Strategic Learning in Design Contests

By

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To

Lord Krishna

for his numerous blessings

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Declaration

Abstract

This dissertation examines strategic learning as learning from events and experiences that have significant consequences for organisational survival in a competitive environment. The study is centred on design contest as repeat event systems that in their time bracketed generational progression, provide for an ideal setting to analyse such learning.

Convergence that constrains experimentation to a few elements that define the strategic configuration of organisations is posited as a natural consequence of performance feedback. Strategic learning is seen to be manifested in the interplay of behavioural and cognitive attributes that moderate such convergence. Effective strategic learning is seen as key to distinguishing 'winners' from the 'also-rans' where the former counter overt convergence by striking a balance between 'searching for the competitive edge' and 'creating the competitive edge'.

In its conceptualisation of strategic learning, study design, and selection of research sites, the study successfully navigates most of the problems that have confounded research in the relatively nascent area of strategic learning. The dissertation comprises three empirical studies. The first two are based in the quasi-experimental settings of a robotic design contest called *Robot Wars* where the strategic learning model emerges by an examination of convergence as consequence of performance feedback, and the factors that moderate it. The last study is based on the sequential event system of *movie-sequels* to provide external validity to the study.

The study presents the first comprehensive examination of strategic learning in repeat event systems. It provides empirical evidence for the effect of performance feedback on convergence, and the consequences this has for future performance. Evidence for the interplay of behavioural and cognitive forces in moderating convergence for effective strategic learning, completes the strategic learning model that this dissertation delivers as a contribution to research and managerial practice.

Chapter 1

Introduction

1.1 Context and Objectives

"In times of profound change, the learners inherit the earth, while the learned find themselves beautifully equipped to deal with a world that no longer exists."

(Eric Hoffer, 1955)

This aphorism from the "Passionate State of Mind" by *Eric Hoffer*, an American social writer, and a one-time Longshoreman, was written more that fifty years ago. It will continue to appeal to both individuals and institutions till we continue to encounter events and experiences that have significant consequences for survival in a competitive environment. Learning from events that have significant consequences for 'long run adaptability' (Kuwada, 1998) stems from an evaluation of the fundamental choices that shape organisational strategy. In this dissertation, we posit this as strategic learning or learning that impacts organisational sensemaking for striking a balance between convergence to 'what worked best' and exploration of new strategic choices.

Strategic learning can also be seen as an extension of 'double loop learning' (Argyris and Schon, 1979). By definition, double loop learning impacts the fundamental assumptions governing a system, or in the organisational context, on the routines and practices underpinning the existing strategic choices. Double loop learning tends to concern itself with the extent of impact of performance feedback -distinguishing itself from the lower order 'single loop learning' that is about error correction and does not question fundamental assumptions. Strategic learning extends this predominantly cross-sectional view by positing a longitudinal perspective that gives emphasis to the linkage between two events across time. The first is where performance feedback originates, and the second is the event for which this performance feedback leads to action for inducing changes.

Given the importance of establishing a link between two events across time for strategic learning, examining such learning is much enabled in event systems characterised by repeat events that have significant outcomes, or strategic events in a generational sequence. Given that such events are classified as 'repeat events' because they share key characteristics like actors, environmental settings and underlying concepts, there is a relatively unambiguous link between performance feedback from the past event and the resulting action that foreshadows the next event.

For example, sequential product development like that for the successive generations *Microsoft Windows*, seeks to improve the product in an iterative fashion over time. Each generation of the *Windows* platform provides performance feedback to inform the next. Another example is that of movie sequels that we will also use as a research site in this dissertation. Here an original concept is extended over time based on performance feedback of prior movies. This dissertation seeks to examine strategic learning in context of such repeat event systems based on the following central questions:

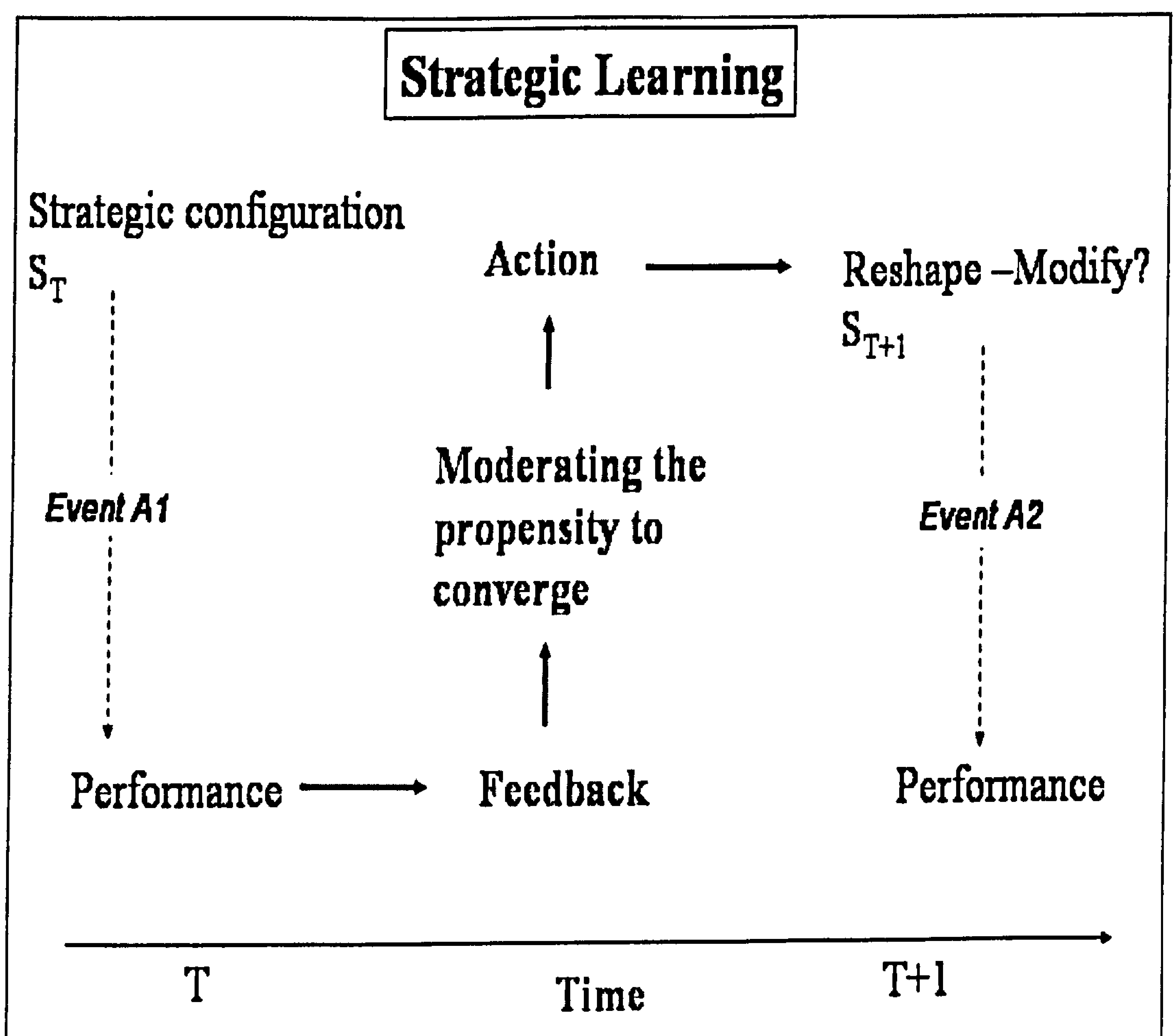
How does performance feedback from prior outcomes affect subsequent actions?

and;

What factors moderate this link?

The examination of strategic learning under these questions is as encapsulated in figure 1.1. Performance feedback from one seminal event is interpreted and assimilated to impact on the organisational core of routines and practices. In turn, the 'sensemaking' (Weick, 1995) that underpins this assimilation and interpretation moderates the propensity to converge. Strategic learning is manifested in how organisations strike a balance between converging to strategic choices that shape their existing 'strategic configuration' (Lengnick-Hall, 1992; Mintzberg et al., 1998), and exploring new ones to reshape and modify the configuration.

Figure 1.1: Strategic Learning



1.2 Motivation

While managing strategic learning undoubtedly remains critical, the problems in examining strategic learning makes research and practice of strategic learning very challenging. Extant literature struggles with some well identified bottlenecks that make a comprehensive examination of strategic learning difficult. The first relates to difficulty in monitoring the learning process over strategic events, as they tend to be rather sporadic. The second is the problem of ambiguity between actions and outcomes that comprises such experiences (Huber, 1991). Last, but arguably the most discussed problem in strategic learning and related research, is the issue of multiplicity of levels, actors and the partial contexts in which they engage in learning (Levinthal and March, 1993; Weick, 1995; Miner and Anderson, 1999).

As far as academic research goes, with its relatively greater freedom of choosing the settings to examine, these problems can be partially addressed in environments that by design control for the discussed factors of performance ambiguity, multiplicity of levels and generational identity. The controlled settings make comparison over time less susceptible to the influence of exogenous variables.
Comparison of case study based research in strategic learning supports the assertion that controlled settings make a huge difference to modelling of the phenomenon of strategic learning. These include case studies on business organisations where the study of strategic learning is influenced by uncertainties like those due to market conditions (Grundy, 1994 and Kuwada, 1998) and alternatively, organisations like the Army (Thomas et al., 2001), where there is relative lack of some of the factors that pose methodological challenges.

Recently, staged competitive events of *Design Contests* have come into prominence as portals that test new technologies. In such contests, contestant teams pit their nascent designs against each other under controlled conditions. In their time bracketed and controlled competitive milieu, the contests typify research environments that are conducive for strategic learning research.

Origins of such contests can be traced far back in time. They have been deployed for a variety of purposes, ranging from testing new technologies to entertainment and have also been used to study socio-technical evolution (Bijker, 1995; Jenkins and Floyd, 2001). In the last few years, design contests with explicit attribute of heredity, or successive contest series, are making their presence felt as important social and commercial portals. For example, contests where robotic machines compete against each other for establishing superiority of their designs are becoming a wide spread phenomenon. The *European Land Robot Trials* by the *German Army* in May 2006, *Defense Advanced Research Projects Agency (DARPA) Grand challenge* of 2004 and 2005, are prominent examples of such contests.

From a research point of view, such re-occurring contests are conducive for examining strategic learning as a process over time. This learning is manifested in shaping of actions from performance feedback over a generation of repeat events. The view of teams as an approximation of organisations, albeit with helpful characteristics of reduced multiplicity of levels and partial contexts has informed research in organisational learning (e.g. Senge, 1990; Edmondson, 1999). Design contests with a setting of competing teams in an arena mimic the competitive milieu of the business environment: organisations trying to out do each other by seeking that aft elusive competitive edge. Each contest generation is bracketed by a definite time frame. It is also a strategic event for contestant teams given the clear and decisive *win or loose* outcome of competitive engagements, often ambiguous and subjective in the real world business environment.

At the last count, only in the sub-category of 'Robotic' design contests, there were fifty-six contests around the globe deployed for reasons ranging from research and education, entertainment to commercial testing of emergent technologies. Old ones keep dying and new ones keep mushrooming, albeit making an ever increasing number of such events. The indication is that such contests are here to stay, as institutional mechanisms that deploy and develop nascent robotic designs for a variety of purposes. Thus:

The importance of and methodological problems in examining strategic learning on the one hand, and the opportunity to examine the phenomenon in controlled settings of design contests on the other, come together as the motivation behind this dissertation.

The issue of generalisability of findings from such quasi experimental research sites is critical to answer the 'so what?' question for implications that can be carried forward to organisations in traditional industries. This is addressed in the dissertation by examining strategic learning in sequential projects systems in the *Motion-Picture* industry. Movie sequels are repeat event systems as a sequel is an extension of a core concept and tends to share characteristics with its predecessors. This resonates with the settings of *Robot Wars* where teams modify their robotic designs over contest iterations.

Interestingly, *Robot Wars*, a contest deployed as a spectator sport for entertainment purposes, where nascent robotic design are pitted against each other in combat, has its origins in the motion-picture industry: It's founder *Marc Thorpe* had a prior career as a mechanical model developer for *Indiana Jones* and *Star Wars* films. In part, this link also helped us in the search for a suitable site that could be examined for providing generalisability to our findings from the quasi-experimental site of *Robot Wars*.

1.3 Overview

These research sites are profiled in greater detail in the subsequent chapters of this dissertation. The dissertation comprises three empirical studies that examine the process of strategic learning and factors that affect it. These follow the next chapter that discusses the moorings of strategic learning in extant literature.

1.3.1 Chapter 2

This chapter profiles the growth in thought on organisational learning and the moorings of the relatively new area of strategic learning research. The chapter takes into account the mutiple perspectives that contribute to extant literature on strategic learning. Constructs from literature that deal with behavioural and cognitive explanations of strategic learning are profiled for the potential they offer in operationalising strategic learning.

1.3.2 Chapter 3

This chapter examines strategic learning as manifested in narrowing of focus to some features of the design that are identified as critical to competitive advantage. This concept of 'simplicity' (Miller, 1990,1993) is at the core of the chapter that addresses the question: *How does learning lead to convergence and what are the implications of this convergence for subsequent performance?*

The quasi experimental site of *Robot Wars* as a design contest is examined to provide empirical evidence for convergence and for the variation in such convergence between the overall set of participant teams and the teams associated with superior performance. The study lays ground for examining the moderating effect due to the interplay between the inherently contrasting attributes of inertia and aspirations strategic learning in context of past performance and experience in the next chapter, which examines strategic learning by individual teams as a function of the team's inertia and aspirations.

1.3.3 Chapter 4

In continuation from the empirical examination of convergence in context of specific design features in chapter 3, this chapter broadens horizons to examine propensity to change the strategic design, in other words, the strategic configuration. This configuration is manifested in the combination of different design features in a design space defined by a basic typology of such features.

Change in the strategic configuration is seen as an indicator of strategic learning, a function of performance and past experience in *Robot Wars*. Inertia and aspirations are operationalised based these to provide an explanation for extent of change in designs. The chapter addresses the question : *How does a team's inertia and aspirations affect the convergence associated with strategic learning?*

1.3.4 Chapter 5

Given that the examination of strategic learning in the preceding chapters is based on a quasi experimental research site, the issue of external validity is important for contributions this dissertation seeks to make to the area of strategic learning. For this purpose, the research site of motion picture industry is put under focus in this chapter to validate the empirical model that posits the twin forces of inertia and aspirations as shaping strategic learning.

