REFLECTIVE ARGUMENT AS A DESIGN THEORY

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Abstract

This paper presents a design theory, an explanation why to use a particular structure for the design of socio-technical systems. This theory was created from merging argumentation theory and reflective thinking. After highlighting the relevant attributes of these, the paper goes on to demonstrate three different ways this design theory has been applied in practice. The dialectic of argument and the a priori of participants are seen as significant resource to avoid an idealistic search and quantitative evaluation of all issues and options that present themselves when designing a complex socio-technical system. Some of the existing research in support this theory is summarized, as are some future research possibilities; ones that keep the IT artifact relevant.

Keywords: Argument, reflection, design theory, socio-technical systems

REFLECTIVE ARGUMENT AS A DESIGN THEORY

Introduction

This paper presents a design theory that states that the principles of critical argument and reflective thinking are useful for the design of complex socio-technical systems. Specifically the paper will explore the conjecture that a synthesis of critical thinking (Eemeren 2003) and reflective thinking (Dewey 1910) called, 'reflective argument', provides a pragmatic (i.e., it works in practice) design theory and thus an appropriate means to define, design and develop complex socio-technical systems. Socio-technical design is seen as a creative group process of research and application. The design theory being suggested here makes extensive use of participants' prior experience and of their editing conjectures, through social interaction, to achieve a solution agreed by the stakeholders to be satisfactory given the situation. It is therefore more aligned with the softer systems thinking theories (Churchman 1971) than a causal social theory.

After briefly explaining its interpretation of 'what is design theory', the paper will discuss the many facets of critical argument to establish its credibility as a pragmatic research and design tool. Next, reflective thinking will be explained with its emphasis on validating conjectures. This is undertaken to bring out the attributes of these social practices for creative yet pragmatic design. Three illustrations of processes designed around the attributes of reflective argument are then presented to illustrate how the theory can be applied. The conclusion will attempt to summarize reflective thinking as design theory after some suggestions for research that flow from reflective argument theory.

Explaining Design Theory (Theorizing)

Hooker (1991) argues that design theory is possible, while Gregor (2003) and Markus (2001) and Walls et al. (1992) think more design theories are required for socio-technical system definition and development. All of them appear to believe that a working definition of 'theory' is as an explanation 'why'. It may also be a classification or a prediction; whether it is also a perspective or an argument is left to debate elsewhere (Hooker 1991) (Walls et al.

1992). Of course, care has to be taken not to confuse theory with 'in theory' or theoretically meaning 'hopefully' or 'in an idealized state'. Walls et al. (1992) define a *design* theory as 'explanation how to structure' but this seems to be another way of saying a theory 'explains why' a certain structure should be used[1]. The more universal the number of systems that can be designed from one particular 'explanation why', then the more elegant is the theory. For example, that bodies attract each other is a fairly universal explanation of why unrestrained weights tend to move towards the earths centre and why pendulums swing; the theory of gravity.

However, Hooker (1991) argues that given unique human groups and their situations, a universal (all time, all place) theory is not possible. While agreeing with Hooker about the problems with the universality of human behaviors, it is still claimed in this paper that argument and reflective thinking can provide a generalized design theory to explain why people may want to use a certain process. Hooker, a software engineer, seems to be assuming a design theory is a step-by-step machine-like process. However, as an 'explanation why', reflective argument theory is seen as similar to the softer systems theories of problem solving (Checkland 2000; Ackoff 2000) in providing a useful explanation why stakeholders should be involved in designing complex systems and thus how so. Design is assumed to be essentially a group based creative thinking and research process, under constraints of time, cost, imagination, functionality, relativity and hierarchy. In this environment, and given the rapid changes in technology, design is perhaps as much about how to gain insight as it is about the rigorous collection of information.

That designing successful socio-technical systems is a very complex exercise has been identified by numerous researchers; e.g., Avison et al.(1998), Wastell (1996), Fitzgerald (1996), Truex et al. (1999), Mitroff and Linstone (1993), Settle-Murphy and Thorton (1999) and Checkland (2000). These authors point out that design is a difficult enough task with physical construction projects, but with socio-technical systems being designed amidst dynamic technological development and involving life sustaining knowledge, the problem can be particularly complex; problems and politics emerge. Many researchers (e.g. Mitroff and Linstone (1993); Checkland (2000); and Darke and Shanks (1997)) emphasize the need for ongoing appreciation (Vicker 1984)) of stakeholders' viewpoints as an essential aspect of

[1] The question why and how are linked. Repeated (child like) asking 'and why is that', leads to 'how'.

the design of process. Darke and Shanks (1997) list fifteen possible techniques for understanding and representing viewpoints; but they then observe, with some concern, that within their case studies very little time was actually spent on aligning viewpoints. Settle (1971) argues that organizational critique is the key to complex social system design. Ulrich (1983; 2001), over a period of twenty years, has been arguing for managers to develop critique heuristics to reveal underlying assumptions inherent in proposed projects. The bag of critique methods available for organisations to apply includes Morgan's metaphoric analysis (1986), and Marx and Engels' dialectic forces (Sowell 1985). However, this paper will focus on one of the most ancient and most common of all the methods of critique, that of critical[2] argumentation. The core tenet of critical argument, while being more of a conceptual frame than Darke and Shanks' fifteen techniques, is to allow stakeholders to learn from rationally justifying their own viewpoint, while appreciating the rational justification of other viewpoints.

Explaining Argument (Theorising)

Without Contraries is no progression. Attraction and Repulsion,
Reason and Energy, Love and Hate, are necessary to Human existence
(William Blake, extract from "The Argument")

As the design theory outlined in this paper draws on dialectic argument as a creative mechanism for research and design, the choice of argument to provide a theory needs to be justified. This will be attempted by identifying the relevant attributes and assumptions inherent in the process of arguing.

Social and Political

Argument provides a design theory where rationality is explicitly immersed in social and political reality. Eemeren et al. (1987) provides the following definition:

[2] This defines 'critical' as critique, insight, not as it is intended in critical social theory, or engineering, or medicine.

"… a verbal, social, and rational activity aimed at convincing a reasonable critic of the acceptability of a standpoint by putting forward a constellation of one or more propositions to justify this standpoint."

This identifies argument as a group knowledge sharing process that affords some respect to all those present, which should not be confused with quarreling. The images conjured up by structured 'debate' or 'negotiation' may be more insightful. An argument is a means of critiquing conjectures with the aim of gaining insight from different starting positions. Eemeren's definition is in danger of over emphasising the persuasive attributes of argument; rather its role is as part of a creative learning process. Attempts at convincing are important but only to establish a creative dialectic.

The creative dialectic is possible if one proponent takes a position and attempts to present convincing evidence to others in order for them all to explore alternative claims. The audience is expected to take an active role in creating understanding by responding with counter arguments. Within this dialectic, back and forth process, learning (knowledge creation) is expected to 'unfold' (Ulrich 1980) and knowledge claims to be validated (Churchman 1971). As will be discussed in more detail later, this approach of creating and validating ideas may provide some egalitarian thinking about how a justified design can be created. Presenting design as an argumentative *process* makes it clearer that it involves an ongoing two-way dialogue between all parties intended to encourage both the designers (as researchers) and those being designed for to learn interactively from each other. The primary purpose of an argument is to not to persuade but rather to provide an interactive means of inquiry and co-learning, to enable all involved to better appreciate the situation (Gage 1996).

