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Using Complexity Science to Facilitate Self-Organizing Processes in Teams

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Introduction

Team building is an important intervention for an OD practitioner. Using survey feedback methods, various team development instruments, and process consultation, the consultant helps a new or struggling team gain a clearer sense of its mission, negotiate roles of the members, and work through any interpersonal snags that are impeding group productivity.

Team building is generally successful if team members and the leader are open to the process, if there is a sufficient level of trust, and if there is a willingness to commit sufficient time to the team-building process.

When these conditions are not present and the team is dysfunctional, the science of complexity is helpful to explain and proscribe interventions.

The field of complexity has developed over the past 30 years within the science community as an endeavor to discover the underlying principles that affect the development of complex adaptive systems (CASs). The leaders include Murray Gell-Mann (Physics), Ilya Prigogine (chemistry), and John Holland (computer science). The "new sciences" of chaos, nonlinear dynamics, and quantum theory all provide revolutionary ways of thinking about causality in natural systems. Kevin Dooley (1996) identifies three complexity principles which explain the behavior and evolution of a CAS:

- 1) order is emergent as opposed to hierarchical,
- 2) the system's history is irreversible, and
- 3) the system's future is often unpredictable.

The basic building blocks of the CAS are agents. These agents have the freedom to act in unpredictable ways and whose actions are interconnected such that one agent's actions changes the context for other agents, e.g. termite colonies, stock markets, the Internet, gardens, human beings, and teams. These agents seek to maximize some measure of

goodness, or fitness by evolving over time. Change occurs at the micro level where relationships, interactions, small experiments, and simple rules shape emerging patterns.

Self-organizing in Teams

Self-organization is the CAS pattern that is most closely related to changes which occur in teams. It describes the tendency of a complex system under some circumstances to generate new patterns spontaneously. As a team opens to feedback from within and without the team, it generates new structures and patterns based on its own internal dynamics -- even evolving its own purpose and leadership as the team members interact. These processes are self-organizing processes. Self-organization is not necessarily good or bad. In team building a leader must guide the evolution that emerges from the interaction of team members instead of specifying changes in advance and required conformance to those changes.

The dimensions of change in a CAS are illustrated in *Figure 1, Self-Organizing Dynamics in Teams*. This diagram presents an iterative nonlinear process, which includes two phases. The phases happen on many dimensions at the same time.

