Organizing Patterns of Interaction:

A Knowledge Representation Approach

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Abstract

The organizing pattern of interaction has received little attention in collaboration engineering research. Knowledge representation and knowledge management disciplines are used to examine the definition and role of conceptual organization from a philosophical and theoretical perspective. A case study of a collaborative research project to develop an ontological model of the social process and its use in a large scale collaborative engineering project are described. Conceptual organizational schemas are social knowledge constructs that operate as both means and ends in collaboration engineering.

Introduction

The organizing pattern of interaction in collaboration engineering is defined [1] as moving from less to more understanding about the relationships that exist between concepts. Typically this pattern of interaction is not an end in itself but is used to facilitate more divergence and elaboration of concepts.

This paper will examine this definition from the perspective of Knowledge Representation which suggests that conceptual organization is a critical dimension of organizational knowledge and collaborative action. Conceptual organization indeed facilitates further elaboration and divergence of ideas but is also an end in itself as the organizational schemes that are developed represent organizational knowledge. Organizational knowledge is shared knowledge that is a necessary element of organizational collaboration and action.

First the paper develops a philosophical and conceptual foundation for this pattern of interaction using referent disciplines in knowledge representation, knowledge management, and philosophical inquiry. Then a case study in collaboration is presented where a research project in knowledge engineering provides a key conceptual model for a large scale engineered collaboration event.

Knowledge Representation

Knowledge representation is a new field of research that explores the forms of representation of knowledge. It draws from a number of referent disciplines in knowledge engineering and artificial intelligence for its computational characteristics and has deep philosophical roots in logic, epistemology and ontology. Several classical

philosophical models in knowledge representation and knowledge management are foundational in understanding theory and application of the organizing pattern of interaction in collaboration engineering.

One of the benchmark works in the field is Knowledge Representation: Logical, Philosophical, and Computational Foundations by John F. Sowa [2]. Sowa describes the philosophical antecedents of current knowledge engineering efforts in artificial intelligence research. This work is an important bridge between classical philosophical epistemology and current knowledge engineering tasks.

Logic forms the basis of much early work in AI. Logic has its foundations in the epistemology of Plato [3] and his student Aristotle [4]. Socratic reasoning through systematic dialectical inquiry of basic truths led to the development of a philosophical understanding of the nature of knowledge and then a practical vocabulary for representing knowledge. Terms we use today like *category, metaphor, hypothesis, quality, quantity, genus, species, noun, verb, subject, and predicate* are coined words borrowed from either Greek or Latin by Aristotle to describe elements of knowledge representation. Interestingly in collaboration engineering we primarily use category as a primary organizing schema. Aristotle developed logic as a primary mechanism for reasoning about knowledge. While logic and logic systems form much of the legacy work in AI, the rigor of symbolic logic and its computational forms is now only one of the tools used in knowledge management systems. Of more recent interest is Ontology [2].

Ontology as a field of philosophical inquiry has been concerned about describing "what is" Ontological categories are classically defined and comprise much of the work of ancient philosophy and the work of Heraclitus [5], Plato [3], and Aristotle [4]. Later work by Kant [6], Hegel [7], Peirce [8], Husserl [9], Whitehead [10], and Heidegger [11] built on the earlier work of the ancients to develop top-level categories that form the basis of modern ontological systems. This interest in top-level categories that start with everything that is and work downward with more specificity is the opposite of current knowledge engineering approaches that work from the bottom up. Knowledge systems are built from specific databases and are concerned with micro-worlds in which all the specifics are known and their relationships are explicitly stated. AI works best when problem domains are strictly defined and delimited [12]. Both top-down approaches from classically defined categories, characterized as the Platonic approach, and bottom up approaches, characterized as Aristotelian, are used in building ontological knowledge

structures. We will examine such a structure used in a large scale collaboration engineering project later in the paper.

The principles of knowledge representation Davis, Schrobe, and Szolovits [13] summarize its role in AI but also can serve as a guide to organization of concepts for collaboration. A knowledge representation is:

1. A surrogate. Model building as a basis of problem solving is a common task in both AI and collaborative work. Surrogate models enable computational support of decision making tasks
2. A set of ontological commitments. Determining what exists in the problem domain provides a conceptual framework that helps organize and contextualize diverse ideas into coherent relationships. In the second part of this paper we will explore an ontological framework for the social process.
3. A fragmentary theory of intelligent reasoning. Organization of conceptual entities represents a *theory* of the problem domain. Such theoretical models are powerful predictors of behavioral dynamics and interactions. Theories are grounded in the problem domain and are summaries of analytical thinking and intelligent reasoning. Theoretical models can also be the basis of further computational modeling and simulation.
4. A medium for efficient computation. Collaboration engineering involves both facilitation practice and computational support. More powerful collaboration tools utilizing AI techniques based on organizational patterns and schemes which can be easily translated into computational models need to be developed.
5. A medium of human expression. Knowledge representation plays a bridging role between the reasoning done by domain experts and systems engineers who build computational versions for exploration of the problem domain and solution set. A critical outcome of engineered collaborations would be representations that can efficiently be converted into computational models that are realistically representational.

These principles provide answer the question of what an organizing schema is and the potential role that they can play in collaboration beyond just enabling further elaboration and divergence. They also raise the possibility of a further role that AI processing can play in providing innovative support for collaboration support tools. New technological support and facilitation scripts can be developed to enable successful collaboration.