Eemeren et al. (1987) (2001) point out that an argument uses emotions to improve reasoning. Emotion is likely to be present in any social activity where there are two people present holding differing concerns derived from different histories. While the rules of argument provide the structure to ensure reasoning prevails through this act of mixing differing concerns, emotions are needed to provide motivation. This is needed to both start the argument process and to encourage creative counters. Argument is an 'an activity of reason' that makes emotions explicit rather than merely condemning them as inappropriate. Eemeren

et al. (1987) (2001) contrast this with alternative models of knowing, where knowing is only acknowledged as the linear output of solo unemotional reasoning or empirics.

Habermas (1990) provides very extensive and detailed rules for how to use argument in the public sphere for emancipation, democracy and public debate where issues of power imbalance become very relevant. Mao (1967) had already made the point that in any argument there will be a strong side and a weaker one. The task of arguing against the dominant forces is far harder than arguing for the 'established'. The greatest challenge to any design theory may be how it deals with unequal power between stakeholders. The rules of argument at least make the issues of unequal power between interlocutors explicit. While accepted that it is most likely impossible to totally remove power issues from any social activity, by making the rules for argument explicit at least some attempt is being made to counter power not reasoning from determining the design of society.

Meyers and Seibold (1989) provide an extensive review of the use of argument in the decision making literature. They conclude that utilising argument contributes to higher quality decisions, and that it is both useful for surfacing assumptions and evaluating information in uncertain and ill-structured situations. They go on to say that arguments are both the 'medium' and 'outcome' of group interaction. Well managed, argument is a group social practice, which is why it works so well for negotiations between powerful stakeholders (constituents, interlocutors). Arguments are both a system (observed patterns of interaction) and a structure (the unobservable generative rules and resources that enable argument). This links into the structuration theory presented by Giddens (1984), who sees society only in terms of rules and resources. Argument can be seen as culturally appropriate and sanctioned rules for social action through dialogue. Meyers and Seibold (1989), following Giddens, state that argument provides the interaction system (rules) needed to re-allocate resources. This is contrast to Luhman's view of society as only communication between people. However, this too can be linked to argument as one way to structure these communications.

Epistemology

Argument is an ancient epistemology; it validates and thus creates knowledge claims. Design is seen as an argumentative process and technical artifacts are seen as containing inherent

knowledge claims that need to be exposed, validated and improved. This next section will briefly summarize the history of argument in order to demonstrate how it is linked to the production and validation of knowledge. By presenting the history the pedigree of argument as an inquiry methodology is reestablished and perhaps a beginning is made to rationally explain the epistemology of reflective argument theory. Its epistemology determines how knowledge relevant to the design of a system is collected and validated.

Making the connection between argument and knowledge validation dates at least back to Socrates. We know this from the writings of his student Plato about Socrates' Dialogues with Athenians around the middle of the 5th Century BC. Plato presents Socrates as being aware that questioning and language has to be the basis of reason and appreciating the need to be explicit and upfront with knowledge claims which then have to be justified to a skeptical community. The political and social dialectic that fuelled Socrates' and Plato's knowledge validation system was their opposition to the influential Sophists. Many of Plato's dialogues demonstrate and explore Socrates' questioning method and his struggle with the Sophists. While all parties agreed with the need for the presence of persuasion, Socrates accused the Sophists of being more focused on the art form we might call 'rhetoric', that is, to persuade for its own rewards, not persuasion for the understanding and inquiry. Aristotle (in *Rhetoric*) classifies types of dialectic argument. His classification is linear, moving from rigorous logic (e.g. if X and if Y then Z), through informal logic, courtroom style controlled debate, speeches of politicians, to quarrels where ad hominem attacks have to be countered. Poetry as descriptive work was treated separately, as he thought this was a higher form of language not relevant to validating knowledge. Interestingly Aristotle was nervous of Socrates' questioning method of validating knowledge claims, preferring instead reason and logic statements.

Walton (1998) updates Aristotle's classification providing further categories of the less formal types of argument. He demonstrates the many uses and facets of argument (see table 1) suggesting that each facet is best appreciated by evaluating competitive dialogue in terms of its purpose (drivers).

Table 1. Eight Types of Argumentative Dialogue:

Type of Dialogue	Initial Situation	Goal	Benefits
1. Critical Discussion	Difference of opinion	To convince other party	Understand positions better
2. Debate	Adversarial contest	Persuade third party	Clarification of Issue
3. Inquiry	Lacking proof	Prove or disprove Conjecture	Knowledge
4. Negotiation	Conflict of interest	Maximise gains	Settlement and Consensus
5. Planning Committee	Collective action required	Joint plan or decision	Airing of Objections
6. Pedagogical	Ignorance of one party	Teaching and Learning	Spread of Knowledge
7. Quarrel	Personal Conflict	Hit out verbally	Venting of emotions
8. Expert Consultation	Need for expert advice	Decision for action	Second hand knowledge

While all types of argument might be used in the design of a socio-technical system this article will focus on argument as a means of inquiry (item 3). Perelman et al. in 'The New Rhetoric' (1969) offer a rich discussion on argument as integral to rigorous and insightful inquiry. They present new ways to construct evidence, discuss types of arguments, types of counters and the role of analogy in argumentative inquiries. The creative powers of this form of argument are believed through what Churchman (1971) calls the 'guarantor' of competition between well motivated interlocutors.

After the ancient Greeks, the next philosopher who seems to have had an influence on how we see the relationship between argument and knowledge is Ramus in the early 16th Century. Crosswhite (1996), who is interested in reconnecting voice and reasoning in research, and

Ong (1982) who is interested in the demise of orality, are both concerned about the influence of Ramus. While Ramus is mainly credited as being the father of the modern University lecturing modes of learning (the Sermon on the Mount model), he seems to have also started the separation of 'voice and reasoning' (the decay of dialogue) in rationality. The modern image of the silent scientist, not as an arguer, may result from his influences. Aligned with the idea of purified priests, and absolute monarchs, Ramus saw becoming a scientist as a path towards purification by striving to rise above bias, and in the way monks undertook periods of silence, language in science was seen as a source of bias. Bacon, with his four idols of the marketplace, the tribe, the theatre, and the cave, is not convinced that bias can be purified from the mind. So his influence was to encourage use of repeatability by a sceptical audience to define valid knowledge. However, Ramus influence still may have undone Socrates, Plato and Aristotles work and encouraged the separation of argument from knowledge.

In his historical study of 'Classical Rhetoric', Crosswhite (1996) continues to identify how argument became temporality separated from science. He notes that Bacon's guidelines for appreciating bias are turned into rules by Descartes, according to whom knowledge was inside you, drawn out through very careful reasoning, perhaps arguing but only with yourself (Billig 1996). 'Flowery' language and loose 'political' argument with others was to be avoided. This further encouraged the image of the silent lone scholar. Both Ramus and Descartes were focused on the individual, the sinner; in contrast, the modern understanding is of sociology where humans are seen to very influenced by social networks (Luhmann 1995), culture, and their associated paradigms (Kuhn 1970). For Descartes and Ramus the lone scientist creates knowledge, it is not held Giddens like (1984) as rules and resources of a networked scientific community. They see language as only used to inform the scientific community, not to create knowledge. Argument with others was seen as acceptable for communication between scientists but it was not how to create valid knowledge. Broad and Wane's (1982) extensive listing of the political and self serving antics of famous scientists further undermines any belief that scientists are, or should be, 'pure' priest-like and unaccountable to society, only required to argue with themselves.