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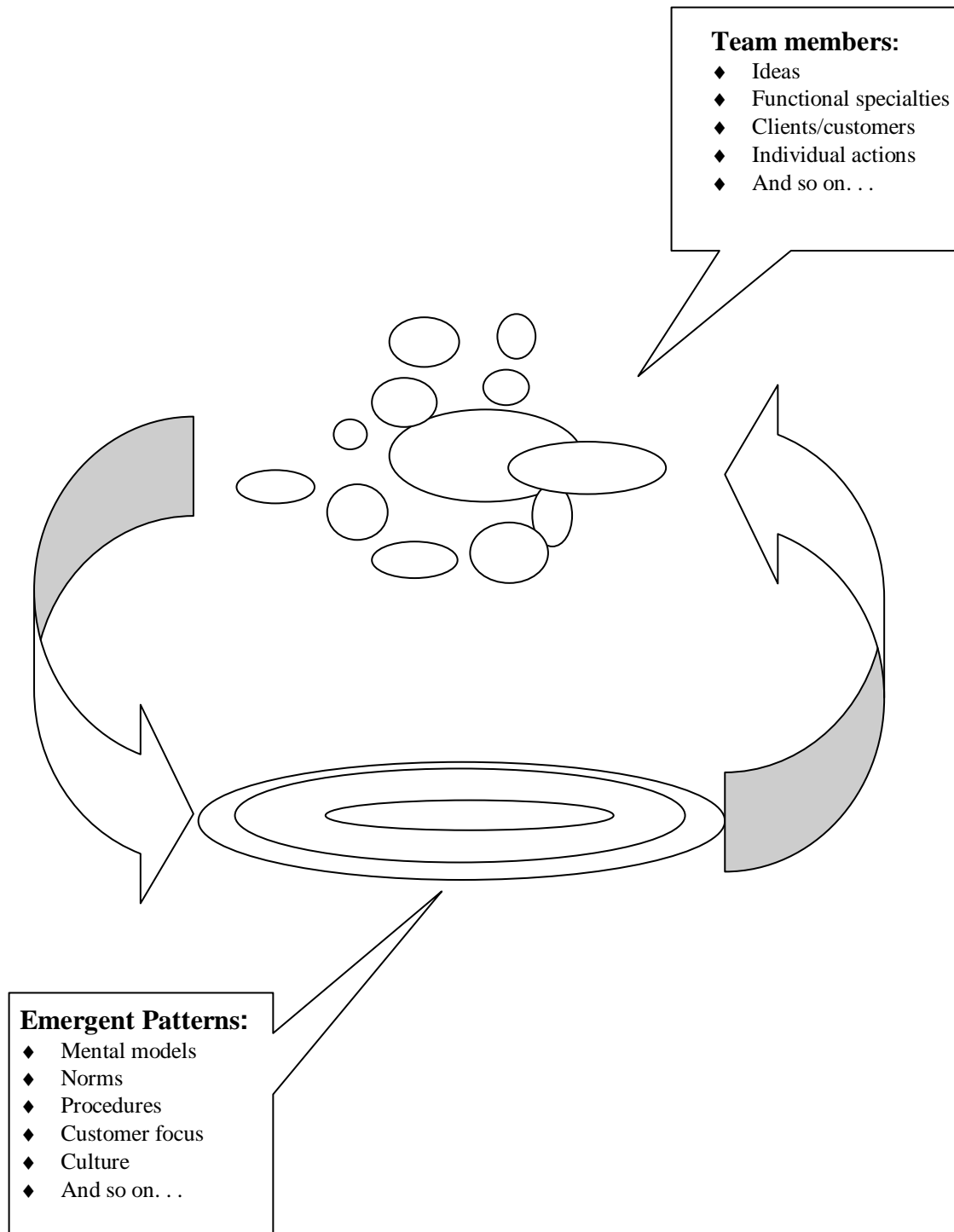
One phase starts with the interactions of the team members and generates a team pattern. The other phase begins with the emergent patterns and affects the interactions of the members. As the patterns emerge, they constrain the behaviors of the team members in their future interactions. In this messy and iterative manner, the team lurches and searches its way to new relationships and roles. For example, a company marketing and sales team at any given time has a set pattern of how names of prospective customers are found, strategies for contacting customers, and ways of relating with the production and accounting departments. This pattern is the result of many cycles of interaction and pattern formation in the history of the company. New sales team members are expected to learn the ropes. Almost overnight, with the introduction of new technology like the cell phone, the old patterns of interactions will give way to new patterns.

At the same time that the new pattern is emerging, the old pattern is having its influence on the behavior of the members. Corporate culture, group norms, and documented procedures are examples of ways in which previously emerged patterns become entrenched and affect degrees of freedom for members later actions. Patterns of team interaction establish traditions and habits of team life that tend to bring order to individual interactions.

On the one hand, this constraint is beneficial because it makes some actions and decisions automatic, releasing energy for more creative and challenging tasks. On the other hand, too much dependence on old patterns of behavior locks individuals and teams into habits that may not be adaptive in new circumstances.

This phase of the process is denoted by the upward arrow on the right side of Figure 1. The system-wide patterns can be considered both effects (of previous member interaction) and causes (of future member behavior). For example, we worked with a team that was receiving a large number of customer service complaints. Early observations revealed that team members complained about customers. They had an informal ritual. Whenever they got together, they would trade stories about the most recent and most stupid customer interaction. Of course, this pattern of behavior encouraged team members to focus on, and collect, outrageous stories about customers. New members quickly fell into the pattern. Some team members, we suspected, would even provoke absurd customer remarks to have a good story for the next lunchtime sharing session. Recognizing this pattern, the intervention we designed sought to refocus the lunchtime conversation. When the habit was disrupted, other, more productive behavior developed.

