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CARTOGRAPHIES OF CATASTROPHE AND COMPETENCY: IS IN THE LONDON AMBULANCE SERVICE (LAS)

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Abstract

The London Ambulance Service (LAS) attempts to enhance its services through the adoption of a Computer Aided Dispatch (CAD) system is a well known and well documented, if not notorious, ongoing narrative of information systems (IS) failure and success (Fitzgerald, Guy & Russo 2005). This paper suggests that René Thom's catastrophe theory (Thom 1989) could be used as a visual metaphor, which can be used to interpret the historical saga of this possibly catastrophic and possibly successful technological and social change. The capacity of the imagery from 'cusp catastrophe' to further inform socio-technical practices, gleaned through these interpretations, will also be discussed.

Keywords: Catastrophe Theory, socio-technical approach, LASCAD, visual metaphor.

Introduction

The main aim of this paper is to explore the potential of the of René Thom's (1989) 'Catastrophe Theory' to help understand information systems development (ISD) and deployment, within organizational and societal contexts. Catastrophe Theory is deployed here as a **visual metaphor** to interpretively explore the recurrent occasions of catastrophe and competency exhibited by the London Ambulance Service (LAS) in its repeated attempts to improve its services. LAS sought to do this through better information and information systems (IS) in association with changes to working practices and staff/management relationships. The focus is on the manner in which computerized IS were seen as a means of enhancing the LAS's capacity and competency in scheduling and delivering effective emergency services (Beynon-Davies, Paul 1995; Finkelstein & Dowell 1996; Fitzgerald, G 2000; Page, Williams & Boyd 1993). This paper proposes that catastrophe theory has the capacity to act as an 'ocular analogue' of the socio-technical landscapes created by the cumulative

agencies of humans and related non-human informational artefacts, across an organizationally self delineated space/time that makes up the LAS. In this way it seeks to explore and demonstrate the utility of Thom's theory as a graphical representation, capable of facilitating an understanding of informational successes and failures within organizational contexts. The expectation is that this will enable an appreciation of the complex behaviours of real world situations, incorporating information systems and other artefacts acting in concert, or not, with human agencies, as they collectively constitute an organization's functionality. It is these human\machine ('humanchine' networks, see Brooks & Atkinson 2004) and their cycles of success and failure that act as a point of departure for the explorations of such organizational networks.

The paper is structured as follows. Catastrophe theory, as used in this interpretation of the dynamic case, is firstly explained. This is followed by narrative accounts of the London Ambulance Services' successes and failures in adopting the Computer Aided Dispatch (CAD) system(s) and the ramifications of this for the service and for the people of London. The latter is then revisited, and viewed, through the 'lens' of catastrophe theory, so as to interpretively explore the dynamics of the services' sequence of failure and success. Finally the utility of Catastrophe Theory, in comparison with other theories deployed in interpretive information research (such as Structuration Theory (ST) (Giddens, Anthony 1984), and Actor Network Theory (ANT) (Latour 2005)), is reflected upon in terms of its capacity to contribute to the growing set of theories used in the interpretation of real world information systems within organizational and societal settings.

Thom's Topography of Continuity and Catastrophe

Thom was a highly respected mathematician, the recipient of the Fields Medal for mathematics; an award, within his academy, on a par with the Noble Prize for literature. His scholastic centre of attention was the manner in which cartographies - geometric landscapes - are mathematically represented (Thom 1989) and deployed.

Of particular interest, here, is one of those geometrical landscapes, the 'Cusp Catastrophe' which accounts for continuity within its topography and instantaneous

domains of change, i.e. catastrophe (Sheridan & Abelson 1983). For example, Cusp Catastrophe can be used to model the behaviour of a stressed dog; which may respond by becoming cowed or becoming angry. The suggestion is that at moderate stress, the dog will exhibit a smooth transition of response from cowed to angry, depending on how it is provoked. If the dog starts cowed, it will remain cowed as it is irritated more and more, until it reaches the 'fold' point, when it will suddenly, discontinuously snap through to angry mode. Once in 'angry' mode, it will remain angry, even if the direct irritation level is considerably reduced (Flay 1978). As may be seen in a graphical analogue of Thom's topography (see Figure. 1), Cusp Catastrophe offers a three dimensional (3D) landscape, with the capacity to represent the dynamics of an organisation's non-linear and possibly disastrous behaviours (it has also been previously used to model things such as the failure of a bank (Ho & Saunders 1980) and employee turnover (Sheridan & Abelson 1983)). It is proposed that these organisational dimensions contribute to behaviours and interactions of humans and non-humans that serve to:

1. Replicate and enhance the organizational functionality.
2. Destabilize the organization and its functionality.
3. Vector the organization out of its replicative and destabilized human/machine agencies to a higher level of functionality.
4. Strand the organization in a stasis, i.e. where it is going nowhere.

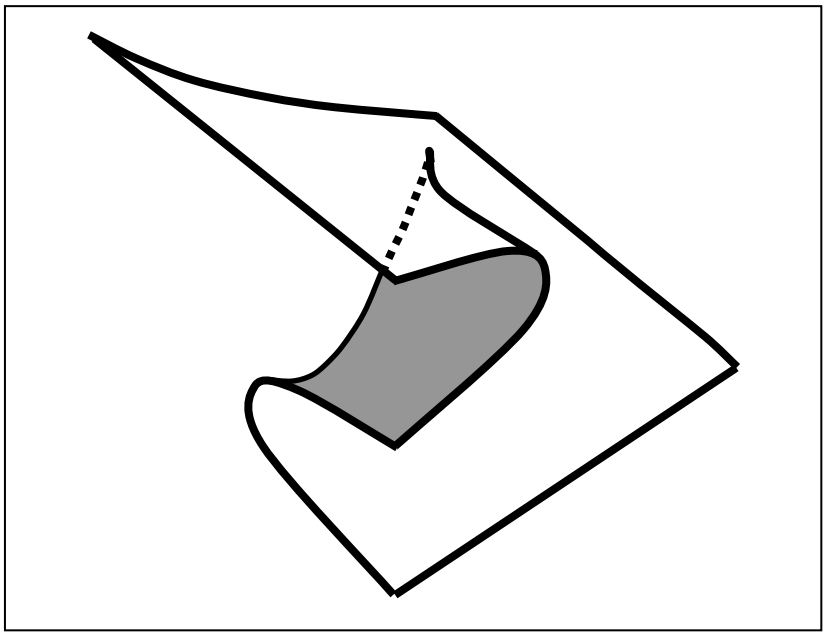

Figure 1. Thom's Cusp Topology

This paper suggests that Catastrophe Theory offers a means of representing the phenomenology of social/organizational contexts, whose inner workings are accessible and whose overt behavioural manifestations of its human and non-human actors may be witnessed. Adopting this landscape of catastrophe provides a means of visually representing the patterns of agencies and interactions exhibited by humans and non-humans, or humanchines, (Brooks, Atkinson & Wainwright 2008), as they constitute the socio-technical networks that are organizations.

The socio-technical organization and its functioning may be represented as being on a specific trajectory within Thom's cartographical landscape. These are identified in Figure. 2 as functional trajectories A to D:

A. **Advancing** in their functionality and/or growth. This is a dynamic trajectory in which the organization is becoming increasingly effective in its informated socio-technical capability and cohesion, as well as its overall functionality.
B. **Building** from a low or non-existent position to increase its functionality and start to enhance its informated socio-technical cohesion and capabilities. Whether it gets there depends on internal and external contingencies over time and its capacity to perform effectively.
C. **Catastrophic** in behaviour, having sought to enhance its socio-technical functionality and social cohesion the organization fails to maintain both of them and falls back over the functional cusp and dissipates or reverts to its former state, though stranded and quiescent, in the doldrums (D) of low functionality.
D. **Doldrums** (stranded in them), having attempted to increase its functionality and social cohesion it has initially shown some movement along that vector towards advancement; it is now, however, stalled and oscillates between entropy and a possible higher level functionality that could, itself, be advancement or catastrophe. This domain could also be called 'Deconstruction'.

Each of the domains A – D established in this Thomian landscape, along with the landscape itself, will be used interpretively to delineate both the states of the LASCAD and the dynamics of its unsuccessful and successful attempts to reconfigure its working practices, incorporating a new ambulance dispatch system.

