison and Fitzgerald (1995, p.445) describe the use of the SDLC as the "traditional (NCC) approach" and thus associate it with a recommendation of the United Kingdom's National Computing Centre of the 1960s. By contrasting it with some of the more modern and holistic methodologies they associate it with the faults of those early times and the excessively strict interpretations of how its stages should be followed that arose because of the domination of IS by technical types. They thus marginalise it as one of several methodologies, as have others (e.g. Whitten, Bentley and Barlow, 1994 in the third edition of their text). Avison and Fitzgerald (1995: pp. 30-35) regard their criticisms as 'potential' because not all organisations fall into the potential traps of misusing the SDLC.

A misunderstanding of the SDLC as inflexible has led to its decline in popularity. The SDLC is not just an approach; it describes a meta-methodology within which different methodologies can be operated. In reality the overlapping of stages within the cycle is often forced by the situation, particularly where there is interaction such as between the design of the new system and the acquisition of hardware and software. In this author's experience it has been very helpful to explain each stage by reference to nomological structures. The study phase, for example, emphasises the somatic, i.e. tangible and measurable aspects that exist in the current system; it also focuses on the end-users. The SDLC should be viewed as a generic structure that is not limited just to IS. If people understood its broader context they would use it more flexibly, i.e. they would apply the spirit and not the letter of the rule. If decision advisors understood that its structures arise from development decision-making they might have more respect for the decision-maker's or organisation's freedom to decide when enough time or effort has been given to any activity or stage. This aspect is particularly relevant to the criticism of the SDLC because of its over-prescriptive past.

As implied in Figure 1, the SDLC decision structure should be used as a conduit through which to draw from other fields, including from general management. For example, commonly found IS processes that have three phases or levels of committing such as Understand the Problem or Opportunity, Develop a Solution, and Implement a Solution (O'Brien, 1993) have parallels with Simon's (1977) Intelligence, Design, and Choice, and consequently with the satisficing concept. The eclectic use of ideas such as this from general management should be reinforced amongst IS managers. The use of colloquial language such as in Tables 1 and 2 could help to enhance decision-makers' sense of ownership of the process. IS people generally come from a technical background, and so could benefit from having their intuitions and feelings affirmed. Because frequently in an IS context there can be many interacting and overlapping projects leading to multiple SDLC cycles, sometimes in several layers, it is even more important that decision-makers have the maximum control possible over the process.

The combination of eight adjustment activities that are carried out within each of the nine development activities of an SDLC can be viewed as a sort of "Nomological Map" to help decision-makers to locate where the decision process is at any point in time. This framework can help to provide indicators about what decision-makers should do at a particular stage of adjustment or development. Information such as this could help to move an organisation

onwards by revealing to the members where there are blocks to change in the process or where there is a need for targeted effort. It can also help decision-makers and advisors by indicating the type of behaviour associated with each stage, as it is exhibited and manifested in the feelings of the organisation and its members. It can also point to suggested guidance with regard to such behaviour.

The three independent dimensions of committing, convincing and adjusting can also be viewed as a cube. At any point in this cube one can distinguish the activity occurring by analysing the nature of the feelings about that activity, particularly by where they are directed. For example there can be three different *types* of anxiety. 'Committing Anxiety' focuses on worry about committing oneself or one's organisation to some proposed new system. 'Convincing Anxiety' emphasises the concern that one is using the approach that is best for one's customers or end-users. 'Adjusting Anxiety' focuses on worry about adapting to new circumstances. It is not necessary to take committing and convincing separately. The combination of the feelings associated with convincing within committing levels have their own well defined characteristics as stages of relating (Brugha, 1998c). These can be combined with the other descriptions (Tables 1 and 2). For example, similar to an individual, an organisation can get stuck in inertia. This is essentially an emotional problem in which a group of executives feel that they cannot trust themselves or others in the organisation, when judging what to do in some situation such as whether or not to make some major purchase. It also applies to more general (emotional) commitments that an organisation should make from time to time. In the context of IS development an example of such an issue would be the commitment to a genuine incorporation of IS in the mainstream of the organisation.

A broader understanding of the SDLC has implications for IS education. Future IS managers could benefit from a broader and more eclectic education that drew more from management and psychology. Most people embarking on an IS project got their first exposure to the SDLC in the context of a real-life situation to do with their own personal lives, and nothing at all to do with IS. This need not be a dramatic experience such as the bereavement process mentioned above (Kubler-Ross, 1969). A challenge to educationalists would be to teach students how to bring to IS projects the understanding that they have developed in their life experiences. This could help to improve the management skills of people who chose a technical career because of an aversion to dealing with softer issues of people management.