Figure 1. Self-Organizing Dynamics in Teams



Conditions for Team Building

To influence these self-organizing processes an OD consultant must understand and affect the three conditions that determine the path and outcome of self-organizing in teams: significant difference, transforming exchange, and containers.

- **differences** in the team provide the potential for change
- **transforming exchanges** connect across the differences in the team to realize that potential
- **containers** hold the team together while change occurs.

The more constrained each of the three conditions, the more predictable are the patterns. The less constrained, the less predictable are the patterns.

Significant Differences

The first condition for team building is the recognition of **significant differences**. Differences, such as levels of expertise, functional specialty, cultural differences, alternative views about quality, differing views about where to allocate resources, and the exercise of power are the engine for change. If, for example, level of expertise is a significant difference, the patterns that emerge will embody the various areas of knowledge and experience inherent among the team members. Difference introduces the potential for individual learning and the emergence of coherent patterns of meaning. In the same way that a difference in elevation sets the context for a bubbling brook, difference in a team sets a context for vibrant interaction and change. If each member focuses on a difference that are significant to him/her, but the group as a whole has no shared significant difference around which to build a generative interaction, the team will stagnate. One function of the OD consultant is to discover and/or articulate the important differences that are hidden or unacknowledged among the many differences that exist in the team. By focusing the group on the most significant differences the consultant will help the group move to self-organizing.

Transforming Exchange

The process of team building also requires **transforming exchanges** that damp or amplify the differences to feed the process of self-organizing. These media for these connections can be face-to-face conversations, team meetings, email, interactive software, or voice mail messages. The content can be feedback, providing information or support, customer data, non-verbal signals, or a complex combination of messages and media. If these exchanges are tightly constrained by top-down direction, the value of the information flow will be reduced. A team with an autocratic leader may be so constrained that it cannot self-organize. At the other extreme, when team members only exchange minimal task information, they will find it difficult to support each other when

individual workloads increase. The consultant has the opportunity to see if the feedback mechanisms are adequate and if the available channels are used. If not, s/he may identify and intervene on the aspects of the team that are blocking the flow of quality information. Without meaningful exchanges and appreciative discussions, the team members work as disjointed or independent parts and fail to come together into a pattern than spans the entire team.

Containers

All of the other important factors that affect a team's development are **containers**. Containers provide boundaries, center points, and connections. How a team frames its purpose, its culture, and its processes provide multiple containers for its self-organizing activities. If the containers are too strong or constricting the team will not be able to self-organize. If the containers are too weak or loose, the team also will not be able to self-organize. Self-organizing occurs only when the containers allow the members to freely interact and for new patterns to form. For example, a team that schedules its meetings at times and in places with constant interruptions has a physical container that doesn't provide sufficient boundaries or center point or connections. A team that tolerates individual functional "stovepipes" has an organizational container that does not foster coherence. A team with cultural norms that suppress dissent has behavioral containers that are too strong or tight. A team that has a rigid work processes has conceptual containers that are too strong.

The degree of appropriate constraint seen in the team's container is situational. It may be appropriate to have tight deadlines and strict protocols when dealing with mechanical or routine procedures where worker safety is a major concern. It may be appropriate for a team to be very loosely organized when it is in the ideation or creative stage of a new project. The point is, a major focus for teambuilding is diagnosing and intervening to reach an appropriate level of constraint in a team's container. Without adequate containers to establish semi-permeable boundaries, center points, and connections for team building, the team members interactions will fail to generate useful patterns.

