Complex Phenomena in Orchestras - Metaphors for Leadership and Enterprise

Patrick Beautement, Christine Brönner

The abaci Partnership LLP, 10 Beauchamp Road,
Tewkesbury, GL20 7TA, UK
patrick@abacipartners.co.uk, christine@abacipartners.co.uk

Abstract. This paper recognises that comparisons have been made between the role of the conductor of an orchestra and leaders of enterprises, but that little note has been taken of how the complex dynamics of orchestras can provide metaphors for transformational and / or evolutionary behaviour in complex enterprises. The paper intends to identify some of the dynamic musical patterns and phenomena that exist in orchestras and show how these can provide insights for other domains where similar complex federated structures emerge 'on-the-fly' by providing and using a complexity-inspired framework.-

1 Introduction

In the pursuit of effective business leadership, insights have been drawn from apparently related activities. For example, the achievements of great sportswomen and men, of military leaders and of charismatic individuals have been held up as models for others to emulate. Also, the nature of team working (in situations analogous to business) has also been used as a source of insight - as is evident in the continued use of 'outward bound' activities to forge teambuilding. Music too has been a source of inspiration with the role of the conductor seen as being equivalent to that of a business leader and the orchestra as equivalent to the enterprise [1].

However, though these orchestral comparisons are anecdotal (and entertaining) they are limited in their value for a number of reasons. For example, they tend not to explain the dynamic and emergent aspects of organisations (as these are seen as 'difficult' and are outside most people's formal educational experience), nor do they offer a systematic context in which to discuss and compare the issues raised.

This paper intends to address these issues by identifying some of the pre-event enablers and the during-performance dynamic musical phenomena (that exist in and around orchestras) and show how these can be mapped to provide insights for the business domain - where similar complex federated structures emerge 'on-the-fly'.

It is not possible to understand these complex behaviours by trying to break them down in a reductionist manner. Instead, this paper uses a 'Complexity Framework' (described below) and shows how it can be used to enable the different aspects of these musical phenomena to be captured, visualised, understood and subsequently exploited.

2 The Complexity Framework

The emergent properties of complex interactions are often portrayed as unwelcome, chaotic and destructive, but nothing could be further from the truth. In reality, emergent phenomena become interconnected, interdependent and creative and the whole world depends upon it (as in ecosystems and living creatures for example). These Complex Multi-modal, Multi-level networks of interactions display persistent, emergent patterns which are adaptive over time. It is well understood that these complex behaviours cannot be understood by breaking them down in a reductionist, linear manner - instead approaches from complexity science must be used.

It is outside the scope of this paper to provide a tutorial on complexity science. There are many excellent resources available [2, 3, 4, 5, 6]. Also, the paper will not examine the philosophical or spiritual aspects - though they are obviously relevant.

In complexity science, the persistent entities and emergent patterns arising from interactions have been called Complex Adaptive Systems (CAS). In the social and human context CAS have additional elements such as purposeful sensing, learning, problem-solving, prediction and acting. The term Complex Adaptive Reflexive Systems (CARS) [7] has been used for these purposeful entities - examples of which extend from social groupings to the brain. Human communities, such as the orchestras and enterprises which are the subject of this paper, are also CARS and we assert that the Complexity Framework we describe here, based on the understanding from complexity science, can be used to capture, visualise and understood their behaviours.

It is important to note that if we only focussed on the activities of conductor and orchestra during 'The Performance' we would miss many critical factors (such as the role of the composer and the score, the way that musicians acquire their skill, the significance of the performance and the nature of the environment in which the performance occurs). The Complexity Framework is designed to address these potential shortfalls by using four distinct 'perspectives' (described briefly below) They focus on the different aspects which affect how emergent phenomena come about:

Perspective 1: Precursors and Enablers (The Givens). This perspective considers the environmental context (the so-called 'substrate') in which the interaction occur. Emergent phenomena could not arise, nor complex systems exist without the persistent existence of certain things. These include, for example, enduring 'precursors' of emergence (such as the Physics and Mathematics of music) which are relatively fixed and 'enablers' over which composers, conductors, musicians and the audience have some influence (an example is the materials used to make instruments).