Support for the epistemology of argument is has gathered numerous and diverse supporters in the 20th Century. At the turn of the 20th Century, Dewey wrote about '*How We Think'* (1910).

In his early definition of thinking he attempts to distinguish between 'daydreaming' and thinking for inquiry. He uses the term reflection to explain this careful thought process:

> *…the most important factor in the training of good mental habits consists of acquiring the attitude of suspended conclusion, and in mastering the various methods of searching for new materials to corroborate or to refute the first suggestions that occur. To maintain the state of doubt and to carry on systematic and protracted inquiry – (J.Dewey, 1910, How we think)*

This sounds very much like an argument if only with oneself. Billig (1996), a physiologist, explores this issue of arguing with yourself, something he calls 'witcraft'. Mental problems are seen as a failure to win an argument with one's self. Unresolved issues, such as moral dilemmas about how to act in some awkward social situation, or why you can be fond of someone who treats you badly, need to be argued in your own head first, Descartes-like. Failure to do so may cause mental stress and instability. Relating this to the design of a socio-technical system, does it mean that there is only one designer who needs to win the argument with him or herself before arguing with the stakeholders; surely not? Discussion with the other designers and stakeholders must be part of everyone's creative thinking processes. However, Dewey and Billig's focus on arguing with oneself does support argument as a process that aligns to how *we* think, with how *groups* think.

Churchman (1971), philosopher, and past editor of the Journal of Philosophy, has an Aristotelian view of argument for inquiry. This is evident in the way he uses the word dialectic, which is picked up by his now eminent ex-students (Mason 1969), and his understanding of argument as a way of letting in different concerns to improve appreciation. Given Churchman's very significant influence on the softer systems thinking theories, the link between the epistemology of systems thinking and argument is made (Ulrich 2002). He credits Kant, in his Kantian inquiry system with the approach of argument for the justification of empirics. Churchman, in his Hegelian inquiry system credits Hegel with the idea that society needs to argue out new interpretations (paradigms) against established community knowledge (Missimer 1995).

No discussion of argument in the 20th Century can fail to mention Toulmin (1964). His work allowed a justified move from predicate logic, which at the time had been so dominant in English philosophy, to reasoned discussion. The relaxation of the rules of logic into informal logic, also allowed by Russell's work, highlights the need for apparent leaps of faith even in mathematical proofs. Informal logic moves away from a conclusion (Socrates was mortal) that must be 100 per cent derived from the premises (all men are mortal, and Socrates was a man), to a conclusion being somewhat reasonable given the 'weight of evidence'.

However, it was Popper's writing in 'Conjectures and Refutation' (1963) that provides the strongest justification for argument as a rational epistemology and thus a valid means for designing socio-technical systems. He sees a knowledge claim as starting as a conjecture (hunch, supposition claim, argument) that one scientist tries to support with reasoning and empirics anticipating others will, and should, try to refute. This is Popper's theory of 'trial and error'. Popper's theory is important because it aligns with how this article suggests system development should be designed; namely, as a contest of ideas. It also aligns with the second thread of reflective design theory, presented later, namely Dewey's reflection.

Rehg (1999) provides direct epistemological support for argument. He sees it as a middle road between objectivism and relativism. He sees the need for a wider definition of knowledge than only measurable and repeatable facts for the design of complex socio technical systems within reasonable timeframes. However, including personal experience and interpretations of stakeholders as knowledge may allow in the horrors of relativism. The middle ground is to allow for both, a physical world and interpretations (viewpoints) of that world. However, both of these have to be fully and rationally justified to a knowledgeable sceptical audience.

Creative Dialectic Tensions

Having discusses two attributes of arguments relevant to its use to design socio-technical systems, a third is now introduced. Missimer (1990) presents the case for argument in terms of its being preferable to aggression, lying and ignorance. She also (1995) seeks empirical evidence that argument leads to knowledge creation. The examples she draws on include Galileo and Columbus as these people had to argue their case against a dominant

understanding. They won, and so knowledge increased. Missimer is therefore an advocate for her Alternative Argument Theory, which states that an argument is improved if it is against an alternative rather than just the negative of itself. Her work underscores the drivers of argument as a knowledge validation method as including dialectic tension.

Engels (1964) discusses the centrality of the dialectic tension in nature, as background for his interest in underlying tensions in society. An animal exists in dialectic tension with its environment. If it wants to eat it must kill something in its environment. If its young are to survive other young must die or not be born. The design of a new building is the result of numerous tensions between functionality and cost. These tensions struggle with each other and what we see physically is the result of those tensions. When admiring the detail of the human body, the skill of an animal or the beauty of a building, what is being admired is the creative power of the underlying tensions which we know can only too easily become destructive. This tension if not too excessive and not too weak seems to provide an breading ground for the creative generations and validation of ideas.

The psychology researchers Tracy and Glidden-Tracey (1999), propose three elements that are pertinent when a group need to learn from each other: "(a) focus on underlying assumptions, (b) avoidance of compartmentalizations of components, and (c) iterative comparisons of assumptions across components." This can be seen as a call to allow creative tensions. Revealing underlying assumptions should be slightly challenging and surprising to those involved creating some tension in their reasoning. Compartmentalising, of decomposing components is a way of avoiding tensions, paradoxes and contradictions compared to when the components are synthesised. For example I could compartmentalise my evaluation of a colleague as a nice person who is very poor at meeting deadlines. When asked if he or she should be asked to undertake a task, some tension would arise in my mind.
This emphasis on revealing underlying assumptions and not over controlling cross fertilisation of ideas is an integral part of argument because it creates tensions. Tracy has found empirically this lead subjects generating more ideas. This is particularly relevant to the creative participatory design of socio-technical systems.

Mason and Mitroff (1969), following Churchman, take a more organisational theory approach to encouraging a creative tension. They suggest developing corporate strategies by equally

funding the background research into two alternative strategies, which then need to be argued through with the senior managers. Niessen takes up this idea (1996) of encouraging creative tension and identifies the presence of up to five organisational tensions that already exist. He warns they should not be allowed to become to tense but may be creative if well managed. Linstone (1999) suggests using a multiple perspective on complex problems to encourage a creative tension between these perspectives with the intention of learning. His perspectives are a technical, organisational and personal. For example, a machine may be technically efficient, exposing a company to take over risk and yet very demeaning with the operators. Tension is caused by asking if the company should invest in this machinery.

In Summation

The three principle attributes thought relevant using argument as a design theory have just been discussed. These are summarised in table 2, 'Attributes of Argument'. They encourage two further implicit attributes that are summarised in table 3. Later, these will be used as guiding principles to explain why process of designing a complex socio-technical system should be structured in a particular manner.

Attribute	Comment	Reference
Social and Policial	Argument is a social inquiry process that deals with power issues by providing dialogue rules to give all stakeholders a voice.	Eemeren, Perelman, Churchman, Ulrich, Gage, Habermas, Mao, Myers and Seibold, Giddens,
Epistemology	There is a long history of evidence that argument is a research (inquiry) method, it creates and validates knowledge in a rational manner using reasoning and empirics.	Socrates/Plato, Aristotle, Walton, Crosswhite, Ong, Gage, Dewey, Billin, Popper, Regh, Toulmin.
Creative Dialectic	Argument for design uses dialectic in a mildly competitive manner to its creative abilities. Alternative arguments, and competitive dialogue are examples.	Missimer, Engles, Tracy, Churchman, Mason, Mitroff, Niessen, Linstone.

