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Design and the Art of Management — *themed issue*

Ken Friedman, Laurene Vaughan and Jonathan Vickery

The editors of *Aesthesis* have been thinking of new approaches to 'the art of management' – or perhaps thinking about new ways to approach old problems. It seemed natural for us to think of design and design thinking as central to this intellectual endeavour – design is the process by which designated problem-solvers address the problems of legitimate stakeholders using innovation and creativity. But design is more than just problem solving. Design engages the sensibility, and designed artefacts take their shape in terms of feeling and form as well as function. The papers submitted for this issue on design, management, and organization covered all those areas and more.

In different shapes and guises, the articles in this issue all merge on the subject of 'design thinking', whether looking at 'tools', processes, experience or interactions. In terms of subject matter, the term 'design' in this issue emerges as a dynamic element of investigation into organizational learning, collaborative networks, product development, organizational resource management, service capability development, strategic urban planning, organizational creativity, contemporary art, and the conceptual-philosophical content of the epistemic functions of design that give us frameworks to think, create, assess, analyse and evaluate. Design always involves three great questions. How do we make things? How do we make things work? How do we make things work better?

Nobel Laureate Herbert Simon (1982: 129) defines design as the process by which we '[devise] courses of action aimed at changing existing situations into preferred ones.' Creating something new or reshaping something that exists for a purpose, meeting a need, and solving a problem, are courses of action toward a preferred situation even though we may not yet be able to articulate this preferred situation. This definition therefore covers most forms of design.

Design is not necessarily an outcome, but rather a process. The verb 'design' describes a process of thought and planning, and this verb takes precedence over all other meanings. The word 'design' had a place in the English language by the 1500s; its first written citation dates from the year 1548. Merriam-Webster (1993: 343) defines the verb design as 'to conceive and plan out in the mind; to have as a specific purpose; to devise for a specific function or end'. Related to these definitions is the act of drawing, with an emphasis on the nature of the drawing as a plan or map, as well as 'to draw plans for; to create, fashion, execute or construct according to plan'.

The American architect and designer Buckminster Fuller (1981: 229-231) describes design as the difference between a 'class-one evolution' and 'class-two evolution'. Class-one evolution is natural evolution according to Darwin, the natural phenomena studied through evolutionary biology. Class-two evolution involves 'all those events that seem to be resultant upon human initiative-taking or political reforms that adjust to the change wrought by the progressive introduction of environment-altering artifacts' (Fuller 1981: 229). Design is both intrinsic and essential to human development in a fundamental sense, but also creates artefacts that change the very context of that development.

One argument for the importance of design is the increasing number of areas now subject to human initiative. The vast range of technologies that surround us mediate most of the human world and influence our daily lives. These include the artifacts of information technology, mass media, telecommunication, chemistry, pharmacology, chemical engineering, and mechanical engineering, along with the designed processes of nearly every service industry and public good now available other than public access to nature. Within the next few years, these areas will come to include the artifacts of biotechnology, nanotechnology, and the new hybrid technologies.

Fuller's metaphor of 'the critical path', which was the title of his last book (1983), articulated a scenario where our world is as much subject to disintegration as it is development or growing better. The way that the new artificial world affects the natural world has immense ramifications that parallel Fuller's idea of class-two evolution. This is what Victor Margolin (2002) called 'the politics of the artificial', where design has become so intrinsic to our environmental development that we need seriously to assess its power, and create new boundaries, ethics and agreed protocols.

Design plays a role in the evolution of an increasingly manufactured world, from ordinary objects to advanced technology. The design process takes on new meaning as designers take on increasingly important tasks. These tasks are important not because designers are more visible and prestigious, but because design has greater effects and wider scope than ever before. Despite this scope and scale, however, robust design solutions are always based on and embedded in specific problems. In Jens Bernsen's (1986) memorable phrase, the problem comes first in design. Each problem implies partially new solutions located in a specific context. The continual interaction of design problems and design solutions generates the problematics and knowledge of the field.

Design as an activity translates utilitarian, symbolic, and psychological needs into functions; it translates needs and wants into ideas; and it translates these ideas into the structural descriptions and entities to produce required functions that satisfy needs. As such, design always serves strategic goals on some level, large or small. The different forms of professional design practice require a process incorporating the strategic and managerial aspects of design as well as the hands-on developmental application of design. These move from thinking, research, and planning at one end of the process, on to manufacture, assembly, packaging, and presentation at the other.

For business firms, design is a comprehensive part of an integrated process that links selecting challenges and solving problems to developing products and marketing them successfully. For business firms, design is a comprehensive part of an integrated process that links selecting challenges and solving problems to developing products and marketing them successfully. The immaterial forms of design process have long been hidden, and now we are in the midst of a transition. Getting from one point to the next in this complex map of process, project, and product requires 'design thinking'. Design is in the business literature and designers are being brought in to organizations as they seek new ways of being, working, and producing. It is an exciting time of evolution. The literature on design thinking and the role and contribution of design to the fields of organizational and business development is expanding – and this issue of *Aesthesis* is part of this process.

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Making Dance: Learning & Designing Issues in Biotechnology Networks

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Palminder Smart

Focusing upon choreography and dance (Rowe 2008) this paper looks at the designing of complex systems and their Organizational Learning [OL] implications, extending previous usage of the *terpsichorean metaphor* (c.f. Rowland 2004). In this way, drawing upon dance theory reveals the *design imperatives* emerging from management research in biotechnology. Dance is pertinent to this complex field of investigations because it lies 'in the moment' — in those kinetic, at times transient, but nevertheless potent, relationships *between* participants. This paper therefore explores the contention of dance theorists (c.f. Shay 2001), that an understanding of dance — through the detailed aspects of dance (such as choreographic technique) or the wider socio-political context of dance forms — furnishes us with insights that can be employed beyond the art itself. Can dance help us understand *design as creative practice* in high technology industries?

The debate surrounding networked organizations in sectors such as biotechnology, has gained much attention because of the intricate and complex design issues involved (Granovetter 1985; Liebskind et al 1996). Central to this paper is how *the learning process* is embodied in a multifaceted series of relationships, involving the individual, team, organizational and often inter-organizational levels (c.f. Jones and McPherson 2006). Despite investigations into the 'dynamic capabilities' of networked organizations, recent research by the authors of this paper highlight concerns that our understanding of *inter*-organizational dynamics in this area remain neglected (Smart et al 2007).

Consequently, developing a cross-disciplinary perspective permits us to engage further with the dynamic relationships that follow learning in biotech networks. Questions arise as to whom we refer to as the 'performers', how (and who) the 'steps' and 'sequences' are defined through which this constructing of reality takes place, including the role and status of managers as network 'architects' or 'choreographers'.