We examine movie sequels as repeat event systems in this chapter. Observations from the industry on the nature of movie sequels; empirical evidence for inertia and aspirations in shaping succesive sequels, and industry specific insights, combine to provide external validity to the examination of strategic learning.

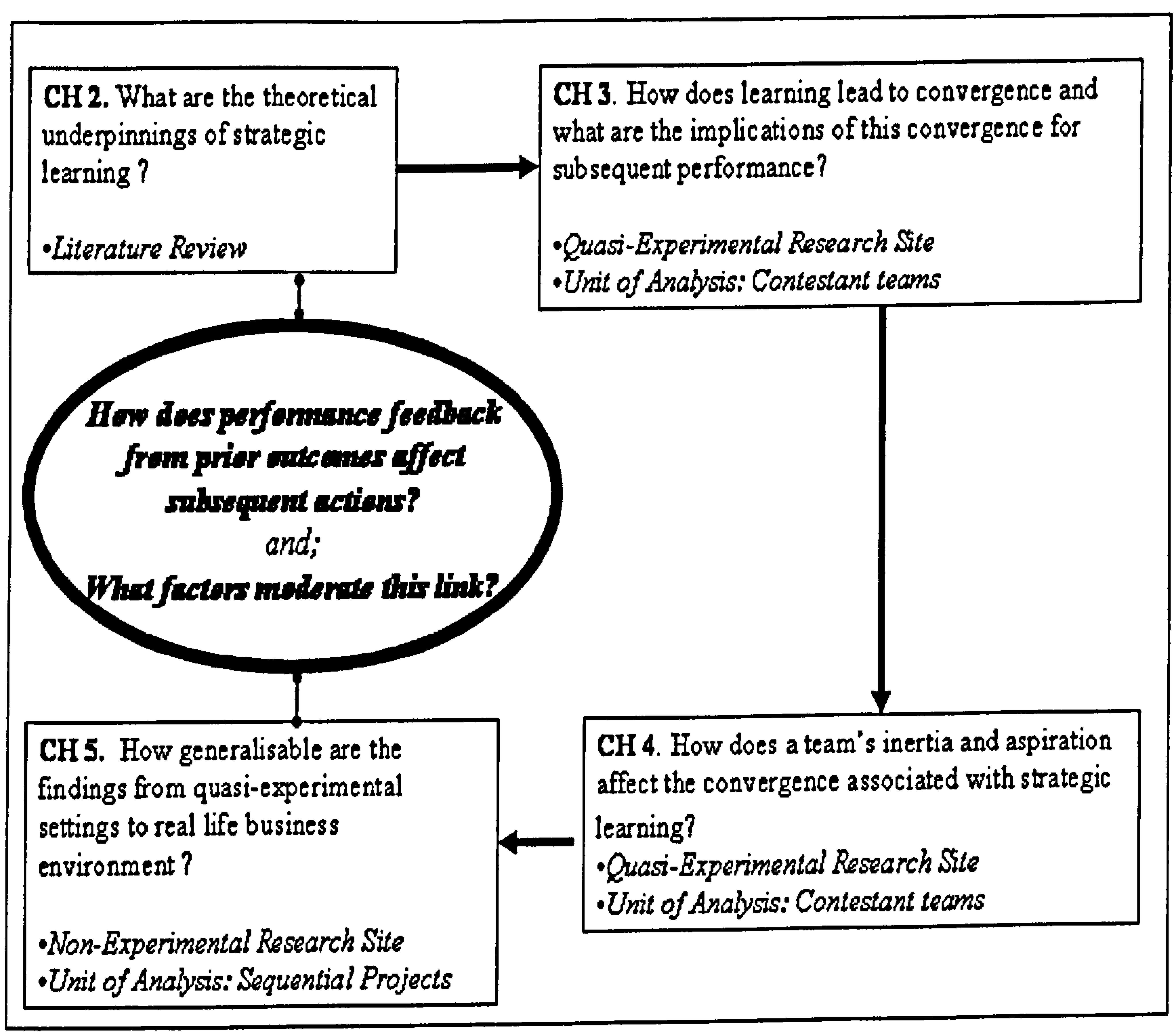
1.3.5 Chapter 6

In this final chapter of the dissertation, we present concluding thoughts and pull together the essence of contributions made by this study. We present implications for research and managerial practice to close by a discussion on the limitations of the study.

1.4 Outline of the Dissertation

The three empirical studies that are reported in chapters 3, 4, and 5 are interrelated but may also be read separately. The next chapter leads the way by looking at extant literature and constructs therein that help operationalise strategic learning. Thereafter, chapter 3 looks at convergence as a consequence of performance feedback by competing teams in quasi-experimental settings; chapter 4 examines strategic learning as a function of the interplay of inertia and aspirations to moderate convergence as a consequence of performance feedback; chapter 5 examines strategic learning in the shaping of movie sequels again as a function of the twin forces of inertia and aspirations, to provide generalisability to this study and; finally chapter 6 sums up the contributions made by this study and its limitations. Figure 1.2 provides a schema of the progression of the dissertation.

Figure 1.2: Outline of the Dissertation



Chapter 2

Strategic Learning:

Moorings and Perspectives in Literature

2.1 Introduction

This chapter explores the moorings of strategic learning in the wider body of research on 'learning in the organisational context'. We outline perspectives that shape contemporary understanding of learning in, and learning by organisations. This is followed by a discussion on learning and the scope of change that learning may induce by striking a balance between pressures to converge and the opportunities to explore. Strategic learning is then profiled as a phenomenon that juxtaposes evolutionary, cognitive and behavioural explanations.

Theoretical constructs in the ambit of such explanations like sensemaking, variation and selective retention, inertia and aspirations, and causality are discussed to illustrate their congruence in modelling strategic learning essentially as a capability to moderate convergence as a consequence of performance feedback. In the penultimate section a commentary on some key strategic learning research is presented. This is to highlight conceptual and methodological issues that make a case for design contests to be ideal settings for examining strategic learning.

2.2 Perspectives on Learning

The growth in literature in *organisational learning* has been interjected by the *learning organisation* perspective. While the former concerns itself with the intrinsic process of diffusion of learning within an organisation (Cyert and March, 1963); the latter focuses on the link between learning and competitive performance of the organisation (Senge, 1990; Garratt, 1994). Thus by design, the *learning organisation* perspective is oriented towards change for organisations to become better learning systems. On the other hand, *organisational learning* refers to learning in given organisational settings. Arguably, strategic learning, given its focus on learning from performance feedback to moderate convergence, belongs more to the fold of the *learning organisation* perspective.

Easterby Smith (1997) has outlined the literature on learning in the organisational context as interplay between several broad disciplinary perspectives. These are summarised as follows to lead on to an elaboration on the leanings of strategic learning: invariably tied more closely to the perspective called the 'strategic perspective' which has idea of competitive dynamics at its core.

- *The Psychology and OD perspective* has human development in the organisational context as its central concern. This perspective is arguably the broadest and comprises five sub-themes: Learning can be *hierarchically arranged* in stages of progressive ability to learn when the same situations are repeated; The progression in ability to learn is manifested in modification of the *cognitive maps* of individuals; *Experiential learning* outlines the stages through which individual learning is enacted; The concept of *learning styles* refers to the distinct dispositions or preferences individuals may have about the way they want to learn and; Why is it difficult to learn? engaging the dichotomy between *espoused theory and theory in use* (e.g. Revans, 1971; Kolb, 1973; Bateson, 1973; Dixon, 1994; Talbot and Harrow, 1993; Argyris, 1986,1992)

- *The management science perspective* is concerned with gathering and processing information about the organisation. (e.g. March and Simon, 1958; Argyris and Schon, 1978; Huber, 1991; Nonaka and Takuchi, 1995).

- *The sociology and organisational theory perspective* focuses on broader organisational social systems and is the founding grounds for the contingency approach to organisational systems. (e.g. Pettigrew, 1973; Hedberg, 1981; Talbot and Harrow, 1987).

- *The production management perspective* examines relationship between learning and organisational productivity. Conceptualisation of the learning and experience curves associate productivity as a benchmark for organisational learning. Organisational process are undermined in this perspective making it difficult to examine the link between learning and productivity (e.g. Buzzell and Gale, 1987; Garvin, 1993)

- *The cultural perspective* relates to cultural characteristics influencing the ability to learn. For instance, analysis of learning styles across different countries may suggest a cultural affiliation (e.g. Ouchi, 1978; Shibata et al, 1991)

- And finally, there is *the strategic perspective* on learning that concerns itself with competitive dynamics and competitive performance, the evolutionary and processual view of strategy being central to this perspective (e.g. Hamel and Prahlad, 1993; Whittington, 1993; Hannan and Freeman, 1989; Miner and Haunschild, 1995).

The strategic perspective has its roots in the knowledge based theory of the firm that postulates knowledge as a key resource and the cornerstone of organisational systems

(Kogut and Zander, 1992, 1996; Nonaka, 1994, Spender, 1996; Grant, 1996). This perspective on knowledge from the resource based view of the firm views knowledge as evolving through iterative cyclical processes; concerns itself with the role of learning as a capability that shapes this process to impact organisational performance (Prahalad and Hamel, 1990; Wernerfelt, 1994; Barney, 1999).

Learning is associated with an evaluation of performance that is used to retain performing elements and discard non-performing ones. Given the baggage of performance over time, some elements tend to be ingrained as central to the functioning of businesses, whether product design attributes, or best practices for project management, among others. The retention prone orientation is a useful characteristic that allows seeking efficiency through fine tuning existing elements of the configuration. However, it can often block organisational propensity to experiment and explore new ways of doing things. Overt convergence at the expense of exploration becomes particularly dangerous when the business environment is characterised by complexities like frequent and major technological disruptions.

2.3 Learning and Change

The higher the level of inter-dependence of actors and higher the complexity of the work environment, the greater is the challenge of learning. For this reason, the organisational context, juxtaposed with the institutional environment, to define goals, means and transactions, is at the heart of learning theories (Anderson, et al., 1988; Day and Chen, 1993; Amburguey and Rau, 1996; Tisdell, 1996).

The growing complexity and fickleness of the business environment has made the distinction between 'mechanistic and organic' forms of organisations increasingly relevant to the idea of learning organisations (Burns and Stalker, 1961). The former is at odds with the learning organisation premise as there is growing evidence that incompatibility with change leads to an unviable organisational schema (Merton, 1957; Crozier, 1964; Bauman, 1989).

Before organisational theories came of age, the organic analogy had already extended the evolutionary perspective associated with development and change in a variety of contexts like societies, technology and knowledge (Comte, 1838; Spencer, 1876). The growth in thought on organisations as organic, less predictable and less bounded entities, flourished by drawing on these strands to foster what is known as the 'contingency approach' (Miles and Snow, 1978; Mintzberg, 1979; Shrivastava, 1983; Mintzberg, Ahlstrand and Lampel, 1998).

This approach is relevant to strategic learning as it propounds different strategic configurations, or in other words, combination of characteristics into an actionable design that is contingent on the strategic direction followed (Hamel and Prahalad, 1989). By extension, it also emphasises the need to anticipate change and the need for feedback from performance to inform such change.

The arrival of the global corporation in the 1980s presented new decision making challenges for managers as conflict, competition and assessment of impact of change became ever more complex (Allison, 1971; Child, 1972). The need has been to balance the risks and returns related to change in light of the contextual factors that affect the enterprise: for instance, deciding on the appropriate degree of customisation of products for strategic niche management (Karnøe, 1996; Lampel and Mintzberg, 1996).

The emergence of project-based organisations is arguably the most recent development towards attaining a high degree of flexibility in strategic configurations. A project based organisation, is one in which structures, empowerment, and resources are aligned as far as possible with the needs of projects (DeFillipe and Arthur, 1998; Lampel and Jha, 2004). Projects in turn, are customised systems characterised by a specified time frame and a unique deliverables. They can be formulated to target different emerging needs, and the experiences of doing projects can feedback to inform subsequent projects.

The process of feedback entails diffusion of knowledge to the wider project portfolio of the organisation. This diffusion is but a means to the end of improving organisational performance. For example, a firm engaged in oil exploration may experiment with and successfully deploy innovative cost reduction mechanisms. Whether this learned know-how disappears with the completion of the project or is carried forward to other projects in the future depends on several interconnected factors. This can be listed as: capturing and interpreting this knowledge; internalizing and diffusing it through organisational systems and; thereafter, effectively translating the knowledge into actions that induce change to improve performance. In the next section we look at performance feedback to elaborate on the idea of strategic learning

2.4 Strategic Learning

As contextualised upfront in this dissertation, Argyris and Schon's (1978) framework of learning from performance feedback is a useful starting point to conceptualise strategic learning. In this framework, 'single loop learning' is posited as a lower order learning that does not engage governing variables of the system, and is essentially operational in nature. For instance, detecting a seasonal drop in sales of a product and adjusting production accordingly without causing any upheaval in the nature of production technology used. However, when the reasons behind outcomes become equivocal, the governing variables like core product technology or established ways of working are questioned. The framework labels this as 'double loop learning', opportunities for which arise when, for instance, there is loss of competitive position induced by new product technology being deployed by a rival, or a merger that requires reshaping and convergence to agreed and consistent ways of working.

Furthermore as pointed earlier, double loop learning is closely associated with the understanding of strategic learning. Strategic learning shapes actionable feedback through moderating the propensity to converge. This is to ensure that experimentation with new ways and elements to inform the existing strategic configuration remains on the agenda when it comes to translating performance feedback to future actions. The longitudinal perspective of strategic learning that seeks a link between two events across time to generate the 'actionable feedback' is thus what distinguishes it from the predominantly cross-sectional view of performance feedback in the 'single loop - double loop' conceptualisation of performance feedback.

During the course of their existence organisations encounter events and experiences, which have significant consequences for, and potential in, improving their long run adaptive capability' (Kuwada, 1998). Mergers, a major downturn in performance, change in leadership, or impact of new technologies that tend to render existing business models obsolete, are some examples of such events.

Organisational efforts to generate actionable feedback from such events to foreshadow future events, is a manifestation of strategic learning. We have enumerated before the difficulty in action-ability of such feedback in light of methodological challenges that confound strategic learning research. We will revisit these later in this chapter to reflect on some key literature ascribed to the folds of this relatively nascent concept of strategic learning. In the next section we take forward our conceptualisation of strategic learning to discuss theoretical perspectives that provide behavioural and cognitive explanations to the phenomenon of strategic learning.

