
Leadership within emergent events in complex systems: micro-enactments and the mechanisms of organisational learning and change

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Abstract: One tradition within the complexity paradigm considers organisations as complex adaptive systems in which autonomous individuals interact, often in complex ways with difficult to predict, non-linear outcomes. Building upon this tradition, and more specifically following the complex systems leadership theory approach, we describe the ways in which leadership emerges in events. To do so, we examine the micro-level interactions among agents within these groups in terms of the programmes of action that they enact. We call these building blocks *micro-enactments*, propose that they can be observed and coded by researchers, identify and classify them and argue that they are used to construct the systemic mechanisms, which enable organised action and change. We offer propositions that suggest how these micro-enactments can be assembled into organisational mechanisms that enable change processes. More generally, we propose that organisational change is constructed when specific micro-enactments are assembled to reconfigure an organisation's capabilities and competencies.

Keywords: change management; complex adaptive systems; complex systems; complexity; complexity leadership; dynamic capabilities; dynamical systems; emergence; groups; leadership; mechanisms; micro-enactments; non-linear systems; organisational capabilities; organisational change; organisational learning; self-organisations; synergetics; teams.

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1 Introduction

Leadership and change are important areas where complexity science might offer new insights and approaches. To further this perspective, there has been increased interest in considering leadership as an emergent phenomenon within the interactions of individuals and in groups (Lichtenstein et al., 2006). One popular approach that has come from the complexity paradigm considers organisations as complex adaptive systems in which autonomous individuals, the agents, interact with one another, often in complex ways and with difficult to predict, non-linear outcomes (Marion and Uhl-Bien, 2001). This stream of research makes the argument that the existence of these interactions and their interdependencies create situations where leadership can and in fact must emerge if successful organising is to occur (Uhl-Bien, Marion and McKelvey, 2007). Leadership is defined here as specifically *not embodied in an individual* but rather as *an emergent outcome of human interactions* that serves to organise human activity; in a sense, it is the flip side of what might be called self-organisation by an observer who sees larger-scale patterns emerging among the interactions but is unaware of the intentionality and influence among the agents involved.

In the present conceptual analysis, we take a systems perspective and follow Goldstein (2007) who argues that self-organising is often assumed to be synonymous with emergence. Like Goldstein, we assume that in human systems, emergence is constructed by the communication and actions of agents such that self-organised patterns in the collective result from what is called 'leadership' by the agents who experience it. Stacey (2001) and Johannessen and Stacey (2005) posit leadership to be 'complex responsive processes', also focusing on human interactions, but treating communicative acts as the unit of analysis. The reader should note that the meaning we are taking here is different from their perspective. However, we agree that the communicative act is a useful unit of analysis. In this light, Panzar et al. (2007) describe the importance of communicative acts, instances of communication between agents, in shaping the emergence of leadership influence patterns in groups. We build upon this idea to include communication that describes the environment and potential responses to it. Thus, we build upon the Complex Systems Leadership Theory (CSLT) approach (Hazy, Goldstein and Lichtenstein, 2007), which focuses on the system of interactions to explore the detailed processes or grammars, which govern the communicative acts that embody leadership.

CSLT describes two distinct dynamics that are at work within these systems. On the one hand, instances of *communicative acts* among agents – communication among individuals that operates within generalised concepts such as 'leading' or 'following' – bind interactions into recognisable patterns that enable correlated action. We argue that taken together, these communicative acts are observed by agents as a dynamical system

wherein the focal point of influence within the communicative acts changes over time (Panzar et al., 2007).

Agents experiencing these sequences of communicative acts identify patterns and resonances and search among the possibilities that present themselves to identify and either dampen or reinforce potential collective approaches to action. In particular, as circumstances change, individuals operate within the context of the social objects that organise choices and action – for example, traffic signals are placed on roadways to organise individual choices for automobile drivers, or as is more to the point here, the attribution of ‘leader’ to certain individuals focuses influence on those individuals – as they, each individually and in concert, implicitly decide whether to rely on the influence of a formal leader, to choose an expert to follow as an emergent leader, or to develop a kind of group norm or concurrence, called ‘shared leadership’ to determine a course of action (Panzar et al., 2007). These possibilities are implicitly explored within the group until a sudden phase change in the dynamics of influence relationships enables coherent, highly correlated action by the group (Guastello et al., 2005).

