
Using a red-blue exercise to facilitate learning about complex systems

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Abstract

The red-blue exercise is an example of an iterated prisoner's dilemma (IPD) and is commonly used in educational and training settings to help participants to develop skills in conflict management, negotiation, and inter-group dynamics. In this paper, it is argued that the exercise is poorly suited to these learning tasks. However, the exercise does provide a powerful yet manageable example of a complex system in action. A systems analysis is offered that both demonstrates why red-blue is unsuitable when used primarily for personal development training and shows how it may be used as an educational tool to introduce the subject of complex systems.

Introduction

The red-blue exercise is based on a famous decision-making structure known as the prisoner's dilemma, in which the consequences of participants' decisions are dependent on the unknown decisions of other participants. Red-blue takes a particular form known as an iterated prisoner's dilemma (IPD) and involves a series of decisions in which consequences accumulate. This exercise is commonly used in educational and training settings to help participants to develop skills in conflict management, negotiation, and inter-group dynamics.

Drawing on extensive experience of teaching negotiation and conflict management courses, Maughan *et al.* (1996) suggest that this exercise can give trainers an understanding of some of the barriers to achieving planned learning outcomes. In particular, they highlight the importance of an awareness of the distinction between espoused theories and theories-in-use (Argyris and Schon, 1974), and issues of distancing and disconnectedness (Argyris, 1985). The main learning outcome for participants is in relation to their own tendency for discrepant reasoning (i.e. I believe one thing but find myself justifying doing something else).

Using the exercise in the context of learning about inter-group dynamics, such as conflict, competition and collaboration, I used the red-blue exercise for a number of years and, like Maughan *et al.* (1996), experienced significant barriers to achieving planned learning outcomes. The exercise appeared to offer the potential for gaining insight into inter-group dynamics. However, in practice the dynamics that Maughan *et al.* (1996) identify were more prominent. Furthermore, the powerful emotional

dynamics within the exercise were too frequently creating a negative learning experience for some participants that was difficult to review constructively. Where the exercise was used at the beginning of a programme, dynamics of distrust of other participants were sometimes found to persist for the whole of the group's time together. As a result, I stopped using red-blue.

However, I began using the exercise again when I realised that the fact that participants generally fail to achieve the task set suggests that the primary dynamics are systemic rather than a feature of personal skill. As I explored this possibility, I became more convinced of the importance of a systemic understanding of the exercise and I now use red-blue only in the context of providing groups with an experience of complex systems theory in action rather than as a basis for personal skills development.

In this paper, I summarise the thinking that led me to this conclusion. This emphasises the importance of an analysis of the structure of the system, the identification of dominant patterns of behaviour, and the significance of these in influencing personal reactions. The discussion also highlights some important aspects of the tutor role.

Setting up the exercise

The established and shared understanding of the power of the tutor role in setting up activities (and in "setting up" the participants!) is an important feature in this exercise. Socialisation processes in educational settings have established the right of the tutor to define a situation. The high degree of dependency on "teachers" as authority figures means that groups generally passively wait for the tutor to fulfil this expected role.

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As a result, the participants are in a state of mind in which they tend to accept uncritically the rules of the exercise. Participants trust that the tutor will set them a task that is possible. However, the reality of the red-blue exercise is that it is virtually impossible to succeed. While groups do occasionally achieve the objective, this occurs in a relatively small number of cases.

Participants are generally unaware of the significance of the nature of this relationship with the tutor and of the manner in which setting up occurs before the exercise is “started”. However, the nature of the system is absolutely central – participants are placed in an impossible situation. To run red-blue on this basis is an act of deception, intentional or accidental, on the part of the tutor – often disguised by the notion of “play”.

Sometimes this is realised but it is extremely difficult for participants to act on this belief. If participants are unable to act on their beliefs (espoused theories) then there will inevitably be a discrepancy between their espoused theories and their theories-in-use. Participants respond with actions that do not make sense, that are based on discrepant reasoning. This was observed and described by Maughan *et al.* (1996).