The major implication for IS practice arising from the discussion of decision structures is that each of the development stages should be implemented using the rules of adjustment decision-making. The principal requirement is that there should be balance in the usage of alternative managerial approaches. This is an "objective" requirement. For instance a manager could cause harm by bringing to the job a particular bias in favour of planning as against putting plans into effect. Having an awareness of such potential imbalances can offset such a bias. Another benefit is that the model can be used to match the needs of an IS task with the management styles of the existing members of an IS task force when recruiting new members.

The combination of alternatives on each of the three dichotomies produce the following eight activities. These can be viewed as coherent "activity tools" that can be used independently or as part of a cycle that is applied within each SDLC stage. They reflect an unfolding process that could go through the whole cycle or just the first few steps around the "clock" described in Figure 2. For example, someone simply proposing a workable solution might deal with the requirements of an SDLC stage very easily. Typically those who are in place in the organisation,

who have control over the resources, usually will first try some solution that does not involve too many other people. The combination of a *proposition* activity that is done using one's *position* (i.e. the control one has over resources, people or influence) is described as *pounce*, a sudden shift in direction of resources or emphasis that has not been widely discussed or agreed. The other extreme on the dimension of which way to solve a problem is by focus on the *person* instead of on one's *position*. If a pounce solution is inadequate then go "in person" to those who are in place in the organisation and see how the problem affects the work that they do. So, a *proposition* activity that is centred on the activities of each *person* involved would be directed at improving the *procedure* whereby the problem is usually solved.

If following the usual procedure to sort out the problems has not succeeded in dealing with a situation it, will be necessary to develop a better *perception* of what should happen in that stage. The initial preference is to use some objective measure of what people think, such as "what would people be prepared to pay for this activity?" The combination of a *perception* activity that is found through examining one's *position* (i.e. in some competition for resources) is described as the *price* that people are willing to pay. The other extreme within the perception activity is to focus on the person instead of on one's position. Each person can be asked to make proposals and, through some group process, a combined view can be formulated. Thus, a *perception* activity that encapsulates the wisdom of each *person* involved could lead to the development of a new *policy*.

The formation of policy is the summit of the planning activities. Once the policy for dealing with the problem has been decided upon then the balance moves from planning to favouring putting plans into effect. The next step entails the first of the *putting* activities. As with policy this is aimed at people and uses a personal approach, so the demands of the change are not excessive. Having developed the policy and got it agreed, now it is necessary to *pull* the people into line. Initially the focus is on the person instead of on one's position. Each person needs to be persuaded individually, or as part of a team, to implement the policy. Thus, a *pull* activity that emphasises primarily the involvement of each individual *person* corresponds to *promotion*. If the benefits of using promotion begin to diminish the focus changes to using an objective measure of the contribution to the agreed goal. A *pull* activity that is evaluated using one's *position* (i.e. in some competition for resources) corresponds to the *productivity* of the people or departments in the organisation. The kinds of questions that are asked under productivity are similar to those asked under price. "How does this or that contribution improve our position?"

The nature of the *putting* activity then changes from a *pull* to a *push* activity aimed at the structures and practices of the organisation that require changing. If the pull activities, with all their emphasis on getting people to work for the common goal, have shown up some faults or weaknesses in the institutional structures and methods, it then becomes opportune to impose or push through appropriate changes. So, the first focus is on the *person* instead of on one's *position*. Through examining each person's informal relationships within the organisation it may be possible to define a better formal structure that reflects the new directions and targets. Correspondingly, a *push* activity that re-orientates the place to correspond to the needs of each *person* involved is dependent on the *pliability* of the organisation and its structures. A lack of pliability can be a significant stumbling block to progress particularly in large organisations. Fitting the structures to the current needs leads to greater focus and a clarification of any difficulties with putting plans into effect. Once the structures are in place it is important to not continue adapting them. At the other extreme on the position / person axis, the combination of a

push activity that is done using one's *position* is described as *practice*, the ongoing administration of the work of the organisation in a regular way. The emphasis is on using one's position to complete the process.

This is a generic problem-solving process that is usable at each stage of the SDLC. Occasionally it can help to carry out a formal review of where one is in the cycle, especially where there appears to be a problem. Priority-Pointing (1974, in press) clusters and synthesises answers to questions such as "what do we have to do to complete the design process?" and "what is preventing us from delivering the new system?" (Table 3). While a group of decision-makers may offer a variety of answers to such questions, the imbalances in the number of the answers in the context of the many different combinations of two, four and eight cells in Figure 2 usually indicates clearly the next step that should be prioritised. The cluster of respondents' answers that articulated this view can then be reported as a proposed next step, in their own language.