Design and Organizational Learning

Real learning is not copying. That's the wrong word. Copying is taking somebody else's solutions. Learning is taking somebody else's problems (Twyla Tharp in Contu 2008: 49)

How do we understand and conceptualise 'design' within the disciplines of management and organization? It has been suggested that management and organization disciplines are actually 'design' sciences – who produce 'design-orientated' knowledge (Gibbons et al 1994). Unlike the 'explanatory' sciences (e.g. biology or chemistry) these disciplines generate 'grounded and field-tested' rules that are 'developed in the context of application' (van Aken, 2005). Elsewhere, the notion of a 'design epistemology' has been connected directly with OL (Rowland 2004). This notion offers the possibility of a *distinctive way of knowing*, because designers routinely engage with 'ill-defined' problems, and whose problem-solving methodology is 'constructive' rather than merely solution-focused, and (connecting with the learning perspective) based upon a 'reflective conversation with the materials of the situation' (Rowland 2004: 39).[1]

Rowland argues that the logic of the traditional sciences (similar situation/similar response) is found to be wanting when met by the context-dependant nature of such problems. Dunne and Dougherty (2006) assert that biotechnology needs to go further than a purely 'engineering-based' approach to incorporating scientific exploration – which they conceive of as a 'searching for clues'. Essentially, this suggests the necessity for a complex design-related epistemological perspective in managing OL. *Designing* (c.f. Rowland 2004) can be seen as transcending scientific or engineering based models of ordering and re-ordering material. It is rather a form of *composing*, whereby codes and underlying languages configure parts, relationships and their underlying principles, requiring a more holistic view of a given situation, such as that provided by systems thinking prevalent in much OL theorising (Issacs 1993; Senge 1992). However, granted, there

is a prevalent tendency to use systems thinking also in an overly-positivistic, apolitical manner (Oswick et al 2000).

Consequently, in this paper we explore further issues surrounding the development of 'design-orientated knowledge' by drawing upon the creative arts, namely *dance*, in order to engage with relatively novel organizational forms emerging from high-technology industries.

BIOTECHNOLOGY, DANCE AND ORGANIZATIONAL LEARNING

Whilst the biotechnology industry in recent years has expanded, what is also significant are the concerns surrounding the lack of profitability in the sector. The high costs, for instance, of bringing a product to the later stages of testing can be prohibitive for all except the bigger pharmaceutical firms, leading some commentators to suggest that the industry is experiencing 'a negative learning curve – costs have gone way up while output has gone way down' (Dunne and Dougherty 2006: 3).

There is undoubted scope for research that explores learning processes from novel positions, not in the least because of this apparent naivety in extant organizational and managerial models. Dougherty's (2007) recent thought-piece contends that too often 'knowledge' is relegated to abstract dualisms (e.g. tacit versus codified; complex versus simple; exploit versus explore, and so on). These representations are either too simplistic or irrelevant due to the 'situated complexities' of developing new products in a sector where there 'are no architectures, platforms or even learning curves, and limited knowledge accumulation'. She argues that biotechnology is 'non-scalable' (because it is difficult to scale up bespoke production processes) as well as non-decomposable – because its complex processes cannot be easily broken down into a discrete set of 'steps' to be easily allocated between organizational actors. Similarly, she warns of 'techno-hype', reflecting the need for a social conceptualisation of 'knowledge' rather than purely technologically-focused analysis.

Dougherty is cautioning those who would assume that we can configure biotechnology networks in a manner akin to the scientific management school, which envisaged large manufacturing organizations as a 'machine' – a metaphor which itself has been seen as reducing complex dynamic processes to ossified conceptualisations of structures and processes (Morgan 2006). Similarly, critics of OL methodologies warn that the 'organismic' metaphor underlying the systems thinking perspective has its own shortcomings (Oswick et al 2000; Rowe 2008).

This paper follows a different line, expanding upon a *choreographic conceptualisation of design* as a set of dynamic protocols (Foster 1998). A 'design' perspective here provides a tentative framework through which to begin to develop general solutions for types of situations (van Aken 2005), through the development of heuristic rules (in a situation similar to X, it is generally important to do Y) as much as strict algorithms. It does so by following the recommendations of employing evidence from multiple cases. By drawing from the authors' own sector-specific empirical research along with other studies, we begin to develop a framework to articulate specific knowledge, rather than the generalised capabilities criticised elsewhere in biotechnology research (Hagedoorn et al 2006).

Employing dance as a metaphor enables us to look beyond the 'micro' (specific interactions between performers) to begin to understand the 'macro' – the broader institutions of dance communities (Novack 1995). Consequently, we begin to develop a framework incorporating the dialogic methodologies and the practice based approaches in OL theorising.

Dance has proved particularly 'apt' as a metaphor for many aspects of organization theory (Cook and Brown 1999; Senge et al 1999). However, there have been concerns raised concerning the assumptions that underlie extant organizational learning metaphors (c.f. Lennon and Wollins 2000; Oswick et al 2000; Rowe 2008); this has resonance for understanding OL particularly in relatively new complex sectors, such as biotechnology.

Much has been written about OL. In effect, the neat boundaries between the different perspectives are more ambiguous than at first glance. Elkjaer (2004) has tried to elucidate the recent semantics of the OL field by suggesting that certain root metaphors can be identified in extant literature, for example, learning as the 'acquisition' of particular dialogic skills (such as the more cognitivistic approaches of Senge et al 1999) or 'learning as participation' – drawing attention to the practice turn in learning (Lave and Wenger 2001).The former of these investigates OL in terms of the evolution and revolution of these schemas, but struggles somewhat to conceptualise an understanding of *collective* learning. The latter is a practice based constructionist work, where the focus is upon the negotiation of realities within communities of shared practice. Knowledge here is envisaged as not so much static bodies of knowledge that can be separated out from socio-cultural contexts, but as 'knowing' – a form of 'social accomplishment' (Orlikowsky 2002: 249) emerging from an infinite dance between knowledge (codified, explicit) and knowing (tacit, implicit). Other approaches have tried to use a network-based view, utilising concepts such as 'dynamic capabilities', for example, although Miettinen et al (2008) cautions that this approach tends to be overly focussed on general organizational and managerial 'routines'.

Essentially, OL methodologies emphasise dialogic tools that can improve the 'flow' of critically reflective learning (Issacs 1993; Senge 1992) as a responsive, perpetual constructing of shared realities – manifested at an individual level (through internal conversations) as well as collectively at group or organizational levels, through shared narratives (Rowland 2004)). However, whilst *dance* is an intuitively 'apt' metaphor, there are limitations. For instance, there are still concerns that the current emphases is animated by the rather positivistic systems thinking model metaphor (c.f. Rowe 2008). There is therefore a need to understand a 'generative dance' from a more critical perspective, which takes into account the 'lived experience' of the various performers.

Beyond Dance as Illustrative Metaphor

There are direct analogies between dance and OL. Both can be seen as *communicative*, even when there is no audience – drawing upon a Deweyian concept of an 'inner dialogue' (c.f. Elkjaer 2005; Hannah et al 1979). Dance is not purely emotional (Hannah et al 1979), but can incorporate the cognitive in the transmission of ideas, and can involve (and also be influenced by) socio-cultural values.

The metaphor of a 'generative dance' (Cook and Brown 1999) has been employed to describe the interplay between (explicit) knowledge and (tacit) knowing, and has also been proffered as 'a dance that creates more dancing' (Rowland 2004: 38). The metaphor of dance has also been applied to biotechnology networks – such as the

uneasy nature of alliances between large pharmaceuticals and small Research and Development firms in Biotech, being analogous to a 'dance between an elephant and a flea' (Lam 2004: 59), with the attendant physical and zoological challenges of such cross-species liaisons.