Knowledge representation only deals with explicit knowledge however; knowledge that has been created and encoded for processing either through computation or through engineered collaborations. Knowledge management (KM) explores how knowledge is created and has insight into the construction of explicit knowledge constructs or representations. The primary dichotomy employed in knowledge management is between knowledge that is tacit and knowledge that is explicit. One of the primary goals of knowledge management is to convert tacit knowledge into explicit knowledge so that it can be shared. Collaborative mechanisms and processes are frequently employed for this task of knowledge creation and sharing. One of the key philosophical bases that is used for KM theory is Michael Polanyi [14] and his book The Tacit Dimension. Polanyi's observation is that "we know more than we can tell". Much of what we know is tacit. We know it but it is not easily articulated. Even so tacit knowledge has a structure. The structure of tacit knowing and the conversion of tacit to explicit knowledge is a process of divergence and organization of discrete elements of knowing into a comprehensive organizational scheme that Polanyi calls a *gestalt.*

The structure of tacit knowing

Polanyi identifies two terms of tacit knowing: proximal and distal. The proximal term is the particulars which we are tacitly aware of for the purpose of attending to the distal term. The distal term is the whole which we are focused on. The relationship between the proximal and distal terms of tacit knowing has three aspects; functional, phenomenal, and semantic (see Figure 1.)

The *functional structure* of tacit knowing is an attending from the proximal term to the distal. For example, in analyzing strategic situations our focus is on the situation itself. It is what we are attending to, thus it is the distal term. The situation is composed of many strategic factors that are the features of the situation. This is analogous to a human physiognomy where the strategic situation is the face and the features of the face are the individual strategic factors. These features are the tacit assumptions that together comprise our understanding of the situation. These assumptions are not articulated and are tacit because we attending from them to the strategic situation as a whole. The strategic assumptions are initially unarticulated and we know more than we can tell. We may say we understand the strategic situation intuitively without being able to articulate easily our intuition.

Polanyi next discusses the *phenomenal structure* of tacit knowing. "We may say, in general, that we are aware of the proximal term of an act of tacit knowing in the appearance of its distal term; we are aware of that from which we are attending to another thing, in the appearance of that thing." (pg. 11) In other words when confronted with a strategic situation composed of a particular set of strategic factors we are aware of the proximal strategic factors, from which we are attending, to the strategic situation itself.

These two aspects are combined in a third relationship between the proximal and distal terms, the *semantic structure* of tacit knowing. When a certain combination of strategic factors is perceived, a characteristic strategic situation is anticipated. This is the intuitive sense or "gut feel" that a manager has for certain strategic situations. The manager is made aware of certain strategic factors, the proximal terms of the situation. She attends from these individual factors to their joint meaning. The manager may not be able to identify the individual factors that create the strategic apprehension; she only knows them in terms of their joint meaning. It is their meaning to which her attention is directed and toward which action is taken.

A fourth aspect is deduced from the other three, the *ontological*, which is the relationship to the reality we have tacit knowledge of. The threefold relationship between the two terms of tacit knowing jointly constitutes an understanding of a comprehensive entity. In our example, the strategic situation is understood as a comprehensive entity which is jointly constituted by the individual strategic factors and their perceived meaning in a composite whole. The manager perceives strategic factors, that together constitute a characteristic strategic situation which is a reality perceived as a comprehensive whole. This perception represents the existential learning of the individual gained through interaction with the strategic environment.

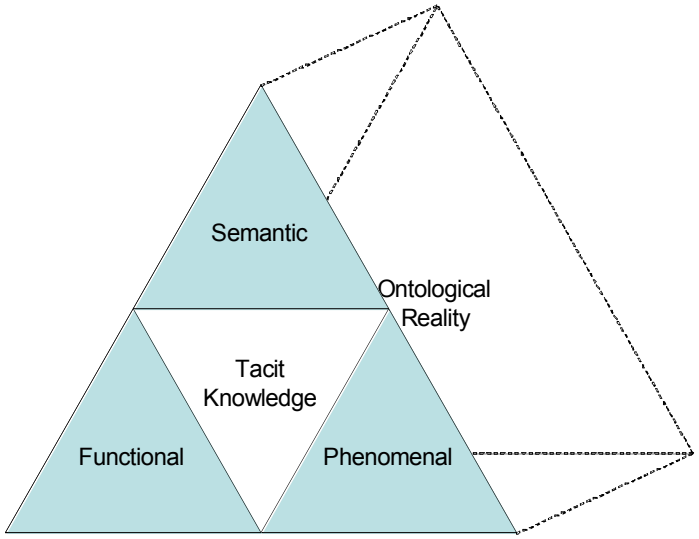

Figure 1 Polanyi's structure of tacit knowing

Tacit knowledge is also an adaptive structure that incorporates new ontological facts into its internal representational structure through the process of indwelling. In indwelling, particulars are integrated into comprehensive entities through interiorization. Instead of focusing on external particulars as comprehensive entities in themselves we make them function as the proximal terms of tacit knowing. The particulars are integrated and we dwell in them (attended from them) and attend to the comprehensive entity that they jointly represent. An awareness of a new strategic factor is thus appropriated and internalized in the perception of strategic situations. The new factor becomes part of our proximal assumptions and we perceive it only in terms of its relationship to the whole. These new particulars thus constitute information in that there is a change to the structure of our tacit knowledge.

