

# Community of Practice Variety from a Complexity Perspective

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## Abstract

A new framework for understanding communities of practice is required to unite the disjointed approaches currently employed. This paper proposes an approach based on complexity theory, and applies a framework developed by Axelrod and Cohen [1]. A set of mechanisms is explored to understand how a designer might influence variety (of strategies and types) in a community of practice. Four mechanisms are addressed: (i) the process of copying strategies and types; (ii) copying with error (mutation); (iii) recombination of ideas; and (iv) the role of the physical environment. An understanding of these mechanisms enables a designer to increase or decrease variety within a community of practice.

*Keywords: communities of practice, complexity, knowledge management, variety*

## 1 Introduction

The literature on communities of practice is voluminous and disjointed. Indeed, it has been suggested that a new framework is required for this organisational form [2]. The research underpinning this paper examines the culture and impact of a community of practice that has developed in the area of public-sector knowledge management. The first stage of the research responds to the apparent lack of a suitable framework for understanding such a community of practice.

Any attempt to develop a framework requires the use of a common language and approach to understand the key *processes* that affect communities of practice. In a changing and unpredictable environment, the most important

aspects of the framework will come from an investigation of these processes, rather than from a focus on the structure and content of communities of practice [3].

This paper develops a new framework for understanding communities of practice by applying Axelrod and Cohen's [3] model based on complexity theory. Complexity theory is gaining in prominence as a way of thinking about organisations [4-6] because there are parallels between the basic features of complex systems and modern organisations. These include many interacting components arranged in networks, non-linear interaction between components, self organisation, positive and negative feedback loops, and emergent properties. Stacey [3] illustrated this point in relation to feedback and non linearity:

Organizations are clearly feedback systems because every time two humans interact with each other the actions of one person have consequences for the other, leading that other to react in ways that have consequences for the first, requiring in turn a response from the first and so on through time. In this way an action taken by a person in one period of time feeds back to determine, in part at least, the next action of that person.

Communities of practice are, in many ways, microcosms of larger organisations—but without a formal hierarchy and rigid bureaucracy. Consequently, the arguments for applying complexity theory to organisations pertain equally to communities of practice. Furthermore, many leading thinkers on communities of practice have alluded to the complex nature of communities with reference to emergence [7] and self-organisation [8].

Asserting that it is learning that gives rise to communities of practice is saying that learning is a source of social structure. But the kind of structure that this refers to is not an object in itself, which can be separated from the process that gives rise to it. Rather it is an emergent structure . . . [7].

Even when a community's actions conform to an external mandate, it is the community—not the mandate—that produces the practice. In this sense, communities of practice are fundamentally self-organizing systems [8].

Wenger, McDermott and Snyder [9] implicitly endorsed the complex nature of communities in stating that their first principle for a community of practice was 'design for evolution', and other authors have highlighted the relationship between complexity and communities [10-12]. However, none has attempted to apply complexity concepts directly.

The primary intention of Axelrod and Cohen's [3] framework was to provide managers with a coherent approach to the design of interventions using complexity theory. The focus of their framework was on what designers and policy-makers can do to make a difference. The present study has a similar focus in applying complexity theory to communities of practice.

The paper draws on interviews and a survey from a community of practice called 'ActKM' (pronounced 'Act-Kay-Em'). This community was formed in 1998 with the purpose of promoting public-sector knowledge management [13]. It has 890 members who participate in an online discussion forum, meet monthly, and convene a yearly conference which attracts approximately 100 attendees. In

addition to these formal activities, informal activities include site visits among members, workplace discussions, and spin-off collaborations.

## 2 A complexity perspective of communities

Axelrod and Cohen [1] provided 12 terms which the present study adapts in describing aspects of communities of practice.

- **Strategy:** a conditional action pattern that indicates what to do in certain circumstances.
- **Artefact:** a material resource that has a definite location and response to the actions of agents.
- **Agent:** a collection of properties (especially location), strategies, and capabilities for interacting with artefacts and other agents (for example, people).
- **Population:** a collection of agents or strategies.
- **System:** a larger collection, including one or more populations of agents and/or artefacts.
- **Type:** all the agents (or strategies) in a population that have some characteristic in common.
- **Variety:** the diversity of types within a population or system.
- **Interaction pattern:** the recurring regularities of contact among types within a system.
- **Space (physical):** the location in geographical space and time of agents and artefacts.
- **Space (conceptual):** the 'location' in a set of categories structured so that 'nearby' agents will tend to interact.
- **Selection:** processes that lead to an increase or decrease in the frequency of various types of agents or strategies.
- **Success criterion or performance measure:** a 'score' used by an agent or designer in attributing credit in the selection of relatively successful (or unsuccessful) strategies or agents.