However, these allusions invoke a somewhat superficial representation of dance as an illustrative metaphor (Brown 1977). Dance is essentially about organization – a dynamic 'constant organizing of bodies, movement, décor, music' (Letiche 2000: 159). Dance theorising, such as *dance anthropology* (c.f. Hannah et al 1979), emphasises the semantic as well as the pragmatic – exploring the practical and the meaningful facets of OL. Here, we will be exploring the metaphor further – emphasising the importance of dialogue between participants as a fundamental part of OL as a shared storytelling process, characterised by the complex responsive relationships that is an holistic experience (comprising the rational as well as emotional aspects), as participants 'make sense of' successive situations that they encounter in their working lives. However, this conceptualisation places emphasis upon the widespread participation in this storytelling process – that there is the possibility of multifarious narratives, re-presenting differing understandings of reality.

We can define dance as 'a series of measured steps' (Rowe 2008). However, steps and sequences often emerge through informal ongoing negotiation: they involve dissonance as well as consonance in aligning and realigning communities (Gherardi and Nicolini 2002). Foster suggests some indicative choices that confront the choreographer in her 'laboring at the craft of dance making' (Foster 1998: 9), whether in terms of choreographing the specific performer (such as the engagement with the surrounding space; or the timing of movements and their sequencing of movements), or the relationship between performers (for example, following each other and/or reiterating one another's moves, or evidencing a range of emotional responses with others), as well as the choices to be made about 'the dance' itself (referring to previous dances; narrating a particular story – perhaps to represent a set of values or relationships, and so on).

While it is tempting to focus upon just this definition, further exploration of dance theory demonstrates that we cannot explore 'measured steps' in isolation when considering 'making dance'. The second and third parts of Foster's list demonstrate that we need to go further, as (Rowe 2008) the dance metaphor model suggests. For instance, conceptualising dance as a 'social function' investigates how shared understandings are constructed – wherein the process of organizational learning develops a sense of 'community', which engenders meanings 'in common' (Bohm 1996). Thirdly, there are those who have to *perform* in the dance. Performance in collective learning requires both the possession of technical knowledge of dialogic techniques, but also knowing how to participate fully within a particular community (Elkjaer 2004). Consequently, these three definitions draw together the various 'schools of thought' in OL discourse.

The following sections draw upon the authors' own and other empirical studies of the biotechnology industry in order to find some measure of synthesis with dance theory, specifically adopting dance notation, we begin to articulate how the three definitions of dance metaphor can be developed to facilitate future configuration of networked organization in biotechnology. We can explore this definitional framework by adopting from choreographic models such as *Labanotation*. Whilst there are concerns with the assumptions underlying notational systems, unpacking Laban's notational ideas on organised movement raises a series of questions – first, in terms of the Body, *what* (or rather *who*) is moving (the Body – individual or collective – and the knowledge implicated in this process); then *how* the body is moving (effort – physical, cognitive or affective); and where and particularly *when* it is moving (in time and space); (Bradley and Szegda 2005).

MAKING DANCE: REPRESENTATION, LEARNING AND KNOWLEDGE

It has been pointed out that too often research has provided somewhat limited representations of the complex nature of the biotechnology industry.[2] One of the concerns in OL research is the issue of how to represent learning and to what extent this reflects the 'lived experience' of the different performers or predominant interest groups. As Rowe (Rowe 2008) has pointed out, the traditional reliance upon systems thinking raises questions over the epistemological status of the system. Accordingly, this paper acknowledges that there are representational challenges facing the use of dance theory – one danger being that one's own emerging theoretical model can itself engender 'static understanding' and thus minimise the profound processual features of dance.

Essentially, notational systems have two main purposes. Firstly, to enable a choreographer to present his/her ideas to performers or other choreographers. Secondly, notation has been used in order to capture the nuances of existing dance forms – a vital part of dance ethnology. Notational systems have seen major developments through the implementation of novel technologies.[3] However, the difficulties of representing movement have still been manifold – Laban himself warned of the 'illusion of standstill' through 'snap shot' perceptions (Schutzman 2006: 278-9).[4] Clearly, it is an immense task attempting to register a wide variety of possible movements. Farnell (1994) argues that despite these limitations, the Labanotation perspective has strengths over other media, such as video, because it attempts to investigate action in terms of the individual participant's perspective, rather than as a two dimensional meta-narrative.

It is in the spirit of Farnell's last point that the following discussion draws upon elements of Labanotation, emphasising the need to understand the 'lived experience' of the performers as they make sense of their situation.

"We have to stop reinventing the wheel ... not coming up with bright ideas in isolation, but because a great scientist, or perhaps another company or academic is brought into the equation. Our scientists do recognize this and we are mentoring them...that is the way of the world." (R&D Manager, Big Pharma)

The above quotation from our research suggests that there are clear imperatives relating to OL and knowledge management. This is unsurprising as others have described the biotechnology industry as 'a competence-destroying innovation' (Powell et al 1996: 117), as it draws from different scientific disciplines from the established knowledge base of the pharmaceutical industry.

Also, it is noted that traditional scientific disciplinary knowledge by itself is insufficient for participating in the biotechnology milieu, as one marketing manager noted, "A lot of people have 3 degrees, but the real challenge is taking that learning back into the business and doing something with it. Everything needs to be contextualised." (Managing Consultant, Life Science Consultancy). This links with Dougherty's (2007) concerns as to the naivety and limitations of traditionally discrete black boxed models of 'knowledge' in the face of a complex array of knowledge systems involved (academic sciences, the industrial life and chemical sciences, strategy and process management). In this case, it could be argued that these diverse knowledge systems constitute different sets of choreographed steps.

Indeed, as Swan et al (2007) point out, it is often the intestacies between knowledge

systems which constitute a crucial factor. Although Dougherty notes that how these intertwine is difficult to comprehend in practice, because while people might perceive this intertwining as a whole life system 'fired off' like a lightning strike, requiring complex, often collective, judgements, 'these complex judgements can be more systematically informed' (Dougherty 2007: 269).

Significantly, Dougherty is suggesting that *both* cognitivistic as well as practice based learning is required. She argues that knowledge integration is social – drawing upon a more practice-based perspective with its emphasis upon communities developing shared understandings (Wenger 2000) – the reference to 'systems view' links with the OL methodologies allied with Peter Senge and the MIT associates. However, it is important to question whether any single performer can see the 'whole system' – because as seen in the 'who' section, there are differing perceptions.

We have suggested that OL in Biotech networks conforms to practice-based learning – using a metaphor of 'participation' (Smart et al 2007) – however, in dance, we can also talk of individual's skills inculcated through teaching. Dance theorists suggest that, in practice, 'bodily knowledge' draws upon the interlacing of tacit and focal (explicit) knowledge evolved through developing and refining 'bodily schemea'. These are not simply individualistic 'cognitive maps', but reflectively practicing socially and culturally shaped skills as we become 'bodily sensitive in the respect of the kinaesthetic sense and one's own motility' (Parviainen 2002: 20), which form an intermediary between image and rule (specific and general). In Martha Graham's terminology, not only is a 'movement vocabulary' acquired but learning about the motility of the body moving through space takes place.