The rules of the exercise

The tutor begins by getting participants into groups of approximately six, depending on the size of the whole group. For the sake of simplicity, in this paper an exercise that involves two groups, A and B, will be considered, although frequently three or more groups are involved. The groups are positioned as far away from each other as possible within the room, or put into separate rooms. Groups cannot communicate with each other, except where the rules of the exercise allow.

Once in groups, the rules of the exercise are introduced (see Figure 1). The learning aim is to explore inter-group dynamics within a complex system. There is one task objective: “that you avoid having a negative score after Round 7”.

There are seven rounds, and in each round each group will make the decision, “red” or “blue”. Decisions are reported to the tutor, who calculates the scores of each group, reporting these to the groups before the next decision round begins. Different scores are obtained depending on the decision of the other group.

It is made clear that the groups are not allowed to communicate before the first two rounds are completed. After Round 2, an

opportunity is offered for one representative from each group to meet for a limited period of time (five minutes maximum). A second opportunity is offered after Round 5. A meeting cannot take place unless both groups agree to participate. Rounds 6 and 7 score double.

A pattern of behaviour based on the uncertainty of not knowing

The scoring system means that one or both groups must “go red” enough times to achieve the objective of completing the exercise with a non-negative score. If all groups “go blue” too many times then all will finish with a negative score. However, to “go red” is to make oneself vulnerable to the worst possible group score if the other group “goes blue”. To “go blue” is interpreted to be the safest option because, while likely to lead to a negative score, this is the least-bad negative score possible, and guarantees that the other group will not be in a better position. This is the most common strategy in the early rounds and amounts to setting aside the objective, substituting it with two new objectives:

- 1 “minimise possible losses”; and
- 2 “do not be beaten and, if possible, win by scoring better than the other group”.

The intention may be to adopt this as a “short-term” strategy until it is possible for the groups to meet (after Round 2). However, this rational, contingent strategy tends to be influenced by the emotional experience of the exercise. This is explored further in the discussion below.

This pattern of interactions is what Senge (1990) calls “shifting the burden”. In this pattern:

an underlying problem generates symptoms that demand attention. But the underlying problem is difficult for people to address . . . So people “shift the burden” of their problem to other solutions – well-intentioned, easy fixes which seem extremely efficient (Senge, 1990, p. 104).

From the very first round, it is impossible to know exactly what to do because the outcome of the decision is dependent on the unknown choice of the other group. This creates what Senge calls the “problem symptom”, in this case, the uncertainty of not knowing.

There are two ways to reduce the uncertainty of not knowing. The first (a symptomatic solution) is that described above, and involves shifting the burden. This is represented in the right-hand cycle in Figure 2.

The second way to reduce uncertainty (a fundamental solution) is for a group to be prepared to trust: to “go red”. However, given the rules of the exercise, this requires the group to trust the other group to go red without knowing whether they are trustworthy.

The game theory literature suggests that one of the most successful strategies that can be developed in an IPD is “tit-for-tat” (Axelrod, 1984). In theory, the meeting points in red-blue can be used to co-ordinate future decision making in such a way as to repay the group which has “gone red” in the previous rounds. Once agreed and understood, the trust strategy makes sense. The more frequently this strategy is experienced to be successful, the less uncertainty is experienced (see the left-hand side of Figure 2: “cycle reducing uncertainty through trust”).

However, where red-blue is undertaken by groups for the first and only time, with a limited number of rounds (seven to ten is common) the likelihood of identifying and implementing this “tit-for-tat” strategy is very small.

The plan for the shifting the burden approach to be short-term (i.e. until the first meeting) is generally short-lived, and this pattern is likely to become established for the whole exercise. The underlying reason for this is the shift that occurs from the rational to the emotional: what begins as a cerebral, problem-solving exercise prior to the first decision, transforms after the first round of results into a strongly emotional experience. Shifting the burden creates a complex set of emotional dynamics that make the original problem even more difficult.