On the other hand, individual collaboration strategies with espoused or promised outcomes are themselves proposed by individuals (Phelps and Hubler, 2006). These are selected by the group through a similar phase change in the system’s dynamics. To clarify what is meant by agent choice in this context, agents are assumed to continually make choices. For example, mindlessly pursuing one’s daily routines involves continual choices in this context. These choices can be implicit – sitting down for a family breakfast – or explicit – deciding to join the group at Starbucks. In this way, groups of individuals negotiate patterns of influence choosing to comply or not and also negotiate coherent *programmes of action* (POA) to coordinate their actions (Hazy, 2008b). They then recruit individuals into the project (Dal Forno and Merlone, 2006), and the specific approaches that are taken impact the network structure within the group (Schreiber and Carley, 2006).

This paper contributes to this stream by examining the micro-level events that construct reality for the agents within these groups both in terms of the influence networks that emerge and the POAs that are enacted. We build on the concept of *micro-enactments* (Silberstang, 2007), focusing on specific behavioural patterns that form the building blocks of interactions. Following the notion of enactments described by Weick (1979), we argue that *micro-enactments* are used to construct the systemic mechanisms that enable organised action (Hernes, 1998) within a complex adaptive system of human interactions (Silberstang and Hazy, 2008).

2 Micro-enactments and complexity

In this section we describe the building blocks – as characterised by micro-enactments – and the context – as described by complexity science – that under the right conditions emerge as leadership events that can lead to learning and change within organisations.

To begin to develop our argument, we take as the unit of analysis a single instance of a *communicative act* that facilitates collective sense-making (Panzar et al., 2007). This occurs when one person espouses, or in some other way communicates to another or to a group, a proposal for or position on a particular idea or programme. In other words, our unit of analysis is an individual communicative act that enacts sense-making or sense-giving for a collective with respect to recognising stimuli in the environment or

formulating a collective response to them (Gioia and Chittipeddi, 1991). For simplicity, we call such information, idea or programme a *POA*. The question we address in this section is how the diverse individual communicative acts eventually converge into a common POA among agents, a necessary step for correlated behaviour among organisations of individuals (Hazy, 2008b).

Drawing on literature in psychology and social-psychology (see, e.g. Digman, 1990; Wyatt, 2001; Ellis et al., 2003; Riggio et al., 2003; Sessa and London, 2006), we have identified seven distinct micro-enactments that categorise the various communication acts that characterise agent interactions in collectives that formulate POAs. For this analysis, we assume that agents act in two distinct dynamic modes with either '*contingent self-interested*' or '*group oriented*' motives. (Brewer and Caporael, 2006, p.156). Therefore, depending upon the specific parameters that define their internal and external situations, they are assumed to act as either:

- 1 self-interested actors or
- 2 cooperative group members.

Also relevant is the potential for agents who while operating in the latter mode, switch from one cooperative strategy to another, perhaps with different participating agents, as circumstances change.

As individuals navigate dynamical phase transitions between individual self-interested action and cooperative activity in support of collective interests – they can be observed to engage in seven generalised social objects. In particular, they initiate, accept, negotiate, question/synthesise, reject, recognise/imitate or ignore/defect with respect to an espoused or emerging POA. The many specific instantiations of the micro-enactments that make up these categories are comprised of discrete actions that individual agents take as they interact with one another and react to each other's ideas, decisions and actions.

The seven types of agent interactions are the primitives of the language of interaction. Together with the grammars that organise them into patterns, they give meaning to cooperative action. As such, these seven interactions are intended to be a first step in defining a complete set of the micro-enactments that form the subjective environment experienced by agents as leadership in organisations. In other words, we posit that, when a particular series of micro-enactments is observed to unfold around a set of individuals, one could analyse those micro-enactments and then predict whether those individuals will upon reflection report an experience of either having been led or having been a leader. The focus of this paper is on micro-enactments that occur within groups as they establish norms, gather information about the environment and frame an action plan.

Micro-enactments are distinguished from roles, behaviours, styles or personality traits that are commonly used for analyses of this type. Using individual level traits to predict the outcomes of *dyadic* or *group* level behaviours is problematic as little is known about how combinations of traits influence team performance (Barrick et al., 1998). Furthermore, traits may be malleable when group tasks and outcomes require group interdependence (Wageman, 1999). Thus, the focus of leadership within emerging events is on agent interactions, namely the relationships between the micro-enactment types themselves and dyadic and group outcomes.

2.1 Seven micro-enactments defined

The micro-enactments described next are summarised in Table 1. Each is assumed to be a social object, a category of communicative acts recognised by others, with specific instantiations varying depending upon the agent and the situation.