This has implications for collaboration engineering in that a focus on the particulars (divergence activities) can destroy our understanding of complex situations. For example, traditional strategic planning focuses on an understanding of the particulars through list making. The interactions that constitute the whole are lost unless explicitly reintegrated. SWOT analysis is typically done through a listing of factors that focuses on the particulars without a re-integration of those factors into a composite whole. Endless

decomposition and analysis destroy the meaning and understanding of the whole. This is the advantage of well constructed scenarios. They are an integration of separate factors into integrated patterns that put particulars into context. The focus is not on the particulars but the composite whole they jointly represent. Particulars once analyzed must be interiorized and reintegrated. The recovery of the meaning of the particulars as they are placed into a comprehensive whole changes their meaning. We now have a more complete and accurate understanding of the whole. In this way new particulars can be swept into a tacit comprehensive whole through explicit analysis and reintegration. The key is the interiorization of the particulars and reconstruction of the whole.

The same process is followed in systems analysis and design and the design of software. The process of functional decomposition is an explicit rational process that asks us to detail our experience, to decompose or deconstruct it into its constituent parts. This phase of knowing is analytical and destructive of the composite whole. The reintegration of individual components is a synthesis of the particulars back into a cogent designed whole. The awareness of the particulars is retained but the whole must be recreated from its constituent parts. Polanyi calls the integration a ***gestalt***. This is a broader conception than the one used by gestalt psychology where it is strictly related to perception which links the biological function of perceiving with higher forms of knowing.

Both the reading and writing process are examples of tacit knowledge in action. The writing process proceeds in two stages. The first is a brainstorm of particulars. The free writing process surfaces tacit understands without regard to the final form or rationality of the ideas. These ideas are surfaced in free association. The same process is at work in brainstorming. A good brainstorming session brings to light many proximal bits of knowledge that have previously been un-articulated. The second stage of writing is to bring these together into a rational whole. This rational process forcefully integrates the proximal parts. The relationships between the parts are brought together through large organizational structure. The structural relationships between sentence paragraph and section form a single whole of related parts that communicate an integrated thought. A well written paper is a ***gestalt*** of an author's perception.

The reading process also proceeds in stages. The first stage is a survey stage is a pre-reading stage that assembles individual parts and constructs a contextual whole that illuminates the author's structure of thought. This then provides a context for the understanding of the specific individual parts that comprise the writing. Once a

perception of the whole is formed, reading in depth can be pursued to more fully understand the intricacies of the author's thought. This is symmetrical with the writing process which proceeds from proximal parts to distal whole. The reader first gets a picture of the whole that provides for assimilation of the individual parts. Without the whole the parts have no frame of reference and lose their meaning.

These illustrations emphasize the normative implications of Polanyi's work for collaboration engineering. Patterns of interaction must be consistent with the tacit structure of knowing to be effective. It is not a matter of converting tacit knowledge to explicit. Analytical processes that simply decompose our understanding of situations without a corresponding reintegration will lead to a loss of knowledge in an organization. Organizational learning can incorporate new insights gained from experience through rational learning processes that allow individuals to internalize new particulars through explicit reintegration. Explicit processes (like causal mapping) that follow the structure of tacit knowledge are successful because they are consistent with the way humans gain knowledge and understanding. The design of thinklets must follow the tacit structure of knowledge for organizational effectiveness.

The power of a gestalt as an organizational schema is the power to communicate and create shared knowledge and understanding. Research in knowledge management supports the view that shared knowledge is a powerful factor in building consensus and the effectiveness of collaborative efforts. Polanyi has little to say about how shared knowledge is created at the group level. The structure of tacit knowledge is individual in nature and collaboration engineering is inherently a process of developing shared knowledge. Knowledge is not only personal but social as well.

The structure of collaborative knowing

Kenneth E. Boulding [15] in his seminal work: The Image: Knowledge in Life and Society describes a social knowledge transcript to which the individuals of the society contribute. Each individual has an image (Polanyi gestalt) that is a factual multidimensional view of the world. The image has the primary dimensions of space, time and relationships: causal, personal and emotional. In addition there are other dimensions of the image: relative certainty/uncertainty, reality/unreality, and the Jungian levels of consciousness, unconsciousness, and subconsciousness.

Boulding's theory is an organic theory of knowledge development and growth and therefore learning. The primary question is "How does the image change and grow?"

The image is changed by the arrival of a message from the environment. Facts are accepted messages processed through a value image. Messages affect the image in one of four ways. First the message may have no affect on the image. Either it is ignored as an already known fact or it is rejected by the value system. Second the message can change the image in a simple way. Such changes are minor changes of understanding of facts or information that is paid attention to because it is consistent with the existing image. Third the message can produce a revolutionary change in the image. The message content has the effect of reorganizing the image dramatically. Finally, since facts are processed messages, they affect the relative certainty/uncertainty or reality/unreality of portions of the image. Messages that threaten the stability of the image are generally resisted. But some messages overcome the resistance.