2.5 Strategic learning: Explanatory perspectives

Learning from events with significant consequences is a subject matter that encompasses several perspectives: The first is primarily *cognitive* and referred to as the sensemaking perspective (Weick, 1995). The second is learning through creation, modification and replication of routines (Nelson and Winter, 1982; Hannan and Freeman, 1989; Cohen, 1991; Paoli and Principe, 2001), and has origins in the *evolutionary perspective* of 'Variation and Selective Retention' (Campbell, 1960, 1965). The third perspective relates to the propensity to change in light of strategic experiences and is arguably, both *behavioural* and *cognitive* in orientation. This perspective postulates that interpretation of strategic experiences and their subsequent impact is shaped by two forces. One is *inertia,* understood as the propensity to entrench or hold on to a strategic configuration over time (Hannan and Freeman, 1977; Greve, 1988; Levinthal, 1997). The other is *aspirations,* understood as the propensity to experiment with and change the strategic configuration (Starbuck, 1963; Cyert and March, 1963; Levinthal and March 1981; Haunschild and Sullivan, 2002). The fourth perspective is close to the issue of addressing performance ambiguity in strategic learning research. It looks at causality in terms of *complexity of causality, or* extent of heterogeneity of causes attributed to performance (Hedberg et al., 1976).

All these perspectives recognise the influence of tendency to converge from performance feedback over time. In addition to the difficulty stemming from complexity in sensemaking when organisations engage in exploration of choices outside those that combine to shape the existing strategic configuration, the bias in 'making sense' of 'what works', as in discovering the performing elements of a configuration is arguably the first step in evaluating the efficacy of a strategic configuration. In context of the 'variation and selective retention' paradigm, failure to moderate convergence pressures may eventually lead to overt 'simplicity'. As a consequence of this, variation tends to follows retention where experimentation is limited to improving those elements of the existing strategic configuration that are locked in the organisational mindset as being central to performance.

The perspective that examines 'propensity to change' as a tension between inertia and aspirations, is directly related to the issue of moderating convergence as a consequence of performance feedback. Finally, the last perspective of 'causality' that we enumerate, also relates to how past performance is reflected upon, whether it is confined to a few explanations or alternatively, examined in context of a wide range of factors.

In the sections to follow, we outline each of these perspectives with a view to examining their potential contribution to the understanding of strategic learning.

2.5.1 Sensemaking

For the purpose of strategic learning research, the process that leads to an interpretation of the action-outcome relationship is referred to as "sensemaking" (Weick, 1995). Sensemaking is a rather vaguely defined term borrowed from psychology (e.g. Kaplan and Kaplan, 1977). It can be seen as a "socio-cognitive process" (Resnick et al 1991) that has been used to connect human cognition to the environment, to also throw light on how people or actors partially produce the environment they face (Berger and Luckman, 1967; Kaplan and Kaplan, 1977; Pondy and Mitroff, 1979; Daft and Weick, 1984).

Despite its conceptualisation by Weick (1979) as not only a metaphor or being about developing plans, but as a concept that is in some ways codifiable, sensemaking remains difficult to decipher given its origins in human cognition. The concept has found appeal in empirical strategy research to do with industrial schema (e.g. Porac, Thomas and Baden fuller, 1989; Anthony et al, 1993; Martins and Kambil, 1999; Johnson and Hoopes, 2003), and easily forms a central feature in any explanation that is attributed to the phenomenon of strategic learning.

In Weick's construction of the idea, sensemaking is mainly "retrospective", as in making sense of past experiences; however, "prospective" sensemaking has had its role recognized in literature as in making sense of anticipated future events (Gioia and Mehra, 1996). In literature "discovery" and "foreshadowing" as strategic learning constructs also mirror the temporal nature of sensemaking (Snyder and Cummings 1998; Schulz, 2001).

Sensemaking as a socio-cognitive process to reflect on the past and anticipate the future remains central to learning. However, being embedded in human and social cognition arguably makes it very susceptible to convergence that we have referred to as a natural consequence of performance feedback. There are no prescriptions about 'right' sensemaking that balances convergence with exploration. Empirical evidence suggests that in situations of high environment complexity and uncertainty, organisations are disposed towards avoiding cognitive pressures for making choices based on exploration outside the existing configuration (Hammer and Champy, 1993; Miller and Shamsie, 1999). Sensemaking remains a product of, and also shapes, organisational mindsets – the rationale behind why most organisations find effective learning so difficult and at other times, never quite find the optimum balance between convergence and exploration.

There is a more explicit side to strategic learning than the very broadly scoped and arguably non-codifiable cognitive process of sensemaking. This is concerned with explicit takeaways from experience in the form of say improvements to routines that are the genetic codes of the organisation's knowledge base (Nelson and Winter, 1982) and has been referred to as "genetic learning" (Lampel and Jha, 2003).

2.5.2 Variation and Selective Retention

The Variation and Selective Retention (VSR) paradigm is central to the evolutionary perspective and has groundings in biological evolution. It was originally used outside it to provide an explanation for the evolution of knowledge (Campbell, 1960, 1965), and has well documented parallels in organisational and social evolution (e.g. Campbell, 1969; Weick, 1979; NW, 1982; Baum and Singh, 1994). Strategy research has also drawn on these developments, like for example, the conceptualization of the VSR process at different levels in organisations, and in a succession over time that sees emergence of new populations from the old (e.g. Lomi and Larsen, 1996; Ginsberg et al, 1999).

VSR is 'blind' in the natural selection order of things. This implies that at the most fundamental level variation processes do not know which of the variants they produce will turn out be selected. Darwinian evolution and to an extent, the basics of economic life as in the natural selection triggered by demand and supply, are expositions of this idea.

The VSR model is not blind all the time, as unlike natural selection and in some ways economic life, not all systems are characterised by lack of goal directedness. However, the adjustments towards 'directed' (as against 'blind') VSR are labelled as 'inductive achievements' of some original blind-VSR in the past. The 'blind' component is said to exist at, at least some levels of the concerned system (Campbell, 1965). Different evolutionary theorists have adjusted the VSR paradigm for their domains. For example, the 'goal directedness' in evolution of socio-cultural artefacts differentiates it from the 'blind' evolution by natural selection (Basalla, 1988). The aspect of goal directedness is also seen as critical in defining learning performance in organisations (Levinthal and March, 1981; Lant, 1992).

Bickhard and Campbell (2003) emphasise that the concept of variation and selection has a broad scope and requires adjustment to provide an explanation to different phenomenon. One of the points they make to structure this argument is that there are "intrinsic explanations" unique to the system where there is "an involvement of some agent that is capable of goals or purposes". Intrinsic explanations refer to explanations that depend on internal characteristics of the system. Bickhard and Campbell also use the concept 'boundary conditions' in their argument. The concept of 'boundary conditions' has parallels with rules in an organised contest's perspective that scopes and limits the action-outcome interactions. The 'agents' or players, make strategic choices within the scope of the 'boundary conditions' for achieving their goals.

Choices that shape strategic configurations are subjects to the VSR process. When convergence sets in and starts compromising exploration, the focus is increasingly on improving and fine tuning the existing elements of the configuration. When it is only these retained features that are subjected to experimentation, variation tends to follows retention. By extension, one can say that this is evolution gone wrong by overt propensity to converge. Effective learning for adaptability in a dynamic environment would thus entail moderating such pressures for convergence.

The idea of the connection between learning capability and evolution is quite old. It has been discussed by biologists in the 19th century (Baldwin, 1896; Morgan 1896) and has been extensively taken forward in recent times in the development of artificial intelligent systems (e.g. Newell and Simon, 1972; Belew, 1990), research in complex adaptive systems (e.g. Holland, 1975; Holland et al, 1986) and in studies on emergence of organisational populations (e.g. Hannan and Freeman, 1977, 1989; Lomi and Larsen, 1996; Ginsberg et al, 1999). Contemporary research in the area of artificial intelligence is also an indication of the potential of this connection (e.g. Jain et al, 1996; Xiong, 2001).

2.5.3 Inertia and Aspirations

Learning capability and evolution are connected by the enactment of learning that induces change in strategic configurations. This enactment is controlled by the 'propensity to change' that is both self referential and comparative i.e. with reference to the performance of rivals. For instance, a firm may make online sales a priority because of a good feel about the potential of e-commerce, or in turn, it may be influenced by the performance of rivals in the industry who have significantly increased their revenues through online sales.

Organisational inertia and managerial aspirations are defining variables for 'propensity to change' in light of given performance. In event of strategic experiences such change impacts on the fundamental assumptions that shape the organisational core of routines and practices, or in other words the strategic configuration of organisations that encounter such experiences.

The specific use of organisational inertia as a disposition that influences the capacity to change is strongly linked to the theory of organisational routines (Cohen and

Bacdayan, 1994). Literature posits a variety of sources for organisational inertia. Though inertia has been argued to have political and cognitive leanings (Hannan and Freeman, 1984), in the main, extant literature sees inertia as behavioural in orientation: protecting that status-quo and suppressing rationales that call for change in strategic configuration. Cyert and March (1963) and Nelson and Winter (1982) see inertia as a function of embedded rules, routines, and practices that emerge over time and provide consistency in the way organisations deal with the business environment.

The concept of inertia is very widely used in research given its metamorphosis that is inexplicably intertwined with organisational development. It has found place in discussions on organisational and industry evolution, in discussing the impact of positive feedback in making it difficult to change strategic direction, and in investigating organisational learning (Hannan and Freeman, 1977, 1984; Kelly and Amburgey, 1991; Amburgey et al., 1993; Levinthal, 1997; Wright and Goodwin, 1999; Burgelman, 2002; Nickerson and Zenger, 2002).

Organisations respond to performance by reinforcing what worked best in the past, rather than exploring alternatives that may lead to even better performance: a perspective that has shaped the idea of 'simplicity' versus variety in experimentation (Miller, 1993). The literature sees an inherent opposition between inertia and aspirations. Aspirations being a general term used to describe future orientation by individuals and organisations. The 'level' of aspirations, unlike inertia is less ingrained in over time emergence of rules, routines and practices. It is more fickle; is arguably a function of short-term performance and; is seen as relatively more cognitive in orientation.

The relationship between performance and aspirations is strongly mediated by what is learned from performance (Starbuck, 1963; Cyert and March, 1963; Levinthal and March 1981). In the case of inertia the learning focuses on current routines and practices, and more generally on the effectiveness of current configuration and its constituent elements that have emerged over time. In the case of aspirations, the learning focuses on the degree of effort that is needed to attain aspirations, and resourcing of these efforts. From a learning perspective, performance is often interpreted in context of causality, or the interpretation of the reasons behind the realised outcome. Shaping of inertia and aspirations subsequent to performance is also likely to be influenced by this interpretation which we discuss in the next section as 'causality'.

2.5.4 Causality

Complexity of causality, or multiplicity of factors that can be ascribed to performance, has been examined in recent literature. It has been frequently cohabited the space of causal ambiguity, which is a concept that implies lack of clarity in causality, somewhat different from multiplicity in causality. Causal ambiguity is seen as the main bottleneck in achieving resource imitability and reducing the risk associated with change (Reason, 1997; Ambrosini and Bowman, 2005). On the other hand, complexity has a more positive perspective on multiplicity of factors as an opportunity to learn as against converging to a few easily available explanations (Lippman and Rumelt, 1982; Rumelt, 1987; Beckman and Haunschild, 2002; Haunschild and Sullivan, 2002).

Low complexity or homogeneity implies fewer interconnected factors and by extension, high complexity or heterogeneity suggests several and highly interconnected factors. Empirical evidence seems to be in favour of heterogeneity providing more opportunities to seek improvement in strategic configurations, albeit the risks of misinterpretation leading to expensive failures remain (Haunschild and Sullivan, 2002). Homogeneity in causal factors is in some ways convergence at the stage of performance evaluation itself. This biases learning even before the feedback impacts to shape the set of choices defining the strategic configuration. Arguably, in this case, convergence becomes both a precursor to learning and a consequence of it.

Attribution to sources of causality has also been examined in context of downturns in organisational performance, and strategic events in organisational life (e.g. Hedberg et al., 1976). Locus of causality or attribution is seen in literature to be associated with the perception of controllability (Seligman, 1975; Miles, 1982; Greenberger and Strauss, 1984; Ford 1985). The perception of control on factors to which performance downturns are attributed has different implications for the strategic actions taken, especially in response to performance downturns. When such actions stem from a perception of control over causal factors it may be founding grounds for aspirations to better address such factors. By extension, given the perceived risk quotient, the propensity to change may be reduced if there is a perception of lack of control on factors that influence performance.

2.6 Strategic Learning Research and Design Contests

As discussed upfront in shaping the motivation for this dissertation, research in strategic learning has been constrained by the following difficulties:

a) Monitoring the learning process over strategic events or strategic experiences, as they tend to be relatively rare and infrequent;
b) Performance ambiguity that characterises input-output relationship in context of strategic experiences and;
c) Multiplicity of levels, actors and the partial contexts in which they engage in learning

(Huber, 1991; Levinthal and March, 1993; Glynn et al, 1994; Weick, 1995; Miner and Anderson, 1999; Lampel and Jha, 2003).

In Table 2.1 we outline some key literature that is ascribed a direct association with strategic learning. However, this is not an exhaustive listing of research that could claim to be in the area of strategic learning. The brief commentary presented for these papers, summarises conceptual and methodological issues of interest given our positioning of strategic learning research.

Table 2.1 : Key Strategic Learning Research

Authors	Theme	Commentary
Grundy, 1994; *Kuwada, 1998*	-Transformation of business level learning to corporate level or strategic learning. -Intra-organisational ecological process as crossing the bridge between short run and long run adaptation.	Strategic learning is seen as a function of competition while the performance of rivals is underplayed in these two papers. The papers use one to two case studies to posit good practice approach for conducting strategic learning.
Doz, 1996	-Examining strategic alliances to understand how learning leads to evolution of cooperation and the success and failure in such initiatives.	The study uses a small contrasting sample. The author acknowledges a bias due to lack of focus on multiple levels and lack of control in the initial conditions.
Thomas, Sussman and Henderson, 2001	-Strategic learning from discrete events as feedback and feed forward.	The learning unit in this paper is fragmented by having different observation, interpretation, and diffusion units. Also, in the chosen research site, feed-back process is biased by selection at the organisational level of which lessons should be diffused and which should not.