Using these terms, a community of practice can be viewed as a **population** of **agents** consisting of many **types interacting** on a regular and ongoing basis. The **agents select** and apply **strategies** to enhance their positions in the population. These strategies are applied in **physical** and **conceptual space** and result in the creation of knowledge and **artefacts**. Successful agents or strategies are **selected** according to the community's or agent's **success criteria**.

This view of a community of practice has immediate utility in that specific aspects of a community can be explored by a designer with a view to improvement. Strategies can be identified, types can be discerned, variety can be

modified, and success criteria can be articulated. Most importantly, new questions can emerge when a new framework is introduced.

In their generic framework, Axelrod and Cohen [3] focused on three building blocks: (i) variety; (ii) interaction; and (iii) selection. These building blocks were influenced by a range of mechanisms that affected micro-level interaction among agents and macro-level patterns that emerged. The present paper focuses on one of these building blocks: variety. Subsequent papers will address interaction and selection.

### 3 Variety

Because communities of practice are voluntary, what makes them successful over time is their ability to generate enough excitement, relevance, and value to attract and engage members. Although many factors, such as management support or an urgent problem, can inspire a community, nothing can substitute for this sense of *aliveness*. [9]

'Aliveness' is at the core of a successful community of practice. This sense of aliveness is also conveyed by complexity theorists when they articulate the differences among the terms 'order', 'complexity', and 'chaos'. Aliveness occurs at the edge of chaos (or complexity) when "... coherent structures that propagated, grew, [or] split apart [are] recombined in a wonderfully complex way." [14] The variety of agent and strategy types significantly influences a community's aliveness.

Variety within a community is reflected by the number of distinct types present. These 'types' might be recognised by members of the community or might be recognised as a result of analysis by an outside observer. For example, community members will distinguish male members from female members, or might discern certain people as being 'theorists' as others as being 'practitioners'. Regardless of the types recognised by the community there are always more unrecognised types. The types that become apparent to the community are a function of the group's interests, the frameworks adopted by the group, and the questions being asked. However, the types that interest a community designer are those that might affect community *behaviour*. Consequently male/female ratios might be important to a designer, whereas types relating to members' heights are less likely to be relevant.

Variety is an important characteristic in nurturing a community of practice. During a community's life there are times when new ideas, new perspectives, and new voices are essential to maintaining the 'liveliness' that ultimately attracts and sustains community membership. There are other times when the community discussion is awash with concepts, thus making the pace of change overwhelming. Kauffman [6] called this latter state 'eternal boiling'—a chaotic state in which patterns rarely form. Consequently, there are times when diversity should be encouraged and other times when it should be discouraged.

A community of practice is not an homogeneous entity. Successful communities tend to have a core team that undertakes key community roles, an active group that participates in most events, and a peripheral membership that monitors community development while dipping in and out of activities spasmodically [15]. It makes sense, therefore, to consider variety within these three sub-groups, as well as within the entire community. In particular, the variety of the core team is instrumental in setting the schedule of events and discussions for the community. ActKM has therefore specifically ensured that at least 50% of its core team is composed of people from the public sector. This has been done to guard against the possibility that private-sector interests might re-orient activities away from public-sector issues.

Complex systems are inherently unpredictable, which creates a problem for community designers. Specific outcomes cannot be predicted, but designers are expected to devise definite plans to increase the chances of success for their communities of practice. Traditional interventions, which presume discernible and consistent cause-and-effect relationships, are usually ineffective [11].

Organisms, artifacts, and organizations are all evolved structures. Even when human agents plan and construct with intention, there is more of the blind watchmaker at work than we usually recognize.[6]

Effecting sustainable change in a complex system (such as a community of practice) is best done by creating conditions that encourage self-organisation. This moves the system in a general direction, rather than driving it towards specific goals and outcomes. One approach is to provide the conditions that change variety of types and variety of strategies. The present study examines four mechanisms that affect variety in a community: (i) simple copying; (ii) copying with the introduction of errors; (iii) recombining; and (iv) the role of the physical environment [1]. A discussion of when variety should be encouraged or discouraged follows.