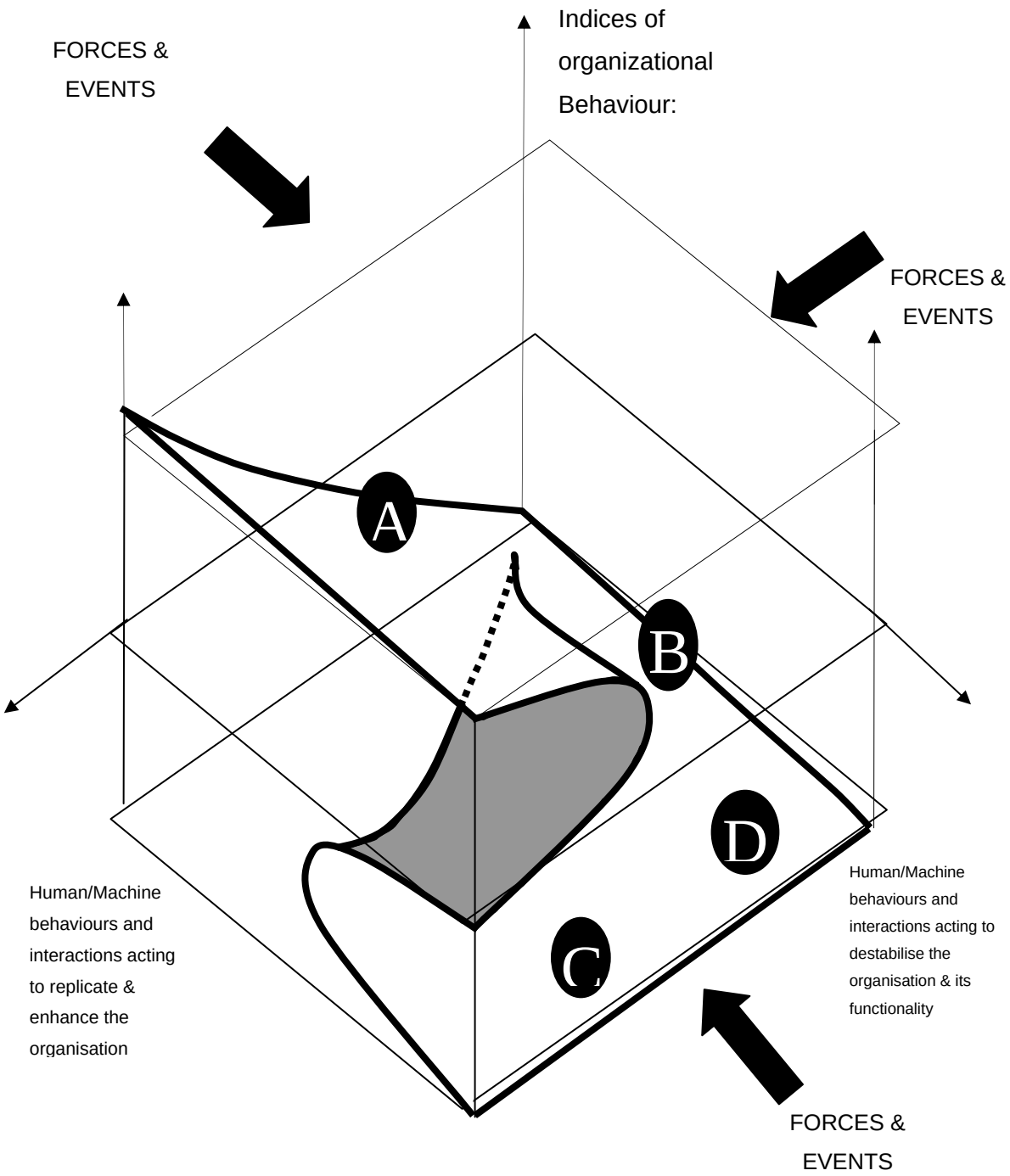

Figure 2. The Topographical Domains of Thom's Catastrophe Theory
(The diagramming here, and in subsequent versions, draws on the work carried out by Thompson (1979) that in turn draws on Thom's Catastrophe Theory)

