

# Complex social systems and their facilitation

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This document owes much to the work of Dave Snowden of Cognitive Edge <sup>1</sup> and his models and processes. I've added to his ideas drawing on my own experience of the facilitation of learning and change, and included material from Karl Weick and Kathleen Sutcliffe.

Some problems respond well to rational problem solving methods. Some don't. Those that don't are sometimes called "wicked" problems. In this brief paper I talk about how to tell when you are facing a wicked problem, and what to do about it. I begin by identifying the core characteristic of a wicked problem — that you can't tell what effects your solution will have until you try it. I next consider the effect of adding people to the situation. The following sections consider two Cognitive Edge models and some material from Karl Weick and Kathleen Sutcliffe on "high reliability organisations". A final section presents the Cognitive Edge "ASHEN" model. In many instances specific suggestions are offered for facilitators.

## **Complex systems and the butterfly effect — small changes can have large consequences**

The experience of Edward Lorenz in the 1960s provides an illustration of complexity. Lorenz modelled weather systems on his computer. His computer model generated typical weather patterns.

On one occasion he observed an interesting pattern in the print-outs from his computer. To observe it again he re-keyed the data into his weather model. Strangely, on the second occasion the pattern diverged from what had happened previously.

That shouldn't have happened. Computers are deterministic. Apply the same procedures to the same inputs and you get the same outputs. Lorenz could have decided that his primitive computer was malfunctioning. Instead he studied the situation further.

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1 <http://www.cognitive-edge.com/>

He usually entered data into his computer to six decimal places. In his haste, on the second run he did so to only three decimal places. That's what gave the different outcomes. Yet that's a change of less than one thousandth of a unit. I imagine weather forecasters would be glad to have data accurate to a thousandth of a unit.

This is the effect known as "sensitivity to initial conditions". Its more popular name is the "butterfly effect". To use Lorenz's colourful example, a butterfly flapping its wings in Brazil may trigger eventually a tornado in Texas.<sup>2</sup>

This is not to say that a butterfly can deliberately start a tornado. In fact, quite the opposite. The effects of even large actions aren't necessarily predictable. It refers to situations where lots of things affect lots of other things. These are complex systems.

Stafford Beer provides a useful metaphor. Imagine a number of ball bearings connected together by springs. Imagine taking hold of one of those ball bearings and giving it a slight jiggle. If there are few ball bearings and not too many springs the cluster of ball bearing may move a little. The movement will quickly subside.

Now imagine lots of ball bearings, richly interconnected, with many of the springs under tension. Jiggling one ball bearing even gently may disturb the entire system greatly. The disturbances work their way through the links. Eventually some of the disturbances find their way back to the ball bearing which started it all, perhaps with a disturbance far greater than the initial movement.

In complex systems trivial initial changes can lead to massive changes in eventual outcomes. Except in the short term Stafford Beer's ball bearing contraption and weather systems are inherently unpredictable. You can't tell in advance what effects initial changes (including your own behaviour) might have.

What are the cause → effect relationships? If they can be known ahead of time because they are simple or researchable, prediction is possible. Otherwise it isn't.

**For complex systems which contain humans there are further complexities —**

**People accept the first solution that fits.** Especially when they are expert in a field they make sense of complex information by seizing the first pattern which fits well enough. They seldom look beyond the first "good enough" fit.<sup>3</sup>

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2 Lorenz, Edward (1972). Predictability: does the flap of a butterfly's wings in Brazil set off a tornado in Texas? Paper presented at the December 1972 meeting of the American Association for the Advancement of Science, Washington DC.

If they find a solution quickly they are unlikely to analyse further. They may overlook any evidence which doesn't suit the solution they have chosen. If the conflicting evidence is drawn to their attention they may invent reasons why it may safely be ignored. (Note that, here and below, the "they" are us.)

*Non-experts may be better at spotting an unusual pattern. It may be to our advantage to discourage experts from using their expertise, or challenging them with information they can't explain.*

*As facilitators we can achieve this by*

- *mixing novices with experts, for instance by making use of informal networks so that people are working with those from different organisations or parts of an organisation*
- *using novel processes*
- *forming teams of experts from different disciplines and initially forbidding them from contributing information based on their expertise*
- *use some of the techniques of creative problem solving which encourage people to view situations as if they were novices*
- *deliberately generate multiple solutions and then evaluate each of them*
- *discourage premature solutions, for example by taking people there in multiple steps.*

**People impose meaning.** The thirst for meaning is so great that people can find patterns where none exists. They loosen their criteria until a pattern is found, even if the pattern isn't really there or is an accident. Having "found" a pattern they tend to search for evidence which confirms (rather than challenges) their guess.