Revolutionary change in the image can occur because of the power of a message or the relative instability of certain parts of the image in terms of the dimensions of certainty/uncertainty or reality/unreality. Powerful messages have their impact due to their ability to radically reorganize the image and its relationships. Since the image controls behavior, changes in the image mean changes in behavior. Consider the impact of two completely different messages: the image of the earthrise transmitted live by Apollo 8 during Christmas of 1968 and the recent bombing of the World Trade Center. Both messages powerfully altered our image of the world, its relationships, and our behavior.

Related to the image of fact is an image of value. The image of value is a scaled reflection of the image of fact. Value scales are simple better or worse comparisons that operate according to the welfare function of economic theory and are associated with some but not all images of fact. Value scales exist as a hierarchy that filters messages and determines their impact on the image. The value image is also changed by messages. Changes in the image can result in changes of the value scales. The value image is the guardian or guarantor of the image of fact and will resist certain messages. Non-threatening messages will be allowed to change the image. Messages that are considered hostile by the value image will be rejected. Sometimes messages of sufficient power or repetition can penetrate and produce change in the image that forces a reorganization of the image and its associated value structure.

While the image is a knowledge structure that only truly exists at the individual level, it also has a public dimension. Key components of the image are shared with others and are thus “public” images. Public images are shared and communicated

through an external memory structure or transcript. Subcultures, such as scientific disciplines, have shared images as well that are transcripts of the interplay between the image and value structures of individuals in that subculture. Scientific knowledge is contained in a public transcript that represents the public dimension of individual shared images. Scientific investigation and knowledge has contributed to the growth of man's relational image especially with regard to cause and effect relationships.

Herbert Simon [16] describes this sociological transcript as a blackboard. The blackboard is a messaging system that allows scientists to communicate asynchronously, without regard to time or space. Messages to the public image are processed through its value structure (a sub-component that is itself a collection of individuals) and potentially become part of the structure of knowledge at that level. Messages are frequently rejected by value structures or can be modified to conform to the value structure. If a message is sufficiently powerful, it can be forced through the value structure to occasion change in the image including the value structure itself. The process of learning is essentially a process of image reorganization.

While public or subculture images are not strictly images (only individuals truly have images), they have many of the same structures and elements. For example the process of blind reviews in the scientific publication process employs a value image that filters messages and therefore their impact on the public transcript. Even here, though, it is an individual reviewer's reading of the message. The message is processed through a personal value image and is accepted, rejected, or revised in some way. The value image of individual reviewers may or may not be shared with the values of the journal, the value image of the editor, or that of other reviewers. The interplay of values, the construction of the message, and the repetition of the message all have their affect on what shows up on the blackboard.

Knowledge representations are ontological statements about reality that are both individual retained and shared through sociological transcripts like Simon's scientific blackboard. Organizing schemas in collaboration are similar sociological transcripts that represent the grounded theory of the group at hand. They represent the tacit knowledge that the group process has made explicit. To be effectively communicated and shared they must be seen as a holistic gestalt or image. The next section of the paper describes a case study of a large scale collaboration engineering project and the development and use of a collaboratively constructed gestalt.

A Collaborative knowledge gestalt:

The Social Process

In the fall of 1970 a massive research project was initiated by the Institute of Cultural Affairs (ICA), an international not-for-profit organization concerned with the Human factor in world development. Today the organization is based in a series of nationally incorporated organizations and an international umbrella organization: ICA-International. More than 1500 books representing foundational writings in social dynamics were analyzed by a global group of volunteers and staff from the ICA. This diversification or ideation stage represented a massive brainstorm that was then organized into a multidimensional model by a smaller group of researchers. The triangular fractal model, a Sierpinski [17] triangle fractal, systematically organizes the social process dynamic into six levels of increasing detail that organize 364 discrete categories into a single integrated model. In the process of construction, successive levels of detail enabled clarification of the immediate preceding level. This had a ripple effect during the creation of the model such that the elaboration of categories lower down in the model would clarify and stabilize top level categories. In practical terms only the top 3 levels are used as an organizing schema.

Jon Jenkins [18] in his book The Social Process Triangles describes the primarily anthropological basis of the analysis. The top level categories are Economic, Cultural, and Political. In Jenkins's schema the terms social and cultural are interchanged to conform to correct usage in anthropological literature. The model is "a series of interlocking triangle which deal abstractly with the process of creating commonness of social facts which goes on in any culture at any time…The cultural (social) process triangles operate out of a single abstract rational. The foundational or lower left, pole of any Triangle pertains to the drive for self-preservation. In the context of the whole cultural (social) process, this is the process of economic commonality. Within the economic process, this is common resources; within the political process it is order, and so on. The foundational pole of any triangle is that without which the other two processes do not go on….On the lower right hand pole of any triangle is the communal pole. Which pertains to the relationships of power and decision-making in the midst of any social group…The final dynamic of the cultural process in any triangle is the top

pole, the rational dynamic. This is the dynamic which dramatizes the uniquely human in the triangle: it is the spirit which make participation in the social process worthwhile." p. 13 (See Figure 2 Level 0-3 Social Process Triangles)

