

# A Soft Systems Analysis of Social Cognition In Boundary-Spanning Innovation

Susan Gasson

College of Information Science and Technology, Drexel University, Philadelphia PA

Email: sgasson@cis.drexel.edu

## Abstract

*The term social cognition is used in the psychology and organizational literatures to denote many different manifestations of the mental representations and processes that underlie social perception, social judgment, and social influence. This paper presents a systemic analysis of social cognition, employing three levels of analysis: (i) socially-situated cognition, involving interpretive, “framing” processes; (ii) socially-shared cognition, required to achieve joint framing of an information system; and (iii) distributed cognition, which views collaborative cognition as a set of overlapping frames, mediated by conceptual boundary objects. This research framework is operationalized through the use of Soft Systems Methodology. Findings from a case study of a boundary-spanning design group are presented, to demonstrate interactions between different levels of knowledge-sharing, social interpretation and consensus-building.*

## 1. Introduction

The notion of design or technology “framing” is not new to the IS literature. Researchers have been interested for some time in how individuals cognitively process information and how an understanding of that process aids the management of organizational information systems. Hirschheim and Klein [9] argue that an IS design methodology may be seen to have two distinct aspects, process management and design framing. Orlikowski and Gash [15] examined the impact of “technological frames” on the meanings ascribed to information technology, while Davidson [4] examined the constitution of “technology frames” in early requirements analysis. In each of these studies, there is a central understanding that designers define the *form* of an organizational information system with reference to a network of local meanings, ascribed to elements of the socio-cultural context within which they are located. To define and design an organizational information system, designers must interpret and frame both the organizational context and the problems that they wish to resolve [1]. But the processes by which they do this are far from clear. Existing studies tend to focus on established groups: groups that have derived a common language for coordination across their different areas of knowledge and expertise. To produce a joint design, a collaborative group

must first realize that they define design problems and potential solutions in different, partial and non-congruent ways. This may be less obvious to members of a local group than one would expect. In dynamic situations, such as the design of boundary-spanning enterprise IS where managers and other stakeholders are involved in short-term projects, this understanding and the establishment of a common basis for collaboration may be a major problem. We need to understand the ways in which this can be achieved.

The contributions of this paper are (i) to present sample findings from the application of a multi-level framework of social cognition and (ii) to demonstrate how use of the Soft Systems Methodology (SSM) approach and representational methods [2] supports research inquiry into the processes of social cognition in design. The following sections are organized as follows. First, I attempt to place the processes of social cognition within a coherent framework for the study of boundary-spanning IS design. As readers may not be familiar with Soft Systems Methodology [2], a brief introduction is presented in section 3. The research site and methods are introduced, then the framework is operationalized from a systemic perspective, to present an integrated research approach to the study of social cognition in design. The systemic perspective is demonstrated through examples from a longitudinal field study, to understand social cognition in IS design as a complex, multi-level process of interactions. Finally, implications of the multi-level analysis are discussed and the contribution of Soft Systems Methodology to research in social cognition is assessed.

## 2. Theoretical Foundations

In this section, I examine three behavioral, process views of social cognition in the IS and organizational management literatures: (i) socially-situated cognition, involving “framing” processes; (ii) socially-shared cognition, involving joint framing; and (iii) distributed cognition, which allows diverse groups to co-ordinate understanding across multiple knowledge-domains. This is followed by a discussion of an epistemological lens for interpretive research: the use of Soft Systems Methodology [2, 3] to produce a systemic view of boundary-spanning, social cognition.

## 2.1 Design As Socially-Situated Cognition

If one views human agency as socially constructed, then we understand that the design of organizational information systems is influenced by the socio-cultural environment in which it takes place [1, 12]. Design is improvisational and dependent on the contingencies of meaning, as constructed within a local workgroup, or community of practice [1, 23]. Individuals are guided by locally-contingent, *partial* plans [20, 22], to resolve “wicked” problems [16]. A wicked problem is subjectively-defined, interrelated with other problems and may be amenable to many, often incompatible solutions. They cannot be formulated objectively and thus have no correct solution only subjectively better or worse solutions [16]. As Turner states, “the issue becomes identifying what guides the discrimination between significant and insignificant” information [22, page 105].

To understand this process of discrimination, we may employ the concept of *framing*. Goffman [7] proposed framing as a process through which individuals and societies represent, interpret and reproduce meaning. In recent MIS studies (for example Orlikowski and Gash [15] and Davidson [4]), the concept has been related to a definition of technological frames as interest-group perspectives on the role and impact of IT adopted by various communities of practice (CoPs). This approach provides a behavioral, sociological analysis of a cognitive construct [21]. This study therefore uses the term *framing* as a sociological construct rather than making claims to study the internal, symbolic schema that are the focus of cognitive psychology [14, 21]. A behavioral framing perspective involves the inductive exploration of cognitive structures that become more complex, abstract and organized with experience. A “frame” denotes an internalized point-of-view that affects the process or outcome of design [7, 14, 21]. This perspective results from the individual’s location within specific interest-groups or communities of practice [1, 12]. Sensemaking and interpretation of organizational practice are situated within a set of norms, values and cultural practices that affect how the individual interprets new information and knowledge. This presents problems for collective framing, which are discussed in the next section.