*We can use processes which make it difficult for participants to sustain those tendencies. For instance:*

- *encourage the identification of multiple patterns*
- *encourage participants to look for disconfirming evidence and exceptions — in fact, to search them out vigorously*
- *create a climate where difference and dissent can be expressed constructively and are encouraged*
- *create diversity and dissent by including people of widely varying experience and background*

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3 Lipshitz, R., Klein, G., Orasanu, J., and Salas, E. (2001) Taking stock of naturalistic decision making. *Journal of Behavioral Decision Making*, 14(5), 331-352.

- *appoint a “devil’s advocate” whose task it is to find exceptions and conflicting evidence and draw them to everyone’s attention*
- *introduce random information to disrupt patterns.*

**People look for causes.** They “see” cause → effect relationships which may not exist. In particular they tend to explain the behaviour of others by imagining motives. They tend not to test their assumptions. In fact, they often then act as if their assumptions were factual. This can then create a self-fulfilling prophecy.

*This can be reduced by*

- *using the processes which discourage or postpone the adoption of immediate solutions — see “People accept the first solution which fits”, above*
- *forbidding the use of cause → effect explanations until people have explored the situation thoroughly at a descriptive level*
- *encouraging people to test their assumptions, including about others’ motives, before acting on them*
- *distinguishing assumptions from facts, treating the assumptions with scepticism*
- *being a little sceptical even about “facts”.*

**People adopt different roles at different times.** It’s as if they have multiple identities, often triggered by the situation. Depending on which identity is active they behave in different ways on different occasions. People are often not aware of doing this.

*It is useful to take care to activate constructive identities, for instance by:*

- *using and monitoring ground rules which encourage some roles and discourage others (this works best if the groundrules are specific and behavioural, and there are few enough that people can pay attention to all of them)*
- *giving careful instructions which encourage some identities and discourage others*
- *ignoring or reacting negatively to unconstructive identities*
- *recognising and praising constructive identities*
- *using physical layout — and especially novel settings and new ideas — to activate different identities.*

**People have choice.** They can choose to act in different ways at different times. By act of will they can decide to act in more or less ordered ways.

*Much therefore depends on their cooperation. We can achieve this by*

- *giving early attention to building a sense of community and common purpose, including ourselves in the community that is formed*
- *making allies of participants wherever possible, for example by making decisions jointly with them*
- *doing what we can to ensure that the goals of the facilitation and the material being addressed are interesting and relevant for them*
- *using facilitation processes which are involving and (where possible) enjoyable*
- *sharing with them the responsibility for managing the process and achieving good outcomes.*

These differences have the important implication that social complexity can seldom be explained by a small number of simple rules. Flexible facilitation is required.

## **Facilitating complexity**

Consider the complexity model of the Cognitive Edge Institute and its director Dave Snowden. Different strategies are required for different “domains”, two “ordered” and two “unordered”.

**Ordered.** Here, conventional methods of problem solving and decision making apply. Solutions can be implemented with some confidence that they will work. Rational planning is likely to be appropriate.

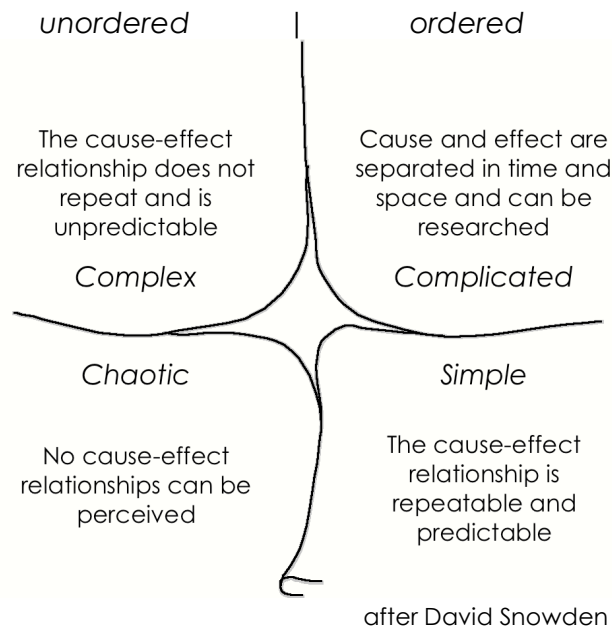
Some phenomena in the ordered domains can nevertheless be quite complicated — there may be too many variables for the human brain to understand them in detail. However they can be modelled in computers. Experts sometimes have learned to understand them. In one way or another they are amenable to rational analysis.

**Unordered.** Consider the “butterfly effect”. You can’t predict cause → effect relationships. In other words you can’t predict the relationship between your actions and the outcomes that they will produce. Planning doesn’t work as intended. Nor does rational problem solving and decision making.

It isn’t just that it’s too complicated for human brains. It is to do with the fundamental unpredictability of the situation. Some alternative to rational problem solving and planning is needed.