Therefore, this does not involve a mere technique or the production of a skill; together with the body's reflectivity, it offers *possibilities* in choosing ways to move. This links together both learning as skill acquisition and participation': the two metaphors of learning from Sfard's work (cited in Elkjaer 2004) Elkjaer suggests can be intertwined in terms of 'social worlds'. This knowledge is not simply centred upon the atomised body, but instead involves what Edith Stein refers to as 'kinaesthetic empathy', whereby even without moving their own body, participants (such as dance teachers and students) 'can both perceive and feel the motion of other lived bodies in their corporeal schema' (Parviainen 2002: 20). Picking up upon the key part of dance being that it lies 'in the moment' - in the kinetic relationships *between* participants and their diverse knowledge systems. It has been acknowledged that diversity has been seen as a key dimension of learning, an arena for the exploration of differing understanding in what has been described as a 'learning space'.[5] As Swann *et al* point out it is vital for innovative learning to be able to navigate those 'knowledge boundaries', that are created by specialized practices, and whose concomitant problems 'concern not simply the transfer of artefacts' (patents, new drugs, medical devices), 'but also the integration of knowledge and information across a distributed network of professional and organizational groups' (Swann et al 2007: 1810).

The learning space is envisaged here as a 'window of opportunity', linking in with what we have termed 'opportunities for serendipity' (Smart et al 2007). Managerial control is relaxed, releasing 'an opportunity to learn' as 'a kind of monetary and creative collusion between people', whereby 'people have freedom to think, explore and engage in uninhibited questioning of such things as managerial control' (Fulop and Rifkin 2004: 42). Creating such space invites improvisation: but how does this sit with the need to also formalise relationships as well?

KNOWING & LEARNING IN CHOREOGRAPHY AND PERFORMANCE

"*Collaborations often fail. And when they fail, this is largely due to behavioural reasons and seldom for technical reasons.*" (R&D Manager, Big Pharma)

In networked organizations, such as those found in the biotechnology industry, it has been suggested that far too much emphasis has been placed upon the structural characteristics of networks – and assuming that these networked relationships are always positive (Swan and Scarborough 2005). Both choreography and performance derive meaning from specific historical and cultural moments.

Both dance and OL see debates raging over the cognitive and affective aspects of this 'flow'. Yet there has been mistrust of the emotive in dance itself – including the restriction of dance forms such as the Waltz. Similarly, the affective dimension is often predominantly viewed as an inhibitor of learning to be overcome through dialogical techniques that take the emotional 'heat' out to allow argumentation to develop (Isaacs 1993). The danger is that this could enable particular participants to make claims to 'ultimate Truth' – to claim to reveal the 'underlying system' (Oswick et al 2000) – whereas Antonacopolou and Gabriel (2001) suggest that learning is shaped partly through the emotional proficiency of the individual to allow or deny an emotion in a given context, suggesting a complex interrelationship between learning and emotion. Supporting this perspective, Foster (1998) notes how poststructuralist analyses in theatre studies have challenged the traditional hermeneutic assumption that the written text bears a fundamental stability in the relation between signification and meaning. By appreciating the potential for any production to morph the original script through staging, action and setting, the focus is placed upon how meaning is performed within social-cultural context. As Letiche (2000: 158) argues, dancers (as performers) are not merely mimetic robots – reproducing codified knowledge from notation sheets.

This surfaces a number of pertinent points. One is the close relationship between the 'training' that takes place within a particular community (organizational, professional or sectoral) can itself influence the style of performance – akin to the socio-cultural understanding of the practice-based approach to learning (Wenger 2000). A further point relates to the complex relationship between performing and choreography. Foster (1998) states that there is a distinction between choreography and performance: the former, even in improvised dance, stands apart from the latter because there are contrasting functions as 'dance making theorizes choreography, whereas dancing presents that theory of physicality' (Foster 1998: 10). However, this is not a dualism akin to the *langue and parole* used in structuralist linguistics, but instead a *duality*, because choreography 'is not a permanent, structural capacity for representation, but rather a slowly changing constellation of representational conventions' (Foster 1998: 17). This can be glimpsed in one manager's recounting of his organization's participation in Government-sponsored foreign delegations:

"*I mean this is all about great learning opportunity, terrific opportunity for a small company to participate, because they learn from the other more experienced companies. In fact before going on the DTI mission, companies participating from U.K. will get together to have a session on what they plan to say [about best practice] abroad. Veterans of this game show us how to do it. It is far more useful ... getting someone from outside giving feedback.*" (R&D Manager, Biotech)

Here we can see the intertwining of knowledge across organizational boundaries (c.f. Jones and MacPherson 2007) between 'veterans' and novices', although there is

not necessarily a static code of rules that the latter have to learn. It is important to conceptualise how *both* choreography and performance evolve over time. When considering choreographers and their labouring, we must be conscious of their engaging with traditions of representational conventions, significantly, with this choreographic coding of meaning. In the biotech industry, research into network design has emphasised the meanings negotiated, shared and fought over (Swan and Scarborough 2005).

There has been great attention given to the ways in which knowledge and learning takes place *between* more traditional boundaries. Critics highlight the naïve idyll of 'community' in organizational learning (Reynolds 2000) because knowledge boundaries are important competitive advantage. As Boland & Tenkasi (1995: 359) point out, these boundaries constitute 'perspective taking' – the process whereby social communities come to recognize and accommodate differences in interpretations such that 'the unique thought worlds of different communities of knowing are made visible and accessible to others'. There is a political facet associated with knowing and learning boundaries. Jones and Macpherson's (2006) empirical study of SMEs notes this, as does Swan and Scarborough (2005). This connects with issues around picking potential organizational partners. An example in our research was the boundaries apparently drawn between 'public' and 'private' elements of research – on the one hand, public research is driven by the need to publish for academic respectability, whilst on the other, scientists are loathe to make widely known the results of many years of research, that could be exploited by competitors.

Clearly, there are many problematical facets of OL theory which takes into account the psychological and material facets. Objects can be mobilized in order to share understanding, but also to signify status, through symbolic referent power, also providing a joint field of practice through shared narratives that can shape actions and assumptions in different cultural contexts (Swann et al 2007).[6] It has been suggested that all activity is passed on through objects (technologies, products or services) and '[I]n activity, something is transformed or created' (Miettinen et al 2008: 205). In dance, the material is important for shaping actions, as is the role of codified knowledge and notational systems in industry – the prevalence of IT in recording and experimenting with IPR, patents, and so on. But, the boundaries are not (purely) physical. As Swan et al (2007) point out, in order to understand knowing and learning in the complex biomedical sector we need to understand how particular practice boundaries are formed. They refer to *syntactic boundaries* (diverging grammar, symbols, languages, labels, etc.), whereby there are no enforced shared meanings, albeit adequate for conversation; thereby a common database could be drawn upon by partner organizations, albeit deploying that information in radically different ways.

Therefore, in terms of semantic boundaries, it is argued that the absence of shared meanings across boundaries can inhibit innovative learning. In dance, such knowledge boundaries are reflected in the use of objects – such as the specific gestures (Mudras) in Indian dance forms, which refer to specific objects (such as animals, goddesses and gods), or the movements employed by nineteenth century ballet choreographers – which have little recognisable meaning to the modern audience (Mackrell 1997). This reflects how semantic boundaries exist even in an apparently straightforward 'language' as movement.

The Performers & Their Relationships

From our analysis of Biotechnology research, there are emerging themes surrounding firstly, the different type of 'performer' (collective as well as individual), secondly, the different roles that are found within biotechnology networks, and thirdly, the relationship between the roles and the implications for their respective performers.