Table 2: Attributes Of Argument

Attribute	Comment	Reference
Underlying Assumptions	Argument can be active in revealing underlying assumptions or hidden bias in knowledge claims.	Socrates/Plato, Aristotle, Walton, Churchman, Mason, Tracy, Meyers and Seibold, Broad and Wane.
Multiple Perspective	To be ethical, argument should give all stakeholders a voice and encourage innovative rationally justified ways of seeing situations.	Churchman, Mason, Mitroff, Linstone,

Table 3: Implicit Attributes Of Argument

Explaining Thinking (Theorising)

This paper's explanation why to structure the designing of a socio-technical system in a certain manner draws on two intertwined explanations of how humans create and validate knowledge. Argument has just been outlined; the second thread is from Dewey's conception of 'reflective' thinking.

It is possible that the conventional wisdom about how humans think, how they solve problems does not accurately reflect Dewey's seminal philosophy. These concerns are not new, many writers including Mason and Mitroff (1981) and Mintzberg and Westley (2001) have reported a mismatch between what problem solvers actually do and the traditional 'steps' of good problem solving. The modern foundation of the 'steps of decision making' appears to be from Dewey's book '*How We Think'*, but they seem to have been misinterpreted. The way the steps often presented are typified by Mintzberg and Westley (2001) as, define the problem, diagnose the causes, design solutions, choose and implementing the solution. At its core is the idea that the solution comes *after* the collection of information. However, this may not be what Dewey intended, which is why he called human problem solving, 'reflective' thinking.

An alternative interpretation of Dewey's argument is that the stepping stones (not stairs) to problem solving place tentative solutions or conjectures (to use his word) prior to a process of rational justification (reflection). Those readers who pride themselves on their scientific, rational thinking may be uncomfortable with the idea that useful problem solutions arrive prior to any reasoned thinking process, including the collection of relevant information. Those who follow Checkland's (2000), Rittle's (1973); Mason and Mitroff's (1981) ideas that problem appreciation ***is*** problem solving may feel more comfortable with this suggestion as problem appreciation is seen as the social construction of problems and solutions. The assumption that problem appreciation and information (evidence) collection comes before solutions is reinforced constantly in ex-Descartes cultures. It is reflected in Sherlock Holmes' advice to Watson not to guess 'who-done-it' until all the evidence has been collected. However, it is being suggested here that these traditional stepping stones to rational thinking are in the wrong order.

Dewey (1859-1952), described by some as the most influential philosopher on thinking and education in the 20th Century, spent the second half of his life in the department of philosophy at Columbia University. Like Schon (1983), he is thought of as a writer on educational philosophy yet both of their works have been seminal to the management literature. Newell and Simon (1972) cite Dewey in their own oft-cited book 'Human Problem Solving,' as does Churchman (1971) in his, oft cited, book, 'The Design of Inquiry Systems'. Simon won a Nobel prize and Churchman was short-listed. In more modern times Mintzberg (2001), a seminal figure in the management research literature, directly attributes the rational steps of decision making to Dewey. Dewey spells out the steps (or as he says, constituents) of reflective thinking (1910).

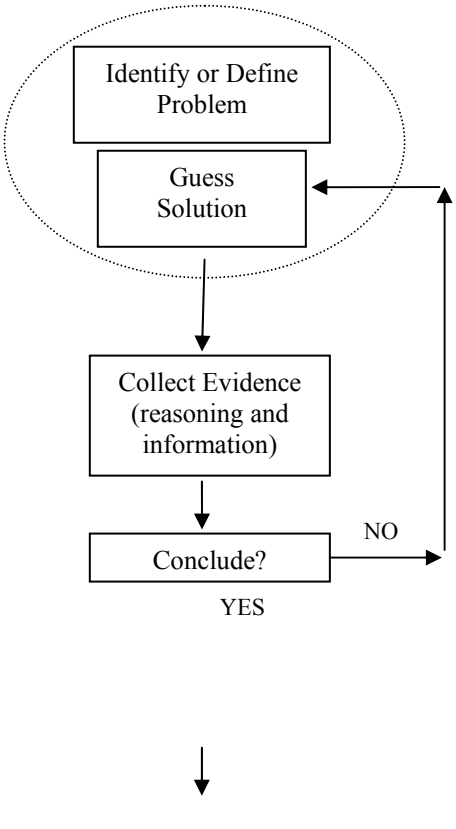
Dewey's book starts by defining thinking, which he wants to distinguish from 'daydreaming'. He specifically means focused, purposeful, rational and intelligent thinking as used by successful scientists. He uses the label 'reflective thinking' in a way we might talk of 'critical', 'careful', 'considered', or 'deep' thinking today, but importantly he seems to insert the word 'reflective' to emphasise thinking as a process of reflecting very critically upon a prior yet to be fully evaluated belief or 'first thought', or conjecture or some other 'supposed form of knowledge'.

Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and further conclusions to which it tends, constitutes reflective thought…

…it is a conscious and voluntary effort to establish belief upon a firm basis of reasons (1910, p. 3).

While the examples of reflective thinking provided by Dewey are very 'everyday' he does argue that we use the same critical thinking process whether it is on everyday scheduling problems, scientific research or large project management. Dewey does not accept we can help but 'jump to conclusions' immediately we start to formulate a problem, a gap between an ideal state and a desired state. Not making these intuitive conclusions explicit, at least as assumptions, may confuse problem solving when having to work in groups. Dewey does not believe that careful thinkers start with an empty head, only coming to a conclusion after some careful consideration of the facts. Rather careful thinking needs to be applied to the un-validated beliefs that jump into our heads when the problem is first being appreciated. He presents thinking as following the stepping-stones as laid out in figure 1.

Figure 1: Dewey's Steps to Thinking



Guindon (1990) provides empirical support for Dewey's explanations for how designers actually think, how they really solve problems. He compiled a protocol analysis of three professional designers who are designing lift (elevator) control software. Guindon struggles hard to apply Simon's ideas of ill-structured problems to describe the trial and error heuristic processes he thought designers were trying to complete in order to produce an effective design. These designers were well qualified, and very experienced. Guindon calls what Dewey calls reflective thinking, opportunistic thinking:

> *This study shows that the early stages of the design process are best characterised as opportunistic (1990, p. 336)*

He found that designers frequently jumped at solutions, and then thought carefully about whether these would work when compared to the requirements. These 'guesses' were accepted, modified or rejected after further thought or testing. There was not a linear process of appreciating the requirements, collecting facts and selection of alternative solutions and then selecting a solution. Guindon does not mention Dewey, rather he is concerned that his designers are not following Simon's interpretation of the traditional steps, suggesting this may be because humans only have bounded rationality and are imperfect at reasoning. This assumes Simon's problem solving algorithms are an idealised form of human problem solving that somewhat inadequate humans should aspire to. Dewey's is more pragmatic; he is interested in how humans really do think.

Mintzberg (2001) has also noted that some problem solving seems to jump to the solution before any reasoning or evidence has been collected. What Dewey calls reflective thinking he calls the 'seeing first' approach (having insights) to problem solving and decision making. He contrasts this with the traditional step approach because he has the experience that people often seem to have solutions in search of problems; hammers looking for nails. This is reminiscent of Chamber's theory laden observation. Mintzberg cites March as characterising problem solving as:

…collections of choices looking for problems, issues and feelings looking for decision situations in which they may be aired, solutions looking for issues to which they might be an answer and decision makers looking for work. (2001, p. 90)

Mintzberg's 'seeing first' approach uses the example of a family seeing a black stool and declaring it as the solution to the problem of a colour scheme for their new apartment. The apartment is then totally redesigned, successfully, around this stool. The conventional thinking approach would suggested been to set the colour scheme (plan) and then find furniture and coverings to suit (actions) the plan.