The micro-enactments described next relate to interactions within a group and among group members. Together they embody the process of forming concurrence or at least resignation around a POA.

Table 1 Definition, properties and potential outcomes of micro-enactments

<i>Name</i>	<i>Definition</i>	<i>Example</i>	<i>Properties</i>	<i>Outcome</i>
<i>Micro-enactments among group members</i>				
Initiate	Specific idea, action or position put forward	Communicate idea Advocate action Begin to assert power	Active	Onset of micro-enactment(s) –idea, action or position begins or is advanced
Accept	Accede to others' idea, action or position	Receive and/or give information Accept action Validate power	Active or passive (adaptive learning)	Idea, action or position continues as is without resistance
Negotiate	Question idea, action or position	Challenge idea Change action Share power	Active (generative learning)	Direction or outcome of idea, action or position shifts
Question/synthesise	Ask exploratory questions and combine ideas, actions or positions	Innovate idea Redirect action Change/challenge in power	Active (transformational learning)	Qualitatively different outcome or direction emerges
Reject	Rebuff idea, action or position	Disagree with idea Refute action Reject assertion of power	Active or passive	Idea, action or position is not accepted
<i>Micro-enactments among group members as group expands or contracts</i>				
Recognise/imitate	Accept/adapt ideas, actions or positions	Discuss ideas Imitate actions Accept power shifts	Active or passive	Ideas/actions of others adapted – group norms and cohesion build
Ignore/defect	Reject ideas, actions or positions	Disagree with ideas Thwart action	Active or passive	Ideas/actions of others rejected – group schism emerges

Initiate. Agents *initiate* interactions in the normal course of human activity. These may be simple communicative acts sharing locally held information; they may advocate action; or they may even attempt to establish a power or dominance relationship over others. These micro-enactments begin the process that may result in the emergence of a leadership 'event' (Lichtenstein et al., 2006). This occurs if going forward expectations about future interactions or choices are changed for the group's members thereby satisfying the definition of leadership proposed in complex system leadership theory.

Accept. Agents may *accept* a micro-enactment that another initiates which is itself a micro-enactment. The information is received, the action is acceded to or the dominance relationship is validated such that the action and choices between the accepting and initiating agents become correlated. Acceptance of a micro-enactment is active when the agent is consciously aware of the acceptance and acknowledges it, or it is passive when the agent implicitly accepts the action without acknowledging it *per se*.

Negotiate. On the other hand, the agents might attempt to clarify a programme or *negotiate* a compromise micro-enactment, for example, a shared-power arrangement, a revised definition or semantics with respect to words, concepts or ideas, or perhaps different terms in leader-member-exchange (Graen and Uhl-Bien, 1995) relationships or resource distribution. This micro-enactment requires a psychologically safe climate where agents feel free to challenge ideas without fear of repercussion.

Question/synthesise. Alternately, agents might opt to ask a pointed *question* in an effort to better understand and *synthesise* different perspectives or explicitly or implicitly explore and synthesise alternative interpretations of events. Thus, these micro-enactments serve to facilitate the emergence of a new POA that is qualitatively different than the others that were initiated previously. This might take the form of creativity, creative interaction or even a challenge to authority or power politics.

Reject. Conversely, agents might decide to *reject* a micro-enactment by refusing to accede to proposals, and refuting actions, or even power plays. When this micro-enactment is a part of an ongoing group effort characterised by established long-term procedures and expectations used to carry out critical work tasks, the group's routines may be highly resistant to change (Howard-Grenville, 2005). In this type of situation, one or more agents may reject proposed changes to the work or the group's approach to their work.

As groups form around POAs, they often tend to grow in size as others become aggregated to an increasingly coherent mass of individuals who join the programme and this in turn is often attributed to leadership style (Dal Forno and Merlone, 2006). In these cases, some bystanders benefit by joining one of these groups, even though they might not have been an original member. This observation leads to two additional micro-enactment types that are utilised by bystanders as well as existing group members.

Recognise/imitate. These enactments are primarily about how individuals relate to one another as groups are formed and change structure. However, there are also individual/group micro-enactments to consider. Agents might *recognise* and then *imitate* an enactment that others are performing, effectively pretending to accept enactments that are currently happening although the agent might not have been one of the original intended recipients. This latter micro-enactment might be called the 'joiner' enactment when a passing agent adopts the practice of others in order to belong and reap the

perceived benefits of membership. As agents engage in group processes, recognising/imitating enactments may become a default behaviour for some group members.