In the discourse of dance theory we have entered, it has been suggested that there is a typically-western emphasis upon *the individual*.[7] Similarly, OL critics note an individual action bias (Huysman 1999) that over-emphasises learning as the individual 'acquisition of skills' – in contrast with the more recent practice based theorising that envisages learning as 'to participate' (Elkjaer 2004). This is not to diminish the insights of methodologies that use dialogic methods to facilitated 'learningfiul' interactions (c.f. Adair and Brett 2005). The need to develop relationships through structural and processual levels relates to the formal and improvisational aspects of dance – mentioned earlier. But, what is also clear is the extent to which these relationships are formed between organizations and/or individuals – as one Alliance manager in a biotech firm confided to us.

"*It falls down to the two people at the interface-person in charge of the liaison from the Big Pharma side with the person from the small biotech.*" (R&D Manager, Biotech)

Consequently, when investigating the bio-tech networks, the question arises as to whom we mean by 'the performers'? For instance, do we look simply at the organizational level, and so ignore the impact of individual-specific relations, which themselves could be even more significant given the relative small size of some organizations concerned; or do we ignore organizational-level relationships, mediated by decisions to pursue equity-based connections or arms-length outsourcing?

OL theorists have identified key roles, particularly for senior management, in the descriptions of roles as 'thought leaders' or 'knowledge brokers' (Wenger 2000). In the biotechnology sector, references have been made to the role of 'cosmopolites' – those individuals who have greater exposure to their organization's environments. This links with the author's own research, which identifies the need for 'design for diversity' (Smart et al 2007: 1082), wherein the biotechnology new product development process places a premium upon utilizing staff who have diverse experiences and high levels of transferable skills (who are therefore able to speak a 'diverse language' in order to work with a variety of different stakeholders). This instance is embodied in the role of the 'Bio Entrepreneur' who has to develop a simultaneous focus upon the need for blue sky research alongside the imperatives of meeting commercial deadlines (Frahm et al 2007). As one senior manager commented in an interview with the authors – there is a pressing need to balance both business development and Research and Development simultaneously.

However, from a critical perspective, it could be argued that such actors can be exceptionally skilled at manipulating meanings and configurations of both objects and relationships (Fulop and Rifkin 1997; Rowe 2008; Swan et al 2007). The earlier suggestion that the biotechnology industry is populated by SME's (the 'fleas') who have the pharmaceutical 'big guys' (the 'elephants') define the steps in terms of pricing and availability. The latter are also seen to perform the roles of 'popularisers' in the marketplace, and so those who set the trends (Miettinen et al 2008).

These multi-faceted power relationships involve trust. The selection (and attraction of) dance partners relates not only to the specific skill of the dancer (individual or organizational) but their *perceived* ability. Our research into biotechnology networks highlights the balance between being open to sharing knowledge across organizational boundaries while also being sufficiently restricted to ensure security to control exploitative activities (through devices such as memoranda of understanding, legal and non-disclosure agreements, exclusive licensing, version control or proprietary access, consortium

agreements). In dance, trust is vital for an effective performance, but political concerns are an integral part of collective learning within organizations; once the impact of the formal legal is included, then this becomes more significant. There are tensions here between openness and security, along with diversity and homogeneity.

Clearly, this acknowledges the importance of understanding which is 'leading' and/or 'following' in this dance of information and understandings. Our research suggests that there needs to be more investigation surrounding when the innovations are abandoned – when the participants opt out of the 'dance'. Extant empirical research into biotechnology reveals how the relative complexity and novelty of the industry places a range of challenges for the choreographing of structures, processes and roles (c.f. Luukonen 2005; Liebskind et al 1996; Hagedoorn et al 2006). The evidence points towards the need for effective learning that transcends formal boundaries (functional and organizational). This learning involves not merely the acquisition of skills but also an understanding of how to participate within a certain community of practice.

Between Performers, Choreographers and Architects

Problematic issues arise when we investigate the relationships between choreographers and performers. Foster suggests that the roles of choreographer and performer tend to become elided in dance theory. This is not to dismiss the fact that performers can become co-choreographers; however, there are different choices required of each role.

Some OL methodologies envisage senior managers as 'designers' and 'teachers' who empower others and facilitate the creative dialogue required for higher level reflective learning (Isaacs 1993).

Critics warn of 'Learning Organizations' becoming dominated by 'ruling courts' of more 'expert' leaders who enforce particular codes of behaviour and cognition (Coopey 1995; Nicolini and Meznar 1995). A similar tension exists in dance between the choreographer's codification and the performers in practice, such as Letiche's (2000) discussion of Kyrilian's uneasy relationship at the Netherlands Dance Company, or the storms generated by the contrasting expectations concerning the freedom of discretion of performers, which allegedly marred Balanchine's relationship with Kirkland (Mackrell 1997: 132).[8]

Crucially, unlike a painter, a choreographer rarely works in isolation, but as part of a community of practitioners who share knowledge about the meaning of dances as the audience's own understanding relates to their capability to decode a particular dance's choreographic meaning. Consequently, whilst there may be some novelty deliberately introduced by the choreographer 'these innovations can acquire their full meaning only through their situatedness within that tradition' (Foster 1998: 9). In this sense, there are connections with the situated learning literature (Lave and Wenger 2000), because through these and other choices, choreography constructs individual and collective identities – forming 'an image of community' (Foster 1998: 9).

Our earlier identification of the role of 'network architect' (c.f. Smart et al 2007) is clearly related to the choreographic role we are discussing here. Our research reveals the investment made in terms of developing dedicated Alliance Managers – but also how the connections that arise have often emerged from other stakeholders. As one Alliance Manager pointed out in his organization, there was an extensive "orchestrated networking program going on." (Alliance Manager, Biotech). Consequently, further questions emerge from our study of dance concerning the 'choreographer' role: to what extent is there a single 'choreographer', or is it a more collaborative exercise? How is this role to be defined – or is it emergent? Of course, we are assuming that there is a recognised 'choreographer'. In many traditional dances, there is no single identifiable 'author' – albeit Foster (1998) argues that there is a set of protocols underlying any sequence of movements.

Between Audience and Performers

The presence of an audience is common to many dance performances, although it is a matter of debate as to whether the audience and performer roles can be equated, either because fellow dancers can observe a solo, or (pertinently for experiential learning theory) because an individual dancer can reflect upon her thinking and action (Hannah et al 1979). Similarly, in biotechnology, the identification of 'audience' can also be somewhat ambiguous. The potential candidates for 'audience' might be Governmental agencies, for example, or other organizations further down the supply chain (universities, research and technology organizations, regulatory bodies).[9]

There is an established corpus of research that highlights how, in hi-tech industries, OL relies particularly upon knowledge gained from inter-firm relationships (c.f. Hagedoorn et al 2006). Smart et al (2007) demonstrate this point, suggesting that there is a need to 'design for strategic innovation and portfolio', because by increasing the numbers of interactions with a variety of different partners the Absorptive Capacity of firms can seemingly increase. However, it is difficult to achieve this improvement in practice – partly because it is difficult to measure and evaluate this improvement. For example, Greve (2005) employs an epidemiological metaphor to investigate the relationship between the leading 'source' organization and the following 'destination' organization. He argues that extant social network research focuses upon *susceptibility* (the motivation and capability of the destination firm to learn from others – which is relatively easy to measure), but less on *infectiousness*; he also suggests that too much emphasis is placed upon formal ties, rather than informal. A terpsichorean perspective is clearly advantageous here, in terms of conceptualising the infectiousness of a rhythm – whether at a macro level, (for example, through the predominance of the Clave rhythm in defining 'Latin Dance') or (at a micro level) how skilled individual choreographers/dancers such as Nijinsky or Isadora Duncan influence others.