Perspective 2: Purpose and Intent (Design / Composition - Score). Given the purposeful nature of both artistic performances and business enterprises there has to be some expression of intent, some formulation of a design and / or of goals - however transitory. This activity shapes much of the context in which future endeavours occur and determines the range of repertoires that are possible. A key aspect is the way the design is formalised and employed to communicate the intent to the performers. In nature, for example, DNA has a role - in music a score is usually written and enterprises use artefacts such as so-called 'business process models'.

Perspective 3: Components and Structuring ('Assembly' / Rehearsal). Emergent phenomena arise from the interaction between 'components' in some environment. The nature of the interactions, interdependencies and influences is largely dictated by the properties of those components - their abilities to sense, communicate and interact and shape their environment. This is true for orchestras and enterprises too, but in different ways. The nature of the instrument, the competence of the musician, the size and composition of the orchestra and the experiences gained through rehearsal all play a part in what then subsequently can be achieved during the performance.

Perspective 4: Dynamic Change ('Run-time' Performance and Perception). A key difference between musical performances and most enterprises is that during performances dynamic adjustment and adaptation is the norm. For example, the locus of authority is continually moving within the orchestra and is adjusted on-the-fly depending on the circumstances. The interplay between three aspects is key to the final performance: the top-down influence of the conductor and of the section leaders; the self-aware and self-regulatory behaviour of the players and their orchestral groupings and the bottom-up effects which arise from individual personalities, motivations and competencies [9]. Most importantly, there is the influence of the audience, whose perceptions, involvement and reactions can have profound effects. In business, this equates to customers and 'the market'. Lastly, there is the environment in which the performance occurs which will have its own influence because of its shape and sound qualities - though it should not be forgotten that the environment itself can be purposefully 'interfered with' to change aspects of the performance.

Employing the Complexity Framework - Required Mindset. The Perspectives above are not independent - they are always interconnected (not always in the most obvious ways). It is easy to forget this and to make limiting assumptions. Hence, it is essential to adopt a suitable mindset[1] when using Complexity Frameworks to analyse orchestras and enterprises. An example would be to always avoid drawing arbitrary boundaries. A musical performance sounds like something with a clear start, middle and end - but this is not so. As in enterprises, performances start long before the event and continue after it - relationships and animosities are formed, trains are late and people have a 'bad day' - all these 'external aspects' impacting on the performance. Indeed, these aspects can be purposefully employed to disrupt performances or coerce performers - as happens when competition occurs between 'orchestral houses'.

3 Complex Behaviours in Orchestras

This section will examine how musicians organise themselves into cohesive but flexible structures in order to cope with changeable and sometimes unpredictable performance-based situations. The Complexity Framework Perspectives will be used to explore a number of aspects of musical performance including: the way musical

1 The principles involved and a description of 'the Mindset' will be the subject of another paper from The abaci Partnership in its 'Exploiting Complexity' series [8].

ideas are transmitted through written scores, the innate dynamics and properties of musical ensembles, general training and rehearsal methods and, most importantly, the varying relationships between performers, conductors and the audience.

3.1 Perspective 1: Precursors and Enablers (The Givens)

The most fundamental 'given' when it comes to music is the nature of sound and the human ability to perceive it. Without either of these there would be no performance - though the visual element of rhythmic movement is important too.

Other precursors of music are tempo, meter and pulse which are used by composers as an agent of cohesion. The two most common approaches are as follows:

1. The system of bars with subdivisions of beats makes the most natural timecode for performers. The literal use of ‘absolute time’ (minutes and seconds) as a time reference is, surprisingly, unnatural (though it has been exploited by contemporary composers to create a sense of distance and alienness in performances).
2. The use of performer-triggered timecodes enables the schedule of events to depend on one or other of the performers in the ensemble. In rehearsal, there is a degree of experimentation involved in discovering the most effective set-up. This method of event-triggering allows the composer to ensure at least some points of convergence in what might otherwise be an open and improvisatory structure.