A Catastrophe Theoretical Interpretation of the LAS

Introduction of Semi-Automated Information Ambulance Dispatch Systems

To explore the capacity of Thom's Catastrophe Theory as a conceptualizing device for interpreting the dynamics of information systems cases, the (in)famous occasions of the LAS's attempts to introduce an ambulance dispatch and tracking system into its control room are explored here. The LAS was, and still is, one of the largest

ambulance services of its kind in the world. Due to an expansion of its activities, and having introduced a (semi)automated ambulance location tacking and dispatch system (CAD), it was suddenly confronted by a virtual melt down in its functionality; shortly after the CAD' go-live activation in 1992. Prior to that, ambulances were dispatched by a semi-manual system, based on practices built up over many years and the use of paper based records. Beynon-Davies (1999, p704) reported that "a flood of 999 calls were spontaneously being cleared from the screens." As a result many calls were not being responded to and there was a danger of loss of life. The queues of calls that were building up, almost exponentially, were suddenly wiped from the screens.

The consequence of this was that large numbers of calls that had built up were not answered. On the 27th October 1992 the inadequate computerized system was turned off and established semi manual dispatch practices were returned to. Although no one died as a result of the CAD implementation, it had been a high risk experience. The outcome of which, was that the existing manual system was resurrected, though some of the computerized functions were maintained. At a later date, however, further problems occurred in which even the printing out of calls was not possible and a fully manual system was instituted as the system could not cope with its task.

The 'Failure' of LASCAD Information Systems Realization

On reflection, which included a House of Commons Select committee's report, it was realized that the changes instituted and the technology adopted in 1992, were simply not realized and, that the service and its senior team, including the Chief Executive, were not up to the task (Page, Williams & Boyd 1993). As a result the Chief Executive and managers were replaced. The factors that lead to this 'failure' (and the use of that terms is in itself contentious) were many and cumulative. The UK NHS was being subjected to number of major reforms in which what had been centrally managed services were being devolved into quasi-autonomous 'Trusts', with centrally allocated performance ambulance response rate targets. There was an urgent need to change in response to these and this meant the new CAD system was required. Unfortunately the NHS, along with all public sector organizations, was subject to European Procurement Rules of the lowest tender wins, i.e. the cheapest option. The outcome of all this, was that a small company, 'Systems Options', with little experience in developing the safety critical, high volume and rapid response

application that was required had been awarded the development contract. Rather than ask the front line dispatch staff to work with the management on the CAD functionality, senior managers determined and set down themselves what was the required functionality. There was no IS development methodology, such as PRINCE, deployed that would have aided both the orchestration of the development process and incorporate end-users as active participants within it, while assuring the application appropriate functionality. The drive to develop and implement the CAD was relentless. When, however, the ambulance dispatch application was finally delivered there was no buy-in from the staff; who did not want it the first place. Nor was there any attempt at the cultural change required in adopting and utilizing dispatch systems to best effect. When the application went live the dispatch system was obviously '…not fit for purpose', it could not handle the calls coming in. The Senior Management reverted to using voice and telephone plus paper records.

The outcomes of this and an accumulation of other non IS factors resulted in an exponentially increasing numbers of calls from concerned prospective patients who, in turn, were also not responded to. The Service was, as a result, swamped with calls. The staff reverted to, in the early morning, manually dispatching the ambulances, using call tape recording along with paper-based records and bypassed they, now, switched off the CAD. As a result the new CAD was decommissioned due to both its obvious lack of fitness for purpose and political concerns. Rumours that a patient had died as a result of the LASCAD's inadequacies, though unproven, were in the public domain. Figure. 3 sets out the time line of the LASCAD episode reported here.