Mintzberg has a third option of 'doing first' thinking, which aligns with the action learning or practitioner ideas of Argyris and Schon (1996), and which suggests that when a problem is identified intuit some action, do it and then think about what happened. We understand our situation from our acts. Again, the thinking comes after the guessed solution. The doing is expected to provide some experiences to think about. This might be seen as similar to the 'seeing approach' where the action is more to 'see' (think) than to act per se.

At a more physiological level an instinctively rapid, rather than considered, response to patterns recognised as threatening does appear to be justifiable in evolutionary terms. It would give survival advantages to those who had these skills. Examples include rapid hand closure on electrocution and rapid eyelid closure on perceiving the approach of explosive heat. These can be seen as a very instinctive form of problem solving. The rapid instinctive action would seem to involve the brain recognising and responding to patterns that evolution has selected as a successful response. However, some readers may want to distinguish this sort of instinctive reaction from 'rational thinking'. Yet, these mental responses involving instant pattern recognition at least opens the door to an approach to thinking that aligns with the idea that the brain very quickly jumps to conjectures, for it is a rapid pattern recognition organ. In the psychology literature this is often referred to as 'automatic thinking' (Bargh, (1997). As Dewey seemed to be suggesting above, reflecting carefully, rationally, scientifically, methodically, and systematically on instinctive responses is perhaps one way of understanding 'high level' thinking. It is to be contrasted with the idea that high level thinking starts with an empty, objective mind.

The 'automatic thinking' line of argument from psychology is that the human brain develops schema or mental models to enable us to interpret what we see. This is similar to Kant's notions of a priori, Churchman's perspectival thinking and boundary shifting in systems thinking (Ackoff 2000), and Chalmer's theory laden observation. At the cognitive level

‘vision’ can be explained as the brain very rapidly putting a pattern on to the stream of input sensed by the eye. This is perhaps appreciated by recounting the experiences of adults who undergo eye surgery to successfully correct birth defects causing blindness. In some cases the blindness is caused by a physical fault in the eye that can be corrected by surgery. After the operation, while technically their eye ‘works ’, they are unable to decipher the confusing pattern of colours and lights entering their eye. This is apparently not due to some further fault with the optical nerves; rather their brain has no schemas to interpret the shapes and patterns of light entering their eye. We need schemas to work with the sensory inputs to enable us to ‘see’.

Gilbert (1991) argues “as perception construes objects, so cognition construes ideas”. He compares Descartes ideas on how we move from an idea to a belief with those of Spinoza, and opts for Spinoza. Descartes suggests we appreciate ideas in a neutral form and then later decide if they are to be believed or not. Spinoza suggests that the act of appreciating an idea is synonymous with believing it. We have to actively then set about a process of critiquing this belief if we are later to disbelieve it. The evidence Gilbert provides to support his argument is quite extensive including noting that children have to be taught to be disbelieving, and that our language defaults to belief, so it takes more words to state something in the negative. Gilbert reviews the psychology literature on people making decisions when stressed. Their default position is to act as if anything they have been told was correct. Moreover, subjects who were told the information they were being given was false, when stressed, then used it as if they believed it. This all aligns with the human information processing research that shows a general failure of people to seek disconfirming evidence as part of their inquiry strategies.

The conjecture-first argument of how we think can also be aligned with writings in the theory of knowledge philosophy. Many philosophers comment that questions are at the beginning of human thought. Crosswhite (1996) in his support for argumentative reasoning argues however that we should really start with the tentative conjectures not the later verbalised question. Children, as well as dumb and deaf people and species without language, all of whom do not have the linguistic device of questioning, or without knowing what a question is, can solve problems. They can be expected to become confused as they try and impose a pattern on sensory input. They can also be expected somehow to make sense of these images

or noises if only to classify them as 'problematic' by thinking up conjectures (solutions, ideas) that do or do not 'fit'. However, unless these people without questions have rational reasoning skills they might not be able to reflect, to justify their conjecture in an explicit manner, which could aid community learning. Crosswhite seems to agree that the brain jumps to conjectures based on genetics or experience almost instantly upon our receipt of new sensory input; it gives pattern and meaning to these inputs. If the patterns work then there is no problem; conversely if the guessed at patterns do not seem to fit the sensory input then a problem is declared. Inductive science suggests we should somehow suspend this instant pattern recognition, and instead collect evidence in a state of suspended judgement. Crosswhite feels this is not really possible and repressing this first impression will distort what is seen as relevant evidence. He rather suggests that we acknowledge explicitly what our brains have conjectured and set about confirming or disconfirming it in a methodical manner.

Removing the evolutionary perspective, the theory of knowledge literature also supports this conjecture-first approach in two related ways. One is Popper's (1963) ideas of presenting conjectures for falsification. Popper's conjectures are meant to be more thought out than instinctive responses, but the basic layout of having an upfront explicit conjecture that needs to be proved to a sceptical audience is the analogous notion. It was intended to be contrasted with the discovery approach of seeking evidence prior to finding some solution. The difference seems to come down mainly to whether you believe that very provisional conjectures can be completely set aside prior to evidence collection, and whether ***non*** theory driven observation can actually be undertaken.

Another strand of thinking that appears to support the 'conjecture-first' approach to thinking may be drawn from the words of that classic problem solving text by Polya (1945): 'How To Solve It', aimed at mathematicians. It provides a method for tackling the creative process of solving mathematical and geometric problems which is to try using existing solutions to old problems. This is elaborated in the third step, which he states as testing to see if the old analogous solution or at least similar concepts work for the new problem. Polya, who is a well-respected author on problem solving, is therefore not suggesting that solutions come after reasoning about alternatives. Rather, he suggests that you search for a conjecture solution (from an analogous problem) and then think about its usefulness for the current problem. This again seems very much like Dewey's advice and the advice of argumentative

inquiry. In other words, conjecture something that might work, and then think about the feasibility of this solution carefully.

So in summary, in situations of socially constructed problems and solutions, with imperfect knowledge, and under time constraints, the 'reflective argument' approach of finding solutions by exploring conjectures seems to be appropriate. These conjectures are generated from experience in an opportunistic (brainstorming) manner. There is no possibility of exploring all the possible solutions and fully evaluating them. It may appear to be a sub-optimal approach, but the situation is too complex, and too socially constructed, for concepts like a complete set of solutions to be useful. The problem solving task becomes one of finding a solution that works well enough to stop those involved being concerned.

As discussed earlier, those trained in the traditional steps of decision making tend to assume that appreciating a problem comes before solving a problem. In the conjecture-first perspective the two are almost synonymous. Put crudely, defining or appreciating a problem ***is*** solving the problem, or at least generating conjecture solutions that will need to be rigorously disconfirmed (Checkland 2000); (Rittle, 1973). Processes designed to help stakeholders understand a problem, such as rich picturing, project briefs, electronic brainstorming meetings and storytelling may be at the same time constructing solutions. This is so at two levels. First, if the brain is a pattern recognition organ then as the problem is explained, understood or appreciated, the brain will be jumping to conjecture solutions, automatically. Second, whoever or however the problem is explained will bring with it a certain perspective. Better problem appreciation methods will make this as explicit as possible. For example, Dewey presented his appointment example from the perspective of a choice between three transport alternatives. He did not present it from the perspective of a city transport design problem. His method of presentation influenced the range of conjecture solutions (patterns) that his brain supplies.