Another given is the nature of the materials and techniques available to us for making instruments. These have dictated the range and types of sounds that we can produce and detect. Recent developments in digitally-generated sound have extended the range of possibilities - only constrained by the limits of sound and hearing.

3.2 Perspective 2: Purpose and Intent (Design / Composition - the Score)

The intent of the composer is communicated to the performers through a score. Since a performance consists of a performer using interpretation and training to bring the score to life, the more proscriptive the score, the less freedom is given to the performer to act spontaneously and musically. Over time, composers have enjoyed a gradual escalation in status moving from that of craftsman to that of artist and creator of 'The Score'. The score is essentially a graphic representation of the music which either codifies the finished result or the actions that need to be taken in order to achieve that result. All scores are approximate and should be taken as blueprints requiring interpretation and realisation in performance. This having been said, if one takes a selection of scores from the last 500 years, an unmistakeable trend can be found. This is the steady but gradual increase in the level of detail in the score.

The level of detail in a score has a direct effect on the amount of creativity required of the performer to ‘complete’ the piece in performance. At one end of the scale are scores by, for example, Plainchant, Palestrina, Dowland and Bach which rely heavily on interpretation in terms of dynamics, expression and articulation. By the time of Schumann, Vaughan Williams and Berg, it is clear that the score becomes much more proscriptive and represents the increase in status of composers across this time period (1820-1920). In the worst-case scenario for players, the composer writes a heavily

proscriptive score, and the conductor then dominates the interpretive process, leaving the musicians little creative space. These scores are not as interesting (from the point of view of studying complex inter-performer dynamics within ensembles) as more modern and expressive scores such as graphic scores which attempt to find new ways of communicating with musicians and conductors.

A large proportion of jazz improvisation consists of taking an established song, known as a standard, and improvising around the melody. Most jazz musicians work with scores that recognise this practice called lead sheets which are stripped-down scores from the original song which provide the melody and accompanying chord progressions, using a bespoke harmonic shorthand. The players then bring their pre-set riffs, catches, scales and embellishments and work them around the skeleton. The power of this notation is that it recognises the complex nature of the task being undertaken and provides a direct, uncluttered score to enable the performers to focus all their energies on the improvisation task. Success here is nearly entirely due to the creativity of the performers in interpreting some of the 'non-sensical' scores.

3.3 Perspective 3: Components and Structuring ('Assembly' / Rehearsal)

Some scores provide flexibility by not specifying the instruments required to bring the piece to performance. In other words, the nature of the music depends on which components are present (players and instruments) and how their inter-relationships are structured and how those structures can 'reconfigured' through rehearsal.

Musical Components and Configuration of the Orchestra. As en example, the Modern Symphony Orchestra has two main configurations. The most common (A), distributes the instruments from left to right (as heard by the audience) in order of high- to low-frequency instruments. This arrangement affords the audience a stratified frequency distribution which leads to clarity of musical line. The second arrangement (B) aims to produce a more blended and homogenous sound by placing the violins in a stereo configuration and placing the lower strings in the centre of the stage. It should be noted that, in terms of cohesion, arrangement A has the edge on B in that most players hear the higher-frequency-based instruments in their right ear which is believed to be more responsive to high frequencies than the left ear in the majority of the population. The strings can be thought of as the general forces, providing the foundation of the orchestra, whereas the woodwinds, brass and percussion (arranged according to power, loudest at the back) can be viewed as specialist forces that bring individual sound colours and associations to the overall sound.

Leadership Roles within the Orchestra. Each section of the orchestra has a leader or principal player and, beneath the principal, there is a graduated 'hierarchy' in which no player is of an equivalent position in the hierarchy. For example, the violins are arranged in twos (called desks) and on each desk there is a principal, and each desk takes its lead from the desk in front. This ensures both a motivated, competitive structure in each department, but also a coupled one in which all desks act as an extension of the front desk, and ultimately the leader.