The Cognitive Edge model subdivides situations into four possibilities depending on the nature of cause → effect relationships. (For present purposes I’ll ignore the fifth

“disordered” domain at the centre of the diagram, which is for situations we can’t yet categorise.) —



In the chaotic domain there is turbulence and chaos. It is well named. The system is in crisis and urgent action is required. It’s difficult to know what to do. So you act immediately in whatever way seems most likely to produce an area of relative calm in the turbulence. Fortunately, situations in this domain are not common.

This approach assumes that you match your strategy to the situation. If it is simple, with clear cause → effect relationships, then simple approaches will probably suffice. There’s more on this later. One implication, though, is that it is helpful to identify in which domain a situation can best be placed. You’ll find some criteria diagrammed overleaf.

In addition, a complex situation can sometimes be broken down into components. A complex situation may include simple or complicated elements. If so, different elements may respond to different approaches.

In most of what follows I’ll focus on the complex domain.

### **Working in the complex domain**

You’ll recall that this is where you can’t understand cause → effect relationships before the event. Small changes in initial conditions can have large and unexpected effects on outcomes. All you can do is:

- create initial conditions which have some chance of being favourable

## Complex

Multiple causes and effects with complex feedback loops

Causes only perceivable after the end (and that may be adventitious)

Problems keep returning despite attempts at resolution

Others' solutions may not work, but can learn from their mistakes

collegial structures work:



*probe-sense-respond*

## Complicated

Multiple causes and effects with simple feedback (if any)

Cause / effect connections not perceivable, but researchable

Problems tend to remain solved after proper analysis (and trial and error)

Solutions from elsewhere may work after fine tuning or trial and error

professional structures work:



*sense-analyse-respond*

## Chaotic

Multiple and turbulent cause-effect connections

There is no point in talking or thinking in cause-effect ways

Each problem is unique

Don't worry about solutions; act quickly to create stability

structures are little help:



*act-sense-respond*

## Simple

Few causes and effects, simply connected

Cause and effect connections predictable and repeatable

Problems tend to remain solved at least in short and intermediate term

"Best practice" solutions will work

bureaucratic structures work:



*sense-categorise-respond*

- watch closely to see what happens
- support favourable outcomes
- counter or mitigate unfavourable outcomes.

You can't predict that any particular initiative will work. It makes sense, then, to use multiple initiatives. If you monitor the results closely you can act quickly to capitalise on beneficial outcomes.

Although multiple initiatives are desirable you can't afford to start too many. You have to be able to watch them closely and intervene as soon as constructive or

unconstructive outcomes appear. You may have to pay attention to subtle clues. Choose indicators which appear early rather than late as a solution collapses.

Each of us as an individual is capable of acting like a complex system. When several people come together the unpredictability can be multiplied. This is most likely to happen when the unexpected occurs. Cooperative commitment is then helpful.

The style of facilitation required in the complex domain is therefore flexible, responsive, and participative.

### **The Cognitive Edge “ABIDE” intervention model applied to the facilitation of socially complex situations**

The “ABIDE model” is not a categorisation, but rather five perspectives from which the facilitation of complex situations can be viewed. It can be applied both to the solutions developed (that is, the *content* of the problem) and to the facilitation of the problem-solving (that is, the *process*).



**Attractors.** These can be regarded as anything that keeps people in a particular situation or attracts them to it. As results can not be predicted in a complex situation, multiple attractors are desirable.

*The facilitator has several potential attractors which can be used in facilitation, for instance:*

- *creating good relationships and a sense of community*
- *facilitating engaging and enjoyable activities*
- *keeping material relevant and worthwhile*
- *creating a space where people feel more in control of their own destiny.*

*The problem solving group can be encouraged to develop multiple solutions which can be trialled simultaneously. They can also develop leading (not lagging) indicators of impending success or failure.*

**Barriers.** Barriers impose or suggest limits to behaviour (or acceptable behaviour). For facilitation, clear but permeable boundaries seem to work best. Permeable boundaries don't collapse the first time someone breaches them.

*Negotiated and modifiable ground rules can limit the behaviour that people will express. Feedback on behaviour and process can make transgressions more evident.*

*Permeable boundaries (or preferably a single permeable boundary) can be built into the problem solution.*

**Identities.** As mentioned above, humans can fill multiple identities or roles. These emerge in different situations. They are activated by the environment or situation or relationships, including the relationship with the facilitator.

*Facilitators can take steps to activate constructive and cooperative identities. To do this they can use the physical environment, the early conditions when a group forms, the type of relationship developed, their own modelling, and the form of instruction for activities.*

*Attention can be given in implementation planning to securing the cooperation of those who will have the responsibility to get the solution to work. Ongoing monitoring is necessary, remembering that some solutions will probably fail.*

**Diversity.** Diversity and dissent can be expressed cooperatively and for collective benefit. When this happens it increases the innovation within a group or community. It can decrease reliance on old patterns of perception, belief and action ("entrainment").