## 2.2 Design As Socially-Shared Cognition

Adopting a framing perspective allows us to distinguish between the *knowledge* required for design – the process and domain expertise that lead to an appropriate outcome – and *understanding* – the internal process of interpretation and sensemaking that tells us how to act [14, 23]. The group design of organizational information systems is a socially-situated process in which people jointly and discursively make sense of the activities in which they engage [23]. Design involves the

surfacing and merging of individual and partial understandings of a local, socially-constituted, organizational world, to produce joint representations and shared understanding [20, 22]. It is this externalization process that allows us to understand what we know [6, 12, 23]. But interpretations of relevant expertise and (application) domain-specific knowledge is are located within an understanding of local practice (“how we do things here”) [1]. Contextually-situated views conflict with the rule-based formulation of procedural knowledge that is expected for IT system requirements. Thus, definitions of legitimate and appropriate knowledge and goals change, as views from competing expert designers, interest groups and influential stakeholders influence the design process in different ways over time [12]. Additionally, locally-situated knowledge cannot be completely shared. Thus we need to understand the role of distributed cognition in achieving a consensus design solution.

## 2.3 Design As Distributed Cognition

Professional expertise and other domain-related knowledge tend to be interpreted within the socio-cultural norms and expectations of a local community of practice [1, 12]. While a diversity of perspectives is necessary for a sufficiently wide number of design alternatives to be considered, a wide spread of experience, such as that found in boundary-spanning groups, conflicts with the need for intersubjective (cognitively-shared) understandings of potential outcomes [6, 16]. Theories of distributed cognition [10, 18] address the interdependency between actors’ individual design frames, but also reflect a lack of framing congruence and the mediation of meaning by means of external representations [6]. Understanding is not so much shared between, as “stretched over” members of a collaborative group [18]. Intersections between individual cognition are managed through the use of “boundary objects” [17] – external representations and artifacts that are sufficiently plastic to be adapted to local meanings, while sufficiently generic robust to provide a unifying mechanism for coordination across knowledge-domain boundaries. For example, a map of a local transit system may communicate useful routes to passengers, or maintenance hotspots to engineers, or charging-zone information to ticket officers. But it allows members of these various groups to collaborate via a common representation of the transport system.

Studies of distributed cognition in collaborative workgroups have examined how group co-ordination and group “memory” is managed through the production of shared design representations, artifacts, workspaces, or forms and procedures [6, 10, 18]. Thus, an analysis of individual or shared frames is insufficient to understand how a group conceptualizes a consensus design-space. It

is also necessary to examine how they use texts, diagrammatic representations, or technological artifacts, to manage the interstices between individual cognitive frames, and to negotiate across knowledge-domains.

### 2.4 A Framework For The Analysis of Social Cognition In Boundary-Spanning Groups

The three levels of analysis lead to the framework for boundary-spanning, social cognition shown in Table 1.

**Table 1: The Integrated Research Framework**

Level	Theoretical Construct	Processes of Interest in Boundary-Spanning Design
<i>Individual</i>	Socially-situated cognition	How individuals conflate and confuse multiple problem-boundaries and definitions.
<i>Group</i>	Socially-situated cognition	How individuals from different organizational domains frame design problems and solutions
	Socially-shared cognition	How groups negotiate shared definitions of design problems and solutions.
<i>Group / Organizational Communities of Practice</i>	Distributed cognition	(i) How groups understand what they know, as a group. (ii) How distributed and partial understandings are coordinated.

This framework provides us with five processes of interest for collaborative groups engaged in boundary-spanning design that are addressed in the findings below.

### 3. Epistemological Lens: The Use of Soft Systems Methodology To Analyze Framing Perspectives

Checkland [2, 3] proposes an epistemological approach by which to express and negotiate IS-related change outcomes, through the use of Soft Systems Methodology (SSM). A “soft” systems perspective recognizes that multiple, competing definitions exist for any purposeful system of human activity. Individuals may simultaneously define multiple purposes for which they understand a system of human-activity to exist. Some of these may coexist and some conflict. Individuals may only become aware of conflicts when called upon to resolve incompatibilities between activities required for one purpose and activities required for a conflicting purpose. But this depends upon those activities being made explicit, though the definition of systems of human-activity, or “soft” systems. SSM provides a set of modeling techniques that enable a systemic approach to problem inquiry and resolution. These permit the separation and surfacing of multiple, “purposeful systems of human-activity”, and an inquiry into how each system view may be achieved. SSM was originally defined as an action research approach, to enable organizational actors

to jointly inquire into and learn about organizational problems and appropriate solutions, especially in the IS domain [2, 3]. The approach focuses on the *served* system of human activity in an IS, rather than the *servicing* system of data-processing

What follows is a necessarily superficial description of SSM, based on the original set of stages and modeling techniques [2]. More recent developments define SSM in terms of a less prescriptive model, that enables a more fluid and iterative inquiry into the problem-situation [3]. For an introduction to the representational tools as the basis for framing analysis, I focus on a basic description.