Summarising the attributes of reflective thinking just identified:

Attribute	Supporting References
Design as appreciating, validating and perhaps generating stakeholder's a priori conjectural beliefs.	Dewey's steps
	Guindon's opportunism
	Mintzberg's seeing first
	Checkland's appreciating
	Polya's solutions
	Pattern recognition brain
	Gilbert's Spinoza system

REFLECTIVE ARGUMENT

Hopefully the relationship between argument, reflection and design is becoming apparent, as is the design theory being suggested. It is very much a theory based in the facilitation of communication between the stakeholders to build a group based creative solution to problems. The reflection literature suggests that design needs to assume stakeholders come to the design process with provisional proposals or with old design solutions, looking to reuse them in the new situation. These, coupled with their past experiences of design processes, arrive at the start of a new design process as underlying assumptions. Any calls for everyone to empty their minds will have to be a call for them to accept, until convinced, a new perspective for the project. Further, any calls for an impartial search of all alternatives and their objective quantitative evaluation, is considered utopian. However, for whatever options that come up for consideration, there needs to be extensive evaluation, including giving equal voice to all justified alternative views. Argument provides one way of structuring the dialogue appropriate to these ideas, but exactly how it is operationalised does require some creative thinking. While this paper has attempted to reveal the attributes and underlying assumptions (interlocking constructs) of reflective argument design theory, these are very broad design guidelines. It is being suggested that the designer, aware of these attributes and assumptions, should simply ask themself how any design activity might be organised to take advantage of these attributes and assumptions rather than treating them as faults in human reasoning. How these attributes can be used to advantage is a creative input from the designers.

Small Group Application

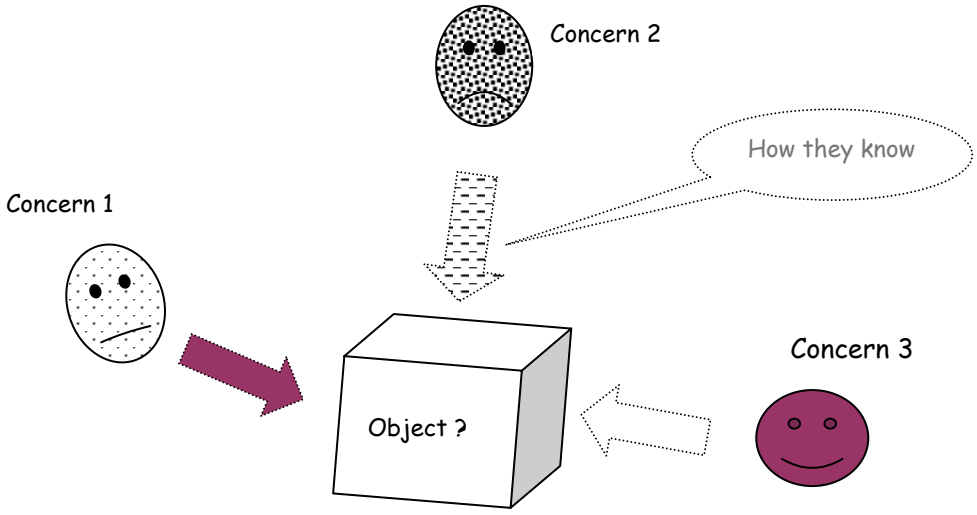
Below is one suggestion for operationalising (Argyris 1996) the design theory presented merely to demonstrate how it has been applied in the past. The first step was to argue one on one within a small group situation. The next two steps involved taking the argumentative process to a wider audience, with one process being more structured than the other. The project design exercise is one of interactively building up a participatory design constructively by using the conflicting stakeholders and the resource constraints in slight tension. The design and the criteria will be dynamic, each changing as ideas are added and explored.

The reflective argument design attributes suggests starting from forming a group to try to articulate the problem. This social construction of the problem needs to be done in a manner that gives voice to all concerned yet there is a pragmatic need for this group exercise to conclude with a clear and agreed upon problem statement. The new system design will be very dependent on this problem statement to provide initial direction therefore and its conclusion needs also to be rigorously and critically reflected upon. The problem statement, stated appropriately, is analogous to an argument. It has a one line conclusion and supporting evidence. For example, if the problem is *that* we have an inadequate KM system; the argument is *that* we have an inadequate KM system. Both need to be fully justified.

While eventually giving a voice to all those concerned the problem statement may at first be argued out using a small group. This may turn out to be a 'straw man' statement but the reflective argument theory rather implies a process of identifying some idea to critique. The use of a small group audience is justified using the small group performance literature (Hare 1976) (Armstrong 1985) which still suggests that a group of 5 to 8 people is more creative than one person and a large group. This appears to be because multiple perspectives and experiences are able to learn from arguing one on one. The obvious small group to use is the designer team or primary project owners group.

While the reflective argument theory suggest arguing for learning it does not say exactly how this argument should be structured. The first of three options presented in this paper is to integrate it with the creative problem solving processes identified with systems thinking,

namely 1) analyse, 2) synthesis and 3) evaluate. *Analysis* starts with 'picking apart' (1910); the argument or problem statement can created by first picked apart conjectures. Any conjecture sentence has an object and a concern (subjectivity), as will the future problem statement. Consider the conjectural problem (argument) statement: 'That we have an inadequate KM system'. The object is: 'The KM system" and the concern (subjective) is: 'Adequacy'. Of course argument over what is actually agreed to be the object and concern subject that will make up the project statement is required.



So, the actual process will involve the small design group starting to try and agree the object under consideration and what concern it is causing. Having constructively argued out the identity of these, the reflective argument design suggests combining these into a problem statement. Typically, it works as follows; after some brief background discussion, the facilitator starts a series of questions starting with, "So what exactly is the object (or thing) under consideration"? Let's say after some discussion the conclusion emerges, "our corporate KM system". Using a falsification test, the response may be, "OK, so the new system will not include management of social networking for knowledge sharing". If the answer was, "Yes, KM is about who talks to whom" then 'social networks' may be agreed to be the label for the object under consideration.

The next question to the group may be, “What is it that concerns you about social networks?” A possible answer could be, “How best to encourage departmental expertise while avoiding developing a siege or silo mentality within departments that undermines our capacity to launch a strategy response to environmental changes”. This may suggest that the concern is ‘optimum strategic responses’. Again, falsifications may be tested. Having identified the ‘object’ and project owner’s ‘concern’, the next stage is the *synthesis*, or weaving together (1910) of these two into the problem statement. In this example it may be, ‘that effective strategic response requires an improved knowledge creation and sharing system’.

It is assumed that group members will be encouraged to articulate their conjectures in a generic ‘brainstorming’ environment and then constructively explore their validity. It helps if someone constantly asks, ‘how do you know that is true’ and ‘what disconfirming evidence is there?’ If external advice or data is required then it should be sought before the argument continues too far. The problem statement is believed to stimulate ‘automatic’ responses in the form of Dewey’s conjecture solutions. At the end of the session to identify the problem, if effective, the participants may well have ideas about possible solutions. These may need to be recorded for a more rigorous and insightful inquiry into their viability.

Notice that this convergent questioning approach assumes that the experience of those present is sufficient to identify the problem. There is not any suggestion of an exhaustive independent search of all the options or an exhaustive independent review of present operations. The group is socially constructing the problem in a mildly competitive environment that demands rational justification in the face of alternative from peers. Yet it is designed as a convergent process. The output should be an initial problem statement not a list of issues, which is often the output of focus groups.