Ambrosini and Bowman, 2005	-Causal ambiguity –Use of causal mapping as a tool to uncover ambiguous success factors.	The paper uses a single case example that reduces both cross-sectional and temporal validity. It is more about causal mapping as a technique to trigger managerial introspection of sources of advantage, and as a mechanism to support the feedback side of strategic learning
Chinander and Shapira, 2005	-Decision dilemma to balance feedback with appropriate actions: predictive information and warning in hurricane evacuation decisions.	Ponders over poor translation of feedback from predictive systems into actions. Points at the difficulty in systematising strategic learning due to judgemental errors that stem from: partial contexts of actors, and lack of trust in feedback in case of strategic events. 'assimilation to action' part of strategic learning is clouded and in effect, this is the central argument the paper makes.
Baumard and Starbuck, 2005	-Venture project 'failures' as strategic outcomes; barriers to learning from failures.	Points to the problem of configuring a strategic experience and learning from it. Posits the locus of causality as a function of partial contexts of actors and scale of the strategic event. In some ways sees this as magnifying performance ambiguity: large failures are exogenised and; learning from small failures is made difficult as personnel with the experience are moved around inhibiting effective assimilation. Does not complete the picture despite dabbling in learning from success: do successes work the other way around: are large successes endogenised? Hints at the possibility of confining success by continuing to sharpen 'that competitive edge' instead of balancing it with flexibility.

Methodological issues that make strategic learning research difficult can be addressed to a large extent in environments that by design control for factors of complexity, uncertainty and ambiguity. For instance, behavioural simulations have found appeal in investigation of inter-organisational learning in organisational ecology studies (e.g. Ginsberg et.al,1999; Baum and Berta, 1999) and laboratory experimentation has informed the areas of organisational memory and routines (e.g. Cyert and March, 1963; Cohen and Bacdayan, 1994).

As outlined earlier in this dissertation, naturally occurring and highly structured environments like design contests have characteristics, which are relevant for investigating strategic learning, and are similar to that of organisations. They have been investigated for studies in socio-technical evolution and competition using archival data that arises in a contest perspective; is structured by rules; has specified conditions of entry and exit; has limited influence of external variables and; has clear performance assessment mechanisms (e.g. Bijker, 1995; Jenkins and Floyd, 2001).

In the business world such systems can be found wherever competition is structured by technology and industry structure into sequential competition; for instance, a generational succession of projects as design events benchmarked against similar projects of other organisations. We use design events in the settings of the design contest of *Robot Wars* as the quasi experimental research site for this study. Here competition and its outcome are clearly discernable through robotic designs in combat. Thereafter, we examine strategic learning in the sequential project system of Hollywood movie sequels to provide external validity to the study.

2.7 Discussion

In this chapter we have outlined the moorings of strategic learning within the wider body of organisational learning research. The different perspectives outlined as explanations of strategic learning, help reflect on strategic learning in context of the tendency to converge as a consequence of past performance.

We have also briefly discussed 'causality' as an explanatory perspective for strategic learning. This is given its connection with strategic learning by way of the perception of control on causal factors and opportunity to learn from multiplicity in causal factors. Though we do not explicitly examine causality in this dissertation, it remains of interest for future research, especially in connection with the interpretation that underpins different performance assessment mechanisms we come across in the subsequent chapters.

In the next chapter we examine 'simplicity' (Miller, 1993) in experimentation versus 'variety' in experimentation as a precursor to the examination of inertia and aspirations in shaping strategic learning in the chapters thereafter. The duality of variety and simplicity closely approximates the classic tension between 'exploration and exploitation' (March, 1991). Simplicity resonates with 'exploitation' while variety shares space with 'exploration' by looking at future possibilities that are outside the ambit of the existing configuration.

The simplicity perspective posits that competitive performance tends to embed specific features of design in the organisational mindset as being central to competitive advantage. In turn, these features tend to absorb most of the organisational resources for experimentation. Engaging in this 'search' for sources of competitive advantage as against, 'creating' new sources of competitive advantage, has been seen as the failing of many a established business models and successful organisations (Hamel and Prahalad, 1989; Peteraf, 1993).

Chapter 3

The Failings of Simplicity: Evidence from Strategic Learning in Design Contests

3.1 Introduction

Learning from performance feedback in repeat event systems leads to a 'convergence' to some parts of the strategic configuration that are seen as central to performance (Tushman and Romanelli, 1986). Such convergence represents a movement towards 'simplicity' as it reduces the variety in experimentation that is associated with a given strategic configuration over time (Miller, 1993). In the case of repeat event systems, such an association of performance feedback with convergence is more pronounced. This is because there is a clear generational relationship between events that allows performance feedback to be readily linked to different parts of the configuration. In the case of repeat events with 'significant consequences' by extension, this is link is very crucial in informing strategic choices.

While harnessing and improving the performing elements of a configuration is important for performance in the short run, superior performance in the long run requires moderating convergence to simplicity. The need is to 'seek to create' rather than only 'search for the competitive edge' in light of past performance (Miller, 1996; Miller and Shamsie, 1999).

One of the numerous accounts that illustrate how avoiding simplicity can lead to new breakthroughs for creation of sources of competitive advantage is Canon's success in the photocopying market. The need to break into the market as a new incumbent in the 1960s led Canon to reshape the core technology in a 'variety of areas' as against 'simply' focus on getting better at the established standards leading from the dominant Xerox model.

This chapter examines the tension between variety in experimentation and simplicity that constraints experimentation. We illustrate the impact of learning on convergence, and the implications this has for subsequent performance. We do this in the quasi experimental settings of *Robot Wars,* a design contest that we have introduced before and elaborate upon in this chapter.

Based on analysis of variance in design features, we interpret results that show differences in such convergence between performance groups, and the overall set of participant teams in the contest. Our results suggest that superior performance is characterised by a relatively higher level of experimentation.

3.2 Convergence and Simplicity

Simplicity resonates with the notion of inertia, where organisational efforts are directed at improving and sustaining what they are already good at. It has similar consequences for long run adaptability of organisations by increasing incongruence with the environment and eventually resulting in a conflict with environment; the story behind numerous corporate disasters (Starbuck, Greve and Hedberg, 1978; Meyer and Starbuck, 1991).

This is partly because success in particular usually brings with it a propensity to preserve it, an idea that is at the core of simplicity. As an organisation experiences and attributes more and more success to certain features of its business model, it responds by inducing more systemisation to exploit the successful model by focussing on these 'select' features.

We have argued that specific design features embedded as a source s of competitive advantage constrain variety in experimentation by absorbing all efforts at experimentation for improving future performance. The search process informed by competitive performance over rides the propensity for exploration to create new sources of competitive advantage.

In making the connection between evolutionary theory, and learning from performance, Tushman and Romanelli's (1985) model of convergence closely approximates the 'variation and selective retention paradigm', which is at the heart of the evolutionary theory (Campbell, 1965). The model captures how experience with a given design feedbacks to inform underlying assumptions about the design. Subsequently, this shapes actions to experiment (variation -fermentation) for improving the design's performance under conditions of competition, where successful characteristics are retained for future designs (selection-heredity).

The manifestation of simplicity in this context is that organisations frequently choose to focus on retained design features for variation: performance based retention locks 'select' features as being key to competitive advantage (Levitt and March, 1988, March, 1991; Miller 1993). Thus, variation tends to *follow* retention, eventually bringing organisations in conflict with the environment.

The extent to which an organisation subscribes to 'simplicity' as against 'variety' in experimentation reflects on the 'sensemaking' (Weick, 1979) process that underpins organisational interpretation of strategic experiences. Sensemaking of strategic experiences is different at different levels of the organisation. Thus, it is frequently difficult to examine the extent and the manner in which performance of a deployed design is drawn on to inform the tension between simplicity and variety in experimentation to inform strategic choices. Furthermore, extant literature suggests a need for examining simplicity over time to get a better picture of this tension (Miller, 1993).

In the following section we profile the design contest of *Robot Wars*. As indicated before staged competitive events with multiple episodes of competition over time, and clearly delineated levels viz. organisers and contestants, are ideal settings for examining convergence to simplicity over time in response to performance feedback.

3.3 Robot Wars

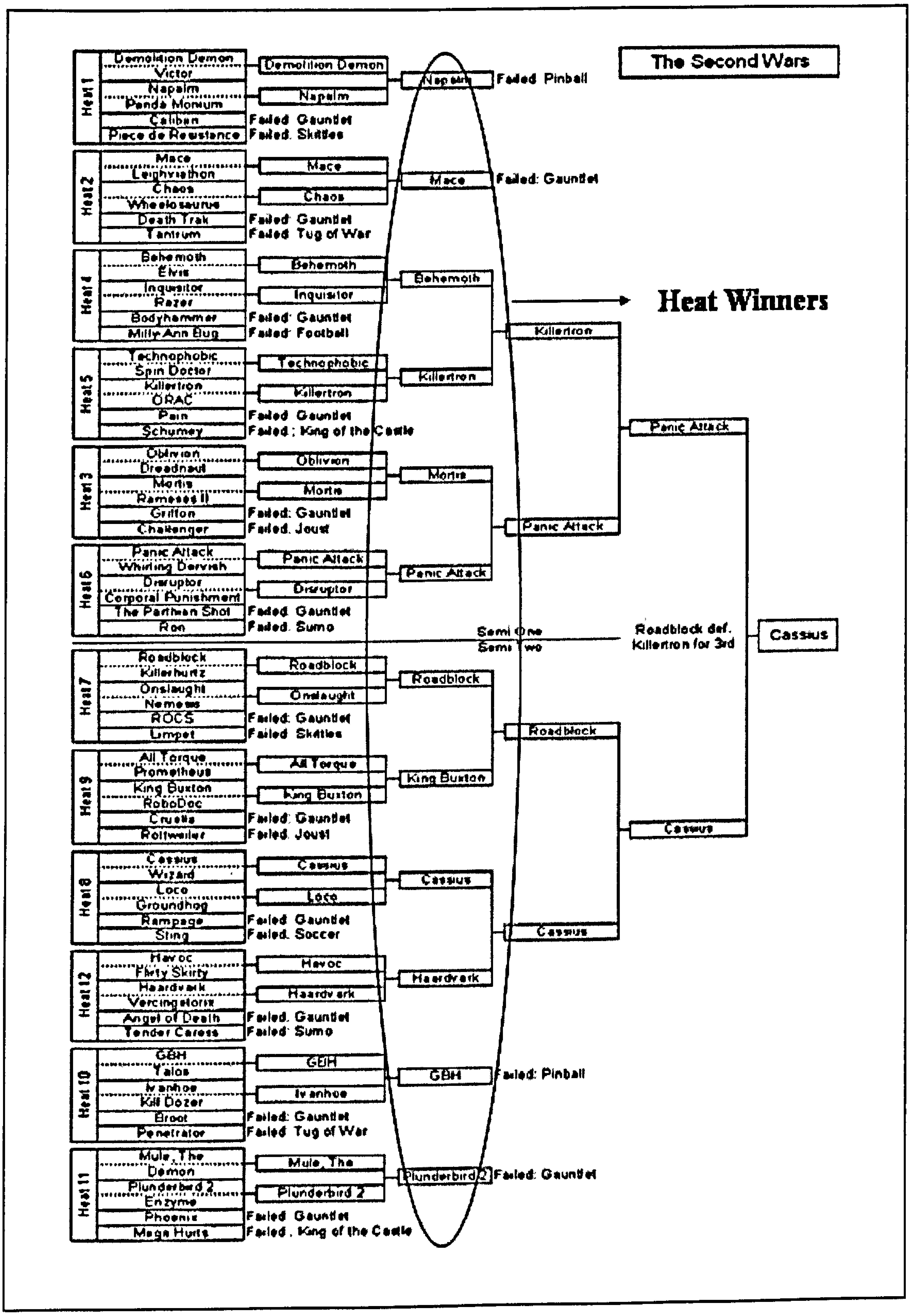
3.3.1 A Background

Robot Wars is one of the labels given to the sport of *Robotic Combat*, described as "the first sport to break into the popular culture in the new century" (Stone, 2003). *Robot Wars* is a tournament style competition where contestant teams participate through their remote controlled robotic designs that *compete by combat* under specified rules in a given arena. It ran on the BBC over 1998 to 2003 and a total of seven series were telecasted during this time, re-runs of the show are still popular on European television.

Robotic contests were first staged in the 1970s in *MITs* mechanical engineering classes. The first robotic combat event, *Critter Crunch*, was presented at the 1986 science fiction convention in Denver and the first tournament style robotic combat event, *Robot Sumo,* was organized by Fujitsu's chairman *Hiroshi Nozawa* in Japan in 1990. *Fujitsu's* involvement being an indication of corporate interest in design contests as portals to experiment with nascent technologies. The robotic contest concept was subsequently transformed into a spectator sport by toy designer *Marc Thorpe* who developed mechanical models for such films as *Indiana Jones* and *Star Wars*. From 1994 to 1997, *Thorpe's* tournament, called *Robot Wars*, brought together a dedicated group of enthusiasts in the San Francisco Bay area. He subsequently fell out with his main investor, and after a prolonged legal conflict the event shut down in 1998. The next year it split into *Battle Bots* in the United States, and *Robot Wars* in Britain (Stone, 2001, 2003).

Robot Wars is an institutional system with the primary goal of spectator entertainment much like the gladiator events of the *coliseum* days, albeit through deployment of nascent and attractive robotic designs in combat. The teams are arranged in elimination rounds or 'heats' where the winners progress to the next level, culminating in the series final as illustrated in figure 3.1. When teams participate in the next series they have the experiences of the previous series to interpret what is likely to work, and what is not, from amongst the multitude of design options available within the rules of the contest. Appendix A presents the charts for progression in each of the seven series of *Robot Wars.*

Figure 3.1: Illustrative Chart of Progression: A *Robot Wars* Series



The rules do not allow for making changes to the deployed designs during a series itself apart from repairs that may be required to address damage sustained in combat and necessary for a design's operability in the next stage of the contest series. Matches are frequently decided by a knock-out, sometimes due to damage sustained in combat and at other times due to defects like engine failure. There is also a set time for which the combat takes place, if there is no result at the end of this, judges comprising mainly of experienced robotiers, and presenters from other technology intensive television shows decide the winner based on criteria of attacks made and damage delivered. The robotic combat takes place in an enclosed arena that has special features like spikes and flame pits as hazards and as tactical options for the contestants. Appendix B provides a floor plan of the battle arena: a microcosm of the business arena with the research advantage of: absence of any incertitude about performance, actors, and what comprises the deployed designs.