The Role of Rehearsal. A. The success of a musical ensemble in achieving its objectives depends, to a large degree, on how robust, supple and adaptive that ensemble is. Although the character of any musical organisation is clearly a function of the individuals of which it is comprised, the way the ensemble is trained has an enormous bearing on the flexibility of the resultant group dynamic. With poor training and rehearsal, even individually-excellent players can deliver a shoddy performance.

The most common and powerful rehearsal technique, used universally for ensembles of any size, is that of dissecting the piece and consolidating every instrumental strand before re-assembling. As orchestras become familiar with a piece of music through rehearsal, it is easy for the individual players to fall into patterns of playing which start to rely on the surrounding players.

For a passage in a typical orchestral piece (involving strings, woodwinds, brass and percussion) the conductor will often ask each orchestral section to play their parts separately, without the surrounding parts. This often highlights possible weak moments as it both takes away the parts on which players may have been relying and also puts that section of the orchestra under pressure to perform in front of their peers. This rehearsal technique of strengthening of the separate strands of the music to make the whole more resilient to internal failure really comes into its own when dealing with ensembles comprised of significantly less-accomplished musicians who tend to behave in a less-independent way, making catastrophic failure far more common.

Having repeated this process with the different sections of the orchestra, significant combinations of instruments will then be rehearsed. This way, each component of the orchestra is helped to develop both a sense of independence and also a number of different lenses through which to understand the music. The knowledge of what all the other parts should be doing allows each player to react intelligently to emergent conditions in a performance situation. It also allows the conductor (the leader of the rehearsal) to embed elements of style and interpretation within the orchestra itself rather than imposing it from above.

3.4 Perspective 4: Dynamic Change (Performance and Perception)

Once the day of performance arrives, despite all the preparations, much can change - either deliberately or accidentally. The performance itself is 'emergent' and can (like all emergent phenomena of this type) be influenced from three directions: either top-down (eg, by the conductor); or by the bottom-up behaviour of the players and / or their instruments; or from the 'middle' - through self-organisation, self regulation etc (sometime called self-*). The interplay between these three directions of influence is key to the final performance. Each of these is discussed below.

Influence from the Top-down. The role of the conductor is often misunderstood by the casual observer. It appears that the conductor’s primary function is to keep time and to bring in the various instruments as and when required. This may be true of the conductor of an amateur orchestra, professional orchestras are composed of highly-trained musicians who don’t need a conductor to indicate when their next entry is or

which beat of the bar the piece has reached. So, the main role of the conductor is to direct and emphasise the focus of performance at any one time.

This description of the conductor's job sounds rather managerial. However, it should be appreciated that the decision-making process, and the communication of these decisions, is tied into a creativity and an artistic expression. Another crucial task that conductor performs is that of communicating an overarching vision for the music that will allow the players to more intuitively recognise their role in the organisation.

There are two distinct and well-known caricatures of conducting style. They represent the extreme positions on an axis - most conductors try to bring together elements of each in order to maximise both the discipline and flexibility of their organisations. However, for the purpose of this paper, it will be useful to highlight the features and effects of these two 'extreme' approaches. The first type is 'the Dictator'.

The Dictator imposes his will on the orchestra and ensures that he leads both the 'leading' instruments and the supporting instruments. There is very little room for personal musical/creative interpretation of the score on an individual basis and the success of the performance relies heavily on the performance, and investment of energy, of the conductor on the day. These orchestras tend to be extremely tight in terms of ensemble but are quite brittle structures which can fall apart catastrophically if the conductor either makes a mistake, or departs from the expected interpretation of a piece. The players, without the chance to invest the music with their own interpretations, relinquish ownership of the music to the conductor and are therefore dependent on the conductor for their corporate coherence. This sort of operational style tends to stifle the innate flexibility of the orchestral structure but is often considered successful as the vision of the conductor is often more clearly (and ruthlessly) realised without the 'interference' of players' differing interpretations.

The Persuader, on the other hand, invests authority in the principals of all sections and will seek to create space for individual interpretations of the music within a defined, overarching concept. This approach, in moderation, allows the fluid hierarchical structures to work well, to support emergent musical situations and to cope well with conducting and player mistakes. The potential weakness of this approach is a lack of discipline, and lack of coherence and ensemble, and a overly consensus-lead approach preventing a meaningful musical expression.