A key lesson drawn from our research in biotechnology reveals how organizational performers need to portray themselves in a certain way, in order to attract partners. The R&D manager below articulated to us how his firm addresses this thorny issue of attracting network partners.

"*A strategy for small companies is to talk about the quality of their pipeline. Take one or two focused products and move them forward in a big way and then approach the Big Pharma. People come to us because we have established that profile*" (R&D Manager, Biotech)

This Alliance Manager is not seeking to challenge the expectations of his 'audience' (with whom he hopes to engage as fellow performers), as a Nijinksy or Trisha Brown might do, but to engage their expectations. However, whilst this research begins to engage with the complexities of this, there are issues that remain outstanding. For instance, as Coleman (1988) points out, in having a dense network a number of redundant connections could be beneficial (at least theoretically) as they allow for previously unknown partnering opportunities to arise – if it is possible to ascertain what precisely constitute 'redundant' connections (c.f. Hagedoorn et al 2006).

There is a further complication because there is the problem as to who we talk of in these networks – organization or specific individual? Again, the empirical evidence of

the alliance manager at Bitotech Company emphasises how it is often dyadic relations between key individuals that is the fulcrum of many relationships.

The dance metaphor could address these factors. Firstly, with its emphasis upon the defining of the steps (in terms of the innovations being adopted). Secondly, as to the participants themselves, what type of organization is 'infectious' or 'susceptible', and particularly those which are viewed as 'cosmopolitan' – which are both (Greve 2005). Thirdly, there are the factors which determine infectiousness/ susceptibility, including size and geographical proximity.

IMPROVISATION AND TIMING IN THE 'DANCE'

There is another *tension* between developing formalised relationships, yet not allowing these to inhibit future associations, which may well promise future rents – albeit there is quite a significant risk that they may not be realised (Smart et al 2007). Here, dance history insightfully reveals how renowned partnerships between dancers evolve in a convoluted manner over time. Their synergistic performances represent the ideal for organizational learning methodologies (Senge 1992), albeit these methodologies tend to focus upon individuals rather than a collective of performers. Further exploration reveals the complex, ephemeral and responsive qualities of this performance.[10]

A key issue facing biotechnology firms is the timing of outsourcing decisions – when to 'partner up', rather than retain in-house, often a decision enforced by circumstance. For example, firms may decide to co-operate when the perceived future costs of production, marketing, or satisfying regulatory mechanisms outweigh the resources available (Luukkonen 2005). This influences the timing by research and development focused-SMEs on when to involve 'major players', such as the large pharmaceutical firms, in the resource-hungry later stages of development (Luukkonen 2005).

We have discussed the development of relationships, and a key choice is *when* to formalise relationships with others. Whilst informal social networks are seen as important for the sourcing of knowledge in biotechnology (Liebskind et al 1996), it has been found that once there is a perceived possibility that a find could have a commercial result, then there is a move towards guarding any intellectual property through patenting and other means.

New Product Development in bio technology is particularly complex. On the one hand, there are specific 'turning points' in the discovery process, often arising from serendipity. On the other hand, there is a concomitant need to understand how relationships can emerge from a diverse array of connections and the importance of appreciating how these relationships may end and, particularly, can transcend single phases of the NPD process. Dougherty (2007: 269) highlights the risks involved in the unknown and managing risks surrounding developing new therapies, disease pathways and targets. Key here is knowing when to cancel projects (without losing the knowledge gained) and balancing 'moving projects along more effectively, but also recognizing the non-linearity of it all', balancing the demands of immediate short-term financial success with the much longer timeframes found in processes like 'drug discovery'. Indeed, the increased pressure of spiralling costs is reflected in the compressing of the drug discovery process (Luukonen 205).

Similarly, dances themselves can be seen to manipulate time – as articulated in Martha Graham's *Deaths and Entrances* (1943), where time is compressed and seemingly made elastic. Indeed, almost as significant as the actual practical/resource issues are the (often differing) *expectations* concerning timing and time frames. In dance, the length of a piece can vary greatly, often to the chagrin of the audience.[11] Balanchine has been quoted that a ballet's structure 'must be tight, like the structure of a building' and that good ballets are seen to 'move in a measured space and time like the planets' (Mackrell 1997: 157). However this perspective, whilst maybe somewhat an extreme evocation of the latter's perspective raises the tension between strict codification and the need for space for performers to explore and innovate 'in the moment'. Mackrell (1997) highlights Nancy Stark Smith's call for dancers to explore 'the Gap' of stillness and uncertainty – that provides opportunities for dancers to develop new material, rather than acting as 'puppets' connecting with the concept of a 'learning space' (Fulop and Rifkin 1997). Undoubtedly, further exploration of the presence of such a 'Gap' in organizational learning is required.

The key problematic, which has still to be resolved satisfactorily in OL theory, is when to permit exploratory inquiry into assumptions around processes, structures and goals, and when to introduce a convergent focus upon the delivery products and services. Cognitivistic OL methodologies envisage codified dialogic techniques to identify the vision around which the organization should align for the future. They require a reflexive awareness by participants as to how their actions and reactions influence reflective dialogue as choreographers of the 'flow of meaning' (Isaacs 1993). However, again critical questions arise as to how and who defines the steps and sequences through which this constructing of reality takes place? What is the impact of codification upon complex learning processes?

The latter paragraph leads us onto the importance of improvisation – when to follow the established 'steps' and when to extemporize. Some dance theorists take issue with this simplistic representation of improvisation. In 'white dance', there is an assumption that improvisation necessarily involves lessening of conscious intent in order to permit unconscious impulses to arise. However, this simplistic conscious/ unconscious binary relationship is challenged by 'black dance' like jazz and break dancing. Here, the dancers combine both by crafting their own composition whilst permitting the opportunity for unanticipated ideas to emerge (Foster 1998). Tricia Rose refers to this as 'social rupture', which she sees as providing a lesson to life outside of the dance studio:

"...be also prepared for rupture, find pleasure in it, in fact, plan on social rupture. When these ruptures occur, use them in creative ways that will prepare you for a future in which survival will demand a sudden shift in ground tactics" (Rose 1994: 39)

This placing in the social rupture is analogous to concepts such as 'Design for Emergence' and the reference to the struggles to 'try to create opportunities for serendipity' (Smart et al 2007: 1082). For instance, as an Alliance manager highlighted:

"*Our people go to partnering conferences, networking events, bio management forums. I think the organizers of these conferences have realised that the whole biotech business underpins a lot of partnering ... a snow ball effect" [in terms of the informal spin-offs]* (Alliance Manager, Biotech).