The robots deployed in combat are designed with different features of weaponry, engine types and physical dimensions within the scope of the rules specified for the contest. These robots are remote controlled by the respective robotiers or contestant teams in glass boxes perched at a level higher than the arena. A remote controlled *ref-robot* or referee is also there to supervise the combat. *House robots* are present to control the combatants and also to act as potential hazards; these are remote operated by *house robotiers:* the robotiers used by the contest organisers to built and operate these machines. The *house robots* tend to provide an element of uncertainty to the combat environment. They are unpredictable and attack contestants that get too close and scavenge on the ones that are immobilised or in difficult situations.

Pre and post match follow up with teams and *house robotiers* adds to the build up to the combat show which is delivered by the medium of television to the audience. Presenters provide live commentary of the combat and live audience is also present to complete the feel of a *coliseum* show. In addition to recognition based on winning in combat, critical acclaim in the shape of special award nominations are also strived for by contestant teams.

Such nominations are generated by web-based forums e.g. *The Tornado Robot Wars forum on: http://www.teamtornado.co.uk.* That many of these forums are patronised by contest organisers shows the interest they have in this performance assessment mechanism to complement the combat performance of contestant teams. Each forum has its own choice of teams for different nominations, and takes into account the views of contest organisers, show presenters, and also the views of select audience that may choose to participate in such forums. In addition to design features and performance in combat, we also took a count of these nominations across such forums for each contestant team to inform our data.

3.3.2 The Robot Wars Community

Research suggests that diffusion of learning is facilitated by the formation of a community that is held together by shared interests and common goals. *Robot Wars* is characterized by such a structure and learning does not occur in isolation for the contestant teams, it is informed and influenced by performance and opinions related to other teams.

Discussions on battles, design features, and also strategies to combat dominant teams, feature prominently on web-based discussion forums associated with *Robot Wars*. Though, with the end of *Robot Wars* as an ongoing show, there has been a sharp decline in such forums, the records to date provide useful data.

When they were active, these forums were home to community like structures that went beyond just being a 'community of interest', where people interested in *Robot Wars* could share views. The richness of interaction and the participation of contestant team members on such forums suggests that they form a 'community of practice' much along the lines described by Wenger and Snyder (2000).

These forums also provide evidence that in several instances, participants meet outside the virtual world to share technical expertise and knowledge. Archived interviews with several of the regular teams at *Robot Wars* provides a source of information for other teams, especially if the interviewed team was a relatively more successful team, and/or had similar design features.

Beyond interviews with teams, more diverse opinion and analyses can be found on the web forums. We find comment and discussion by a variety of participants such as: contestant team members, technically savvy fans who were not participants in *Robot Wars*, other fans, and sometimes also individuals interested in robotics but not necessarily in *Robot Wars* as an entertainment show. These forums have informed the understanding of the contest environment of *Robot Wars*. However, as they do not cover many of the teams in the contest, their use in informing data on robotic designs of individual teams has thus not been possible. An excerpt from a discussion thread is presented below to illustrate the knowledge sharing that went on in these forums to inform the practice of robotic combat at *Robot Wars.*

[In the discussion: Tornado, Dantomkia and Antweight are names of Robotic designs associated with different teams. In the superscript are names/ pseudonyms/ team affiliations of the discussion participants]

Conan (The Destroyer) Is there any way that *Tornado's* pushing power could be doubled?

Nathan Hi Andrew, sorry I didn't post yesterday, I was a bit ill but i'm okay now! Just how much can the most powerful pusher (Tornado!) push? (weight). ....would you be able to add the disc and fix problems in drive reliability? Also has there been any work on Tornado after the 5th wars? Can you also come to Leverstock Green ...Anthony mailed you the details ...

Suk-hwa Chung (Sukhwa) Conan, *Tornado's* pushing power can be doubled perhaps by replacing the current Bosch GPA's with motors with double the power perhaps?

Andrew Marchant (Tornado) It's difficult - it could only really be done if the weight limit was doubled! More power would help, but that needs bigger batteries, and Tornado already weighs nearly 100kg. If Mike Lambert puts *Dantomkia* in Series 6 then we'll have no chance of winning! So I'd better say that we will do something about the design of the side, yes - for those of you that haven't heard, Mike's robot went through the side of *Tornado*

Ed (Stormguy) Andrew.... *Dantomkia* IS entering Series 6 - go look at the thread entitled *Dantomkia* in the competitors thread. Perhaps you'd better start work on the design of the side ;o)

[Tornado Robot Wars Forum, 2002]

As illustrated, there was an opportunity for different teams to benefit from the debates, arguments and observations to make sense of the performance feedback that characterized a range of contestant teams. This could be used to inform potential design changes for improving one's own machine deployed in combat, and to counter schemes of rival teams. Design features influential in combat performance were highlighted and reflected upon. Free-lance technical suggestions and inputs about what different teams were doing, contributed to the understanding of what mattered as a competitive edge, and what could be done to exploit it for augmenting one's own performance.

3.4 Hypotheses

In *Robot Wars,* each contest series is a strategic experience for contestant teams that engage in 'win or loose' combat events. Evidence about what is critical for performance and what is not accumulates over successive series in *Robot Wars*. The interpretation of this evidence is likely to orient the participating teams in future series to converge towards some design features as critical for performance and thereby focus their experimentation effort to improve these. For instance, if many of the eliminations are based on robots being flipped over, focus may be drawn to reduce ground clearance so that the opposition's flipper weapon cannot get under the machine. Similarly, if the arena hazards cause lot of eliminations, efforts may be focussed at altering the width or length of the machine for reducing the turning radius to avoid such hazards. This assertion of overtime performance leading to behaviour of converging to a few elements within the design envelope gives us the following hypothesis:

Hypothesis 1: Overtime, competitive performance will lead to behaviour that promotes experimentation with a reducing number of design features by the overall set of contestant teams.

The successful contestant teams or teams that win their respective heats can be expected to contribute to the most popular set of design features for adoption in the next series. Though there is only one eventual winner, the idea behind using heat-winners (see figure 3.1) instead is that such adoption is also contingent on how close a design is to one's own design. For example, a team that has a flipper weapon is more likely to adopt features from a successful team that has a similar weapon (but say lower ground clearance) than from the eventual series winner with a battery operated cutting disc, whose features call for too many changes in the base design. Irrespective of the interpretation and subsequent convergence that manifests the overall set of contestant teams, the successful contestant teams in *Robot Wars,* as with successful businesses, may *also* come to repeatedly focus experimentation to hone certain design features that are seen as crucial to performance: 'premium group but herd behaviour all the same!' This gives us the following hypothesis for the teams successful in combat (heat winners) in *Robot Wars*:

Hypothesis 2: Overtime, competitive performance will lead to behaviour that promotes experimentation with a reducing number of design features by contestant teams that are successful in combat.

Our discussion of the literature supports that countering the effects of performance for a convergence to simplicity is key to future performance. The overall set of contestant teams, with the 'also-rans', and the sub-set of winning teams are likely to differ by virtue of how they strike a balance between variety and simplicity in experimentation. If the assertion that sustaining superior performance through simplicity is a fallacy were to hold, then given a superior performance bracket, the heat winners are likely to be characterized by greater experimentation with new design features. These are new in the sense that they are not a repeat of past design features experimented with. This gives us the following hypothesis:

Hypothesis 3: In comparison to the overall set of contestant teams, greater experimentation will characterise teams that are successful in combat.

As discussed, the primary objective of *Robot Wars* is spectator entertainment through an attractive display of robotic designs engaged in combat. The attributes of unpredictability, drama and competitiveness in such combat, are all key to achieving the entertainment objective. At the level of the contestant teams, the competitive environment is likely to support convergence as teams engage in a search based on the performance of robotic designs in the past, for the best possible configuration of design characteristics that is likely to improve combat performance.

This is at odds with the contest objective of entertainment that is fuelled by unpredictability and surprise. Thus, at the level of the contest organisers, there may be propensity to moderate convergence in designs deployed by contestants over successive series. As discussed, in *Robot Wars*, recognition is generated not only for teams whose robotic designs win in combat but also in the form of critical recognition manifested in special award categories like most innovative design, most destructive battle participants, among others. Such an alternative performance assessment deployed through institutional mechanism may influence variety in experimentation.

While the hypotheses enumerated before were based on competitive performance in combat, in our final hypothesis we contextualise the influence of the performance mechanism of critical recognition:

H4: Critical recognition through special award nominations will lead to behaviour that promotes experimentation by the overall set of contestant teams.

3.5 Data and Variables

The data is sourced from archival information present on the *Tectonic Robot Wars* web site: *http://www.tectonic.force9.co.uk/* (Mountjoy, 2001-2003)
The web site has data and information for the first four series (1998-2000) of *Robot Wars.* Other web sites, for instance, the *Robots Rule* web site: *http:// www. btinternet. com/~patricks.web/robots/* (Houghton, 2002-2004), with information on these series and also the subsequent three series have been accessed.

The first four series are used in analysis as the data for the latter three series is characterised by missing information on design for about 38 teams in total. This does not allow us to account for the entire set of participant teams or for all the heat winners for these three series. Given this, we have used data from the first four series in our analysis for this chapter. Changes in rules and in settings of the contest arena over successive series are also available from the aforesaid archival sources and have been found to be relatively consistent over successive series. They have been discussed on several sites and have been crosschecked for the reliability (Amok, 2001-2004, Houghton, 2002-2004, Mountjoy 2001-2004).

The data is provided in the form of design specifications of the robotic design that is associated with each of the contestant teams. The 'consistency in repeated measurements' across source sites supports the reliability of the secondary data used (Carmines and Zeller, 1979). Two adjustments in the data set have been done. The first is that the differences across data sources in terms of measurement units have been converted to a standard. The second adjustment has been required due to data gaps, as in the unavailability of two indicators of design specifications from the ten listed for some of the deployed robotic designs. Given the need for uniformity, only eight of the ten consistently available indicators for design have been used as enumerated in table 3.1. The variables in the table refer to design features or strategic choices made to constitute the design configuration of machines deployed by contestant teams. Evidence from archival data in the form of narratives of contests, web postings and archival interviews has helped to structure and categorise some of the indicators outlined in table 1. Visual evidence (e.g. Mentorn, 2002) of the televised contest-shows themselves has also been referred to for further refining the indicators.

Table 3.1: Design Features: Robotic Designs in Combat

LABEL	DESCRIPTION
D1: Weight	The weight of the machine in Kilograms
D2: Size (Length)	The length of the machine in Centimetres
D3: Size (Width)	The width of the machine in Centimetres
D4: Size (Height)	The height of the machine in Centimetres
D5: Ground Clearance	The ground clearance of the machine in Centimetres
D6: Power Output	The power output in Volts
D7: Type of Engine	The type of power for the engines has been classified into the following four categories: 1. Adapted electric (from example: engines/motors for remote controlled cars and lawn mowers) 2. Basic electric motors compiled for the robot from scratch/unspecified electric motors 3. Petrol engines 4. Industrial engines (mainly diesel engines)
D8: Weapon Type	The weapon type has been classified into the following categories given the classification used across data for each design. 1. Stabbing weapon 2. Crushing weapon 3. Cutting weapon 4. Lifting-flipping weapon 5. Slicing weapons [combine motion-impact and cutting, different to stabbing and drilling as in primarily referring the popular category of discs] 6. Drilling weapons 7. 'Body Ramming' as the main weapon

3.6 Analysis and Results

We use Unpaired T –Test (one way Analysis of Variance) to examine experimentation with design features across successive series in *Robot Wars* to test our hypotheses. The robotic designs of the 'winning teams' or teams that win their respective heats are configured around the eight indicators of design as profiled in table 3.2. *There are six such teams in the series 1, twelve in series 2 and sixteen each in series 3 and series 4,* as per the number of heats in each series.

Table 3.2: Teams in the First Four Series of *Robot Wars*

Series	Number of teams	Number of Heats *(and Heat – Winners)*
Series 1	32	6
Series 2	72	12
Series 3	128	16
Series 4	96	16

Statistically significant variations in design features over 'pairs of series' indicate experimentation. There are three such pairs: series 1- series2, series 2 – series 3, and series 3 – series 4. The results show a reducing number of design features that are subjected to repeat experimentation over successive series (Figure 3.2).