Figure 1

Briefing for the red-blue exercise

LEARNING AIM: to explore inter-group dynamics within a complex system

TASK OBJECTIVE: that you avoid having a negative score after round 7.

PROCEDURE: There are two groups: A and B. In each round, each group is required to play either RED or BLUE. You will be required to report to the organizers which colour you have chosen. The organizers will **not** divulge information about the other group’s choice. When both groups have made their choices, the organizers will visit your group to announce the resulting scores. Scoring is as follows:

- | | | |
|-------------------------|------|--------------|
| i) both groups choose | BLUE | – 1 for both |
| ii) 1 group chooses | BLUE | + 2 for BLUE |
| and 1 group chooses | RED | – 2 for RED |
| iii) both groups choose | RED | + 1 for all |

There will be SEVEN rounds. The last two (rounds 6 and 7) will score double.

There will be an opportunity for an **inter-group conference** involving one representative for each group after round 2 and again after round 5. However, a conference can only take place at the request of **both** groups.

In illustration, let us consider a scenario in which the exercise starts with Group A “going red” and Group B “going blue”.

Group A have realised that the objective can only be achieved by “going red”. They can see the risk: in deciding to “go red”, they are half expecting Group B to “go blue”. But they can see that this is the only solution to the task as set. There is a delay while the decisions are collected and the scores calculated.

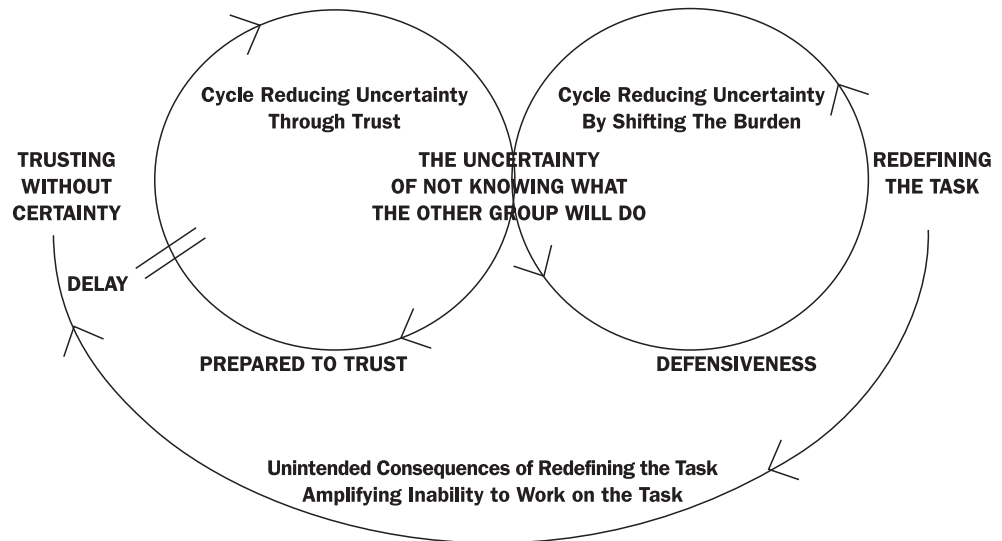
During this delay, Group A experience a shift from a rational, problem-solving state of mind to an emotional, apprehensive state – wondering whether their strategy will succeed or not. This transition, heightened by the delay, is significant. When they receive their result, Group A are surprised by the strength of their feelings of disappointment, hurt, anger and righteous indignation. What had been expected while in a rational state of mind is now redefined, in reaction to these strong feelings, to have been a callous and hurtful act by Group B.

Group B, on the other hand, unexpectedly scores positive. The “go blue” strategy to ensure “not being beaten” is even more successful than they had dared hope. They are elated. They laugh loudly, and smile a congratulatory, if slightly embarrassed, smile at one another. Their strategy has been confirmed as the correct one and the group has taken its first step towards succeeding in relation to the original objective as well as their alternative objectives. Annoyingly, these feelings of success are accompanied by feelings of guilt: “going blue” has punished the other group. These uncomfortable feelings are re-interpreted as the fault of Group A, who were crazy to have “gone red”: “It’s their own fault”.