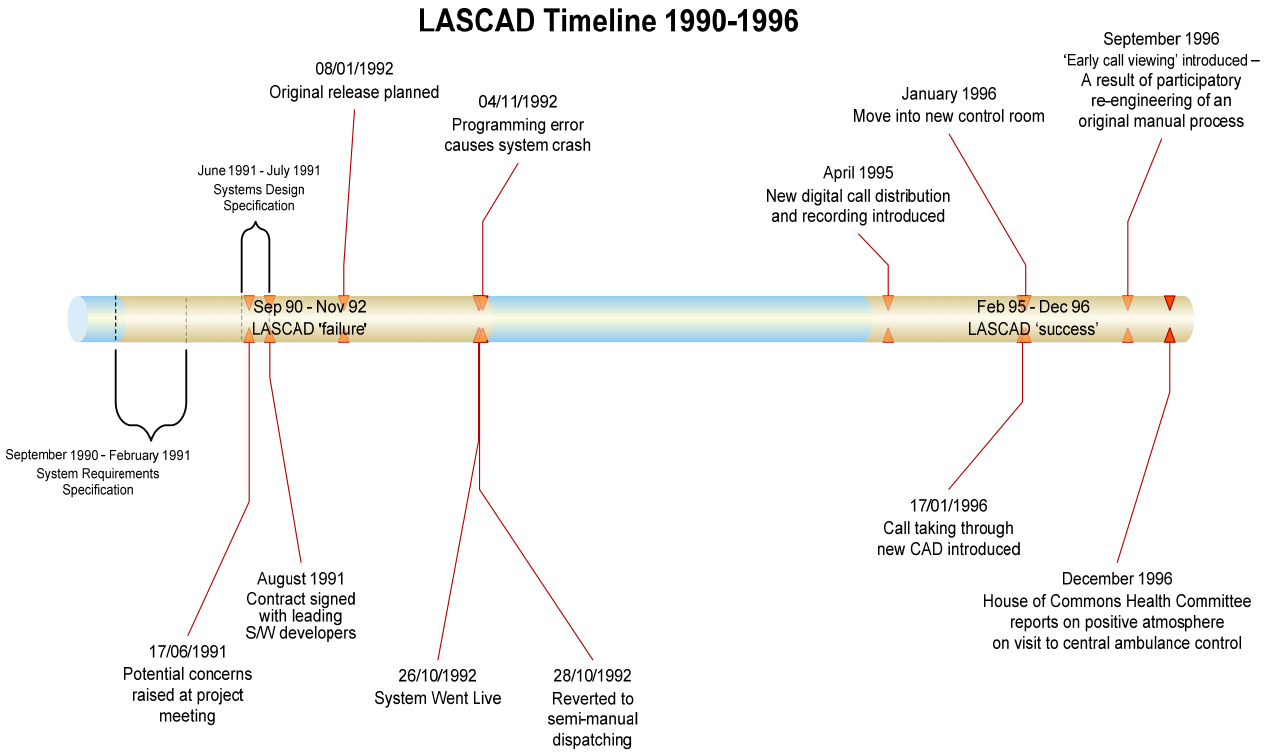

Figure 3. The London Ambulance CAD Failure and Success Time Line 1990 -1966 (Brooks, Fitzgerald & Atkinson 2008)

The Chief Executive, as a result of this debacle, resigned along with a number of the senior management team. The CAD developer was also signed off. This though did not negate the need to increase, through modern dispatch technologies, the efficiency and efficacy of the LAS ambulance services.

The 'Successful' Introduction of CAD into the London Ambulance Service: Forces & Events

Subsequent to the failure of the London Ambulance Service, in 1996 the LAS CAD there was a UK parliamentary committee appointed and a public inquiry was commissioned (Page, Williams & Boyd 1993). This reviewed what had happened with respect to the London Ambulance Service's failure to effectively develop and implement the changes to the Service and their associated information systems applications and technologies. They also made recommendations on future developments with respect to the service's use of technologies though out the service, but in particular the ambulance dispatch processes. This, alongside Trade Union pressure, led to the replacement of the LAS Chief Executive. The new appointee had

offered, at interview, a clear vision of how the LAS would be in the future, including the role of information systems within it. He also clearly mapped the LAS and its CAD development process over the next decade.