This 'snowball effect' arises from the opportunities presented by these various forums.The authors of this paper have distilled the design rule 'Design for lifecycle' (c.f. Smart et al 2007), which highlights the need to be mindful of the entire product life-cycle – understanding the resource contingencies implicated in the various stages of the drug discovery route.

"*We [bioscience Co] are developing the entity and taking it right through the clinics, so we are now taking all the costs and risks and taking into man. And if this works, then our Big Pharma partner would do a 'come back', and pay us 50% of what it has cost and then continues to share*

the costs of development and commercialisation. So we are buying access to their IP by contributing to the next stage of the program. And we are not paying anything up front at all." (R&D Senior Manager, Biotech)

Clearly, this reflects how the company has learned to manage the risk through managing the timing of their involvement.

Which Dance?

It is clear from empirical research that the biotech industry is not a homogenous one. Our study has mainly focused upon the high-profile drug discovery segment. But, Luukonen's (2005) research into organizational forms in the industry identifies at least six major application segments (such as drug discovery; diagnostics; services) – each of whom have differing sets of organizational performer, who are involved at differing stages, whose relationships are mediated in formal and informal ways (this aspect also shifting at different stages). It is necessary for the performers to understand that there are variations in terms of what activities and knowledge is required, who is involved and when they join or leave the 'dance'.

Dance covers a vast array of forms. Indeed, what constitutes 'dance' (or not) is as much a cultural, rather than merely technical, question and what constitute 'dance' or a particular dance form is a product of a dialogue mediated through socio-cultural factors (Grau and Jordan 2000: 2). For example, Desmond (1993) notes the 'upward mobility' of dance forms as they are re-presented in order to conform to the social mores of more 'sophisticated' audiences.[12] Conversely, we observe the vicious reaction to Nijinksy's *L'Après-midi d'un Faune* and *Le Sacre du Printemps*, which challenged the accepted norms of what constituted acceptable 'balletic' form.

Furthermore, observing a dance reveals a multiplicity of narratives at play in the dialogue between performers. Just as (physical) dialogue is a fundamental component of dance, so verbal/written dialogue is the 'the basic unit of work' (Karp 2004: 350) for OL. However, to what extent can we privilege a meta-story of this dialogue? Further exploration of OL theory reveals a tension between the use of 'dance' as the continual co-authoring of shared realities through divergent dialogue in the 'Dance of the Mind' (Bohm 1996), as opposed to the assumption that dialogue can converge (align) upon a singular truth or meta-narrative – represented in OL theorising by an underlying systems metaphor, which has lead to concerns that this privileges certain perspectives (Oswick et al 2000).

This raises key questions – are we talking about a single 'dance' in respect to the biotech industry? Indeed, it could be argued that these separate dances are themselves heterogeneous – emerging dances within an overarching dance-form. Post-modern dance practitioners would be disconcerted by the notion that there was a single 'story'. However, it is important to understand OL as a process of storytelling – for instance, whereby dialogue provides the dynamic upon which 'an organization's story is constantly being co-authored – pasts, presents and futures are endless sources of learning, inspiration and interpretation' (Karp 2004: 351).

THE DESIGN PERSPECTIVE AND RESEARCH

"We can rarely study a dance with the same detachment as an art object. Dance exists through its performers and the movement is filtered through human elements over which the choreographer has incomplete control" (Mackrell 1997: 246).

In some OL methodologies, the 'dance' metaphor is illustratively employed to describe the alignment of all actors around a common set of steps – in terms of a series of prescribed (often formalised) dialogic interventions and procedures (Karp 2004). However, given the criticisms already noted, questions arise surrounding who employs the dialogic steps utilised in the constructing of reality – who is 'leading' and who is 'following' – and the impact of codification upon complex learning processes.

It is attractive to represent OL in Biotechnology as a 'dance' as performers learn how to perform with other players, but what about the researchers themselves? Of course, the researcher is herself, in a sense, a choreographer (Janesick 1998). The ephemeral nature of dance, existing 'in the moment' reflects how shared understandings are not final static representations. As a noted dance theorist suggests, there is no singular interpretation of 'truth' in dance, because each viewer brings with them their own experiences, prejudices, cultural norms etc., meaning that 'the work I see will never be the same as the one viewed by my neighbour'. Even if we both come to the theatre with similar values and expectations, we'll inevitably notice different details in the performance' (Mackrell 1997: 6). This raises fundamental questions surrounding how we engage with organizational phenomena. For instance, to what extent can we as researchers assume to 'see' single narratives of the 'dance' around us? Indeed, to what extent can we address the ephemeral nature of organization learning through dance metaphor?

So when we talk of 'making dance', we must remember that this applies to those who research the dynamics within the biotechnology industry. Janesick's (1998) description of the 'dance of qualitative research design' portrays the qualitative researcher as a choreographer 'who creates a dance to make a statement'; as one who engages with the complex lived experience of managers and staff through the triangulation of data, theory and methodology to create multiple views for framing and investigating problems.

But, to what extent can we assume a researcher can provide a more accurate representation of complex OL processes? We have borrowed from Labanotation in sketching out our framework because it has been identified as engaging with the diverse experience of the dancers. Farnell (1994) claims that more sophisticated methods techniques, such as videotape, do not provide a 'more accurate' representation of dance than script based Labanotation, because of the technical problems of rendering three-dimensional performances into two dimensions. More importantly, there is no considered investigation from the perspective of each performer – although she acknowledges the benefits of incorporating a number of methods. This links with the need for OL research to incorporate a variety of approaches to take into account the differing perspectives – thereby addressing OL criticisms that only partial accounts favour certain perspectives (Coopey 1995; Fulop and Rifkin 1997).

The question remains as to what extent does the researcher 'create' or 'relate' a dance? The organization's 'story' is not necessarily the one presented by particular interested groups – including the researcher. Instead, it is more multifarious, requiring researchers to look deeper into the lived learning experiences of *all participants*.

Here, the three definitions of 'dance' are significant. Simply mapping out who, what, why etc. is insufficient. It is noticeable how the dynamic flow of dialogue is influenced through the socio-cultural context – the social function of dance. This, in turn influences how participants (individual or collective) are able, or are perceived, 'to perform'. The 'measured steps' do not sit neatly outside of the other two definitions. The steps are influenced by socio-cultural context as

well as the identities of the performers. It is argued that this paper begins to unpack the complex learning processes in biotechnology, in order to fulfil dialogue's literal meaning as 'meaning flowing through' (Isaacs 1993).

CONCLUSION

This paper is an early working through of ideas as the authors seek to explore further insights into the current debates surrounding the configuration of complex OL imperatives in biotechnology. The ideas discussed herein constitute not a completed model, but an heuristic device for further development of design-oriented knowledge, derived from both solutions and problems arising from experiences identified in our and other's recent empirical research (Gibbons et al 1994). Taking Tharps' comments, our paper has investigated certain OL challenges that arise from configuring biotechnology networks, as well as investigating some of the solutions – albeit we stress that this does not assume easy solutions to complex context-dependent OL issues (Dougherty 2007).

Distilling the ideas developed in the above sections, we can return to the choreographic 'choices' that Foster (1998) has identified. These choices, we argue, need to be addressed by key stakeholders (for instance as 'network architects') in order to support OL. In doing so, our heuristic framework incorporates both cognitivistic and practice-based understandings of OL – in order to provide 'clues' (Dunne and Dougherty 2006) to comprehend OL in their 'social worlds' (Elkjaer 2004).