In the second round, both groups go blue: Group A out of anger and spite; Group B out of the arrogance of knowing best. Both groups now know what the other group is going to do: “Group B know that Group A will go blue out of revenge”; “Group A know that Group B will go blue because they are thoughtless and untrustworthy”. The problem symptom, the uncertainty of not knowing, has been reduced. Both groups know that, whatever happens, the other group will go blue.

At this point, which in a slightly different form can also be reached where both groups have gone blue in the first two rounds, it is not uncommon for the opportunity to engage in a meeting to be declined. The groups already “know” what the outcome will be! Even where a meeting is convened, the seeds of distrust have been sown, and the “go blue” strategy appears even more robust than in

Figure 2
"Shifting the burden" in the red-blue exercise



the early rounds. The symptom of the problem (the uncertainty of not knowing) has been ameliorated – they are no longer uncertain about the decision of the other group (“they will go blue”). However, this certainty has been achieved at the expense of a further decrease in the ability of the groups to work on the problem (“to avoid having a negative score after Round 7”).

Senge notes that this is a classic consequence of the shifting-the-burden pattern:

Unfortunately, the easier “solutions” only ameliorate the symptoms: they leave the underlying problem unaltered. The underlying problem grows worse, unnoticed because the symptoms apparently clear up, and the system loses whatever abilities it had to solve the underlying problem (Senge, 1990, p. 104).

A systems-level analysis

Senge (1990, p. 52) suggests that an appreciation of systemic structure in an exercise like red-blue can help us to understand the patterns of behaviour which, in turn, explain the range of possible personal reactions at any particular moment in time. If we can understand the high-level structure of the system then we can begin to work with the lower-level explanations more effectively.

The structure of the red-blue system has two important elements. First, the scoring system of the prisoner’s dilemma is such that “no pure strategy is evolutionarily stable” (Boyd and Loberbaum, 1987). In other words, the problem structure is such that the

participants can never “know” what will happen next. The uncertainty of not knowing never fully disappears. This is characteristic of complex systems that operate at the edge of chaos (Stacey, 1996). Our education and other forms of socialisation do not prepare us for such situations but rather train us to assume that problems are solvable and we can come to “know”. In red-blue, this assumption is wrong and leads groups to “shift the burden” in order to create a form of “knowing”.

Second, participants tend to assume that the tutor is “trustworthy” and, therefore, that the exercise is “solvable”. This assumption is also incorrect unless participants are prepared by the tutor to be able to undertake a systems-level analysis enabling the identification of dominant patterns of behaviour within the exercise. The positional power of the tutor role makes it extremely difficult for participants to dare to make a systems-level intervention and challenge the structure of the exercise.

The red-blue exercise can help to provide participants with an appreciation of systemic structure by providing an experience of how structure influences behaviour; how structure in human systems is subtle; and how coping effectively can often come from new ways of thinking.

The structure of the system influences behaviour

The primacy of the structure of the system in influencing behaviour contrasts starkly with the almost universal assumption by participants that the decisions are primarily personal choices. For example, if a group “goes red”, they blame the group that “goes

blue” for their competitive, aggressive behaviour when the exercise clearly requires a “trust” strategy. The group that “goes blue” blame the group that “goes red” for “not seeing the writing on the wall” – that the objective of the exercise is “obviously” to win, and trusting others makes your group vulnerable to losing.

The exercise taps into well-worn assumptions and patterns of behaviour in fragmented, competitive groups. However, the particular design of red-blue, based on the prisoner’s dilemma, sets up a structural contradiction: all must trust for all to win, but if all do not trust then those who are trusting will lose, but then again, if no one trusts then all will lose. The negotiating cycles suggest that it is possible to develop trust through communication, but the limitations on communications mean that the inherent contradictions tend to persist until the very end of the exercise. The structure of the system allows only for a limited range of behaviours that are largely inappropriate for the task as set.