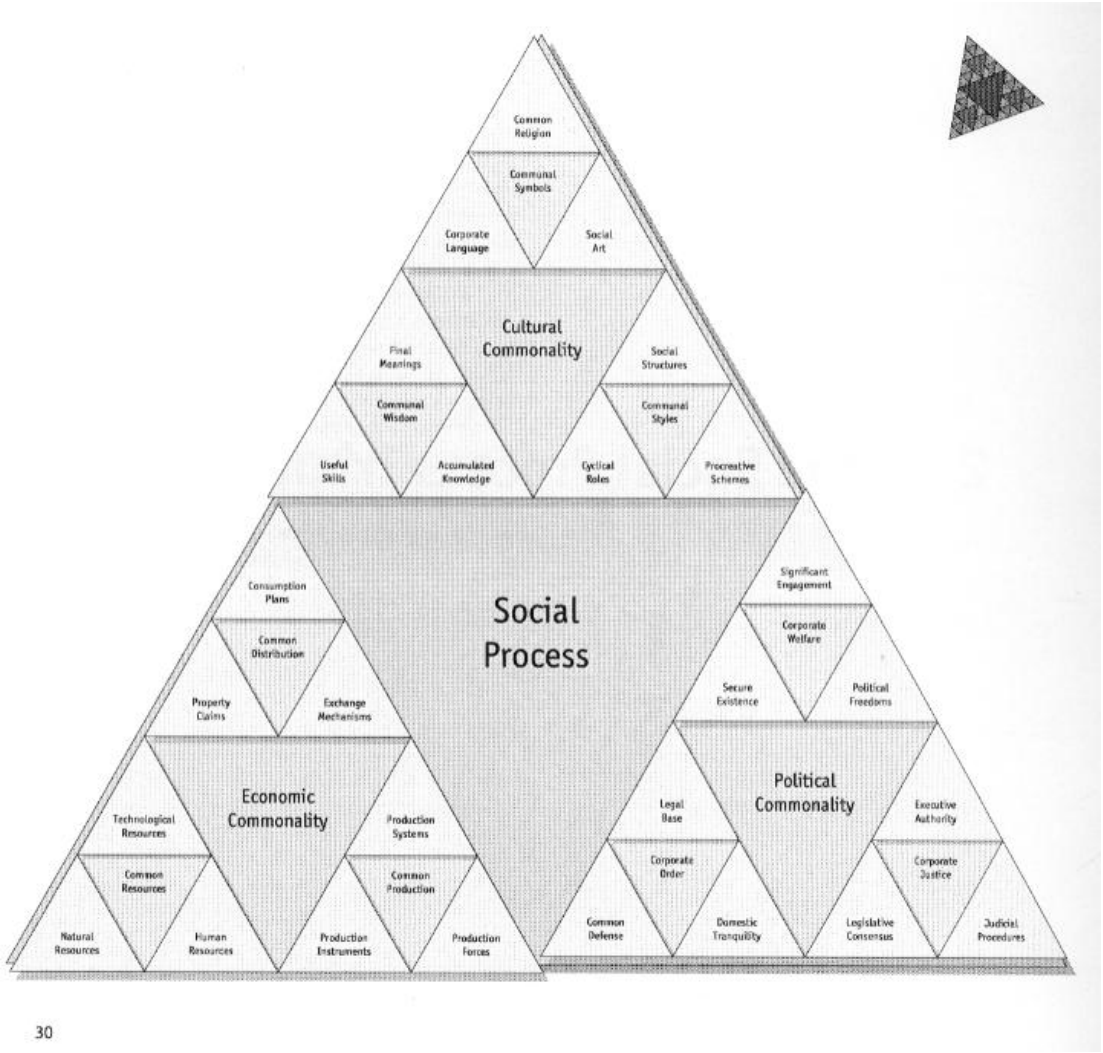

Figure 2 Level 0-3 Social Process Triangles

This underlying rational for each triangle is used to systematize the ontology through all six levels. The ontology is a true fractal in that each triangle is composed of three interlocking triangles which follow this self-similar abstract categorization at each successive level in the model making it a richly dynamic analytical structure. This type of categorization has rich roots in knowledge representation as far back as Aristotle and can be found in other classical philosophical work. Sowa [2] has an interesting quote from Lao-Tzu in The Book of the Tao:

The Tao gave birth to the One;

The One gave birth to the Two;

The Two gave birth to the Three;

And the Three gave birth to the ten thousand things.

Sowa remarks that this insight is remarkably similar to the concept of the *logos* articulated by the Greek philosopher Heraclitus. "The Greek concept of *logos*, which can also be translated account, reckoning, or even *computation*, is broad enough to encompass all the abstractions of mathematics and metaphysics." p. 55 This idea of abstract categorization is essentially Platonic. The changeable flow of everyday experience is determined by the unchanging mathematical form or idea that is the true reality. The "Social Process Triangles" thus are a pure form of Platonic modeling with an emphasis on unchangeable form that determines the observable changeable flow of observable social content. Aristotle however, reversed the emphasis and focused on the observable content with form being an abstraction from the ultimate reality of the observable world. The interplay between these two perspectives describes the essential dialectic that was used to build the construct. As such it represents an interplay of both form and content.