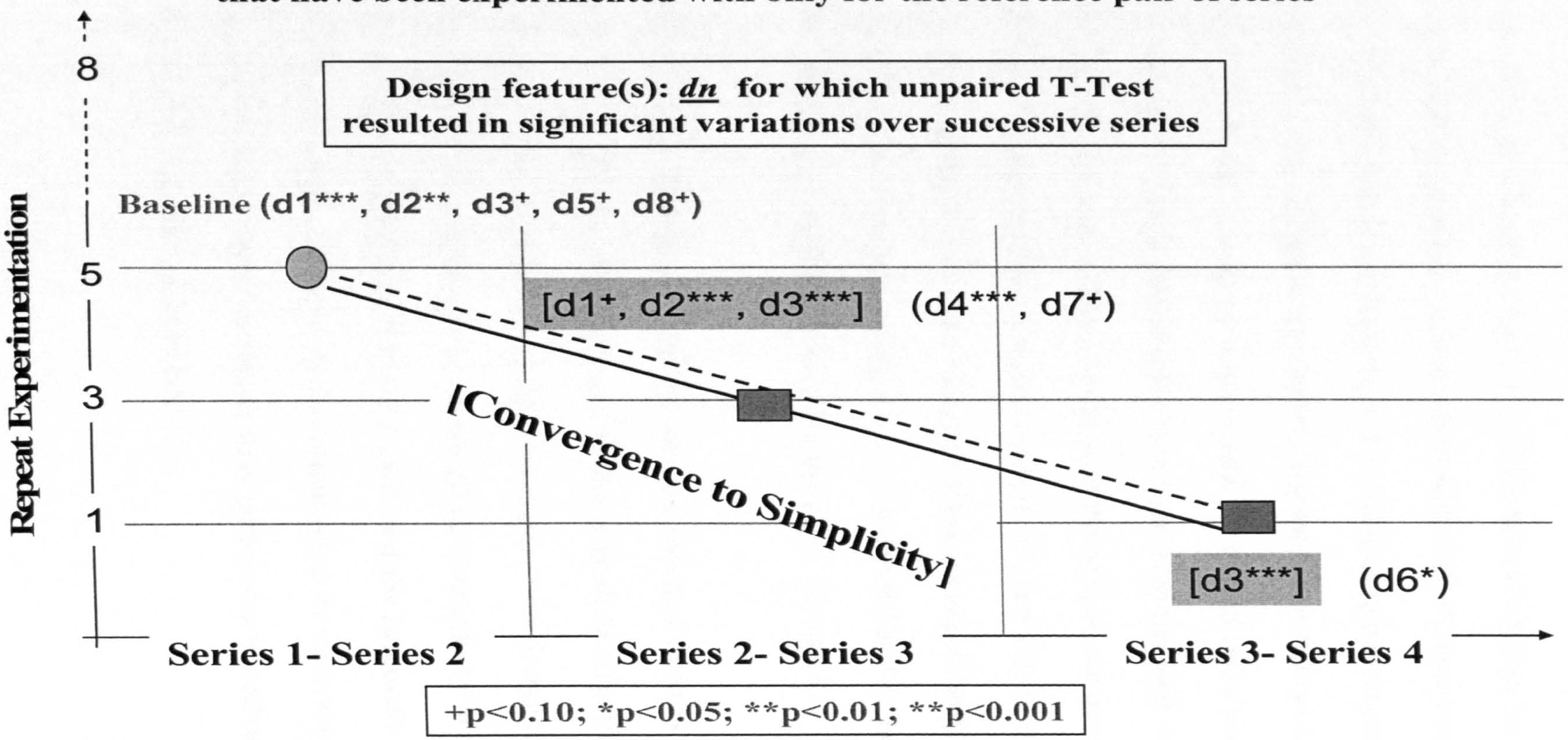
Over Series 1 and 2, which is the baseline comparison, five design features are experimented with (d1, d2, d3, d5, and d8). Of these five, three design features (d1, d2 and d3) are carried forward to the next comparison over series 2 and 3 for experimentation. In this comparison, two new design features (d4 and d6) also inhabit the experimentation space. In the final comparison between series 3 and 4 we find that only one of the design features (d3) is subjected to repeat experimentation and only one new feature (d6) inhabits the experimentation space.

Consistent repeat experimentation with only one feature: the physical specification of width (d3) over the three comparisons could be for a whole host of reasons. For instance, the flip being embedded as the most effective tactic in combat over series, and teams countering it by reducing the width of their machines: streamlined shapes that offer a low cross-section for the flip becoming a pursued standard.

Convergence to d3 as the one design element that is considered worthy of repeat experimentation, and a reducing number of design features being subjected to experimentation over the three comparisons, provides support for hypothesis 1.

Figure 3.2: **Experimentation by 'all the participant teams' in each series**

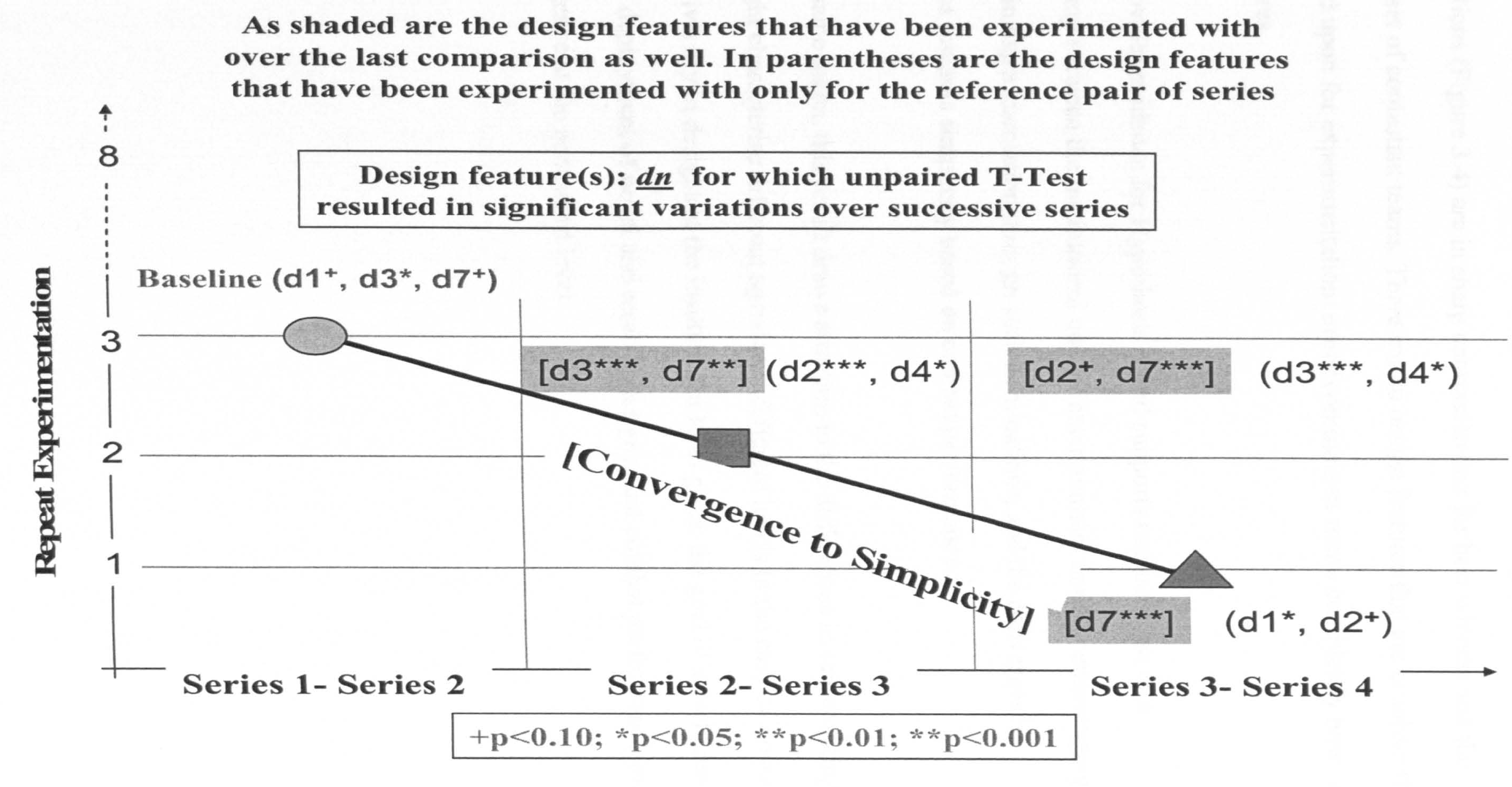
As shaded are the design features that have been experimented with over the last comparison as well. In parentheses are the design features that have been experimented with only for the reference pair of series



Similar comparison using only the heat winners over successive series also shows a convergence. Type of engine (figure 3.3: d7) is the only design feature that is found to have been consistently experimented with over all three comparisons. This provides some support for hypothesis 2 by indicating convergence to repeat experimentation with a single design feature, interpreted as critical to performance. However, in contrast to the results for overall set of participant teams, the number of design features that have been experimented with over time is not declining for the heat winners. In the baseline comparison over series 1 and 2, three design features are experimented with (d1, d3, and d7), in the next comparison over series 2 and 3, four design features are experimented with (d3, d7, d2, and d4) while in the final comparison, over series 3 and 4, the number of design features being experimented with are three (d7, d1, and d2).

Also, in the final comparison for the heat winners, two new features are found to be experimented with, as against only one for the over all set of participant teams. This indicates a relatively higher propensity to explore new design features to experiment with by the heat winners. Convergence to simplicity in the case of the overall set of contestant teams is thus more rapid, and the successful teams characterised by a greater variety in experimentation, or in other words, a greater propensity to resist convergence pressures from performance feedback. These differences provide support for hypothesis 3.

<u>Figure 3.3</u>: Experimentation by the 'heat winning teams' in each series

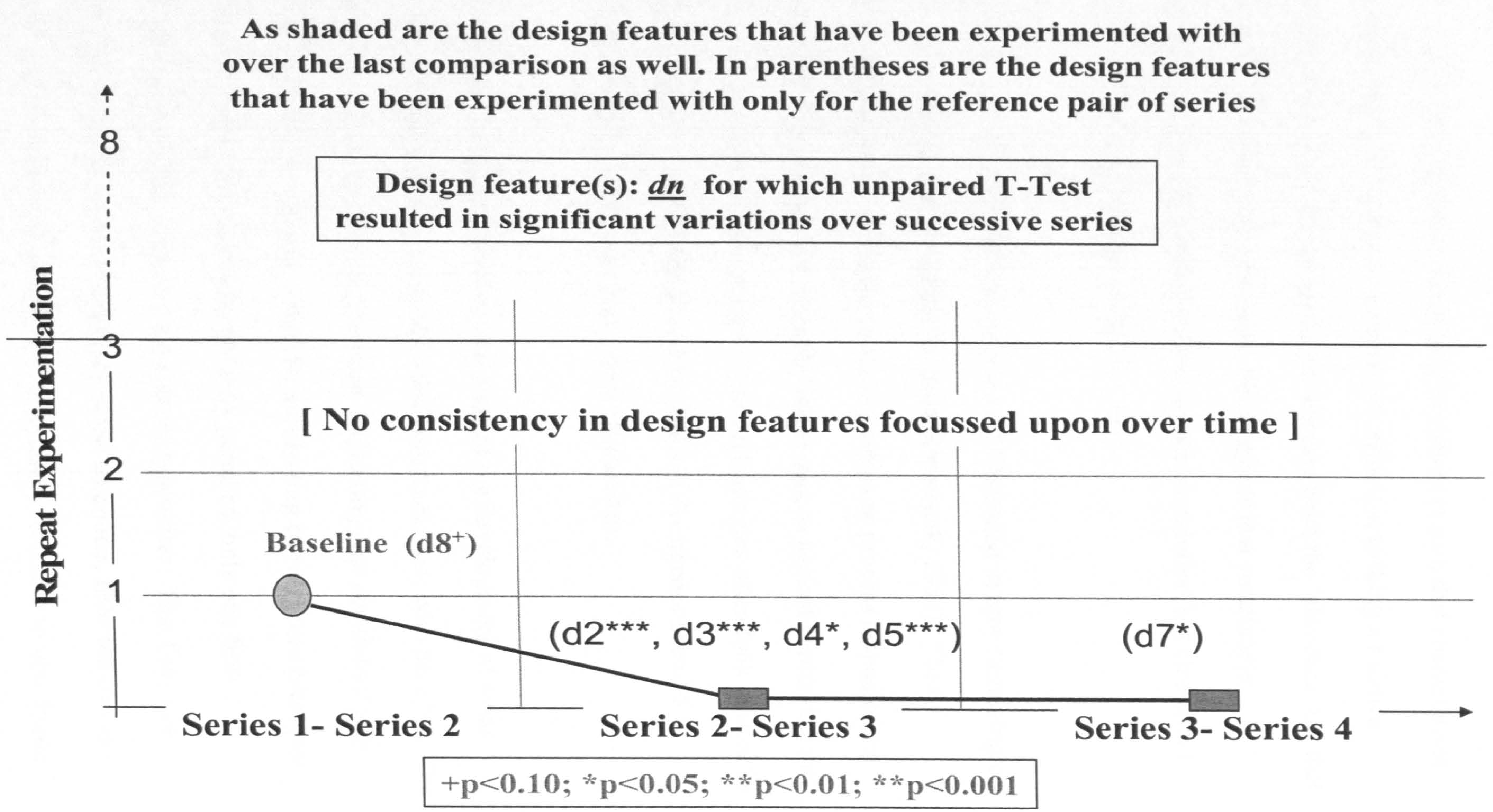


The results for teams with critical recognition as in receiving special award nominations (Figure 3.4) are in sharp contrast to that for heat winners and the overall set of contestant teams. There are no design features that are consistently focussed upon for experimentation: every comparison sees a completely new set of features.

This provides evidence for Hypothesis 4, and supports our assertion of a dichotomy between the institutional goal of entertainment through encouraging variety in experimentation through such nominations, and the convergence pressures towards simplicity based on combat performance.

By the same token, this result draws attention to the differences in sensemaking that might characterise different agendas at different levels in the case of *Robot Wars*: diversity in designs at the institutional level given the goal of entertainment through deployment of novel and creative designs, and combat performance based convergence at the contestant level.

<u>Figure 3.4</u>: Experimentation by 'teams that received special award nominations' in each series



3.7 Discussion

Our results show that convergence to simplicity is a phenomenon that characterises competitive environments. Results also suggest that efforts at striking a balance between simplicity and variety differentiates the winners from the 'also-rans' i.e. that did not perform well in combat. By extension, this suggests that sustainable competitive advantage is not only about exploiting 'past certainties' but also about keeping abreast of 'future possibilities' (March, 1991).

The distinction between winners and also-rans is well illustrated in how technological discontinuities have shaped organisational destinies (Utterback, 1994). These discontinuities are characterised by major shifts in product or process technologies and thus create a tension between protecting the status quo, as against harnessing the potential new technology has to offer. Initially new technologies often look limited in applicability and disruptive in orientation, and the risks of divergence seem to overshadow the potential in exploring new radical alternatives.

For example, a sequence of discontinuities that marked the development of word processing machines clearly distinguished the survivors from those who perished. The former successfully walked the tightrope between 'exploiting past certainties' and 'exploring future possibilities' (March, 1991) by moderating convergence pressures. While many other players in the typewriter industry perished, only one firm successfully moved on from the manual to the electric typewriter. This firm was IBM. As technologies moved on with the advent of the computer, IBM became the dominant player in the mainframe business, still adequately receptive to new frame re-shaping technologies. This allowed it to be more receptive to opportunities offered by new technologies than its peers in a given generation of the word processing business.

However, in the generation that followed, IBM was also rocked by a technology led transition when its response to the arrival of the personal computer was slow. The personal computer shook the mainframe business and also spelled the death of the IBM *Selectrics* typewriters. Eventually feedback from performance over time had managed to push IBM into the convergence trap as well. The belief in past technologies finally arrested its propensity to explore the new arrivals.

This supports our assertion at the onset of this chapter that convergence is a natural consequence of performance feedback. While moderating convergence may lead to better performance, the resulting success usually brings with it a propensity to preserve it, again leading to convergence.

The example also illustrates that performance feedback, especially from seminal events, has tremendous consequences for adaptability. Learning to moderate convergence pressures is key to survival and superior performance in competitive settings.