IMPLICATIONS FOR INFORMATION SYSTEMS THEORY

Iivari et al. (1998) have reviewed the fundamental philosophical assumptions of five contrasting information systems development (ISD) approaches. The ideas in this paper correspond closest to the *Professional Work Practice* (PWP) approach (Andersen et al., 1990) which Iivari et al. included because it exemplified nomotethic and constructive research methods. The PWP approach emerged from empirical analysis of what systems practitioners actually do in practice. It is a descriptive system that relies on field studies and action research. It has been influenced by organisational learning theory and led to the usage of maps for diagnosing problem situations and metaphors for generating visions to help guide practitioners. PWP includes the use of twenty-four principles that are controlled via numerous dualities such as performance versus management, and planning versus evaluation. These dualities are mutually dependent and must be addressed together.

Iivari et al. (1998, p.171) criticise the PWP approach for its failure to see the importance of methods as "intellectual frameworks with which the experience can be compared and reflected upon". The absence of an underlying philosophical framework appears to have made it difficult for Iivari et al. to review the PWP approach with regard to ontology, epistemology, methodology and ethics.

In this paper we have relied on a method from CR of retroduction, which takes well founded empirical research and good management practice and devises a theory to explain them. The parallels between the PWP approach and the decision structures presented in this paper suggest the inescapable conclusion that each validates the other. The empirical evidence that led to the PWP approach supports the decision science proposal to introduce dichotomous thinking into the SDLC. The decision structure proposed here provides the intellectual framework missing from PWP.

The implication for IS theory is that the SDLC is a powerful three-layered generic structure that combines both objective and subjective problem solving processes. Objective processes should be employed within each step of the SDLC and should be implemented using adjustment decision-making to addresses imbalances between dichotomies, an approach that is not well understood in the West. It is clear is that this corresponds with *Yin* and *Yang*, concepts well known in Oriental culture and that, not only could the West benefit from a deeper understanding of them, but processes such as the SDLC would be enriched also.

Subjective processes should determine the movement between the steps of the SDLC and should be implemented using development decision-making in a holistic manner that draws eclectically from management and psychology. Current thinking in IS teaching would appear to be questioning the drift away from the SDLC. For instance, Whitten and Bentley (1998, p. viii) in the fourth edition of their text, have returned to the SDLC they used in their second edition because it offers a "simpler and cleaner 'problem-solving' approach to the subject". Their change of heart appears to have come from seeing the SDLC as a tool that transcends IS. Ultimately the benefit from having a robust formal intellectual framework for the SDLC will come from the increased understanding that it will bring. An example is the location of the design and acquisition stages of the SDLC (Table 3). In their second edition Whitten et al. (1989, p. 89) indicate they are in two minds about the order of these two stages. By the fourth edition (1998, p. 313) they have (incorrectly) put acquisition ahead of design. Their error arose because of the need to overlap these two stages. (In this author's experience, having worked on both sides of the computer industry, the power of the vendor and the limited options of the purchaser often have a major impact on the design of a new system. Nevertheless, deciding what system you want after you have considered how you are going to use it is an essential part of retaining control over one's choices.) This mistake seems obvious when seen in the light of a broader understanding of the SDLC. This point only scratches the surface of the benefits that come from a clear understanding of the structure underlying the SDLC.

CONCLUSIONS

In this paper we have shown that the Systems Development Life Cycle (SDLC) corresponds to a generic development decision-making structure based on a Convincing process embedded within a Committing process. Using comparisons with other systems we have revealed that an Adjusting process is embedded within each stage of the SDLC. Superficially this justifies the reinstatement of the SDLC as an important IS methodology. However, when the SDLC was in its heyday, typically there was one decision-maker, one project, one strategy, and a static IT market, facilitating the implementation of the SDLC as a formula. It appears that the future of IS will be characterised by changing groups of decision-makers, multiple projects, conflicting strategies, and dynamic IT markets. At any point we should be able to reconsider our commitments to IS development projects, check how convinced we are about their benefits, and be able to make appropriate adjustments. In this context we could benefit from having a better understanding of the processes involved and how they inter-relate.