Ignore/defect. Finally, an agent might choose to ignore the observed micro-enactments, a generalised process of choosing to defect in game theory terms. Agents who *ignore/defect*, therefore self-select away from a particular cooperative activity or group, at least in the short term by, for example, engaging in side conversations or making irrelevant comments. They often remain free to engage in micro-enactments in other situations, although not always. Defection can occur when individual, group, organisational and cultural differences impede the expression of appropriate emotions and behaviours, there is a high level of mistrust or conflict, when an agent loses interest in the project or interaction or when there are competing work or interpersonal requirements.

3 Leadership and micro-enactments

As agents interact with one another to determine a POA and then act upon it, leadership emerges in intra-group events. Group members tend to attribute the leadership events to the actions of individuals and call these individuals ‘leaders’. Given the role of micro-enactments in these events and thus in leadership emergence, the following propositions are advanced.

Proposition 1a. Leadership emerges within an identifiable series of discrete micro-enactments, namely it emerges through specific combinations of: initiate, accept, negotiate, synthesise, reject, recognise/imitate and ignore/defect among group members.

Proposition 1b. A series of micro-enactments coalesces to form an identifiable leadership event; group members attribute the experience of leadership in these events to certain individuals who are associated with the chosen POA, and they call these people leaders.

These building blocks can be placed into a context of complex systems. Heterogeneous individuals or *agents* interact with one another to form a complex adaptive system. Each agent interacts with others observing their micro-enactments; each reacts according to local rules and chooses one of the seven micro-enactments. In this way, POAs are espoused and the group dynamics enable leadership events that move the group forward, and this can be modelled (Phelps and Hubler, 2006). The patterns of micro-enactments that agents recognise as meaningful are called the ‘grammars’ of leadership interaction. This process is discussed in more detail next.

3.1 Basins of attraction for individual choice around a POA

To this point, we have been relatively unspecific about what we are calling POAs. Using ideas from game theory mathematics to frame the definition, a POA represents a cooperative strategy among individuals playing a multi-round game. Players can cooperate and gain a benefit. However, as an individual strategy, cooperation has risks because success is not assured, and even if it is, the spoils must be divided according to a set of malleable social conventions.

In the context used here, a strategy is an *attractor* if once agents adopt it and choose to cooperate using it, they tend to remain with the strategy and not defect as long as the attractor remains robust and continues to promise potential benefit. In this sense, it is an attractor for agent choices that occur within a basin of attraction (Nowak, 2006). For simplicity, we call a dynamical state that persists because agents repeatedly make implicit or explicit choices that are consistent with a particular multi-period action strategy, a ‘choice attractor’.

Individuals may participate in many POAs at the same time. For example, when group members tacitly agree not to interrupt one another, they have adopted a POA, agreeing on a strategy for cooperating. At the same time, they may agree to adjourn, gather more facts and then reconvene in several hours. This would be a separate POA that synchronises individual behaviours towards a common goal. The important point is that the adoption of each of these programmes is a direct result of a sequence of micro-enactments among group members. Stated differently, micro-enactments are the ‘messages’ that communicate cooperative strategies in the multi-player, multi-round games that characterise organisational life.

3.2 *Dynamical search among leadership structures*

Non-linear dynamics creates significant challenges for researchers. The system must be modelled holistically to capture all of the interactions among variables in order to understand how the system evolves. Phelps and Hubler (2006) studied the process of leadership emergence in youth organisations and found that self-interested individuals would form around a particular POA when it was proposed by someone considered to be a leader and where there was also social pressure to conform. The micro-dynamics of the process whereby groups congeal around a POA is a key area of research.

Recently a model of these dynamics has been proposed that described a dynamic search (Panzar et al., 2007) in the influence structure within a collective. Based upon the leadership context and the particular situation, individuals would allow certain others, such as a formal leader or a subject matter expert, to lead for a time by acceding to their direction and then shift to others as required. This has been tested empirically by Guastello (2007) and his colleagues who found that teams tended to converge towards identifying one or more individuals as leaders and this attribution followed a swallowtail catastrophe model.

3.3 *Complexity context*

Complexity science describes organisations as complex adaptive systems of autonomous interacting agents, but also as dynamical systems that change their states over time. This dynamical systems perspective provides a way to think about the dynamical states of organisations and how differences in these dynamical states create different contexts under which leadership unfolds.