SSM distinguishes between descriptions of the real world and systems thinking about the real world. Rather than imposing a structure on the situation being inquired into, it aids the inquirer by allowing them to represent structures inherent in the situational context. Thus, it provides an excellent mechanism for self-reflection and for debate centered on implicit understandings of the situation, both in the heads of people involved in the “problem situation” and in the head of the analyst -- the “would be improver of the situation” [2]. Checkland [2] recommends that the inquirer inquire into their own role and impact on the situation. Because of this reflexivity, SSM provides an excellent tool for interpretive research, according with the advice of Klein and Myers [11].

There are seven stages to the original model of SSM [2]. These stages are employed iteratively, to explore emergent understandings of the problem-situation.

1. The first stage is to investigate and to bound the problem situation. Relevant stakeholders, relationships, practices, participants and the history of the situation are inquired into.
2. The second stage requires that the analyst/researcher and participants *express and bound the problem situation*. Rich descriptions are obtained of the problem situation and “rich pictures” [2] may be produced to capture the complexity of a problem-situation in a relatively unstructured form. An example Rich Picture is given in Figure 1, below.
3. "Root Definitions" are produced, to define *systems of purposeful activity* relevant to the actors involved in the problem-situation. They are produced by exploring and “naming” change-transformations that define how issues within the system of human-activity may be resolved, or that define how tasks could be performed in an ideal world. Change-transformations are expanded into Root Definitions of alternate system perspectives, through inquiring into six elements of context, with the acronym CATWOE:

*Client(s)* - the victims or beneficiaries of change.

*Actors* - who performs relevant activities?

*Transformation* – how should we “name” this system of activity or change?

*Weltanschauung* - what worldview makes this transformation meaningful, in its context?

**Owner** – who can authorize or prevent change?

**Environment** - what constraints or enablers apply?

4. A set of Conceptual Models are produced, that define the sequence of activities required to perform the transformation indicated by the root definition. A root definition may reflect one of two transformation types. A *primary-task* model provides the core activities required to perform the system of human-activity. An *issue-based* model represents the chains of problem-solving rationale and activity required to resolve an issue or a specific problem [2]. SSM's ability to separate multiple perspectives of the problem situation provides a key contribution to the analysis of social cognition, as shown below.
5. A gap analysis is performed. Conceptual Models from stage 4 are compared with the real-world situation.
6. A set of actions for change are *negotiated* around the findings of stage 5, that are both culturally feasible and systemically desirable.
7. Actions are taken to improve the situation. These may include IT systems development, but also include procedural and cultural change management.

In focusing on the externalization of implicit and partial knowledge about a situation, SSM provides an effective mechanism for surfacing systems of meaning and for exposing conflicts and commonalities across these systems. **So SSM provides the basis for a set of conceptual boundary objects [18] around which negotiations of meaning may be made explicit.** These

boundary objects may be produced to negotiate meaning between design group members (the original object of SSM), or they may be produced to mediate meaning between the researcher and design participants, which is how they were employed for the purposes of this study. In the following sections, I present findings from a field study, to demonstrate the utility of SSM in providing a research approach for the study of social cognition.

#### 4. Research Context and Method

To illustrate the systemic investigation of the elements of the research framework, I apply this framework to a study of boundary-spanning design, in a mid-size engineering company. A rich picture [2], presenting an unstructured representation of the research site, is given in Figure 1. The subject of inquiry was an IS design project, focused on the co-design of business and IT systems for the company's customer bid response process. This project was typical of the enterprise system design that precedes detailed IT system development. It involved managers and stakeholders from seven different areas of the business: quality and process improvement, engineering product design, corporate finance, marketing, accounting, operations, IS.

This was a qualitative, interpretive research study, where rigor and authenticity were assured through the use of reflexive ethnographic data collection methods and the constant comparison of data analysis over time, to build a