As a precursor to the CAD introduction this time, the staff were actively involved in introducing other changes, 'warm up projects' to the service, ranging from new uniforms, and scheduling systems to other technical aspects such as hand held telecommunications. A new digital PABX/Automatic Call Distribution System, along with a DAT (Digital Audio Tape) capturing all calls and radio traffic, was successfully introduced in April 1995, which actively engaged dispatch and other ambulance staff. Interestingly, the staff, its Union and the management were still in dispute over working terms and conditions. The ambulance dispatch processes, themselves, were also being reengineered. This time, instead of going out to external tender for a CAD system, the decision was to develop it in-house. To achieve this, tight deadlines were dropped and a much greater staff engagement approach along with a more positive atmosphere was created around the CAD application development; including a better management-Union relationship. The PRINCE methodology was used to orchestrate the development processes in a realistic timetable and 'quality assure' a phased CAD functionality introduction. These initiatives contributed to the Service's organizational capabilities, which led on to an enhancement of the ambulance dispatch processes, while getting the control staff used to being involved in technology led innovation.

The Ambulance Service, along with the rest of the NHS at that time, was under relentless pressure to enhance service efficiency and effectiveness. Despite this pressure, the decision was not to be precipitate in introducing a CAD system into the Service and certainly via external procurement. The LAS was, at the time, also being subject to a major restructuring with the devolving of services to four new divisions and a Central London service being introduced. It was essential that the LAS and the capital's population, through its socio-technical ambulance control and dispatch system, worked effectively and efficiency to deal with the increasing numbers of callouts and non-emergency duties, such as patient transfers, that were required. One of the main factors contributing to this success was the co-optation of a Project Manager, for the new CAD, with experience in developing information systems

applications within the public sector, specifically the police and more IT people were employed.

An accommodation over pay and conditions between staff, their Union, and the LAS management was arrived at, generating an environment conducive to the CAD's development and its subsequent adoption by the staff. No blame was apportioned to the staff in respect of the previous failure. The new Chief Executive sought engagement with the staff over working conditions and practices as well as the introduction of a new CAD system.

Instead of going for the appointment of an external supplier and a big bang implementation, as in the previous case, the CAD was built, in-house, over a series of steps, prototyping in all but name, led by the newly appointed CAD Project Manager. Working, directly, with the dispatch staff, their working manual procedures were studied and with the staff's engagement, subsequently, built into the CAD's functionality. Thereby automating those tried and tested working practices, resulting in enhanced performance. As a precaution, the new application had a real time back up of all the ongoing calls and responding dispatch processes along with their outcomes.

A strong buy-in to the project and its deliverables, by the staff was being engendered through the participative approach adopted and the effectiveness of the new Project Manager at his job. They would not go totally live with the CAD until its functionality and the dispatch staff's ability to deploy it were assured. Additional moneys had been made available to underpin the development of the new CAD. The ancillary, 'warm-up' projects had added to this, in that they broke the ice for change and developed an appropriate climate. As the CAD's functionality came on line, step by step, subtle changes to working practices were engendered in the ambulance dispatch and management process. The dispatch staff and management were intensively engaged in these processes. As a result of all these factors an effective CAD system, and associated staff buy-in, adoption and effective utilization was achieved. Not only this, but the performance of the London Ambulance Service was itself was enhanced. It was reported in the UK House of Commons that the project had been successful (Fitzgerald, Guy & Russo 2005). There was no threatening of the near proximity of

cusp catastrophe of the original, top-down tendered out procurement of the LASCAD, rather a participative, effectively in-house, professionally led process of incremental development engaging the staff in arriving at an effective socio-technical solution.