Organisations exist within the context of *adaptive tension* (Uhl-Bien, Marion and McKelvey, 2007) within their environment. Differences and changes in the availability of knowledge, technology and other resources create different levels of adaptive tension. On the one hand, when knowledge sources and other resources are plentiful, competitors and new entrants are ubiquitous, but at the same time such a fecund ecology implies evolutionary selection pressure is limited as many variations spring up, and even the less

fit ones are able to survive. Thus, as March (1991) described when discussing exploration, success relates to growth as new ideas and new ways to consume resources allow novel structures to grow quickly. This is called a *generative context for leadership* (Goldstein, Hazy and Silberstang, 2008) and can be represented mathematically by a dynamical system with multi-stable dynamics, many potential interdependencies and many possible future states. This situation has also been called adaptation on rugged landscapes (Levinthal, 1997).

On the other hand, when resources are constrained, the dynamical systems that are used to describe the organisation's functioning tend to value clarity and simplicity and thus admit fewer complex interdependencies. This implies that in these situations managers would choose to represent their organisations with abstract dynamical systems that tend towards a single stable dynamic attractor state surrounded by a relatively deep basin of attraction (Levinthal, 1997) – achieving profitability, for example. These organising models have been chosen and honed over time by competition among organisations for resources, a dynamic situation that March (1991) called exploitation. Leadership activities can help the system converge towards its stable state within the basin of attraction as efficiency and effectiveness become the focus of attention and action. Due to these dynamics, a situation with restricted resources (including information) is called a *convergence context for leadership* (Goldstein, Hazy and Silberstang, 2008). It can be represented as a dynamical system with a single basin of attraction within which convergence to the stable solution becomes the focus of leadership attention. This description of complex adaptive systems dynamics leads us to advance the following propositions.

Propositions 2a. Leadership events with a greater proportion and a higher rate of initiate, negotiate and synthesise rather than other micro-enactments lead to better, more creative ideas and novel approaches. These more participative leadership events are effective in a generative context for leadership.

Propositions 2b. Leadership events with a greater proportion and a higher rate of initiate, accept and recognise/imitate rather than other micro-enactments, relates to more efficient execution. These more directive leadership events are effective in a convergence context for leadership.

4 Mechanisms of learning and change

In this article, we are primarily concerned with leadership in organisations that face rapidly changing environments. In these cases, new information, technology and other knowledge resources are ubiquitous and flow into the organisation. Therefore, the organisation and its members must learn to adapt to this knowledge and change. For the remainder of this paper, therefore, we focus on organisations in a generative context for leadership, one with dynamics that imply that multiple stable states are possible.

How do micro-enactments elicit learning and change in a generative context? We argue that as learning occurs, micro-enactments are assembled into the mechanisms that enable an organisation to change and succeed. Further, we argue that certain micro-enactment sequences are necessary preconditions for successful organisational change projects and thus argue that these mechanisms are the building blocks of the dynamic capabilities that research has shown are critical to organisational survival.

4.1 Group and organisational learning

As described earlier, a sequence of micro-enactments might eventually culminate in an identifiable leadership event. It is within and between these events that leadership develops, learning occurs and change takes place. We propose that organisational learning and change occur when specific micro-enactments are assembled into leadership mechanisms that build, eliminate and reconfigure an organisation's capabilities and competencies to succeed in a changing environment.

A group's learning capabilities are dependent on the propensity of agents to share, store and retrieve knowledge from multiple sources and divergent points of view (Wilson, Goodman and Cronin, 2007) and to engage in micro-enactments that question and synthesise received wisdom and also the ideas, position or actions of others. As patterns of interactions are repeated, individual and group learning takes place; under the right conditions – in other words with effective leadership– these patterns and approaches can later transfer to other groups and throughout the organisation so that learning occurs at the individual, group and organisational levels (Silberstang and Diamante, 2008).

The invention of the microprocessor at Intel provides an example of how micro-enactment sequences that include the question/synthesise primitives can enable learning in teams that can ultimately transform a company. As described in the *IEEE Annals of the History of Computing* (Aspray, 1997), and as recalled by parties who were on the design team, in the Intel case, interactions between engineering teams at Intel and at one of their customers led eventually to a single chip design for a microprocessor. The product requested by the customer was a series of chips, but this design request was not perceived to be optimal by some engineers. The original design was challenged repeatedly by members of the design team until eventually the 4004 central processor unit (CPU) – the world's first microprocessor – was invented (Aspray, 1997). This single invention changed Intel, and it changed the world.