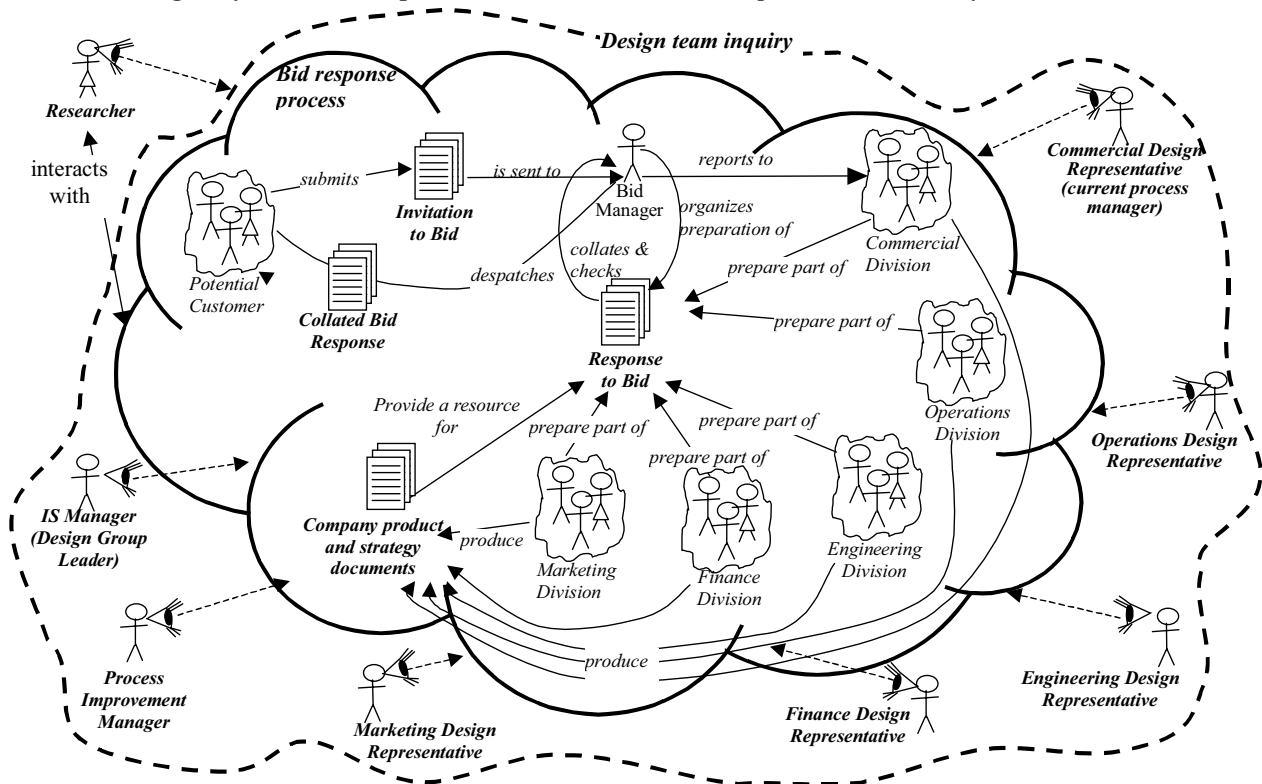


Figure 1: A Rich Picture Of The Context and Process Of Bid Response At The Research Site

substantive theory rather than through hypothesis testing [13, 19]. Data collection focused on the ways in which design team members understood the design problem, solution and process. Approximately half of the group design meetings were observed and tape-recorded over a period of eighteen months. Design documents and working models were collected and analyzed. Ad hoc interviews were conducted frequently with design team members. Design documents and working models were analyzed. Structured interviews were conducted at the beginning, middle and end of the project, to inquire into the precedents of the design initiative [11] and to elicit the ways in which stakeholders framed the design, using SSM analysis techniques. Design group workshops were held, halfway through the study and at the end of the project, to validate findings and SSM models. This paper focuses on the use of interactive SSM methods to elicit and analyze different layers of understanding. These methods were supplemented with qualitative coding and reflexive comparison across multiple time-periods and analyses, to integrate findings across all aspects of the study [13, 19].

## 5. Research Findings

### 5.1 Individual Problem And Solution Framing

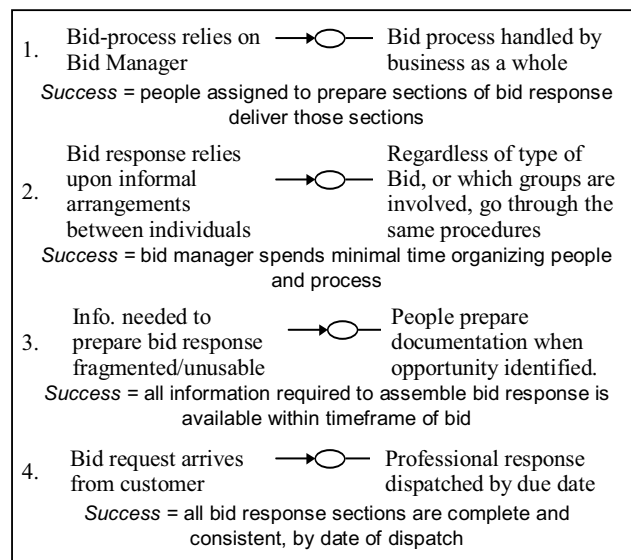
#### How individuals conflate and confuse multiple problem-definitions.

SSM transformations and conceptual models were used to model explicitly-held design frames and to surface implicitly-held cognitive frames. Interactive interviews, based on the production of SSM models, explored participants' understanding of the design *problem*, the design *solution*, and the design *process* (expectations of required design activity and goals). The following example from an interview with the Bid Manager (the manager of the bid process to be redefined for the IS design), illustrates how SSM was used to understand his problem-framing perspectives.