The exercise of arguing for a problem statement will hopefully also result in an explicit statement of the problem ‘boundary’ (2002). The problem statement identifies what is and what is not being included; the latter by not mentioning it. This explicit and implicit bounding is a very systems thinking concept. Writers like Ulrich provide questions that can be asked to critique the boundary to ensure the group appreciate the boundary they are imposing on the problem, which may be too restricting, too wide or too complex.

The approach of stating the problem in the format of an argument acknowledges that, ultimately, it will need to be presented in a way that needs to persuade others. It also brings together the object and concern in a purposeful (drivers) manner. Missimer (1995) 'Alternative Argument Theory' suggests that knowledge is advanced when alternative ideas are in competition. This suggests it is preferable to only design an object and concern problem statement, but also to state what the problem is not. So if the problem is: that effective strategic response requires an improved knowledge creation and sharing system, then it may be stated that an effective strategic response does not require a more centralised decision making. This pair of statements (arguments) should then be bound together for evaluation processes.

During any part of this process the small group may need to call for clarifying empirical evidence to evaluate the problem statements pair. This provides opportunity for the construction of information systems to serve this need in such a manner as to not allow the enthusiasm of a group argument to subside while waiting for information. As evidence is collected, and the progress discussed with the project owners, learning occurs and the problem statements are refined. Indeed, the whole format of the problem statements may change, but it is believed to be important to start off attempting to make the problem statements argumentative, alternative and explicit upfront. Last, the group may want to *evaluate* their problem statement pair by anticipating what evidence it will take to convince the wider stakeholder group that theirs is a reasonable pair of problem statements.

Group Arguments

Popper (1971) suggests that argument needs to be to a universal audience, while Crosswhite (1996) is more pragmatic, suggesting that only a knowledgeable audience is required. In systems design terms this means convening the stakeholders (constituents). The purpose of the larger group meeting is to think about the problem statement provided by the smaller group, and make responses. Hare (1976) argues that if this group is larger than 5 to 7 persons it will need special facilitation processes to overcome the limitations of communications possible with large groups. Again the attributes and assumptions (interlocking constructs) of the reflective argument design theory can be used to design a large group facilitation method.

The common means of acquiring the expertise and experience of those involved in the larger group, includes the use of surveys or focus groups (List 2001). The reflective argument design theory suggests somehow presenting an upfront conjecture to the group, and have them learn by arguing it out. This suggests a slightly different approach than the classic focus group approach of asking the group to list the issues and perhaps vote on their priority. Again, while reflective argument theory suggests an group debate needs to be undertaken, exactly how it is to be structured is left to the facilitator. An explicitly competitive or conflictual form of argument, as used in debating groups or courtrooms, may be tempered by or fully integrated with what has been learnt about participatory processes. Therefore, rather than use the systems thinking approach here List (2001b) has suggested an approach he calls the Consensus Group method. Consensus is seen as common ground; convergent group discussion is encouraged to try and identify the common ground of a clear majority. List (2001) suggests that these group meetings need to be designed around a process that still articulates conjectural statements, but encourages argument around editing these into a revised statement that can be supported by the majority.

The Consensus Group method is the opposite of a survey. With a survey, the questions are fixed; all interviewers must ask each question using exactly the same wording, even if this does not seem relevant to the respondent. The only possible variation, given the way a survey is designed, is in the result, e.g. how many people gave each possible answer to each question. Naturally, these results are expressed numerically, e.g. "37% strongly agreed that X…". The Consensus Group works in the opposite way; a percentage threshold is fixed (typically around 75%), which indicates consensus. Without this agreement a question, or rather a statement will still need to be edited.

It is suggested that the Consensus Group involve three distinct phases. In the first phase, which may be in a written form before the main meeting, the problem statement pair is generated and justified by a smaller group. In the second phase, those present at the large group meeting are asked to debate in turn their concerns about the problem statements, with there being adequate opportunity for those present to question and counter each other's comments. In the third phase, those present are asked to suggest *solutions* also in the form of a draft argument statement; i.e. provide a conjecture, however roughly thought through, on how the problem might be solved.

Continuing the example used earlier, the problem statement may be: *that an effective strategic response requires an improved knowledge creation and sharing system*. A conjecture solicited from the wider group may be: that the organization needs to develop an appropriate intranet. These solution statements need to be discussed, and edited. They may generate further statements that also need to be edited by discussion until agreed by a majority (>75%). Numerous solutions statements need to be generated and argued over, as well as edited until the majority agrees. Again, alternative statements of what the solution is not are required. The facilitator or participants may suggest edits to the wording of the statements to either start the process or split a statement if it contains more than one object and or concern.

With some groups the debate may need stimulating by appointing one member as a 'devil's advocate' or by providing anonymous statements. The outcome from the session is a 'family' of solution statements that have consensus. Note this is a reflective argument design because stakeholders are being asked to debate their responses to an upfront conjecture. Perfect and exhaustive options are not being sought for evaluation. This group of problem statements pairs then need to go back to the small design group to evaluate and synthesise into a tentative overall solution statement and a 'not a solution' statement. To do this they may need to collect supporting empirical evidence.

Design Court

If there are specific concerns about power issues and the absence of free speech, a more structured form of group meeting may be required. Again an obvious alternative that might be thought of by applying the attributes and assumption of reflective argument design theory is a court trial. This approach aligns with the way complex social problems are addressed by the wider community, but is rather untypical of most commercial organisational practices. The formalised debate (court case) approach is only practical for the consideration of a few tentative solutions. Correctly constructed, this provides a decisive and pragmatic way of dealing with disputes; it ensures structured communication, motivation for insightful alternative research, and enables the project owners to say that a transparent process was followed. It is being suggested that this method be used after the Consensus Group method and after those suggested solutions have been evaluated into one revised problem statement

pair provided by the small group. This court based approach is a re-visiting of Mason's (1969) dialectic strategy formulation method, intending to bound and focus the stakeholders around one problem statement, and thus focusing the evidence collection exercise. It also ensures a reasonably independent decision.

It is not being suggested that the court case system in the wider community is perfect, that it provides consensus, or that it reveals *the* truth. In the US, the paragon of litigiousness activity, there is a growing backlash against "going to court." Walker and Daniels (1993) outline some alternative dispute resolution systems but, interestingly, the basic structure of setting up a formalised debate is not put aside, merely the cost and authority of the State's legal system. There are two basic court systems. One is well known to Australians, North Americans and the British. It is the adversarial system with a prosecutor, a defence lawyer, and a jury. The judge cannot call or ask questions of the witnesses. The other is the system used in Royal Commissions and some European courts and East Asia. The judge is able to call witnesses and make inquiries of whoever he or she feels is relevant, in order to be able to work out a fair result. It is unclear which system is preferable, but the objective must be to ensure fair due process. The disadvantage of the Design method is that it can be very divisive. Each side does not necessarily put the truth, but rather the best possible version to support their side. This can cause excessive tensions and not be a healing, consensus building process but pragmatism suggests an end decision has to be made so ultimately hopes of harmony and consensus are going to be naive in a hierarchical species co-competing for uneven economic gain. At least there is a process and a result.