Competitive performance tends to reaffirm faith in some parts of the strategic configuration and creates doubts about others. For instance, if product quality is rated as excellent but customer feedback shows that the product is not readily available, the interpretation is that while manufacturing is a source of competitive advantage something needs to be done about distribution. In this case, the usual response or the first place to look for solutions is what the competitors are doing, and try to up the game to match their standards, mostly by imitating their modus-operandi subject to relative resourcing strength.

Given over time experience with a strategic configuration, organisations tend to have greater faith in their knowledge about what can make a difference? This could be based on industry standards aspired for, or one's own realised sources of competitive advantage. The focus of efforts to experiment and out do competitors comes down to these selected features of strategic configuration.

The need to challenge established assumptions is frequently ignored given this view that seeks a consistent process, or a system of innovation to deliver sustainable competitive advantage. The degree of effort that is required to do otherwise follows our understanding of why 'double-loop learning' is so difficult (Argyris and Schon, 1978).

The idea of sustainable competitive advantage is at odds with imitation and search from amongst existing strategies. Literature suggests that it is not search and imitation but, learning to create and differentiate that lies at heart of achieving sustainable competitive advantage (Hamel and Prahlad, 1989; Peteraf, 1993). At a deeper level literature also suggests that seeking heterogeneity in causes for given performance is a richer source of learning to improve performance (Miner and Haunschild, 1995; Haunschild, 2002).

In our examination of the phenomenon of simplicity in the case of *Robot Wars* it is worthwhile to mention that *Robot Wars* ceased to be a show in its discussed format after seven series. Given the well positioned conflict for our research interest: that between the institutional agenda to induce variety in experimentation for entertainment, and the combat environment influencing a convergence to simplicity, it might be that simplicity stole the show: *Robot Wars* was probably no longer attractive enough to generate the required television ratings!

In this chapter, the focus has been to examine convergence with reference to performance and design features. The next chapter looks at the robotic designs deployed by contestant teams over time to examine extent of change induced in such designs over successive series. Inertia and aspirations as a function of past performance and experience of contestant teams are seen to interact in moderating convergence. This interplay of the twin forces of inertia and aspirations is thus seen as a manifestation of strategic learning.

Chapter 4

Inertia and Aspirations in Shaping Strategic Learning in Design Contests

4.1 Introduction

This chapter presents a study of strategic learning in the staged and managed competitive environment of the television series *Robot Wars*. We examine the two contrasting attributes of 'inertia' and 'aspirations' that shape strategic learning in such systems as their interaction moderates convergence as a consequence of performance feedback. Both of these attributes rely on past experience and performance.

These two attributes that this chapter proposes as underpinning strategic learning are inherently in opposition. One is 'inertia' that can be understood as the *propensity to entrench the strategic configuration*, or hold on to a configuration over successive generation of strategic events. The second is 'aspirations', and can be understood as the *propensity to experiment with and change the strategic configuration.* We define measures of inertia and aspirations and discuss the impact of both on changes in strategic configurations. These are as manifested in the robotic designs deployed by contestant teams in *Robot Wars* the quasi-experimental settings we examined in the previous chapter to examine convergence as a consequence of performance feedback.

In the research settings of *Robot Wars,* dynamics of rivalry are clearly demarcated into a generational sequence over successive series, and performance is clearly discernable with significant consequences for teams given the outcome of 'win or loose'. We use data on 125 teams that participated in at least two of the seven series of *Robot Wars* to examine the interaction of inertia and aspiration in shaping strategic learning

In the section to follow, we outline a framework of strategic learning based on the premises of inertia and aspiration. This is followed by an elaboration of some key features of the research site that help contextualise the formulation of hypotheses thereafter. Thereafter design changes are examined as an indicator of strategic learning to test the hypotheses formulated in this chapter. Our results from multiple regression analysis show that strategic learning is shaped by an interaction between the opposing forces of inertia and aspirations. We conclude with a discussion of the interaction of behavioural and cognitive explanations of strategic learning

4.2 Propensity to Change Continuum: Inertia and Aspirations

The concept of inertia has found place in discussions on organisational and industry evolution (Hannan and Freeman, 1977, 1984), in discussing the impact of positive feedback in making it difficult to change strategic direction (Wright and Goodwin, 1999; Burgelman, 2002), and in investigating organisational learning (Levinthal, 1997). The specific use of organisational inertia as a disposition that influences the capacity to change is strongly linked to the theory of organisational routines (Cohen and Bacdayan, 1994).

When inertia is the dominant force in organisations, the tendency to change is arrested by the disposition to hold on to the existing configuration. Organisations respond to performance by reinforcing what worked best in the past, rather than exploring alternatives configurations that may lead to even better performance. Put differently, the literature sees an implicit incompatibility between inertia and exploration.

Aspirations on the other hand relate to the tendency of organisations to see a given strategic configuration as the basis for experimentation and further improvement. Unlike inertia which is strongly behavioural in orientation, aspirations are more cognition based. The relationship between aspirations and performance, and by implication, the mismatch between aspirations and performance, is often seen as crucial for superior performance (Starbuck, 1963; Cyert and March, 1963; Levinthal and March 1981). Aspirations have been used to inform the propensity to take risks (March and Shapira, 1992) and to reflect on organisational change (Greve, 1988). Thus, in contrast to inertia, aspirations are seen as compatible with exploration.

In the case of inertia the learning focuses on current routines and practices, and more generally on the effectiveness of the current configuration that has emerged over time. On the other hand, aspirations stem from short-term experiences that trigger exploration for changing existing ways of operating and decision making and thus tend to inhibit the propensity to converge. As in the case of inertia, aspirations are also strongly self-referential: individuals and organisations use their own past performance as a basis for adjusting or further developing their aspirations. However, unlike inertia which is overwhelmingly self-referential, research suggests that aspirations may also be strongly influenced by comparisons to other reference individuals or reference groups. Individuals and organisations often condition their aspirations as a function of rivals, competitors, or the industry group to which they belong (Fiegenbaum and Thomas, 1995). Thus, when it comes to aspirations we can make a distinction between self-aspirations and competitive-aspirations. Self-aspirations are shaped by using one's own past performance as a benchmark for setting aspirations, while competitive-aspirations are shaped by benchmarking the performance of rivals against one's own performance.

4.3 The Contest Environment of Robot Wars

In the earlier chapter we introduced *Robot Wars* as a tournament-style competition. Here we present some key features of the contest to contextualise our formulation of hypotheses and variables in the sections to follow. As discussed, the teams and their respective robotic designs, progress through multiple stages that comprise several combat-shows to the final where the series winner is decided. Each contestant team can be regarded as a learning unit, and each series is therefore considered as a learning episode. The goal of *Robot Wars* is to provide spectator entertainment by encouraging novel and nascent robotic designs in combat. We also know from the discussion in the previous chapter that each *Robot Wars* contest series is arranged in stages. Each stage is made up of one or several battles, where contestant teams pit their designs against each other. Losing a battle in the contest results in elimination from the contest, with the winner advancing to the next stage in the competition.

The number of participant teams varies over successive series of the contest and therefore, so do the number of battles that are featured in different series. For consistency in comparison of performance each series has been divided into four progressive stages. The final stage or fourth stage is the series final where the eventual series winner is decided. Appendix A presents the charts for progression in each of the seven series of *Robot Wars*. The contest takes place under clearly formulated rules. The rules have been codified by contest organisers with the assistance of experienced robotiers. These rules govern design specifications and competition as follows:

- Specifications within which the designs are to be created, for example thresholds of physical dimensions and weight.
- Specifications that regulate engine power, type, and types of weaponry that are allowed or prohibited, for example *flame throwers* and weapons that shatter are not allowed.
- Specifications of the arena in which the combat takes place. This includes *arena* dimensions and placement of hazards.
- Rules of combat such as criteria for scoring points and time limit for a combat.

The robotic combat takes place in an enclosed arena. The arena has special features that presents hazards but also creates tactical options for the contestants. Matches are frequently decided by a knock-out that is sometimes caused by damage sustained during combat, and at other times is a result of a major malfunction such as engine failure. The contest rules do not allow teams to make changes to the design during a series itself, apart from repairs that may be required to address damage sustained in combat that are necessary for a design's operability in the next stage of the contest series. There is a time limit for the duration of the combat. If there is no clear cut outcome at the end of this set time, judges comprising mainly of experienced robotiers, decide the winner based on criteria of attacks made and damage delivered.

The robots deployed in combat are designed with different features of weaponry, engine power, and physical dimensions within the scope of the rules specified for each contest series. They are remotely controlled by the respective robotiers who operate in glass boxes perched at a level higher than the arena. A remote controlled ref-robot, or referee, is also there to supervise the combat. The house robots, remote operated by house robotiers or robot, are positioned at the ends of the combat arena. They have a dual role: to intervene and control combat when necessary, and to make the contest more interesting by creating hazards for the contestants. House robots therefore attack battling robots when they stray too close to the ends of the arena, or when they fail to follow the instructions of the *ref-robot.*

Performance in *Robot Wars* is judged by the performance of a contestant team's robotic design. This is understood as success in combat by the deployed design, and is manifested in the progress a team makes during a contest series. There is a cash prize associated with winning in combat and progressing in the contest series.

In addition to competitive performance, another measure of performance is the popularity of the competing teams or 'popular appeal', as measured by the number of special award nominations a team receives in a contest series.

Unlike competitive performance which is objectively determined from the outcome of combat in *Robot Wars*, such nominations are generated by web-based forums that we outlined in the previous chapter. Each forum has its own choice of teams for different nominations, and most take into account the views of contest organisers, show presenters, and also the views of select audience that may choose to participate in such forums.

Special award nominations are given for different categories. Some of these categories deal with performance during the contest. These may be regarded as 'operational' in the sense that they are recognition for expertise in the use of the robots. Other categories, however, are granted for the quality and features of the design. Because design change is our strategic variable we confined our data to these alone. These categories include the following:

- Nominations for the Most Original Design: Given to teams that introduce innovative design elements to the contest like a new armour, a new type of weapon (e.g. *flipper, hammer, cutting disc* etc), or say an attractive physical shape within the size specifications of the rules.
- Nominations for the Best Weapon: Given to robotic designs with the most effective /damage-causing weapon.

4.4 Hypotheses

Strategic learning in Robot Wars takes place against the background of accumulated experience over successive generations, or series of the contest. Though nearly half the teams in the sample participated in only two contest series, and only about one fifth of the teams participated in more than three contest series, *Robot Wars* constitutes a community in which ideas are shared and learning is collective as well as individual.

Because participants in *Robot Wars* are prohibited from making design changes during the series, they can only put this learning to use in the aftermath of one series, and prior to the next. Changes made to the design in function of these learning have all the hallmarks of strategic decisions: they require major investment of resources, and are difficult to reverse once the design is put into action. From a methodological point of view they have the added advantage of being openly declared, verified, and thus easy to observe.

Design changes that are implemented in contest series $N+1$ are the product of competitive experience in the previous series N. Decisions to change design in the aftermath of series N are influenced by competitive performance in that series. The accepted indicator of competitive performance is how far the team reached in series N. This may either be the stage at which it was eliminated, or if it won the series, the total number of contests. Thus, if strategic learning is influenced by self-aspiration, we would expect teams to change designs in $N+1$ in line with their own competitive performance in series N. This gives us the following hypothesis:

Hypothesis 1: With generational experience as a baseline, strategic learning by individual teams will be influenced by self-aspirations as measured by competitive performance in last series.

The interpretation of competitive performance is comprised not only of the team's own performance but also of the benchmarking of this performance to that of its competitors, especially those whose performance had a direct impact on their own performance. Consistent with the aspiration as a driving force, we would expect teams to benchmark their performance against direct rivals to which they lost in the previous series. Inevitably, the better these competitors perform in series *N*, the more this performance is likely to influence aspirations and hence design change decisions in series *N+1*. This gives us the following hypothesis:

Hypothesis 2: With generational experience as a baseline, strategic learning by individual teams will be influenced by competitive-aspirations derived from the performance of their direct competitors in the last series.

Teams are influenced by past experience in two ways. First, they are influenced by the cumulative historical experience generated by the contests. Second, teams learn directly from their own recent experience with special emphasis on the last contest in which they participated. Longer contest participation and superior performance are likely to increase inertial tendency, which in turn reduces the incentives to change design. By contrast, a shorter experience horizon and poorer performance is likely to encourage experimentation and lead to greater willingness to engage in radical change. This gives us the following hypothesis:

Hypothesis 3: With generational experience as a baseline, strategic learning by individual teams will be influenced by inertia as measured by the number of series and competitive performance in these series.

As we noted earlier, the pervasive assumption in organisational research is that inertia and aspirations operate in opposite direction. In the present context, this means that we may expect the impact of strategic learning on design decisions in series *N+1* will be a product of an interaction between inertia and aspirations in series *N*. This gives us the following hypothesis:

Hypothesis 4: With generational experience as a baseline, strategic learning by individual teams will be influenced by a negative interaction between inertia and aspirations.

Finally, in addition to competitive performance as determined in the arena, team performance is also evaluated by the audience. Popular appeal indicated by special award nominations in series *N* is therefore an alternative measure of performance. Teams may be influenced by the potential economic benefits that may result from popular appeal, or may be simply motivated by the intrinsic rewards that come with recognition. Popular appeal may therefore influence strategic learning and thus have an impact on design changes. This gives us the hypothesis:

Hypothesis 5: With generational experience as a baseline, strategic learning by individual teams will be influenced by popular appeal of a contestant team.

4.5 Data and Variables

4.5.1 Data

In this chapter our analysis is based in the main on a purposive sample of 125 contestant teams from a population of 389 teams in *Robot Wars* over the seven contest series. The sampling includes all teams that participated in more than one of the seven contest series. Each successive series, before and after, in which contestant team participated is one observation. The total number of such observations that inform our analyses is 191.

Fourteen teams that meet the criteria of participation and continuity have been excluded due to missing data on the specifications of the robotic design, and a further four have been excluded due to drastic reshaping of the contestant teams that created doubts about continuity of the design. Appendix A presents the charts for progression in each of the seven series of *Robot Wars.*

As mentioned in the preceding chapter, archival data over seven successive series of the *Robot Wars* contest and spanning five years, from 1998 to 2003, are available from web-based and archival sources like *Tectonic Robot Wars* web site: *http://www.tectonic.force9.co.uk, and Robots Rule* web site: *http:// www. btinternet. com/~patricks.web/robots.* The data is provided in the form of design specifications of the robotic design that is associated with each of the contestant teams. The narrative of the battles is also provided for each team's robotic design and further qualitative data on reactions and comments of the contestant teams and show presenters is available from archival audio-visual sources.