"Where we're coming from is a situation where the handling of bids has been developed over the last four years. I wouldn't say quite by an individual but certainly by one group. And it has been developed as bids have hit us more and more, with changes to be type of bids we've modified it to cope. A little bit piecemeal the way it's been approached. And my understanding is that what we want to achieve is to - - I won't say uniform -- it's not as rigid as that -- we want to get a more structured approach to the way we organize ourselves internally. And to take into account that over the next two or three years we're expecting a larger number to come from within Europe -- so far, we've really been 95% plus local orders. And we assume that that will mean that we have to change our approach to some aspects of it."  
(*Bid Manager, describing design change goals.*)

By iteratively modeling and debating the sequence of activities required to fulfill these design goals (stages 3, 4, and 5 of the SSM method), it was possible to identify when change-rationale and framing perspectives had been conflated, or implicit objectives had not been articulated. Exploring the bid manager's statement led to *four* different change-transformations being defined interactively with the bid manager, shown in Figure 2. These transformations reflect the following objectives:

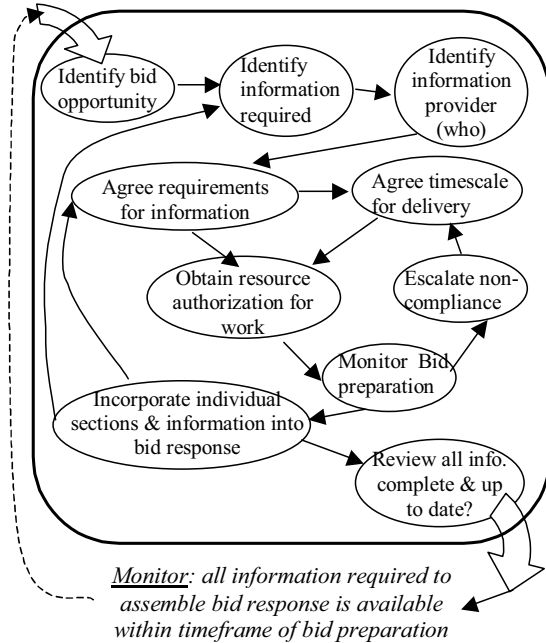
1. The need for managers to assign human resources formally to bid preparation.
2. The need for bid preparation staff to actually deliver the work assigned to them.
3. The need for an information repository, where managers and other staff could record relevant customer requirements and product cost and configuration information.
4. The need for a standardized set of software editing and data presentation tools, to produce a professional response document.



**Figure 2: Four views of the bid response "problem"**

The four perspectives reflect very different change-objectives for the bid response process. Yet a discourse analysis of design meetings shows that the Bid Manager often confused the four different objectives, starting an argument for change from one perspective, but ending his argument from another. The transformations shown in Figure 2 reflect the Bid Manager's eventual separation of the four objectives. Initially, for example, the current state (input) of transformation 3 was defined as "people do not know what is expected of them". This problem-definition, was redefined when the Bid Manager reflected on the conceptual model that I produced from his definition of the sequence of activities required to perform just that aspect of bid response. The resulting conceptual model is shown in Figure 3, which reflects issues related to the

political and cultural situatedness of the problem situation.



**Figure 3: Conceptual Model For Transformation 3**

The type of design-frame illustrated by Figure 3 is not considered legitimate by most IS design methods, so these aspects of the problem would be lost. A typical outcome with traditional design modeling approaches is that cultural problems are dealt with by codifying the desired behavior into a system of control that represents only the dominant culture. Here, surfacing this political and cultural view of the system led to explicit negotiation and debate. The design team in this study decided that they wanted to avoid a controlling system ("this big snake that goes through the organization"). Using SSM techniques enabled the Bid Manager to articulate *implicit* models of problems, to communicate his rationale for changing what he termed "a mess of unstructured procedures". This permitted the *sharing* of real insights about what and how work-procedures should be changed.

Making complex perspectives explicit using SSM proved effective with all group members, even the IS Manager, who had initially been skeptical. The technique revealed rich and divergent constructions of the problem-situation and of appropriate forms of IS solution, that formed part of future consensus models.

## 5.2 Group Problem And Solution Framing

### (i) How individuals from different organizational domains frame design problems and solutions.

Design group members diverged significantly in how they framed design problems and solutions. SSM-based modeling sessions were conducted with individual team members, at three points during the project: at the

beginning of the design, at the approximate mid-point, and just prior to the end of the design study. The SSM conceptual models and interview recordings, along with contemporary meeting contributions by the individual team members, were used to construct goal-definitions that focused on the individual's definitions of (i) the design problem, (ii) the design solution, (iii) the required design process. This allowed the comparison of individuals' design frames along these three dimensions, following the definition of frame-congruence suggested by Orlikowski and Gash [15]: that frames are related in structure (possessing common categories of frames) and content (with similar values in the common categories). The only framing domain where there was noticeable convergence of frame-definitions was the organizational problem definition. The other two domains (solution framing and design-process framing) showed considerable divergence, but in different ways. From the use of shared terminology and metaphors, it appeared superficially as if target system (solution) objectives appeared to converge. For example, all team members referred to an "electronic document library", assuming that they meant the same thing. But a more detailed analysis revealed that different design team members defined the concept differently, as demonstrated by the details of this analysis extracted in Table 2.