There should be a clear statement of what solution is claimed to what problem, who is to defend the claim and who is to counter. The evidence to be presented must be available to all parties before the trial starts. A 'judge', or facilitator, runs the process, including the final summing up to the 'jury'. A carefully chosen jury of (maybe) 'independent consultants' will declare what has been decided and what still needs to be decided. Stakeholders make up the witnesses. The person defending one solution claim will present their evidence first, each part being open to questions in a well-controlled manner. Those presenting the alternative solution will then present their case, while being open to questions. After time for reflection, the first solution should then do their summation, followed by the counter. The stakeholders direct their concerns to the presenter for either solution prior to the start of Court. The role of

the jury is to make suggestions as to what should be done next. This may be a direct decision, or it may be a call for more information. While 12 is a traditional number for a jury the group literature (eg. (Hare 1976)) suggests that a number between 5 to 7 would be more productive, unless an electronic meeting facility was being used**,** in which case 12 may be practical. Thought should be given to having a different jury for each debate. It is important to remember the innovative and reflective purpose of the Court, but also that a conclusion needs to be reached amidst a variety of vested interests.

Research Possibilities

Moving on now from suggesting why and how design argument might be structured, the reflective argument theory points to a path for related research opportunities. Researching argument or problem solving in isolation from technology may not be an IS agenda. Meyers (1989) has already undertaken extensive laboratory style research into argument and business decision making. Of course, there has been a lot of philosophical discussion about argument (Habermas 1990); (Walton 1998) (Eemeren 2001); (Richards 1936). There seems to be less research into argument as a research or inquiry method (Tracy 1999); (Gage 1996) despite its capacity to be common across all the rational epistemologies. There has been some, if only philosophical. Churchman, who has had a considerable influence on the development of OR, IS, and the systems thinking concept can be interpreted as a supporter of dialectic argument for inquiry. His five inquiry systems (1971) assume inquiry is based on rational argument so his work provides criteria with which to 'guarantee' knowledge claims.

However, the most relevant IS research opportunities to come out of reflective argument theory may be in to: 1) the design alternative facilitation method for creative group design, 2) the design ICT to augment interpersonal argument and, 3) recognising the argument inherent in ICT socio-technical systems.

The design of alternative facilitation methods was the primary focus of this paper. This type of research is very relevant to any discipline that calls itself the designers of information systems. The findings will be generic to several disciplines. Examples include crisis management, decision making, public policy, law, industrial design and corporate governance. Perhaps this type of research is more appealing to the soft systems thinkers in IS rather than

the technologists.

The design of technology to augment arguments seems relevant to researchers from the more technical streams of IS. IT to augment argument would include electronic governance, self organisation information systems, virtual community debate, legal systems for remote areas, crisis management, and/or specific user interface design. The defining feature would be group dialogue, synchronous or asynchronous, centred around a statement or knowledge claim. Technology that can argue directly with humans is seen as a longer term goal, defined as successful if the technology could creatively merge two opposing arguments into a solution which was a third argument. Obvious applications of an argumentative technology to persuade rather than to inquire are in e-commerce selling. In the short term augmenting technologies may be creative and rewarding. The number of technologies is already growing to include GDSS (Gopal 2000), Decision Explorer (Cossette 2001), and Argument Mapping (Van Gelder 2003). These may be especially useful for virtual teams (Majchrzak 2000).

However, the main area of research reflective argument theory suggests is in the critique of ICT, much the same as organisation theory includes a critique of organisations (Morgan 1986). There is need for further research into new methods that identify the design arguments (contradictions) inherent in the existing and proposed technological artefacts and related socio-technical systems. Underlying assumptions need to be exposed. This includes identifying the implicit knowledge claims imbedded in these artefacts and evaluating them. One present example is Churchman's guarantors of rationality, empirical support, explanation, alternatives *and* multiple perspectives. Hopefully this will reveal the dialectic of technological advance, how it benefits some and disadvantages others, and how our technologies are the end product of political and social debate. Simple examples include new insights into the differences caused by the presence of certain technologies, that web pages argue for their owners, that databases contain the results of arguments, that ICT argues for asynchronous communication, and that using argument to design is participatory.

In Summation

This paper has explored the argument that a synthesis of the principles of critical argument and reflective thinking provide a pragmatic design theory. 'Design theory' was defined as an

'explanation why' to structure the design process in a particular manner and assumed to need to be creative, just, socially constructed, competitive, and convergent to an outcome. The design theory presented seeks to use social interaction to edit participants' conjectures based on their experience, rather in the way of a Herbert Simon like chess playing that is an idealised search and quantitative evaluation of all possible design solutions. The attributes and inherent underlying assumptions of argument were listed in table 2. This includes the use of dialectic processes and language to emerge creative knowledge claims.

Perhaps more controversially, design was seen as appreciating, making explicit and evaluating stakeholders' a priori design conjectures. This is in contrast to the conventional Cartesian system of problem solving which sees appreciation of an idea and its evaluation as a very separate and linear process. Rather the opinions of Dewey, Mintzberg, Popper, Gilbert, Polya, Checkland and Guindon were used to argue that the appreciation of an idea and the generation of conjecture solutions is synonymous. This was not treated as a fault in human reasoning but a pragmatic, even strength. However, it is acknowledged that these a priori conjectures need to be made explicit and evaluated using group argument processes. The design theory presented explains how this might be achieved pragmatically.

A repetitive call for more and more explanations why or how (to theorise) in response to one explanation can move an explanation from the very conceptual to the very detailed. As was mentioned at the beginning of this paper, the more universal the number of systems that can be designed from one particular 'explanation why' to structure in a particular manner, the more elegant the theory. However, perhaps like General Systems Theory (Bertalanffy 1976) or the Unifying Theory of Everything (Hawking 2002) it is possible for a design theory to be too conceptual to be pragmatic (that is, work in practice). If the theory is too specific then it will only be of use for very specific design projects. Therefore the task, as Weick (1995) and Argyris (1996) keep reminding us, is to provide a workable heuristic, a few guiding rules which can be used to influence and guide our attempts at insightful thinking. It is through the reflective argument design theory outlined here that does just that. It basically says, assume those involved have a priori conjectures, use open competition group processes and alternatives to encourage creative thinking about those conjectures, and ensure all stakeholders are given the chance to present rationally justified viewpoints.

Three processes were presented to demonstrate how this design theory might turn out in practice. Moreover, an attempt to show how it might be used to modify existing group thinking techniques such as systems thinking, focus groups and arbitration, might be adapted under the guidance of the theory. The first small group approach used a combination of systems thinking and the grammatical structure of any statement to set up a dialectic tension between the object and concern in an argument statement. There was another dialectic tension set up between the problem statement and a 'not the problem' statement. Convergence was sought by seeking the output of a public problem statement. The first larger group used a modified focus group, where group dynamics were used to argue for the exact wording of conjectural solution statements. A competitive dialectic was then used in a convergent way to produce the solution statements. The third activity described was labeled 'design court'. This was a much more structured approach thought necessary to make the final choice of a solution. A competitive dialectic between alternatives was present but again around the convergent task of a solution.

The operating range of the design theory outlined here is determined by the word 'argument'. Group think, apathy, strong autocratic leadership or a completely non-competitive dialogue is not a reasoned argument (debate) and is not expected to be creative and insightful. At the other end of the spectrum, quarrelling, yelling, personal insults, emotional blackmail, revengeful acts and threats are also not reasoned argument (debate). These excessive environments have also been found to unproductive. Mild and gentle competition, the freedom to disagree in a respectful and considerate manner, is the environment that should be sought. It will take some effort to establish these ground rules, as is done in court, by debating societies and as attempted in chat-room netiquette, which all go to encouraging constructive idea generation.

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