Consultant as Agent for Self-organizing

In the process of team building all three of the conditions for self-organizing are linked together. A change in one shifts the behavior of the team, which results in changes in the other two conditions. The role of the consultant is to intervene on one condition for a team to self-organize to generate new learning and productive patterns in the other two conditions. OD consultants can choose to:

- help the group focus on the differences that make a difference for the work at hand,
- ensure productive and transforming exchanges, or

- define and maintain useful containers for their client teams

In this article we discuss our work in team building where we used the conditions for self-organizing to guide our interventions to move the teams to higher levels of trust and to build bridges across the individual “stovepipes”. The teams showed marked improvement over about a six-month period.

Orange Team: Example of an Unconstrained Team

We were called in to work with the Orange team by the Department's manager. The Orange team, one of five teams reporting to the manager, had become dysfunctional even though the members were making strong contributions individually. We met with the team's supervisor and together planned an initial intervention of individual interviews with team members and key external customers and a feedback meeting with the team. The five major themes identified in the interviews were:

Conflicts

Several unresolved conflicts among members were seen as affecting the climate and willingness of the team to engage each other. There were various explanations about the causes of the conflicts.

Individual focus; not collaborative

The members generally did not know or care about the work of the others. Some saw this as a function of the technical work they do; others talked about a long legacy over a span of three or four supervisors; others thought it reflected the individual personalities; some customers were aware of team infighting and lack of respect, which diminished their trust in the team.

Information flow/team meetings

The team disliked the contentious team meetings and was unhappy that the supervisor shared information with only a few.

Technical knowledge and skill

The team members respected each other's technical knowledge and skill and believed the team would do what was necessary to get the job done. Many customers were happy with the work of individuals on the team.

Goal/customer issues

The team's goals had recently changed and there were various views about how the team should relate to its customers.

Diagnosis of the State of Self-Organizing

Our diagnosis of the interview themes is presented in Table 1.

Table 1. Self-Organizing Dynamics of Orange Team

<i>Theme</i>	<i>Condition of Self-organizing</i>	<i>Degree of constraint</i>
Conflicts	Difference – the members were aware of disabling conflicts, many rooted in history	Low – the supervisor did not mediate the conflicts or publicly identify the significant differences that needed resolution
Individual focus; not collaborative	Exchange – there were few feedback loops and opportunities for meaningful contacts	Low – the members avoided each other as much as possible
Information flow/team meetings	Exchange – the team only made cursory one-way comments in meetings	Low – lack of formal or informal leadership to model effective exchange
Technical knowledge and skills	Container – the team culture prizes technical skill and individual performance above all	Low – the team pattern of individual competence and individual service let them be independent
Goal/customer issues	Container – the team did not have a clear compelling collective mission	Low – the internal conflicts kept members from supporting each other or finding joint projects

In the feedback meetings with individual team members and with the entire team, there was general acceptance of the feedback, but little optimism that much could be done about it. When given several options for how to proceed, the team choose a two-day off-site. Some thought this would get it over with in a hurry. Others thought that only a concentrated time together would change their patterns. Yet others probably just wanted two days away from the office.

It was clear from the early data that the team was under constrained and that our intervention needed to constrain the conditions for self-organizing. We decided that the intervention with the most impact would be on transforming exchanges in a team-building workshop.

The Off-Site

In Table 2 we highlight the impact of eight off-site activities on the conditions for self-organizing in the Orange team.

Table 2 Major Impacts of Off-Site Activities on Conditions for Self-Organizing in the Orange Team

Off-site Activity	Significant Differences	Transforming Exchanges	Containers
Find your Match warm-up (low risk disclosure exercise)	Surfaced both new differences and common interests		Demonstrated that the workshop would be safe territory
Ground rules and objectives		Encouraged information flow and dialogue	Set the guidelines for behavior in the workshop
Aligning intent and impact (sending "I" messages in dyads)		Each member had a meaningful exchange with one other	
Group trust	Trust factors are prioritized		Established a vision of the trust needed by the whole team
Hooks Exercise		Exchange perceptions with second person in new dyads	
Role negotiation	Members became aware of their impact on fellow team members	Every member made written commitments to change based on feedback and requests from all others	
Managing conflict (Thomas-Kilmann)	Clarified the major conflict modes used by team members and supervisor		Team posts data about their conflict modes in team room to remind them of their collective bias
Team dialogue on issues	Identified major issue to be worked in next meeting	Team had positive experience in resolving issues	Future team meetings seen as occasions to resolve issues