Interpreting the LAS Failures & Success using Catastrophe Theory

The cartography of Thom's Catastrophe Theory (set out in Figure. 2) is used to

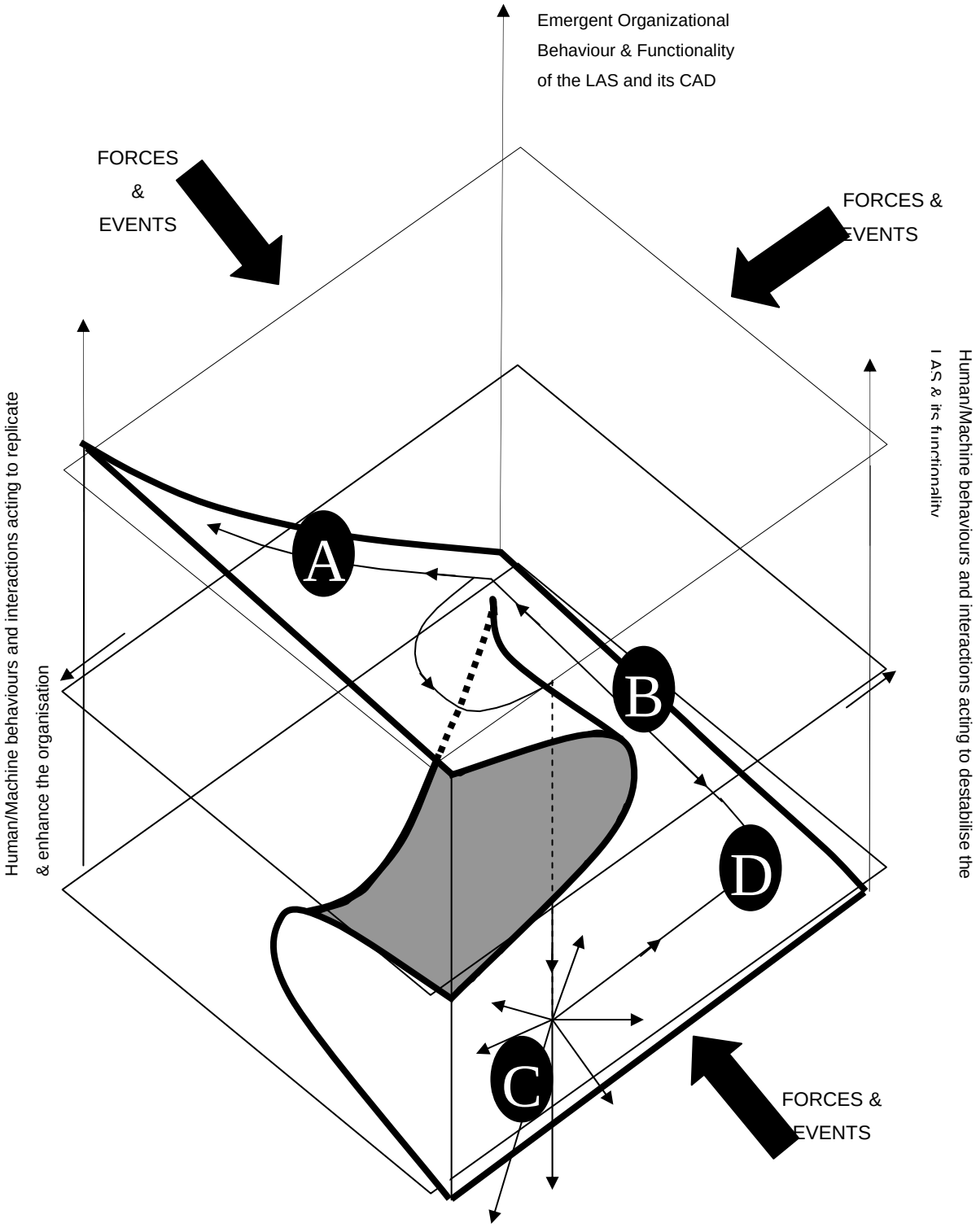

Figure 4. Rene Thom's Cartography of Catastrophe & Competency Applied to the LAS 'Failure' & 'Success' Narratives (with Reference to Thompson (1979))

interpret and delineate the dynamics of the London Ambulance Service, reported earlier, in its attempts at introducing and deploying a CAD system to enhance their services and their outcomes (see Figure 4).

LASCAD 'Failure'

The London Ambulance Service, as described in the above narrative in its failure mode, was initially in domain D, the **Doldrums**; here, while it was functioning, it was not meeting the forces and event of increasingly onerous demands for emergency services made on it by London, along with its population and the British Government and the NHS. The LAS Chief Executive sought to move out of the **Doldrums** (D zone) manually, with the attempted computerization of the ambulance dispatch processing as the flagship for this initiative; it being demonstrably necessary to achieving his strategic intent. The LAS's functional **Doldrums** (D zone) were made deeper, however, by the ongoing dispute between the management and the unionized dispatch and ambulance staff. The attempt to **Build** (B zone) increased efficiency and effectiveness into both the LAS and the new Computer Aided Dispatch (CAD) application failed when the CAD failed to perform; with nearly **Catastrophic** effects (C Zone) for the Service and populous. However, this organizational and functional attempt at **Advancing** (A Zone) the LAS's services and dispatch capabilities through the CAD and new working practices had the almost opposite effect.