### **3.1 Copying**

Simply copying of types or strategies reduces variety in a system. Once a type or strategy has been copied, it is more likely to be copied again in the future. This sets up a positive feedback loop that can result in the copied type or strategy dominating the population. The 'QWERTY' keyboard is an example. The usual arrangement of keys on a keyboard is not the most efficient layout. The QWERTY layout was designed in the nineteenth century to make typists slow down, thus avoiding jamming of typewriters. The Remington company mass-produced typewriters with this keyboard layout [16], and once typists had learnt the QWERTY layout it was easier to keep this format, rather than adopt more efficient layouts (such as Dvorak). Other companies copied the QWERTY keyboard, and the market thus converged (or 'locked-in') on this keyboard, thereby ensuring its dominance.

The likelihood of a strategy being imitated by an agent is influenced by a range of factors including: (i) the dominance of the group displaying the strategy;

(ii) how deeply the strategy has been internalised by the agent; (iii) how often other people display the strategy; and (iv) the reputation of those exhibiting the strategy [17].

When strategies are consistently and frequently copied they become norms of the community. An example of this phenomenon in ActKM is the tendency of members to reinforce the practice of disclosing their names and the organisations for which they work. The acceptance of this norm was illustrated when a member used the pseudonym ‘Gandalf’ in posting a message on the community’s notice board. This resulted in the following reply from a respected member:

I’m not really sure about responding to ‘Gandalf’ on the grounds that anonymity is not normally a part of ACT-KM and I’m not sure it’s really legitimate to participate in this way—maybe this is an issue for the moderators.

There were two more posts from ‘Gandalf’ and a series of responses from other members who also objected to the pseudonym. ‘Gandalf’ then revealed his true identity—thus reinforcing the accepted norm of the community.

Other approaches to online discussion within ActKM have been imitated. For example, a group of new members began posting lengthy academic posts, which encouraged similar responses. This reduced the proportion of posts offering practice-oriented ‘tips and tricks’ and requesting assistance—which had previously been a feature of the online discussion. The copying of the academic style (and the consequent reduction in the proportion of posts that do not conform to this style) has reduced variety in the online discussion.

### 3.2 Copying with error (mutation)

Copying is rarely a perfect process. In most cases errors (mutations) occur. Copying with error increases variety in a community. Misinterpretation and environmental constraints are two factors that affect mutation.

*Misinterpretation* can occur accidentally as agents attempt to copy strategies or imitate other types. Case studies can be a source of misinterpretation because a single case study cannot capture an entire situation because it relies on the written word – we know more than we say, and will tell more than we write down [18]. People who attempt to copy the approach, techniques, and tools described in a case study are therefore likely to copy the strategy with error.

The unique circumstances of a case study can also produce error in copying. Apart from the simplest of cases, people are forced to adapt the material to a new environmental context.

Case-study material therefore has potential to increase the number of strategies available to a community, especially if the newly adapted strategies are reported and are added to the community’s artefacts.

The likelihood of misinterpretation can also be intentionally increased by communicating ambiguous instructions or by using metaphors or analogies to convey concepts. A community facilitator can issue ambiguous or conflicting instructions to encourage diversity by inducing members to interpret and respond.

Metaphor can have a similar effect. Members of ActKM frequently use metaphor and analogy to help them explain ideas.

Copying with error can also produce variety in the population of a community of practice. In 2003 the New South Wales Knowledge Management (NSWKM) Forum merged with ActKM, thus increasing the membership of ActKM by 200. It was assumed that the addition of NSWKM members would add new people of the same type as those who belonged to ActKM—that is, copying types. In fact, by adding NSWKM members, a range of new types was introduced to the community. In particular, there were many more people from the private sector and academia.

### **3.3 Recombining**

In biology, a recombination process occurs during fertilisation when divided DNA is recombined to create new life. Similarly, the recombination of concepts plays an important role in community variety.

Conceptual recombination occurs when ideas from separate intellectual spheres are combined to create a new strategy, artefact, or type. This mechanism increases variety, and is more likely to result in improvement than is the mechanism of mutation—because there is less trial and error involved. For example, Darwin’s conceptual breakthrough of ‘natural selection’ occurred to him while he was considering Malthus’ economic and demographic treatise on population growth [19]. The combination of an economic idea and a biological idea contributed to a new way of thinking in the theory of evolution.

The recombination of ideas is well illustrated by a school principal’s application of ideas posted on ActKM. Over a period of two years the school principal was a ‘lurker’ on the ActKM discussion forum from which she collected ideas. She then combined these ideas with teaching concepts to develop a new knowledge-management program for her students. The principal then relayed her experience back to ActKM. Her efforts were rewarded when she won the ActKM knowledge-management prize presented annually at the ActKM conference.