When new knowledge about the environment is flowing rapidly, in order to facilitate high-quality decisions by the team, divergent thinking is required, whereby a variety of ideas and alternatives are explored (Nutt, 1999). Individuals tend to be better at divergent thinking, whereas teams often utilise convergent thinking, where the focus is on only one answer (Thompson and Brajkovich, 2003), a situation that might involve what groupthink. This may be due to their prior experiences in team settings, perhaps convened in a convergent context for leadership when such thinking might have been appropriate.

One method of increasing the likelihood of high-quality decisions and improving performance outcomes in high-velocity knowledge environments is exposure to minority dissent (Peterson, 1997). Minority dissent is the expression of contrary or differing opinions. Whether correct or incorrect, minority dissent, when listened to – which is not always the norm as is discussed in the next section – stimulates discussion, promotes divergent viewpoints, increases cognitive complexity and prevents premature concurrence, thereby decreasing the possibility of flawed group decisions (De Dreu and West, 2001). Minority dissent helps teams uncover and discuss unquestioned assumptions. For example, when introducing new products or services to unfamiliar markets, individuals acting out the role of leader tend to greatly overestimate the likelihood of a desired outcome (Simon and Houghton, 2003). Opposing points of view could help counteract this tendency. Likewise, senior leadership teams that express dissenting views during private (vs. public) decision-making sessions, enhance their

decision-making process (Peterson et al., 1998). All of this interaction unfolds as a sequence of micro-enactments, the sequence of which determines the effectiveness of the leadership and learning.

Minority dissent helps increase innovation when the entire team fully participates in the decision-making process (De Dreu and West, 2001) regardless of the team composition, members' education levels, and type of task (King, Anderson and West, 1992). In some circumstances, groups can become 'hostage' to a small minority with a differing opinion, who refuse to allow the group to reach closure (Peterson, 1997). A careful coding of the micro-enactments would identify these circumstances where groups must be able to agree to disagree so they can reach a decision and move on to their next task. When groups are not able to do so, and are stymied, group learning suffers. Given the importance of questioning and challenging ideas and proposed courses in facilitating decision-making and learning – micro-enactments that are especially critical in a generative context for leadership – the following propositions are advanced for environments where knowledge is distributed among group members.

Proposition 3a. A greater proportion of negotiate and question/synthesise micro-enactments vs. accept and recognise/imitate micro-enactments, *ceteris paribus*, is more likely to result in higher-quality team decisions and hence enhanced group learning.

Proposition 3b. As the proportion of team members providing input through the micro-enactments of negotiate and question/synthesise increases, *ceteris paribus*, the likelihood of obtaining higher-quality team decisions and enhanced group learning increases.

4.2 *Micro-enactments, norms and culture*

Another, no less important byproduct of micro-enactments is the formation of group norms and culture. Norms, which are generalised social objects that are expressions of corporate culture, convey a similarity of approach and orientation – correlations among choices and acts – and serve to help differentiate between acceptable and unacceptable attitudes and behaviours within a POA in a powerful and efficient manner (Weick and Sutcliffe, 2001). In this sense, the social objects are signals that provide consistent, general information to all of an organisation's actors as a governor of local interactions (Hazy, 2008b). At the same time, through a structuration process they are also modified in their expression in particular events with respect to their generalised influence on future interactions.

An example of norm changes of this type occurred at India Motors where the company engaged in an internal culture change from a farm equipment company to an automobile manufacturer. As described by the researcher who performed the case study analysis as an observer over several months (Surie and Hazy, 2006), the organisation opened its boundaries and entered into partnerships with French and Japanese companies. According to the study, keys to this process were the many individual project teams that formed these cross-boundary partnerships. The members of these teams engaged in micro-enactments to create new norms of learning and collaboration. With the emergence of these new normative social objects – in the form of generalised POAs – teams formed true collaborations and together created the potential for a different future for the company.

Sequences of micro-enactments serve the purpose of consolidating behaviours between and among group members in a generalised POA or norm. As the group accepts

and adapts behaviours and ideas through a series of micro-enactments, similar approaches and orientations converge. Conversely, when the group interactions are divisive and ideas and actions are rejected or ignored, especially in the early phases of group formation (Gersick, 1989; Hackman and Wageman, 2005), a cohesive group norm cannot adequately develop, as the promotion of openness and the exchange of ideas are established during this early phase of group development (Sala, 2003). We propose that a similar mechanism works throughout the micro-enactment cycle.

Proposition 4a. Emergent leadership, comprised of sequences of the seven micro-enactments, forms the building blocks of group norms and culture that together form a special generalised class of POAs.