*Facilitators can encourage diverse small groups, the expression of dissent within consensual processes, a climate in which participants are willing to listen to and to be educated by one another, and a willingness to question conventional wisdom.*

*Solutions can be developed which will be implemented by diverse teams. A willingness to voice disagreement during ongoing monitoring can make it easier for poor solutions to be identified sooner rather than later.*

**Environment.** In the Cognitive Edge model, the environment is "everything else". Here it can refer to the physical environment and the psychological and cultural climate.

*Facilitators can use physical layout to signal a certain type of interaction and to activate certain identities.*

*Problem solving groups can pay attention to this in their solution and its implementation.*

Both during the develop of tentative solutions and their later implementation, some cultures are more likely to provide the required openness to experiment than others. The description by Karl Weick and Kathleen Sutcliffe<sup>4</sup> of “high reliability organisations” is a culture which achieves high openness and flexibility.

### **A culture which supports complex problem solving**

Weick and Sutcliffe were interested in organisations which avoided error despite a high possibility of disaster. These include aircraft carrier flight decks, hospital emergency rooms, bush fire fighters, and the like. Weick and Sutcliffe found that these high reliability organisations exhibited five characteristics:

**Non blaming.** It is important that errors and near errors are studied and learned from. In these organisations you are rewarded for admitting that you made a mistake, not punished for the mistake.

**Acknowledging complexity.** People in these organisations acknowledge that despite everyone’s best efforts disaster is imminent. It can occur at any time. It’s not necessarily anyone’s fault.

**Integrating strategy and operations.** Strategic and operational decision making are done at the same time. Those who have the responsibility for the operations are present and have input when strategic decisions are made.

**Valuing resilience.** Disasters will unavoidably happen. It is important therefore to be able to respond quickly and restore normal operation. This requires resilience on the part of everyone. It must be developed *before* the disaster occurs.

**Expertise outranks rank.** On any issue, those who have relevant expertise and experience are sought out and their ideas are listened to, no matter what their rank or status is.

For occasions when expertise has to be captured and shared, Cognitive Edge has developed the ASHEN model.

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<sup>4</sup> Weick, K.E., and Sutcliffe, K.M. (2001) *Managing the unexpected: assuring high performance in an age of complexity*. San Francisco: Jossey Bass.

## The Cognitive Edge “ASHEN” model

The most important knowledge is often contextual and applied without conscious thought. Quite often it is not accessible to consciousness. It becomes explicit only as it is needed. Probing for it by questioning outside its normal context is unlikely to elicit more than pieces of it.

In the appropriate context, however, it may be able to be elicited by questioning. If the questioning contextualises the request — “*When you make a decision about X ...?*” — knowledge components can be elicited. The components (summarised in the mnemonic “ASHEN”) are as follows.



**Artefacts.** These are existing explicit knowledge and information, codified and captured in processes, documents and databases. They are at their most effective when not unnecessarily duplicated and in the location and at the time when they are needed.

**Skills.** The skills and techniques held by individuals allow them to carry out skilled performances. They can be codified, though it requires time and practice for people to internalise them.

**Heuristics.** Experienced people use heuristics or rules of thumb to make decisions. They are most likely to be used when full information is not known, or is not accessible in the time available.

**Experience.** A deep understanding of a situation is often learned through painful and dramatic experiences. When this occurs, a person often then is highly motivated to learn from the experience and make future use of it. On occasion experience may be collective, held by a team or group.

**Natural talent.** From birth each of us has certain aptitudes, potentials and talents. Those with potential can often be encouraged to turn the potential into high performance and skill. Otherwise natural talents are not in general transferable from person to person.

## A summary of the strategies which can be used in each domain

As a final summary, consider the overall strategy which offers the most effectiveness in each domain.

**Simple ordered:** sense → categorise → respond

sense	notice the problem
categorise	decide the nature of the problem; as soon as it is categorised you know from past experience what solution will work
respond	implement the solution

**Complicated ordered:** sense → analyse → respond

sense	notice the problem and recognise that it is complicated
analyse	gather data, analyse it, and formulate a solution; you may also need to recruit expert help
respond	implement the solution, possibly allowing for some trial and error before it works as expected.

**Complex unordered:** probe → sense → respond

probe	initiate several interventions and monitor them closely (you can use the ABIDE model, above, to help with developing the probes)
sense	monitor each of the interventions closely to detect the early signs of constructive or unconstructive outcomes
respond	act to support and strengthen the favourable outcomes and to eliminate or mitigate the unfavourable outcomes.

**Chaotic unordered:** act → sense → respond

act	this is a crisis, with high turbulence; act to create a space of less turbulence
sense	notice where and when the turbulence lessens
respond	use the respite to escape into a more favourable domain.