**Table 2: Individual Problem-Structure Differences**

Who	Definition of "need for improved IS"
ISM	Need <u>automated</u> information repository (contents to be determined).
PIM	Need <i>information support</i> for (i) basis for cost estimates and (ii) product configuration.
CSM	Need <i>information support</i> for <u>bid strategy</u> : (i) Product strategy, (ii) Customer strategy and tactics, (iii) Product feasibility & configuration.
PEM	Need <i>information support</i> for (i) commercial attractiveness of bid, and (ii) bid strategy.
BDM	Need <i>information support</i> for (i) basis for cost estimates, (ii) customer intelligence for bid request anticipation (scheduling).
PMA	Need <i>information support</i> for (i) basis for cost estimates and (ii) product configuration.
BM	Need <i>information support</i> for (i) basis for cost estimates and (ii) product configuration.

The *electronic document library* concept was interpreted in five, subtly different ways by seven people, even though they had been working together to define terms in common. This led to multiple misunderstandings. Overall, design process frames (whether dealing with actual, expected or prescribed processes) did not appear to converge, at any point in the project. Instead, individuals relied on various design "experts", who prescribed the next set of activities, according to the current focus. The identity of the individual who acted as a design expert

changed, as various knowledge domains appeared more relevant to the design focus at that time.

**(ii) How groups negotiate shared definitions of design problems & solutions.**

From an analysis of framing congruence performed from comparing SSM models and from a discourse analysis of design meetings, it was concluded that the extent of shared understanding of the designed solution was small. It would appear that the design scope was just too wide and too complex to be understood in its entirety by any individual. Individuals negotiated and agreed consensus models of the design outcome. But it is clear that they did not understand these models in the same way, as the following meeting extract reveals.

*Bid Manager:* The discussion we had on Tuesday - I couldn't see what relevance it had got to do with Bidding, which I think I said at the time. We should be concentrating on Bids, not all this other part.

*Engineering Manager:* That's where I'd disagree. The Bid will feed into there as hard requirements.

*Bid Manager:* No.

*Engineering Manager:* And it will invoke all this stuff. You've got to.

Shared understanding of design solution definitions did not appear to increase – in fact, it appeared to remain constant over the whole period of the design project. A decomposition analysis was performed on group discourse at four typical design meetings, evenly distributed over the project time-span. Discussion related to administrative or social issues was omitted from this analysis, which followed the method used by Guindon [8], who analyzed the cognitive processes of individual programmers.. Guindon's coding structure related to program design, so this was adapted to reflect a scheme appropriate to organizational IS design, as follows:

5. Top-level design (definition of high-level business process, overall system goal, or system purpose)
4. Second-level design (sub-process definition, sub-goal, or specific problem with business process)
3. High-level detail (functional specification requirement, role-definition, or type of information required)
2. Mid-level detail (organization or process mechanisms, task-responsibility, or information flow specifics)
1. Low-level detail (specifics of implementation, task-mechanisms, or detailed information components)

The average level of decomposition remained fairly constant, over the period of the project, even though the explicit objective of each meeting reflected successively lower levels of decomposition, as shown in Table 3. One would expect average decompositional levels of group discourse to be high at the start of the project (when goals and high-level solutions are being defined) and to decrease markedly with time, for a goal-driven process, as the group defines the solution in more detail.

**Table 3: Meeting Analysis By Contribution Level**

Meeting	Design Episode	Purpose of meeting	Expected level	Average level
A	1	overall system purpose & functions	4 - 5	3.28
B	3	detailed design of stage 1	3	3.05
C	5	detailed design of stages 2-6	3	2.75
D	6	implementation of stages 2-6	1 - 2	2.82

From Table 3, it can be seen that the design solution was not defined in group discussions at the levels that would be expected, if the process was driven by well-defined goals. Design discussions did center around *slightly* lower levels, with slightly fewer top-level issues as time went by. But design discussions had a much wider-ranging, exploratory nature than the waterfall model would lead one to expect. In fact, *the design team were still debating high-level design goals in the last meeting before design "handover" to the new system training staff* (meeting D).