From Aristotle to Pierce ontological categories have been a subject of study. The triadic form of ontology was first developed by Kant's interpretation of classical Greek categories. Sowa quotes Kant's description of the triadic pattern of his categories:

> In every group, the number of categories is always the same, namely, three. That is remarkable because elsewhere all a priori division of concepts must be by dichotomy. Further the third category always arises from a combination of the second category with the first. p. 58

The idea of triads in categorization is later picked up by Hegel in his dialectic of thesis, antithesis and synthesis, and then by Pierce, Husserl, and finally Whitehead. Again from Sowa [2]:

1. For Firstness, Whitehead used the term *actual entities* for objects and processes that can exist independent of anything else. They are the final real things of which the world is made up…
2. For Secondness, he used the term *prehension* for "concrete fact of relatedness." …
3. For Thirdness, Whitehead adopted the Latin word *nexus*, which repreents an instance of connecting or binding together two or more actual entities…

This classical approach to categorization is incorporated in a unique representation of sociological knowledge. The resulting model represents a collaborative research project in developing a systematic ontology of the social process which has been utilized as part of the organization's Technology of Participation (TOP) method of facilitation. Since the initial construction of the ontology the framework has been known as "The Social Process Triangles." During the United States Bicentennial in 1976 the model was a featured part of five thousand official "Town Meetings" that were held in each county of the United States. The next section describes this event as a large scale collaboration engineering event.

Large scale Collaboration Engineering:

Town Meeting 76

During the United States Bicentennial in 1976 the ICA engineered a collaborative "Town Meeting" that was officially recognized by the American Revolution Bicentennial Administration [19]. The event was sponsored local across the approximately 5000 counties that make up the United States. ICA consultants and staff in 47 cities worked to train local practitioners to organize and facilitate the meetings following a prescribed facilitation model that was distributed in workbook form. The process was self documenting and more than 2500 documents remain in the ICA's archives in their Chicago headquarters. The social process triangles were a key part of the facilitation and were used to analyze and organize participant input into challenges facing the country at the community level in 1976.

The meetings were one day facilitated events. I personally conducted one such meeting in the community of Westport in Kansas City, Missouri. Approximately 200 people attended the day long meeting. Since the number of trained staff facilitators were too few for such a large scale collaboration activity, local practitioners were trained to lead the meetings following a predefined script that was published in a souvenir workbook. The day was broken into morning and afternoon sessions with a lunch interlude between the two session and a closing celebration and presentation of the documented results of the meeting.

The Present Challenges

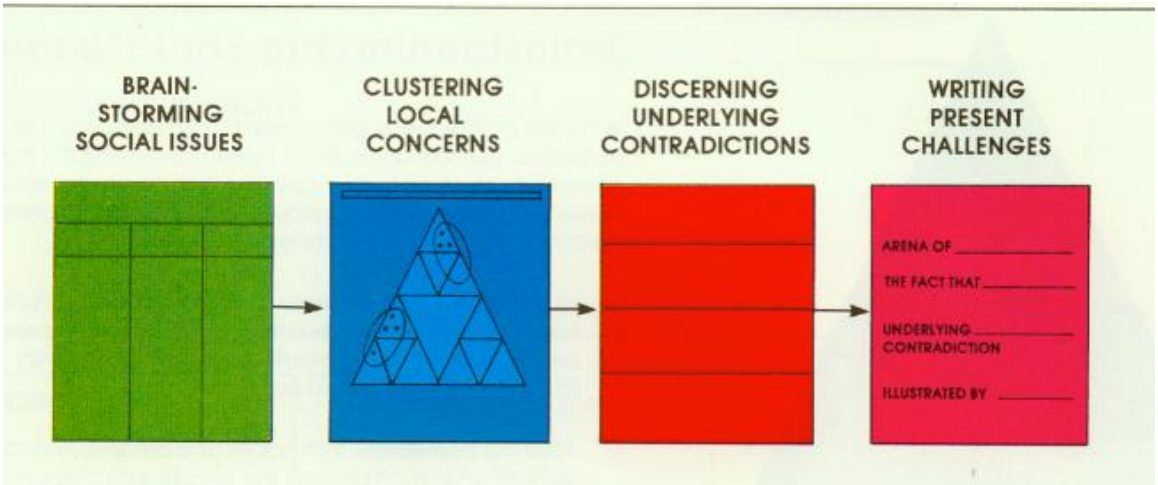

Figure 3 Structure of The Present Challenges Workshop [19]

The morning session focused on creating challenge statements that documented the present challenges facing the community (see Figure 3). The exact form of the challenge statement was prescribed in the following format:

> In the arena of <*arena of societ*> the fact that <*social blocks*> indicates that the underlying contradiction is <*underlying contradiction*>. The contradiction is illustrated by <*local illustrations*>.

The italicized elements were outcomes of the facilitation process and included in the final document as a series of challenge statements. The challenge statements then become the basis of the afternoon session. The afternoon session focused on writing proposal statements for how the challenges would be met. This was reported out also in a prescribed form:

> We the Citizens of <*community*> in order to <*primary intent*> propose <*practical activity*> through <*implementing steps*>.

The resulting proposal statements were then part of the meeting documentation along with output from another working group which created a new community Song, Story and Logo that become the cover of the document.

The present challenges workshop was a highly scripted event. Participants were divided into groups of 20 termed guilds. Each guild briefly discussed the community's hopes and dreams for the future and noted them in the workbook. This constituted the community's operating vision. Preprinted workbooks with complete instructions were

used as the technology in the meetings. They provided a script for facilitation that was common to all 5000 meetings.