In respect to '*choreographing the performer*', consideration has to be given to how performers engage with their surrounding space – directly addressing issues with other stakeholders or through more indirect methods. In addition, when the interactions take place, there emerge not only major decisions at a macro level (for example, partnering) but also at a micro level (such as when interpersonal or intra/inter group meetings should take place). Evidence suggests that this alignment around timing is not simple in biotechnology, where various stakeholders want to move slower or quicker, partly because of their own expectations surrounding their respective activities. This relates also to the sequencing of activities – whether randomly, concurrently or sequentially.

Because of the variety of (individual / collective) performers involved in biotechnology networks, *choreographing the relationship between performers* is significant and complex. This includes interacting with the 'audience' who may vary over time. In differing sectors and at various stages, certain actors take a more prominent role. Again, the important point is appreciating the implications for the 'lead' and the supporting *corps de ballet*, particularly because these roles may be neither permanent nor accepted by those performers. This is particularly problematic when there are multiple events taking place, across different projects, for example, to which managers find themselves presenting and participating in multiple simultaneous events.

As for those *choices about 'the dance' itself*, researchers in biotechnology networks point out how we must not assume that each project follows a neatly prescribed path (Dunne and Dougherty 2006; Dougherty 2007). Indeed, note how various types of 'dance' have been identified, reflecting the heterogeneity of the sector. What is pertinent is how performers appear to draw upon other dances or dance traditions as part of their 'danced argument' – where actors draw upon their own previous experiences or with those they are familiar. This covers both individual attitudes, as well as collective cultural mores whereby, for instance, 'scientific' learning clashing uncomfortably with market-orientated 'entrepreneurial' focus of pharmaceutical companies and those Bio Entrepreneurs who have to balance the two differing dance styles (Frahm et al 2007), or when SME's try to sell their compounds to potential producers.

In effect, what emerges in our research and other empirical investigations is how the various actors spin out stories as to problems, solutions, ideas, which represent particular shared realities – that narrate a story. Indeed, research in this sector can be said to present narratives, through characterisations and responses between characters, or the physiological responses of bodies moving – which is a product of the researcher's own narratives. This is significant in terms of OL because the sharing of experiences between networked firms through the exchange of dialogue is a key driver of knowledge diffusion (Powell 1998).

Clearly, there are both formalised structures and processes put into the diffusion of knowledge and the management of relationships, as well as more informal processes emerging from the experience of alliance managers and so on. However, there is more to consider than just the 'measured steps' of dance. The 'social function' of dance is reflected in the communities of practice that emerge between participants – some crossing organizational boundaries. However, this also alerts us to the socio-cultural context in which the dancers perform – scientists with their concerns for academic rigour and marketing managers concerned with relationships further down the pipeline. This links in with the other definition of dance – 'to perform' – and how particular roles are manifested in these networks, as key individuals or as collectives. //

NOTES

1. The key point being that it is not that problems themselves are 'ill defined' but that this 'ill definedness' is a perception of the designer – 'experience tells designers to treat situations as less well defined than initial statements would suggest' (Rowland 2004: 40).
2. Issues such has the role of clusters have been subject to critical rethinks in recent research (c.f. Birch 2008).
3. For example, the development of new IT systems, such as LabanDancer or Calaban at Birmingham University, has begun to address some of the technical aspects of representing movement (Wilke et al 2005).
4. Similarly, the sheer complexity of representing movement is manifested in the estimate that Birdwhistell can account for over 20,000 different facial expressions alone (Jolly 2000).
5. See Antonacopolou *et al* (2006) or Fulop and Rifkin (1997).
6. An object is anything that can be pointed, referred or agreed upon as being an object (Swan et al 2007).
7. Contrast, for instance, Yoshihiko Ikegami's (Hannah et al 1979: 326-7) oriental vision that 'the dancer is simply a 'location' at which a dance event happens or a 'means' through which a symbolic meaning manifests itself'.
8. The latter claimed that Balanchine insisted upon his performer's adhering to the 'measured steps', challenging the idea (in Kirkland's mind) of the freedom of performance that 'marks the recession of authority symbolized in the choreographer's person to authority as an abstract or essentialized element of totality itself' (Martin 1985: 57).
9. For instance, when SMEs have to outsource production to larger pharmaceutical firms (Luukonen 2005).
10. For example, even the most renowned partnership in ballet required time to evolve because Nureyev's analytical approach challenged Fonteyn's embedded assumptions (Mackrell 1997: 196).
11. Compare Nijinky's *L'apres-midi d'un faune*, at around 10 minutes, with Meredith Monk's *Juice*, performed over many weeks and venues around New York – both of whom challenged their (critical) audiences' temporal expectations!
12. E.g. Harlem Jazz was taken by the white community from the Afro-Caribbean and 'refined' to make it more 'respectable' (Clarke and Crisp 1981).

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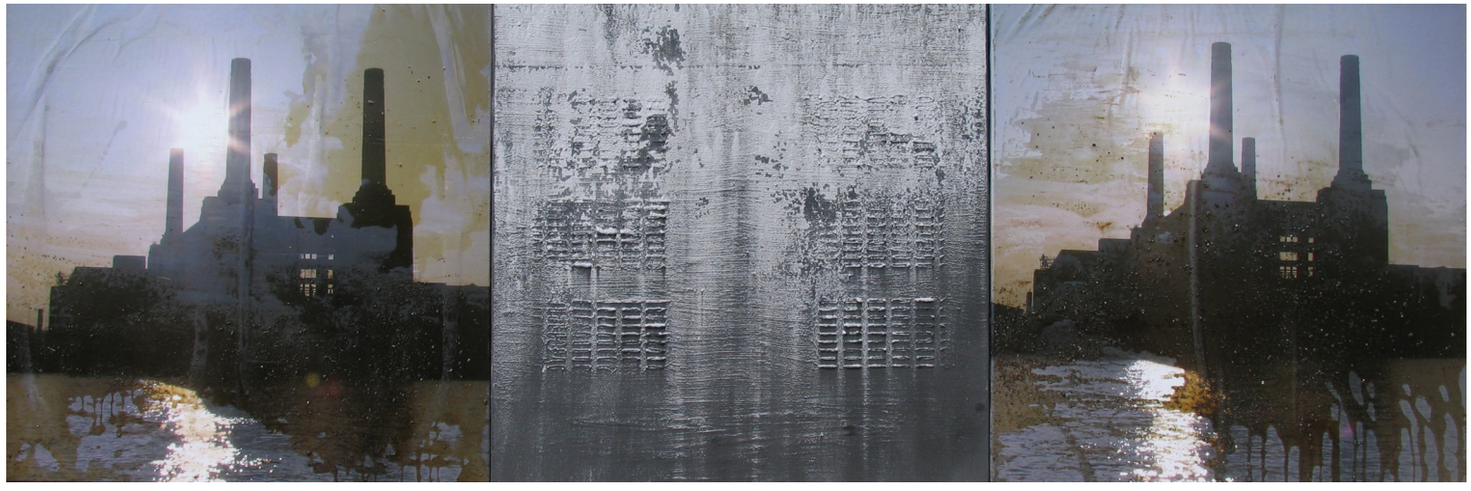

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