Proposition 4b. The greater the number of ignore/defect and reject micro-enactments during the early phases of the micro-enactment cycle, the greater the likelihood that group norms that hinder organised action and change will develop.

4.3 Organisational change

As described earlier, micro-enactments and leadership events that occur in parallel in many teams across the organisation enable organisational learning and the establishment of norms and organisational culture. In addition to learning events in groups, sequences of micro-enactments can lead to the emergence of novel POAs that are brand new to the organisations. This is how the microprocessor was invented at Intel in the late 1960s as engineering teams met with customers (Aspray, 1997). Under the right conditions, this emergent novelty can be reinforced and can spread throughout the organisation through micro-enactments that become positive feedback processes.

Ubiquitous and rapidly changing knowledge resources that characterise today's markets imply the presence of a generative context for leadership. These conditions in turn imply that the dynamical system has multiple stable solutions, implying more than one possible future. Novelty and innovation that emerges when the system is in one of these basins of attraction can eventually enable a shift to a different basin of attraction as happened as Intel shifted from a dynamic random access memory (DRAM) company to a microprocessor company. As Hazy (2008a) showed through system dynamics modelling, this transformation can occur if the local micro-enactments created a perturbation in the broader system's dynamics that was large enough to overcome the norms and culture of the broader system that tend to hold the organisation back in its prior basin of attraction. The invention of the microprocessor was a large enough perturbation to present a challenge to the *status quo*, and this led to the firm's transformation.

Decision-making plays a key role in influencing organisational outcomes and achieving organisational goals. Team decisions are made at all levels of the organisation; however, the quality of the strategic decisions made by senior leadership teams most directly affects overall organisational performance. The group's ability to learn and therefore generate change is also dependent on the types of communication patterns that the groups use.

Proposition 5. Organisational outcomes are dependent on the number, type and pattern of micro-enactments that occur in the organisation over time.

5 Methodological considerations for future research

The ideas described here are positioned to take organisational research in new directions. Fundamental to the approach is the recognition that non-linearities can dominate the processes described and that it is the mechanism of interaction that must be the focus of research, not the traits and behaviours of heroic individuals that are erroneously believed to *cause* change. Because of this, considerably more attention must be paid to developing new data-gathering techniques and analytical support methods to model the behaviour of highly contingent, non-linear complex systems. In this section, we describe a proposed approach for testing these ideas.

5.1 *Gather empirical data through observation and self-reporting*

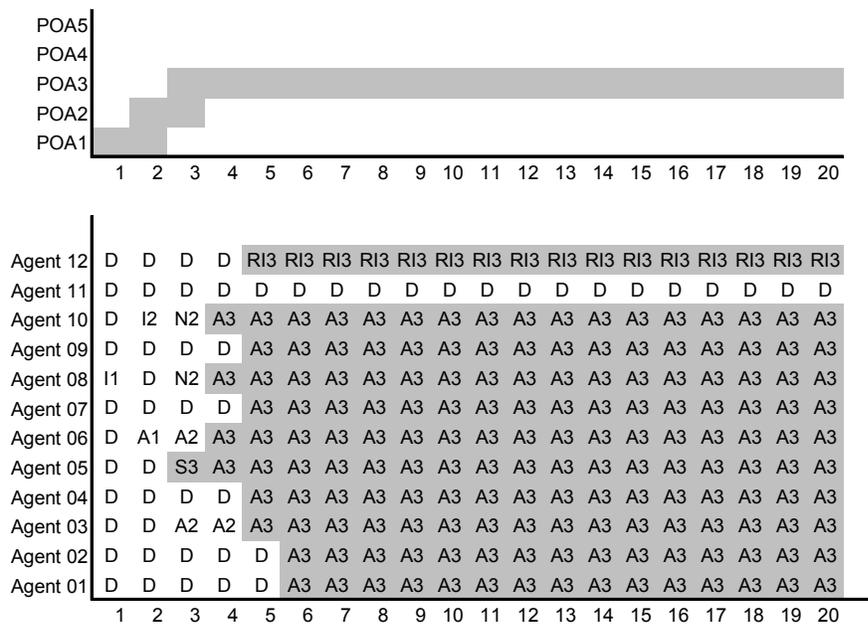
The theory and propositions averred thus far has been quite specific about the micro-enactments that are defined, but quite general with respect to the patterns that emerge in the interaction stream over time. If these micro-enactments are considered to be cellular automata, one might expect simple rules to govern their interaction. In this case, complexity science, or more specifically, Wolfram's (2002) new kind of science (NKS) might imply that even these seven simple actions when governed by simple rules are likely to form emergent, orderly patterns when agent interactions are observed over time. To begin to take this theory to the next level of specificity empirical research is needed. How this might occur is described next.