Some understandings will be crucial to good project management. One is that inter-stage progression should be determined 'subjectively' by the decision-maker or organisation, while within each stage there are 'objectively' good and bad ways to proceed. Another is that good IT/IS management and good people-management should be seen as intertwined. Likewise, the boundaries separating different professions and different cultures should be seen as obstacles preventing us from learning from one another. The hope is that we will be better able to absorb people's experiences and understandings eclectically from every source, from psychology to Oriental philosophy.

REFERENCES:

Andersen, N., Kensing, F., Lundin, J, Mathiassen, L., Munk-Madsen, A., Rasbech, M. & Sorgaard, P. (1990). Professional Systems Development: Experience, Ideas and Action. Prentice-Hall: Hemel Hempstead.

Avison, D.E. & Fitzgerald, G. (1995). Information Systems Development: Methodologies, Techniques and Tools. (2nd ed.). London: McGraw-Hill.

Bhaskar, R. (1978). A Realist Theory of Science. In Archer, M., Bhaskar, R., Collier, A., Lawson, T. & Norrie, A. (Eds.) (1998). Critical Realism: Essential Readings. London: Routledge.

Brugha, C. (1974). The Appraisal and Alleviation of Transportation Needs in a Conurbation, unpublished MBA dissertation, Trinity College Dublin, Dublin 2.

Brugha, C. (1998a). The structure of qualitative decision making, European Journal of Operational Research, 104 (1), 46-62.

Brugha, C. (1998b). The structure of adjustment decision making, European Journal of Operational Research, 104 (1), 63-76.

Brugha, C. (1998c). The structure of development decision making, European Journal of Operational Research, 104 (1), 77-92.

Brugha, C. (1998d). A Generic Change Management Decision Model, In Matching Technology With Organisational Needs, Proceedings of the 3rd UKAIS Conference, Lincoln University, Chapter 39, 420-430.

Brugha, C. (1998e). Considering WSR In The Context Of Nomology, A Generic Meta Model For Systems Studies, In Proceedings of the 3rd International Conference on Systems Science and Systems Engineering (ICSSSE), Beijing, China.

Brugha, C. (1998f). Information Systems Development: Who Owns the Decision?, Systemist, 20, 48-63 (Special Edition). (ISSN 0961-8309).

Brugha, C. (1999). Trust and Commitment in Relationship Marketing, In Proceedings of the IMP Conference, Smurfit Graduate Business School, University College Dublin.

Brugha, C. (In press). An Introduction to the Priority-Pointing Procedure, Journal of Multi-Criteria Decision Analysis.

Checkland, P. (1981). Systems Thinking, Systems Practice. Chichester: John Wiley & Sons.

Churchman, C.W. (1979). The Systems Approach and Its Enemies. New York: Basic Books.

Foucault, M. (1979). Discipline and Punish: the Birth of the Prison. New York: Vintage/Random House.

Foucault, M. (1980). The History of Sexuality. Volume 1: An Introduction. New York: Vintage/Random House.

Galliers, R.D. (1991). Strategic information systems planning: myths, reality and guidelines for successful implementation, European Journal of Information Systems, 1, 55-64.

Galliers, R.D. & Sutherland, A.R. (1991). Information systems management and strategy formulation: the 'stages of growth' model revisited, J. of Information Systems, 1, 89-114.

Gu, J. & Zhu, Z. (1995). The *Wuli Shili Renli* approach: An Oriental systems methodology. In Gerald Midgley & Jennifer Wilby (Eds.), Systems Methodology: Possibilities for Cross-Cultural Learning and Integration. (pp. 29-38). England: Centre for Systems Studies, University of Hull.

Hamilton, W. (1877). Lectures on Metaphysics, Vols. 1 & 2, 6th Ed., in Lectures on Metaphysics and Logic, Edinburgh & London: William Blackwood & Sons.

Hofstede, G. (1980). Culture's Consequences, London: Sage Publications, Inc.

Honey, P., & Mumford, A. (1986). Using your learning styles. (2nd ed.). Maidenhead, Berks., England: Honey.

Iivari, J., Hirscheim, R. & Klein, H.K. (1998). A Paradigmatic Analysis Contrasting Information Systems Development Approaches and Methodologies. Information Systems Research, 9 (2) 164-193.

Inwood, M. (1983). Hegel. London: Routledge & Kegan Paul.

Johnsen, E. (1993). Strategic Analysis and Synthesis - An Axiomatic Model. Copenhagen: Copenhagen Business School Management Research Institute.

Jung, C. (1971). Psychological Types, In The Collected Works of C. J. Jung Volume 6, London: Routledge & Kegan Paul.