Influence through Self-regulation. The background organisation of the symphony orchestra is designed so that the higher-frequency instruments, which are more likely to be playing an important melody-carrying role, lead the lower-frequency instruments (more likely to be playing a supporting role). However, the principal focus in a piece of music is not necessarily the highest instrument. It is nearly always the melody, wherever in the frequency range it is to be heard. And it is in always allowing the instruments carrying the melody a self-regulatory leadership role for the duration of that melody that the orchestra shows its flexibility.

The reality of orchestral playing is that the melodic focus is shifting continually and all players need to be constantly aware of how they each fit into the overall organisational structure and, in particular, which instrument(s) is leading at any time. A 1st violinist, sitting on the 3rd desk, will be subconsciously constantly monitoring the evolving hierarchy of the orchestra and either participating in a leading role or a

supporting one as required. That any instrument could feasibly take the lead, and the remaining instruments fluidly fall into a supporting role without 'internal dislocation', makes the orchestra such a flexible force for musical expression.

Influence from the Bottom-up. Bottom-up musical organisation comes into its own when the score presents the performer with a number of optional musical fragments. The intention is that these fragments are then assembled by the performers in real-time. There is a spectrum as to how ‘leading’ the fragments are; some pieces feature a bewildering array of fragments which seem to not represent any higher order while others provide fragments of musical material which may suggest several possible combinations. For a successful creation in this last scenario, the performers need to first of all recognise the possible combinations and then be able to keep these combinations in mind as they play the piece. Given that the assembly of the piece is essentially improvised, it will contain plenty of bottom-up emergent behaviour.

So, success turns on the individual performers’ ability to constantly monitor the cumulative textures and atmospheres and respond accordingly so that they contribute to rather than disrupt or ignore the emerging patterns. In a sense, all of the types of performance featured above involve a dynamic element in which events feedback into the overall plan; that is, to some extent, the 'virtual score' evolves, bottom-up, in real-time as the performance proceeds. It is not difficult to imagine a system whereby alterations to the score that arise in real-time could be cycled back into a digital form of the score by the performers themselves.

Influence from the Audience (Observers). Concepts such as atmosphere and mood only come into being in the act of listening - indeed the performance as perceived is entirely emergent - in the minds of the audience (each of who enjoys a different performance). Some composers provide scores which notate the listening experience. Here, the composer is effectively delegating all musical elements (such as melody, harmony, rhythm) to the performer who is given the task of musical composition influenced by audience reaction.

Influence from the Environment. The most powerful effect of environment is changing the way sounds are heard. Agents of disruption are rhythmic dissonance and bad tuning as these attack the very core of cohesion in most forms of classical music which ensemble around a common pulse and harmonic consonance. In general, both of these sorts of disruption occur as a result of players either not listening to one another or being placed in an environment in which it is difficult to hear their fellow performers. In both situations the player misses the vital feedback from other players and therefore is unable to make the necessary adjustments because of:

1. Distance between the performers: distance introduces time delays and a greater mixing of direct and reflected signals which can cause a loss of clarity in the source. A good example of this in action is to assess the quality of the ensemble between an organ and a church congregation as the congregation process around the church singing; the almost inevitable result is that the congregation will move out of time and out of tune with the organ the greater the distance between the two.

2. Inadvertent lack of performer monitoring: lack of monitoring inevitably leads to rhythmic and tonal dissonance and is often the result of performer laziness or environmental distractions. This can result in the performer being over-stretched; if the performer commit her resources to the general situation, and has none left for her performance, it is likely that the ensemble will suffer.

Competition and Disruption. Musical ensembles can fail, or be caused to fail, because of the sorts of challenges to the cohesion they face - such as rhythmic and harmonic dissonance, tuning and disruption of the command structure.