The next step was to individually brainstorm the social issues blocking the realization of the community's vision. Participants were asked to list three economic, three political and three cultural issues. This follows the rational provided by the 1st level social process gestalt categories (see Figure 4). An intermediate convergence thinklet was then used to individually star the three most important issues from the list of nine. A wall chart was used to publicly list individual's most important concerns and after stared concerns were listed any other critical concerns that were missed were added. Issues were tallied by level 1 categories (economic, political and cultural) and the workbook provided space for 20 issues per category for a total of 60 issues.

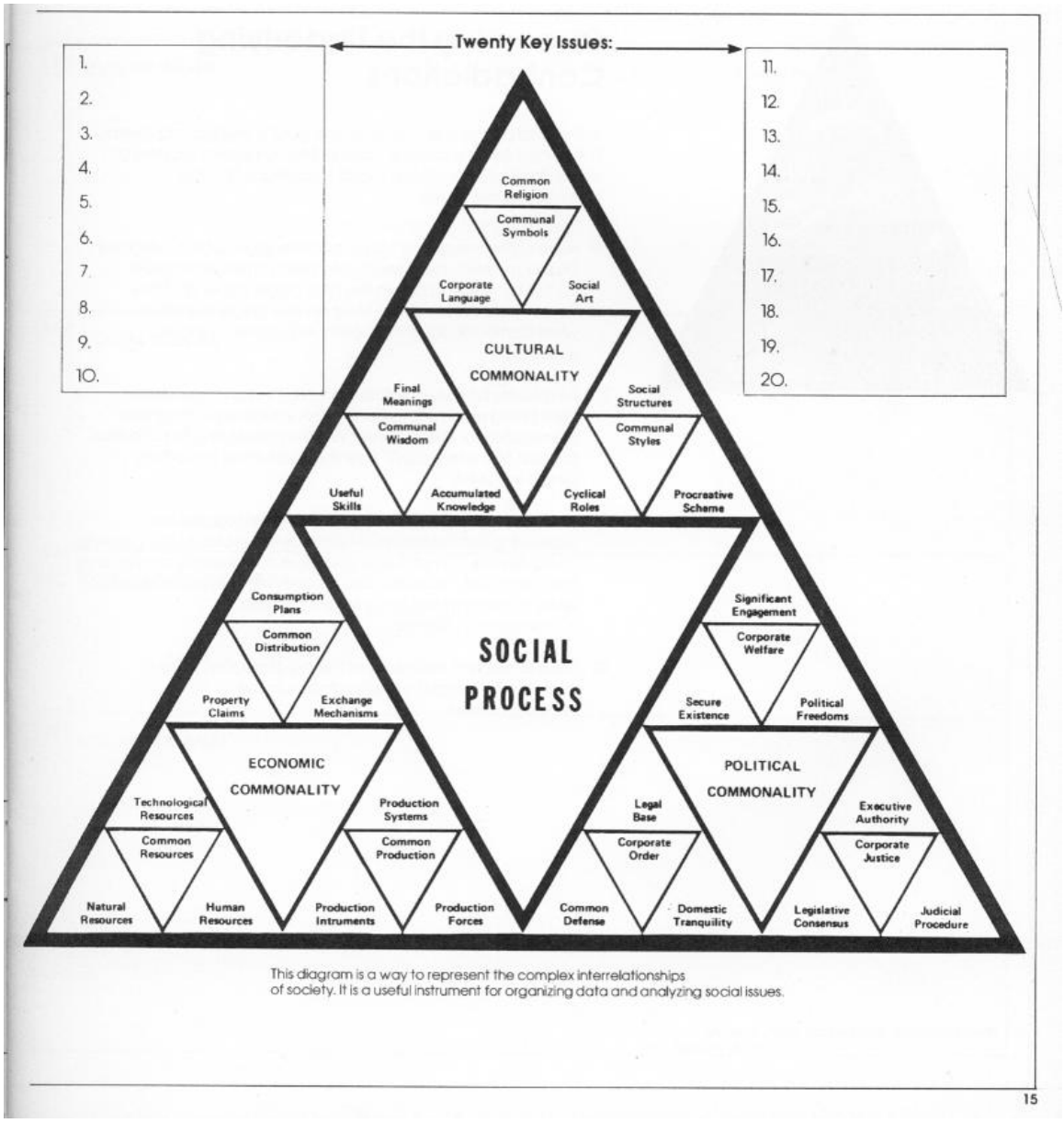

Figure 4 The Social Process Triangles issue cluster page [19]

After the divergence activity, an organizing activity based on the social process triangle at the 3rd level was used to cluster the issues. An initial convergence thinklet was used to reduce the issues list to the 20 most important issues. Individuals were asked to check beside the five issues that seem most important. Then as a group the 20 most important issues were selected and recorded in the workbook again. Participants then were asked to plot these issues on the social process triangle at the lowest level (27 different triangles.) Once the issues were plotted they were clustered into four to five clusters based on proximity of the issues. Each cluster was given a priority number based on the number of issues in the cluster.

Next the guild was divided into small teams with each team focused on one of the clusters. The cluster issues would be copied into the workbook, the cluster number and social arena from the social process triangles would be also noted. The team was then asked to list the reasons these issues were not being resolved. This elaboration would produce a new list of social blocks that was again converged to three most important blocks. Once three social blocks were selected the team was asked to state the one objective social reality that confronted the community in dealing with all the issues. All team responses to this question were recorded in the workbook. This divergence step would be converged to a single statement of the underlying contradiction in the next phase of the workshop. Team participants were then asked to list local illustrations of the underlying contradiction.