The LAS CAD application ceased working due to an overload of calls and the dispatching of ambulance services reverted to the previous **Doldrums** of manually dispatching ambulances. This had the effect of demoralizing the Service and its personnel, particularly the dispatch staff. The NHS prescribed modus operandi of lowest tender external procurement for the LASCAD, had resulted in a small inexperienced developer being chosen to produce the mission critical ambulance dispatch system. The result was not only the CAD, but the LAS's ambulance dispatching functionality, literally 'fell over' the *Cusp horizon* coming near to a **Catastrophic** (C Zone) situation for London, and its population with respect to emergency services. The ancient regimen, managerial and information systems were not that lucky. Their journey over the cusp was, indeed, **Catastrophic** for them both personally and professionally; they and their LASCAD lowest bidder and developer had their contracts curtailed. The Chair and Chief Executives left.

LASCAD ‘Success’

However the LAS, in terms of dispatching of ambulances in response to emergency and planned demand, picked itself up out of the **Doldrums** that was the legacy of the earlier regime. Under the guidance of a new Chief Executive and his introduction of an information systems developer with public sector experience and a participative approach, reinvented and reinvigorated the service and its access to information systems and their effective deployment. As reported above, through a number of participative pilot projects, the dispatch staff was ‘lifted’ out of the **Doldrums** in which they were stranded. The participative and public sector experienced in-house developer delivered them from the despair the LAS had gotten themselves into over the CAD. They were able to start **Building** not only a new CAD, but also an invigorated LAS. As a result the LAS, along with its new CAD, was set on **Advancing** across and up the topographical gradient of improving CAD and service functionality, avoiding the gravitational influences of the cusp catastrophe over which they had previously plummeted to the detriment of themselves, the LAS as a whole and, albeit temporarily, the people of London.

The real world narrative of the LAS and the organizational landscape along which its constitutive human and non-human technological actors journeyed, in their initially unsuccessful and subsequently successful attempts at harnessing the capabilities of a Computer Aided Dispatch system, it is argued, here emulates and reflects the landscape that Thom has delineated and designated as the ‘Cusp Catastrophe’. In doing it so, it is argued, it has added to the ‘smorgasbord’ of social theories, such as Structuration Theory (Giddens, Anthony 1984), Actor Network Theory (Latour 2005), Autopoiesis (Maturana & Varela 1980) and even Rhizomatics (Deleuze & Guattari 2004) that constitute the theoretical pallet available to those who pursue interpretive insights into information systems within organizational and social contexts (for examples of these social theories 'applied' in IS see Atkinson & Brooks 2008; Brooks, Atkinson & Wainwright 2008; Whitley & Pouloudi 2001). Catastrophe Theory can interpretively account for the dynamics of an informated socio-technical network, as it responds to the complexities and forces of its inner and outer environments.

Conclusion

This paper has sought to introduce and explore the concept of the ‘Cusp Catastrophe’ as delineated by the mathematician René Thom (1989). In this instance the Cusp Catastrophe is adopted and deployed, not as an exacting mathematical theorem, but as an extended ‘visual metaphor’. When this is combined with a case study narrative (in this instance the LASCAD failure and success stories), it offers a potential for gaining interpretive insights into real world phenomenology and demonstrates the interpretive utility of the theory itself. It is argued that, like other social theories such as Structuration Theory (Giddens, A 1979; Giddens, Anthony 1984) and Actor Network theory (Callon 1986; Latour 1996) even ‘Rhizomatic’ post modernism (Deleuze & Guattari 2004) and Autopoiesis (Maturana & Varela 1980), Thom’s Catastrophe Theory, in particular the ‘Cusp Catastrophe’, has added to the set of theories available to the interpretive school of research into information systems (Walsham 2002).

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