An example of this would be a clash of egos at the top of the chain of hierarchy. In an orchestral set-up, this sometimes takes the form of the Leader of the Orchestra (the Principal Violin) battling with the conductor. The Principal Violin (in theory, the conductors assistant) has phenomenal power as she leads the whole string section - the foundation of the orchestra - and helps to carry through the conductor's interpretations. If they do not work well together then a destructive tension develops within the orchestra and awkward performance results.

Surprisingly, this scenario is reasonably stable in terms of ensemble as the orchestra is acting as one, in opposition to the conductor, enabled and led by the Principal Violin.

4 Metaphors for Leadership and Enterprises

This section will draw on metaphors from the orchestral domain and will examine how enterprises could organise themselves (and their collaborators and even potential competitors) into cohesive but flexible structures in order to cope with changeable and sometimes unpredictable commercial situations with their 'wicked problems' [10].

The Complexity Framework Perspectives will be used to explore aspects of networked enterprise[2] including: the way ideas are transmitted through shared artefacts of various sorts, the innate properties of the parts of enterprises (including training methods to exploit complex environments) and, most importantly, the varying relationships and interdependencies between personnel, leaders, consumers, producers and the wider environments.

4.1 Perspective 1: Precursors and Enablers (The Environmental Givens)

In the same way that orchestras and their performances are profoundly shaped by their environment, enterprises need to understand better the role of their own environments (eg, physical, economic, social) in shaping the range of behaviours and influences available to them. This means understanding what, for them, and for their competitors and collaborators, are precursors and enablers. Some of these may be limiting, some may present opportunities - but these will vary depending on the nature of the enterprises involved. These need to be mapped out and understood.

2 The term 'creative clusters' (www.creativeclusters.com) has been used for creative economies - where highly agile enterprises 'agglomerate' in mutual support and competition.

Example precursors include number, arithmetic, 'money' and economic 'constants' which underlie all commerce. Enablers, which enterprises can affect, include current and new financial and economic models (such as the 'Futures Market' which provides a way past the limitations of previous business methods).

4.2 Perspective 2: Purpose and Intent (Design / Composition)

There is no direct equivalent in an enterprise for 'the score'. It is not in mission statements, nor is it in process models (as these are designed to be followed, as in a call centre, without 'interpretation'). The orchestral metaphor indicates that part of the way ideas are transmitted is through artefacts designed in advance (the score) and part cones through the intent of the conductor and performers during the event. This latter intent is unwritten and equates to company 'ethos'.

Companies such as Google and Innocent Smoothies have a very clear intent which shapes what they do. This is much more than the brand and shows that enterprises *can* definitely benefit from developing a much richer understanding of purposefulness and intent and the ways in which they can be communicated (not just as terms of its static artefacts, but in how the enterprise 'lives the dream' as it works). This includes appreciating the key role that personnel have in interpreting and enacting the intent.

4.3 Perspective 3: Components and Structuring ('Assembly' / Rehearsal)

Enterprises know that the type of people they recruit fundamentally affects the bottom line. However, too often people are just seen as 'resource' - as pegs to put in holes. It is not well understood how the innate properties of the various parts of the enterprise interact, inter-depend and ultimately how this affects the kind of overall behaviour that will emerge. Without this knowledge, businesses can inappropriately 'optimise' resulting in a lowest-common-denominator, clamped-down behaviour.

The orchestral metaphor shows clearly how the mix and diversity of people, their instruments, interaction techniques and skills enables a rich repertoire to be exploited. Enterprises need to understand much more clearly which aspects of their 'components' sets the range of repertoires that they require and how to change the capability mix *dynamically* to affect outcomes (including providing training in how to exploit complex environments. Like orchestral rehearsals which explore the possibilities).

4.4 Perspective 4: Dynamic Change ('Run-time' Performance and Perception)

The performance of enterprises emerges from the varying relationships, interdependencies and interactions between personnel, leaders, consumers, producers their tools and artefacts and the wider environments. Enterprises can vastly improve their understanding of how to purposefully exploit the dynamics of complex emergent phenomena to give them decisive advantage. This means acquiring the appropriate mindset, adaptive stance and tools and then mastering the mechanisms for asymmetric influence in complex environments described briefly below.