Five of the ground rules we presented helped the team focus on the task of having transforming exchanges and surfacing differences and conflict while maintaining a safe container. They were:

- What is said will be treated with care and respect (create a safe place)
- Respect individuals and their choices to participate (no coercion)
- Share information needed by the team (disclosure where needed, not for the heck of it)
- Disclose feelings to create movement (get out of “stuckness”)
- Assume that everyone is doing the best they can and are intendedly competent (invite inquiry not judgment)

The opening activity of “Find your Match” gave the members an opportunity to engage each other in a fun and safe manner and set a positive tone for the workshop. An activity that paired members to work together in developing and delivering “I” messages to each other set a pattern for transforming exchanges where both the intent and impact of the communication would be honored.

The team ranked a list of factors contributing to group trust with the following result:

Rank	Factor
1	Open, direct communication
2	Honesty
3	Clear expectations
4	Keeping commitments
5	Trusting behavior by the leader

When these divergent views were amplified in trio discussions, three vision statements emerged that energized the group. For example, “The Orange team will be a highly effective organization because it values honesty, open and direct communication and keeping commitments as guiding principles when providing our functional expertise to our customers.” The team owned the differences that were truly important and the degree of constraint in the container we had developed increased enough to move the team into a self-organizing space. This was a substantial change from the awkward interaction among individuals before the workshop began.

A “Hooks” exercise gave individuals an opportunity to develop skills in giving feedback to another member. This was an effective warm-up to the major activity of the workshop – role negotiation which led to individual commitments about promised new behaviors and team agreements to support the behaviors. For example, the team supervisor wanted

more cooperation from the team, but the team saw instances where the leader's loyalty to her boss betrayed her promises to them. The supervisor became aware of this through the role negotiation feedback. A new container for the leader's commitments was drawn by distinguishing the areas where she could give firm commitments to the team from those areas where she needed to defer to her boss.

The managing conflict exercise in which the members disclosed their Thomas-Kilmann conflict mode scores helped the team understand its collective dynamics. The highest ranked mode was "avoiding" or "competing". No one scored above the 50 percentile on "collaborating" or "accommodating". The differences that had been submerged (unknown) are now public so they can openly talk about their blind spots in collaborating.

In the final activity the team acknowledged that sometimes when customers called there was no team member available to meet customer needs. The team agreed that they needed to be two-deep in each functional area to support each other. They identified one other team member as back up.

In the following weeks the cross functional dialogues made the members more sensitive to customer concerns. When customer representatives visited the team met with them as a group. Our interventions had tightened the constrictions on the team without thwarting the capacity of individuals to make their unique contributions.

Apple and Pear Teams: Examples of Overly Constrained Teams

The Orange team is an example of a team that is under constrained, where the containers were not strong enough to support meaningful interaction or safe enough to surface the important differences. We have also worked with teams that have the opposite problem – they are overly constrained by their managers. In these instance the consultant intervention is to loosen up the constraint and move the team to a state of self-organizing. For example:

- **Intervention to work a significant difference** -- In the Pear team assignments of new work were being parceled out to a favored few members of the team. When this difference of equity between members was surfaced, the leader adopted a policy of open competition for new work opportunities.
- **Intervention to improve transforming exchanges** -- In the Apple team the leader complained that the group members did not take initiative. In a team meeting we observed the leader providing answers to questions without pausing to allow team members to respond. Upon receiving this feedback the leader adopted a 10 second rule --- silently counting to 10 before following up on questions. This led to meaningful dialogue in the group.