Recombination creates variety, and is also a product of variety. The likelihood of a new combination of ideas increases as new members from different backgrounds interact. It is impossible to discern which aspect of the system causes another. “Real organisms constantly circle and chase one another in an infinitely complex dance of coevolution” [14]. A designer must therefore develop interventions, detect the patterns that form, and be ready to nurture desirable patterns (or, alternatively, discourage undesirable patterns) [5].

### **3.4 Physical environment**

The community’s physical environment significantly affects diversity. If the physical environment is homogeneous and if there is only one way to conduct

conversations, variety is reduced among people attracted to the community and among the topics discussed. For example, some members are attracted to online discussion forums whereas others prefer face-to-face conversations; some like to explore topics in depth whereas others enjoy becoming familiar with a range of topics.

## 4 Discussion

Deciding when to increase or decrease variety is closely linked with decisions to explore new possibilities or to exploit the benefits of the current situation [1]. Variety encourages exploration whereas convergence (on a strategy or type) assists exploitation. The question is then: 'When should a designer intervene to increase or decrease variety?'

Axelrod and Cohen [1] suggested four heuristics to assist designers in deciding when to encourage variety. Variety should be encouraged when dealing with:

- problems that are long term or widespread;
- problems that provide fast, reliable feedback;
- problems with a low risk of catastrophe from exploration; or
- problems that have looming disasters.

Although these heuristics are useful for general problem-solving, a more specific set is needed for communities of practice. The following set of heuristics is by no means exhaustive. However, based on the present authors' experience in designing and participating in communities of practice, the following represent a useful initial set of heuristics.

Designers should consider *increasing* variety in a community of practice when:

- the discussion becomes one-sided, and there is no argument;
- there is a long period of time without new ideas;
- the level of excitement wanes and membership stagnates (or declines); or
- the focus of the organisation shifts dramatically away from the interests of the community.

Designers should consider *reducing* variety in a community of practice when:

- the core team is establishing the community and wants to reduce noise to concentrate on a few important topics;
- there is too much noise in the community that is unrelated to its stated purpose; or
- there are so many ideas being canvassed in the community that members have difficulty rallying around a concept or practice.



Community designers should remain mindful of variety, and, if appropriate, should use the mechanisms described above to influence it. Designers should be aware that ‘command-and-control’ approaches are rarely effective in a complex environment. The designer’s role is to modify the environment to attract people to join and participate, to encourage useful strategies to be selected and copied, and to ensure that variety among members is appropriate for the community’s current phase of development.

An intervention can be applied by an external force (such as forcing members to use a particular online system) or triggered by an internal force within the community (and then sustained by the internal workings of the community). The mechanisms discussed in this paper refer mainly to the internal forces of the community. These internal forces are self-sustaining and self-organising. Although they are inherently unpredictable, a community designer can intervene in ways that set an advantageous direction. The designer is never in control, but can be influential in shaping the system.

## **5 Summary and conclusion**

This paper is the first in a series of three that attempts to apply complexity theory systematically to a better understanding of communities of practice. By applying Axelrod and Cohen’s [3] framework and focusing on ways to affect variety in a community, a range of new questions and potential new techniques has emerged.

The mechanisms of copying, mutation, and recombination, together with the effects of the physical environment, are important factors influencing variety of strategies and types in a community of practice. By thinking about variety from a complexity perspective, designers have new ways to influence communities of practice.

From a complexity perspective, a designer must adopt a new role. The designer must be aware of the patterns that are emerging in the community, and should design interventions with a view to triggering the internal mechanisms of copying, mutation, and recombination. The designer cannot expect specific outcomes from his or her interventions; rather, after intervening, the designer should monitor developments and nurture desirable patterns (while disrupting undesirable effects). The designer should attempt to alter the system in ways that encourage the self-organising aspects of the system—such as positive and negative feedback loops, interaction patterns, and selection mechanisms—to affect variety and set the system in an advantageous direction.

This paper has explored only a small number of the mechanisms that affect variety in a complex system. Further work is required to understand how interaction and selection work in the context of a community of practice. Issues that might be explored include: (i) the role of barriers; (ii) whether members of a community can be induced to form beneficial patterns; (iii) how strategies should be selected and discarded; and (iv) the role of success criteria and how these

criteria should be determined. The new issues that are emerging suggest that a complexity approach will be fruitful in achieving a better understanding of communities of practice.

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