The final step used a collaborative writing approach to draft challenge statements according to the formalized statement that would be printed in the community document. Each team would be divided into three "units". Each unit was instructed to draft a sentence describing the social blocks, underlying contradiction and local illustrations based on the team brainstorm of these items. The units then met together as a team and selected or combined sentences to draft a single challenge statement and give a title to the challenge. This was recorded on a wall chart for a final plenary session and also produced on a document production form for publication at the end of the meeting.

The Practical Proposals

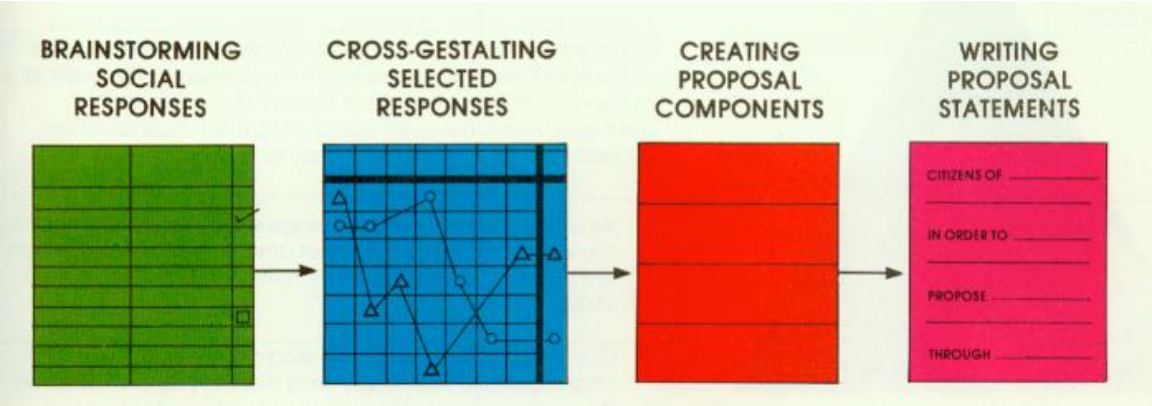

Figure 5 The Practical Proposals Workshop [19]

The practical proposals workshop used the same general approach as the earlier present challenges workshop (see Figure 5). Participants were divided into four guilds. Three guilds worked on the political, cultural and economic challenges from the morning

sessions. The remaining guild was assigned to create the new community song, story and logo. Individuals wrote practical responses to each of the challenges assigned to their guild and ranked their responses by which were the most imaginative, practical and effective suggestions.

In the cross-gestalt the guild worked together to create groups of practical proposals using a cross-gestalt thinklet. In this thinklet the primary organizational tool is a grid. The columns were labeled with the challenge titles and the responses to each challenge were listed in the cells under the title that they were a response to. Then the responses were grouped across the challenges without regard to column affiliation, thus the term cross-gestalt. These grouped responses became the basis for the proposal components that were then reported in the prescribed statement format.

At the end of the meeting the challenges and proposals would be reported out in a plenary session and the group who created the new community song, story and logo would perform a drama to end the session as the newly published town meeting document was distributed to the participants. This little bit of ceremony at the end of the meeting was the take away image (or gestalt) of the meeting and the accomplishments of the participants work.

Conclusion

The organizing pattern of interaction in collaboration engineering has received little attention by researchers. This paper has articulated a philosophical foundation for research in this area that is grounded in knowledge representation, epistemology, and knowledge management. Conceptual organization in collaboration is about building grounded theory that becomes an ontological statement that is representative of a group's tacit knowledge. The process of conceptual organization is the construction of explicit images or gestalts that are social constructions from individual perspectives that are swept into a larger construct that can become the basis for further elaboration and divergence but must ultimately be reconstituted into a new gestalt or the group knowledge is effectively destroyed. This group knowledge is contained in a social transcript or blackboard that is an explicit social knowledge construct.

An example was given of a collaborative research project that focused on the creation of an explicit ontology of the social process. The ontology was a gestalt of a massive literature review accomplished through a collaborative research effort. This

ontology was used as a primary organizing framework and image in a series of meetings that were held in every county in the United States as part of the American bicentennial in 1976. Roughly half of the meetings (2500) produced documents that were later preserved in the institutional archives. Anecdotally some of the 5000 meetings were too small to produce adequate documentation, documentation was never forwarded to the institution or documents were lost. Still the remaining documents provide evidence of the efficacy of an engineered collaboration on a large scale.

Of particular interest to this paper was the use of the social process triangles as part of an engineered collaboration. This organizing construct provided both an organizing schema and context for the facilitation as well as a research end in itself. The social arena information plotted by participants of the meetings would allow for a systematic cluster analysis of challenges listed by communities. Challenges and proposals from the documents were used to validate findings of a research assembly in the summer of 1971 that identified specific social arenas within the social process triangles that were critical change points in society at the time. This data has never been statiscally analyzed and potentially can provide answers to current questions on measurement in the organizing pattern of interaction on which little research has been done. The author is currently working with the ICA to preserve and digitize the archive to provide better accessibility for research in collaboration engineering.

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