After several team-building sessions the Pear team leader stated that the members were still complaining about a lack of sufficient structure and detail to guide their work. Since by this time we had shared our model of self-organizing with the leader, we could involve the leader in deciding an appropriate activity in the next team-building session. We mutually chose a “Feedback Loop” activity which allowed the team to examine their current methods of transforming exchange. The major change in their pattern was to improve their methods of work scheduling and meeting time deadlines.

- **Intervention to reconstruct the container** -- The Pear team had been receiving an increased number of special projects. The rigid role definitions in the team hindered adapting to the change. A revised organization design created cross-functional sub teams to which the incoming special projects were allocated.

Strategies for Consulting to Self-Organizing Teams

From our experience in applying our complexity science model in team building we suggest the following strategies for consultants:

- **Conditions of Self-organizing**
 - Diagnose the level of constraint in the three conditions of self-organizing (significant difference, transforming exchanges, and containers) in the team.
 - Intervene in one condition to move the team toward self-organizing, knowing that the other conditions will also be impacted.
 - Evaluate the impact of the interventions and adapt you work with the team increase instances of self-organizing
- **Significant Difference** --Bring out the hidden or avoided difference that will move the team to adaptive self-organizing.
- **Transforming Exchange** – Maximize the number and quality of interactions among team members and note the self-organizing patterns of connections.
- **Container** – Help establish ground rules for team interaction that can shape coherent self-organization.
- **Teach** - Depending on the client, teach the model of self-organizing as a tool for the team to use in its day-to-day work.

Conclusions

Complexity thinking helps the consultant to gain a better comprehension of teams as complex adaptive systems. A complexity perspective does not give answers *per se*. The unpredictability in complex systems makes it impossible to find absolute answers that work in every situation. Only the questions can be carried reliably from one context to another.

A team-building consultant assesses and focuses energy on the conditions for self-organization: significant differences, transforming exchanges, and containers. They observe how newly formed conditions affect the new patterns that emerge. Then, they begin the cycle again, assessing, intervening, and observing the conditions and the patterns of self-organization that result from the continual interaction of the team members and its internal and external customers. The consultant needs to be very engaged in affecting the conditions of self-organizing when the team is overly or under constrained. As the team moves to a self-organizing state, the consultant only has to monitor the conditions of self-organizing

The consultant's needs to keep responsibility, authority, and decision making for change in the leader and members of the team. At times a leader or the consultant may need to use authority to start the interactive process, but the authority should be widely distributed as soon as possible.

The consultant should watch out for colluding with restrictive practices, rigid procedures, and required "best practices." By tracking the team's readiness for change and championing variation and experimentation the consultant will be increasing the team's resiliency and capability for continual adaptation.

References

- Allison, M.A. (1999). Enriching your Practice with Complex Systems Thinking. OD Practitioner, vol. 31, no. 3, pp. 11 –21.
- Axelrod, R. & Cohen, M.D. (1999). Harnessing Complexity: Organizational Implications of a Scientific Frontier. New York: The Free Press.
- Eoyang, G. (1997). Coping with chaos: Seven simple tools. Cheyenne, WY: Lagumo Publishing.
- Kelly, S. & Allison, M. (1998). The complexity advantage: How the science of complexity can help your business achieve peak performance. New York: McGraw-Hill.
- Thomas K. W. & Kilmann, R. H. (1974). Thomas-Kilmann Conflict Mode Instrument. Tuxedo, NY: Xicom.

Lewin, R. & Regime, B. The soul at work: Complexity theory and business. New York: Simon & Schuster, in press

Lissack, M. & Roos, J. (1999). The next common sense: Mastering corporate complexity through coherence. London: Nicholas Brealey Publishing.

Olson, E.E. & Eoyang, G.H. (2001) Facilitating Organization Change: Lessons from Complexity Science. San Francisco: Jossey-Bass/Pfeiffer.

Petzinger, Jr., T. (1999). The New Pioneers. NY: Simon and Schuster.

Schein, E. (1999). Process consultation revisited: Building the helping relationship (Addison-Wesley series on organization development). New York: Addison-Wesley Publishing Company.