5.2 *Observation coding of micro-enactments in video and audio data*

As micro-enactments occur over time, and encompass the actions of several agents, sometimes acting in rapid succession or even simultaneously, recording the behaviours and conversations of the agents is required. This can be done through direct observation, or ideally by electronic means, so that the micro-enactments can be coded into the seven categories with a high degree of inter-rater reliability. Following the approach of Friedman and Bernell (2006), direct observations, as opposed to self-report, would allow for the coding of discrete behaviours; semi-structured interviews conducted after the fact would enable researchers to gain additional insight into the behaviours and perceptions of the agents including their attribution of leadership characteristics to themselves and others.

As is illustrated in Figure 1, coding of a leadership event with a group of individuals without a formal leader can be represented graphically. In this figure, as time proceeds from left to right along the horizontal axis, two distinct dynamics are shown. The top graph indicates the various POAs that are on the table during a particular time period. When a new POA is synthesised, it is counted as a new POA. The bottom graph indicates the communications acts by each member of the group during a given period. Note how quickly the state changes from uncorrelated to correlated agents as was observed in prior studies (Phelps and Hubler, 2006; Guastello, 2007). Also, notice that in the figure the communication acts in the bottom chart are linked to specific POAs by subscripts.

Figure 1 Illustrative graphical representation of a fictional pilot team arriving at concurrence at time step number 6 with one defector. Concurrence formed around the third programme of action (POA 3) that emerged in time step 3. In follow-up questioning to determine attributed leadership, eight group members might have indicated that agent 5 was the ‘leader’, two might have identified agent 8, one might have said agent 10 and one might not identify a leader



Initiate (I); Accept(A); Negotiate (N); Synthesize (S); Reject (R); Recognize/Imitate (RI); Defect (D)
 Note: Micro-enactment subscript refers to the program of action being referenced

5.3 Self-reporting with surveys and interviews

The data collected through observations, as described before, can be triangulated by measuring the direct self-reported experiences of the participants involved with pre- and post-hoc surveys, interviews or both. This approach would follow the approach taken by Guastello (2007) in prior leadership studies where individuals were asked after the experience to identify a leader or leaders at different times during the event. This data was then used to model the attribution of leadership to individuals by team members. In this way, the limited perspective of the observers could be compensated for, at least to a degree. By running the study with both sets of data, that is, both observer-coded and participant self-report data, to the extent there is agreement, the results of the analysis would be strengthened. To the extent there is disagreement, new areas for research might be opened up.

6 Discussion and conclusion

In this paper, we have described the dynamic actions among individuals as being characterised by the number, type and pattern of micro-enactments that occur over time. As the micro-enactments unfold, they can veer, for example, between initiation and negotiation, acceptance and rejection, synthesis and imitation. We have drawn upon group and team research and game theory to suggest how these micro-enactments can be assembled into mechanisms that configure and reconfigure value-creating organisational capabilities and enhance group learning and change. Under the right conditions – and with effective leadership – through these mechanisms organisations can be transformed.

This article is primarily conceptual intended to advance thinking relating to micro-events and their impact on emergent leadership in complex systems. However, due to the inherent complexity of non-linear dynamics new methods and new ways of thinking are needed. We propose a research agenda that would involve multiple steps to develop both theory and supporting empirical research. First, laboratory experiments are needed to gather empirical data regarding the patterns or sequences of micro-enactments that are seen to emerge. Second, a series of hypotheses could be generated from these laboratory results. Third, using these hypotheses, field research would be conducted to identify micro-enactment patterns – and their outcomes – and how these patterns relate to perceived leadership, to enacted programmes of action and to resulting organisational outcomes, all as observed in actual organisational settings. In this latter case, the impact of the observer on the deliberations would need to be carefully documented and included in the results. The approach we propose represents a beginning of an entirely new way forward for leadership research that is based upon the complex adaptive systems paradigm.

To sum up, this paper suggests a new approach to leadership research that takes full advantage of developing insights from complexity science, when it is viewed from a systems perspective, including the diverse areas of dynamical systems, network theory, agent-based modelling and information theory. Although only a beginning, we are hopeful that the advances in thinking brought about by the active embrace of complexity concerns can lead to new levels of understanding that were heretofore unimagined.

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