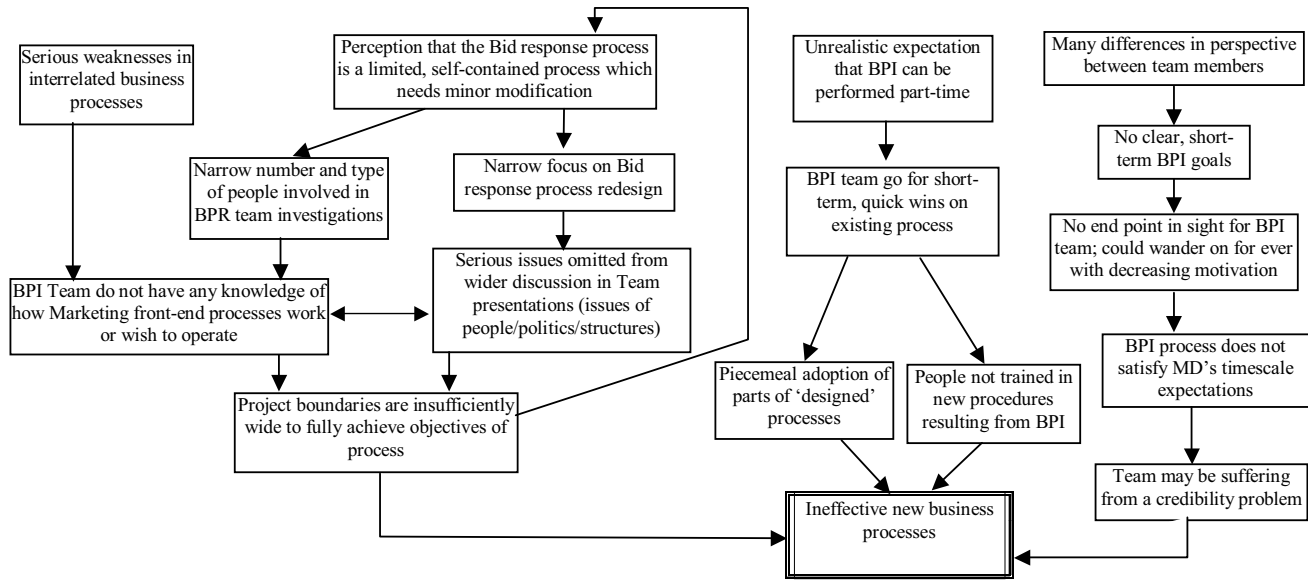
**The design was a success: the new bid process was seen as an exemplar of how to manage change. But this success did not appear to be achieved through shared understanding of the designed system solution.**

In line with Guindon's [8] conclusions about the processes engaged in by individual, expert program designers, I would therefore conclude that the design process in this boundary-spanning design team was "opportunistic", relying on goal-emergence and distributed cognition, rather than shared cognition.

**(iii) How distributed and partial understandings are coordinated.**

The finding that the problem situation and required solution were too complex to be understood by any single individual are supported by an analysis of changes in the design process over time. By categorizing the process activities engaged in by the team, I analyzed four process stages.

At the start of the project, the group expected to share domain-related knowledge and expertise unproblematically. They engaged in what the team derisively labeled "design by committee". The second stage pragmatically acknowledged that different team members possessed the expertise and background to understand specific areas of company operations, while other team members could not envisage how that area worked. So they adopted a process prototyping approach, where an "expert" from the team produced a prototype process flowchart for other members to critique in the areas that they understood.



**Figure 4: Systemic Analysis of Design Process Constraints**

In the third stage, external “experts” were invited to address the team, to describe processes in areas of operations that they group could not define between them. Group flowcharts were produced and validated by the invited experts. In the final stage, there was a recognition that procedures for the business process and IT system support could not be fully agreed, as the team did not share enough knowledge of the organization collectively to do this. So they engaged in a division of labor, that assigned areas of the detailed design specification to individual team members who were perceived as having specialist expertise in the required area of design. Individuals’ descriptions of their areas of expertise at the beginning of the project did not coincide with the areas of expertise assigned to various team members for the detailed design (at the end of the project). This indicates that the design process created new areas of expertise, new skills and new knowledge .

**(iv) How groups understand what they know, as a group.**

Attaining consensus appeared to be very difficult for the design team. The previous section demonstrated that knowledge and expertise were emergent. So an understanding of who-knows-what and of its relevance to the core design was dynamic. The eventual allocation of cognitive labor appeared to be based more on who was willing to act as an expert, than on a group perception of who knew what. A discourse analysis showed that most joint design representations were “agreed” on the basis of goodwill (“trust me”), rather than a consensus that the design was optimal. As reported above, the only framing domain where there was noticeable convergence of perspectives was in organizational problem definition.

Group trust therefore appeared to be constructed through a shared perception of the design problem situation (the rationale for change), rather than of the design solution. The group discussed this phenomenon explicitly. As the design proceeded, they debated strategies for managing the limited group knowledge through investigative prototyping and process work-arounds.

I facilitated an SSM group workshop at the mid-point of the project. The design team first debated and validated researcher-produced SSM conceptual models, then produced consensus models of the IS solution, using a simplified approach to cognitive mapping [5]. This technique allowed consensus models of cause-and-effect to be constructed, showing “vicious circles” and chains of causality, that permit debate about where change would be most effective. It proved very effective as a means of combining individual, SSM conceptual maps. Figure 4 shows a systemic view of constraints on the design process perceived by the team. Team members felt that they did not have sufficient experience or knowledge of business processes to understand the information requirements, technology requirements, or work-process requirements as a whole. They were frustrated that their decompositional design-approach (based on business process redesign and IT development methods) gave them little opportunity to capture and represent organizational design issues. This hampered their ability to achieve significant change.