Structure in human systems is subtle

The structure is the set of interrelationships between people that serve to control behaviour. Some of the dominant influences on decision making in red-blue are shown in Figure 3. While involved in the exercise, it is difficult to see that certain experiences are creating dynamics that make it difficult to achieve the objective – these influences are subtle.

The scoring structure combined with typical patterns of human behaviour (e.g. blame or flight from pain) set up negative and positive feedback loops, which combine to lead decision making towards “going blue”. However, once the decision to “go blue” is made, the structure traps the group in a

vicious cycle (positive feedback loop) with no easy routes back to “going red”. The subtlety means that it is difficult to work out how the situation has come to be as it is, and even more difficult to find a way out.

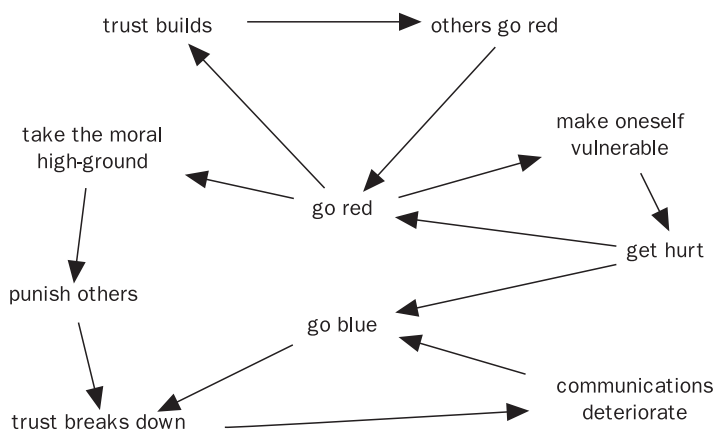
Coping effectively often comes from a new way of thinking

If a group thinks about a strategy for the whole system (rather than for their group), then the only possibility for net gain is through the strategy of “going red”. The only way that the system can move into a net negative is if all “go blue” too many times. The worst that can happen if only one group “goes red” each time is that the aggregate score of all groups (of the system) will be zero. Thus, for the whole system it is always a positive act, in terms of either growth or survival, for this group to “go red”.

The wording of the objective, “you should avoid obtaining a negative score” is important. In English, the “you” referred to in this objective could be singular applying to the small group, or plural applying to all groups, that is, to the system as a whole. Thus, the objective can imply that your group should avoid a negative score, or that sum of the scores of all the groups should avoid being negative.

Dominant assumptions, such as fragmentation (“we are separate groups”) and competition (“this is a win-lose game and we want our group to win”), allow the groups to believe that they “know” the meaning of the objective of the game. It often comes as a surprise to participants when this alternative (whole system) interpretation is offered. Approaches to working within complex systems, such as dialogue (Isaacs 1993; Schein 1993), are based on learning how to surface and challenge assumptions.

Figure 3
 Some dominant influences on decision making in the red-blue exercise



Conclusions

Red-blue is an exercise which highlights some of the key characteristics of complex systems. Because of these complexities it should not be used primarily as a means of personal skill development. While there are lessons to be learned at the level of personal skill in reacting to particular events (conflict management, negotiation, co-operation, strategic planning), the problem with the exercise is that without sufficient preparation the higher level patterns of behaviour and system structure are extremely difficult to interpret. However, as an example of complex systems theory in action, it can be a powerful vehicle for making clear the need to challenge some of

our dominant assumptions about the systems within which we work and our behaviour within them.

This paper has provided one example of an exercise that has been extensively used in an inappropriate manner. This raises the more general question of how frequently training and development exercises are used inappropriately, and thus fail to achieve the desired learning outcomes. Complex systems theory is beginning to be applied in a range of contexts (see, for example, Wheatley, 1992; Levy, 1994) and is helping to identify problematic situations where our current understanding of the dynamics at play are inadequate. There is a need, and therefore an opportunity, for such work to be extended to the development workshop and the classroom (Simpson *et al.*, forthcoming).

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