Kant, I. (1985). Critique of Pure Reason. (Translated by Norman Kemp Smith) McMillan, (First published in 1929).

Kant, I. (1987). Critique of Judgement. Indianapolis: Hackett Publishing Company.

Kubler-Ross, E. (1969). On Death and Dying. New York: Macmillan.

Maslow, A. (1987). Motivation and Personality. New York: Harper & Row.

Matthews, J. (1998). The World Atlas of Divination. Tiger Books International, p. 138.

Mearman, A. (1999). Towards a Critical Realist Econometric Methodology, Faculty of Business & Management Working Paper No. 31 / March, University of Lincolnshire & Humberside, ISSN 1465-2838.

O'Brien, J.A. (1993). Management Information Systems: A Managerial End User Perspective. Irwin: Second Ed. Homewood, IL.

Peace Pilgrim (1981). Steps Toward Inner Peace. Friends of Peace Pilgrim, 43480 Cedar Avenue, Hemet, California 92544.

Peters, T. & Waterman, R. (1982). In Search of Excellence. New York: Harper & Row.

Peters, T. & Waterman, R. (1991). Successful American Companies, Marketing Classics - A Selection of Influential Articles. 7th. Ed., Ed. Ben Enis & Keith Cox, Boston: Allyn & Bacon.

Pierce, C. (1867). in C. Hartshorne & P. Weiss (Eds.), Collected Papers of Charles Sanders Pierce. Cambridge, Mass.: Harvard University Press.

Secter, M. (1993). I Ching Clarified: A Practical Guide, Japan: Charles E. Tuttle Company, Inc.

Secter, M. (1998). The Yin-Yang System of Ancient China: The Yijing-Book of Changes as a Pragmatic Metaphor for Change Theory. David Lam Center for International Communication, Simon Fraser University, Vancouver (Burnaby), British Columbia, Canada.

Simon, H. (1977). The New Science of Management Decisions. Rev. Ed. Englewood Cliffs, NJ: Prentice-Hall.

Ulrich, W. (1983). Critical Heuristics of Social Planning - A New Approach to Practical Philosophy. New York: John Wiley & Sons.

Waterman, R., Peters, T., & Phillips, J. (1980). Structure is not organisation, Business Horizons (June).

Waterman, R. (1982). The seven elements of strategic fit, The Journal of Business Strategy, 2 (3), (winter).

Whitten, J., Bentley, L., & Barlow, V. (1989). Systems Analysis and Design Methods. (2nd ed.). IRWIN.

Whitten, J., Bentley, L., & Barlow, V. (1994). Systems Analysis and Design Methods. (3rd ed.). IRWIN.

Whitten, J., & Bentley, L. (1998). Systems Analysis and Design Methods. (4th ed.). Homewood, IL, IRWIN / McGraw-Hill.

William of Ockam (1993). Ockam's Razor or principle of economic thought, In L. Bahr & B. Johnston, (Eds.), Collier's Encyclopedia. New York: P.F. Collier, Inc.

Woolfe, R. (1993). The Path to Strategic Alignment, Information Strategy: The Executive's Journal, (Winter), 13-23.

Zhu, Z. (1998). Cultural imprints in systems methodologies: The WSR case, Proceedings of the 3rd International Conference on Systems Science and Systems Engineering (ICSSSE), Beijing, China.

Zhu, Z. (2000). WSR: A systems approach for information systems development, Systems Research and Behavioural Sciences, 17 (2), 183-203.

Figure 3: Adjustment activities and eight archetypes of the *I Ching*

Authoritarian, unyielding, control,
resolute, principled, homogeneous

Determined, self-assured, flexible, subtle,
vigorous, cerebral, purposeful, secretive

Passionate,
clever,
explosive,
energetic

Protective,
securing,
reliable,
solidity

Volatile,
provocative,
audacious bold

Provocative,
insecure,
unpredictable

Energizing, impulsive,
imaginative, resilient

Adaptable, absorbing,
cohesion, heterogeneity

HEAVEN / ENERGY · PRACTICE · PUSH · PLACE
WIND / WOOD · POUNCE · PROPOSITION
FIRE / LIGHT · PLIABILITY
MOUNTAIN / MOUND · PROCEDURE · PLANNING
PUTTING
LAKE / PRECIPITATION · PRODUCTIVITY · PULL
WATER / ABYSS · PRICE · PERCEPTION
THUNDER / SOUND · PROMOTION · PEOPLE
EARTH / MATTER · POLICY · NOTION

111 011
101 7 3 001
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110 6 2 010
     4 0
100 000