Influence from the Top-down. The nature of leaders compared to mangers is often misunderstood. Managers follow behavioural templates and work within authority structures given to them by the enterprise - they follow the script they are given. Leaders take risks, interpret the situation and are prepared to take off in new directions - they explore the space of opportunities. In this sense, the conductor of an orchestra has the qualities of a true leader - being prepared to dynamically hand off authority to other leaders in the orchestra who, at that time, are better placed to lead.

Influence through Self-regulation. There are many self-* behaviours that enterprises can potentially display, including responsiveness, initiative, flexibility, resilience, a happy working environment leading to a successful company. The orchestral metaphor indicates how many behaviours are possible, yet, enterprises do not always appreciate they are there to be tapped into.

Influence from the Bottom-up. The role that performers play in a successful performance is obvious but, as has been indicated above, the orchestral metaphor of 'The Dictator', shows that their contribution to the performance can be seriously constrained, even impoverished. If players are to make their contribution from the bottom-up then the enabling conditions must be understood and nurtured.

Influence from Consumers and the Environment. As in a performance, the perceptions that consumers (audience) develop are 'outside' the enterprise, yet clearly affect its success fundamentally. In a similar way, the environment can be a vital mediator of feedback (eg, for an orchestra from disruptive echo in a theatre - for and enterprise in the form of graffiti say) and the environment can even have a direct influence. This was evident at the opening of Heathrow Terminal 5, where the wider environment beyond the terminal had such a profound impact that the Terminal itself could no longer function. These types of 'connectedness' cannot be ignored.

5 Summary

Other writers have compared conductors of orchestras with leaders of businesses. Usually, those comparisons relate only to the relationship between the conductor and the musicians during a performance and so the analogies that can be drawn are constrained by this viewpoint. This paper provides a much richer perspective, by drawing on complexity science, which leads to further valuable insights. These enables us to understand that both orchestras and enterprises are types of so-called Complex Adaptive Reflexive Systems (CARS). Complexity science shows that, to understand CARS, alternative perspectives are required and the paper has used a Complexity Framework for its analysis covering four of these perspectives as follows:

- Environmental Perspective: the precursors and enablers (the environmental Givens) that must be in place before any activity can occur;
- The 'Design-time' Perspective: covers purpose and intent (design / composition) which set the context and goals for activity;

- The 'Assemble-time' Perspective: covers components and structuring ('Assembly' / Rehearsal) which allow the properties of the individual entities to be considered;
- The 'Run-time' Perspective: which examines the exploitation of dynamic change (performance and perception) where adaptation and emergence come to the fore.

The paper has examined musical performances from these four perspectives and has mapped the insights gained to metaphors with relevance for enterprises and leaders - indicating that enterprises:

- need to understand better the role of environmental factors (eg, physical, economic, social) in shaping the range of behaviours and influences available to them - including understanding, for business, what are precursors and enablers with limiting and / or enhancing aspects for different kinds of enterprises (for self, competitors and collaborators) and for different kinds of sucess;
- can benefit from a richer understanding of purposefulness and intent and the ways in which they can be communicated (this is more than just issuing 'mission statements') - including, for business, appreciating the importance of the role that personnel have in interpreting and enacting the intent;
- should understand how the nature of their 'components' sets the range of repertoires that an enterprise can display (the so-called 'pays peanuts, get monkeys' effect) - including, for business, understanding how changes in this capability mix can critically affect outcomes and the 'bottom line';
- can vastly improve their understanding of how to purposefully exploit the dynamics of complex emergent phenomena to give them decisive advantage - including, for business, acquiring the appropriate mindset, adaptive stance and tools and mastering the necessary leadership techniques. This includes the mechanisms for asymmetric influence in complex commercial environments.

These insights lay the foundation for the in-depth exploitation of orchestral metaphors by enterprises (and other domains of human endeavour). These metaphors are particularly suited to turning complexity to advantage by enabling them to extend their repertoire of 'on-the-fly' behaviours - being more agile, adaptive and successful.

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