The combined models produced following individual modeling sessions were validated by the design team at the mid-point facilitated workshop. These were considered acceptable and representative, with very few amendments by team members. This technique may therefore present a good way of assessing systemic

connections between elements of the problem situation, in both research studies and business analysis projects. **An analysis of the model shown in Figure 4 revealed many aspects of individual and shared design frames that the individuals were not able to express directly. But when presented with the models graphically, team members validated the elements presented. It would therefore appear that using SSM provides a good method for eliciting implicit (inarticulable) knowledge.**

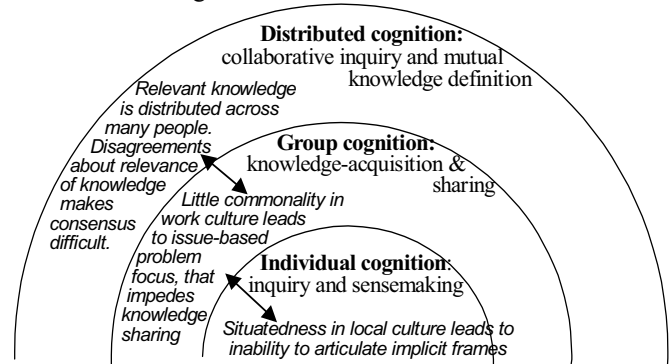
A limitation of this technique is that it was only possible to identify sufficient congruence between individual models to produce cognitive maps at a very high level of detail for process models modeling a *primary-task* Root Definition of a system (system purposes). The most successful application of the technique was in eliciting implicit framing perspectives for chains of problem-solving rationale in *issue-based* Root Definitions, where participants modeled ways of resolving a problem. This is probably because of the distributed and partial understandings reported above.

## 6. Conclusions and Implications of Study

The contributions of this paper were to conceptualize social cognition within a multi-level framework, and to demonstrate how a systemic analysis provided insights into boundary-spanning knowledge-sharing that discrete conceptualizations could not provide. By employing Checkland's [2] Soft Systems Methodology (SSM), the study demonstrated how problem-framing at one level with behavior at other levels of understanding and how situated interpretations of work, that were related to the individual's distinct workgroup, caused problems in achieving a shared understanding of business practice. Interactions between individual sensemaking, group knowledge-sharing and distributed inquiry are summarized in Figure 5.

Individual design frames were constrained by the cultural expectations, values and norms of the knowledge-domain pertaining to each team member's local workgroup and functional area. There was little commonality in the way that individual design team members framed design goals or outcomes, *even when they used the same language to communicate these elements*. This is a significant finding, as the use of shared metaphors is often used as an indicator of shared understanding, in research studies. It is clear that group members were aware of the constraints on effective knowledge-sharing and that they developed work-arounds that permitted the cognitive division of labor whilst acknowledging that understanding was distributed *across* members of the design team. The strategies developed to manage distributed cognition have major implications. Real world design problems transcend the knowledge of individuals and domain-groups. This study has provided a deep understanding of how a boundary-spanning group

managed distributed knowledge, as they gained experience of this type of design. There appeared to be a progression, from strategies based on the team's expectation that they could share domain knowledge and expertise easily, to strategies based on accommodating distributed knowledge.



**Figure 5: Insights From Soft Systems Analysis At Multiple Levels of Social Cognition**

Future studies might useful question the extent to which domain-related knowledge is really shared, in groups analyzing complex, organizational problems. This study has demonstrated that the joint construction of shared goals and solutions may be far from straightforward, as is typically assumed [3]. The process here was driven more by the effective management of distributed cognition than by shared understanding. A form of "consensus knowledge" was derived through the negotiation of *partial* goals and visions, based on convergent perceptions of the design problem, rather than on a common vision of the solution. It was this accommodation that permitted the cognitive division of labor for design completion. The outcome was not shared knowledge, but shared trust. The research question of *what is shared*, when we speak of shared knowledge, deserves more attention than it is currently given in the management and IS literatures.

This research study employed SSM techniques in a different way than is usual [3]. In action research studies, SSM techniques are used in facilitated group sessions, to allow participants to share multiple perspectives of the problem-situation and to enable the negotiation of consensus change-models. The approach developed here used SSM techniques in individual interviews with design team members, to construct an intersubjective understanding between the researcher and a research subject. These were validated through individual interaction and then used as the basis for group discourse in a design modeling and validation workshop. Design participants reported that a major benefit of using the techniques in this way was that they were able to surface implicit sensemaking frames that they could not articulate in their own group design process. This obviously affected the group process, but only inasmuch as it

enabled individuals to clarify their own perspectives. Separation of the multiple perspectives embedded in individual design-frames appeared to enable participants to understand and articulate their own change rationale. The surfacing of implicit design frames has significant implications for both research and practice, that need further investigation. The findings demonstrate the emergent and confused nature of goal-definition in complex problem situations. We have seen how appropriate forms of boundary object, that separate and clarify individual objectives, can mediate understanding in boundary-spanning groups. The study here exposed how difficult the merging of individual perspectives actually is. By enabling individuals to surface implicit perspectives, we may be able to improve the process considerably.

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