4.5.2 Variables and Measures

4.5.2.1 Dependent Variable: Strategic learning measured on the basis of *Design Change*

DC_{n+1}: Design change in series *'N+1'* as an indicator of strategic learning represents the dependent variable for this study. As discussed, this refers to the changes in design made in aftermath of a contest series. Our coding of design change here is based on combing change in different design features for a perspective on the overall scope and extent of change in the robotic design, or strategic configuration

Design Change (*DC*) has been coded from 1 to 4, according to increasing magnitude of change in the design configuration as follows:

- DC=1: Design change in physical specifications only. This refers to changes in the physical dimensions and weight of the deployed design.
- DC=2: Design change only in functional specifications, or specifications of design that are cited in relation to combat performance in narratives of the contest. Examples of these are ground clearance, weapon, and engine power.
- DC=3: Design change where both physical and functional specifications change but the changes are closely interrelated. For example, the team changes the weapon (functional feature) of its deployed design from a flipper to a hammer, but the change in associated height (physical feature) of the design is largely attributable to this change of weapon.

- DC=4: Design change where both physical and functional specifications change but the changes are unrelated. To illustrate, we can again take the example of a team that changes the weapon (functional feature) of its deployed design from a flipper to a hammer. Though the change in associated height (physical feature) of the design in this case is largely attributable change in weapon, we find that the deployed design is also characterised by a changes in its length and width (physical features), which is not due to the change in weapon.

4.5.2.2 Control Variable: Contest Generation

Each successive contest series can be seen as a generation that brings with it a pool of accumulated experiences from participation in previous series or contest generations. We code this history of generations as Contest Generation *(Gn)*. Contest generation is coded as '1' for the succession from series 1-series 2, '2' for series 2-series 3 and so on, until 6 for the succession from series 6- series 7. Thus, a team that is represented by '2' in this coding schema has participated in series1, series2 and series 3. Similarly, a team that is represented by '6' has a longest heredity chain, having participated in all seven series.

4.5.2.3 Independent Variables

We use two different types of performance measures to operationalise our independent variables: competitive performance as determined by combat and performance by popular appeal measured by nominations received.

Competitive performance has been coded as '1' if the team exits from the first stage of the contest series; '2' if the team progresses to subsequent rounds but does not reach the semi-finals; '3' if the team reaches the semi-finals but is not the eventual series winner, and finally 4 if the team wins the series.

In what follows we discuss our aspirations and inertia measures. As we discus below, we distinguish between three types of aspirations. The first, *self-aspiration,* is defined with respect to the team's own past competitive performance. The second, *competitive-aspiration,* is based on comparison with the rival the team lost to, resulting in the team's elimination from the contest series. The third is aspiration that results from popular appeal of a contestant team in a contest series. Our *inertia* measure, by contrast, combines competitive performance and past participation experience.

Self-aspirations by competitive performance from series N: (SA)

Self-aspirations imply shaping future orientation to design change based on a contestant team's own performance. Contestant teams try to achieve higher competitive performance in the next series. At a minimum this suggests achieving a well-defined incremental improvement in the next opportunity. In the setting of 'Robot Wars' this can be equated to going one stage further in N+1 series relative to the stage reached in series N.

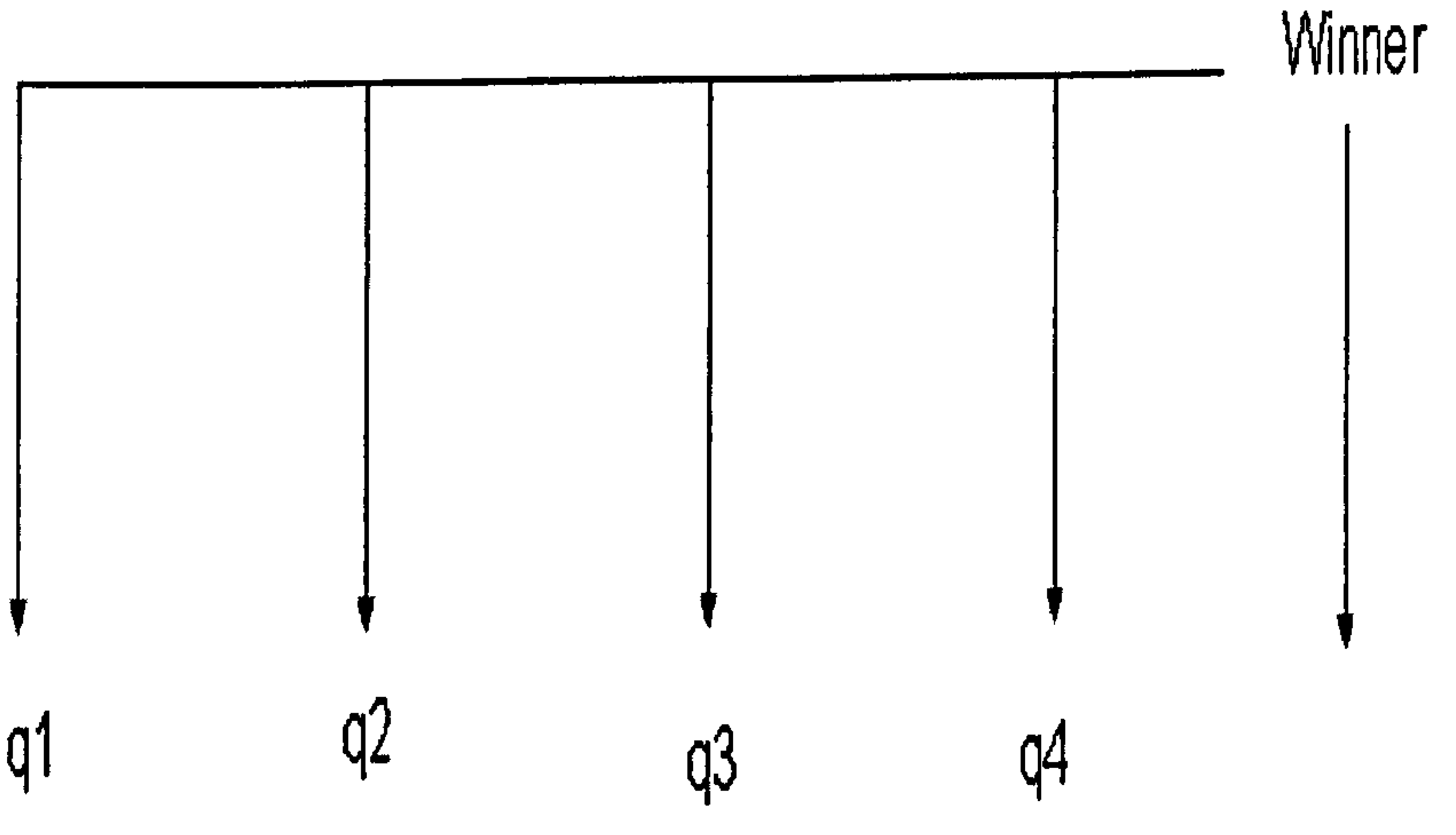
To calculate aspirations based on prior performance we used *Laplace's law of succession* (Howson and Urbach, 1988; Hsu and Knoblock, 1995). *Laplace's law of succession* applies to processes which are history dependent, especially where there is a relatively short history on which to base future expectations. For example, if a researcher conducts an experiment with two possible outcomes, A or B, and obtains A, *Laplace's law of succession* can be used to calculate the expectation that she will obtain A the next time the experiment is carried out.

In the context of *Robot Wars* we used *Laplace's law of succession* to calculate the expectations of teams based on prior contest experience. As can be recalled, each stage in contest series can have two possible outcomes: win or lose, with a loss resulting in elimination from the series. Each team is either eliminated in stage n of the series (n=1 to 4), or it emerges as the overall winner of the series at n=4. *Laplace's law of succession* can be used to calculate the expectations that a team eliminated at stage n of the series can avoid elimination at the same stage 'n' in the following series, thus minimally reaching the 'n+1' stage in the succeeding series. More generally, if a team has been in 'n' stages in a previous series, and has won through 'r' stages, we take the expectations that it will win in stage 'n' and reach stage 'n+1' to be: $E(r)= (r+1)/(n+k)$, *where* $k=2$ *(i.e. win/lose)* (see Figure 4.1).

Figure 4.1: Self-aspirations Calculations

'n' is the stage reached in a given contest series
'r' is the number of stages the team has won through to progress in the given contest series (=n for the series winner and, < n for all other teams in the series)
'E(r)' is the expectation of winning stage 'n' in the *next* contest series for a team eliminated at stage 'n' in the given series (expectation of winning the next series in the case of the series winner)

$$E(r) = (r+1)/(n+k) \quad \text{where } k=2$$



n	1	2	3	4	4
r	0	1	2	3	4
E(r)	**1/3**	**1/2**	**3/5**	**2/3**	**5/6**

Competitive-aspirations by competitive performance from series N: (CA)

Competitive-aspirations are based on the overall performance of a rival, to which a team lost, leading to elimination, as a reference point for forming aspirations when getting ready for the next series. We use Laplace's law of succession (essentially as in self-aspiration), but this time we calculate aspiration levels of the rival relative to the aspiration level of the contestant team.

The greater the gap between the reference team's performance and the rival's performance the greater will be the competitive-aspirations of the reference contestant team and is measured as: For example, if team *A* loses to team *B* in stage '1' of a contest series *N* and team *B* proceeds in the series to be eventually win the series competitive-aspirations for team *A* as from figure 2 will be given by: $CA_{nA} = [(5/6) / (1/3)] = 2.5$. On the other hand if team *B* was to be eliminated in stage '4' of the contest series the competitive-aspirations for team *A* will be: $CA_{nA} = [(2/3)/(1/3)] = 2$. Competitive-aspirations in the first case is greater than competitive-aspirations in the second, which is consistent with our argument that the greater the gap between the winner and the loser in terms of competitive performance in a contest series, the higher is the losing team's competitive aspiration.

Aspirations by Popular Appeal from series N: (PA)

Achievement in a contest series is also seen as popularity of a contestant team in the contest series. This performance indicator of popular appeal is seen as a function of the count of special award nominations received, and of the stage reached by the team in a contest series. This is because in addition to nominations, popular appeal is also a function of the visibility of a contestant team in the overall population of teams that participate in a contest series. Given the elimination structure of *Robot Wars*, contestant teams that survive, end up in more shows. Consequently, these stand out by way of being in a progressively smaller set of teams as the contest progresses.

We code the variable of popular appeal as a product of stage reached in a given contest series and the number of nominations received in that series. For example, if team *A* reaches stage '2' of the contest series and the count of nominations received by this team is '3', the popular appeal score for the team will be: *[2*3=6]*. On the other hand, if another team *B* reaches stage '3' of the same contest series and receives the same number of popular appeal nominations the popular appeal score for the team will be *[3*3=9]*. Though the number of nominations received by both teams in the contest series are equal, team *B*'s popular appeal is higher by the factor of its greater visibility. In the aftermath of the contest series team *B* is likely to be characterised by relatively greater acclaim for the attractiveness and novelty of its design. We use standardised scores in our analysis and base the standardisation on the maximum achievable score.

Inertia (IN)

As we discussed earlier, in contrast with aspirations, inertia is overwhelmingly self referential. The impact of inertia on strategic learning is to reduce willingness or ability to experiment and innovate with new designs. As teams fine-tune their operating skills - for example, as they master the remote driving skills of a design with particular physical dimensions and engine power - they are reluctant to alter the basic design, especially if it is associated with strong performance.

We code inertia as a product of direct experience, or number of series participated in by a contestant team (till stage *N*), and the performance of the deployed design, or the stage it reaches in the contest series *N*. For example, if a contestant team *A* has participated in '3' contest series, and has an average competitive performance in terms of stages reached over the series of '2' the inertia score for the team will be: *[2*3=6]*. Similarly another team *B* having lesser participation experience say of '2', contest series and the same average score will have an inertia score of *[2*2=4]*. The inertia score of team *B* is less than team *A* which is consistent with our argument. Similarly with same level of participation experience of two teams, the greater average competitive performance for one team will give a higher score for inertia for that team. We use standardised scores in our analysis and base the standardisation on the maximum achievable score.

4.6 Analysis and Results

We use correlations and multiple regression analysis to test the hypotheses. To begin with, simultaneous regression was done for the control variable and the main effects. This was then expanded hierarchically by including the interaction effects to yield the full model.

Table 4.1 provides summary statistics for all the variables included in this study. The generational experience is significantly correlated with most of the variables. There is a significant correlation between design change which is the indicator of strategic learning, and competitive-aspirations by competitive performance. This indicates that changes in design are associated with aspirations informed by past competitive performance, and relative achievement of the competitors. Correlation between design change and inertia is also significant indicating an association between design change and inertia based on past performance and participation experience.

Table 4. 1: Descriptive Statistics and Pearson Correlations

			Pearson Correlations					
Variables	**Mean**	**StdDev**	DC(n+1)	Gn	SA(n)	CA(n)	IN(n)	PA(n)
Design Change: DC(n+1)	2.23	0.99	1.00					
Generation: Gn	3.86	1.53	**-0.20**	1.00				
Self-aspirations: SA	0.48	0.13	-0.11	-0.08	1.00			
Competitive-aspirations: CA	1.46	0.35	**0.20**	**0.18**	**-0.44**	1.00		
Inertia: IN	0.23	0.13	**-0.17**	**0.37**	**0.30**	**-0.18**	1.00	
Aspirations by Popular Appeal: PA	0.29	0.47	-0.10	-0.08	**0.22**	**-0.13**	-0.04	1.00

[a] *Correlations at 0.12 or higher are significant at the 0.05 level*
Sample size: 191.

Regression results in table 4. 2 provide some support for Hypothesis 1. Self-aspirations that are based on competitive performance encourage design changes in interaction with competitive-aspirations by competitive performance (table 4.2: model 3). Competitive-aspirations by competitive performance are the dominant predictor of design changes among the main effects (table 4. 2: model 1) providing considerable support for Hypothesis 2. These results suggest that self-aspirations have less impact on the propensity to change design than competitive-aspirations. In the case of competitive-aspirations teams often use more successful rivals as a reference, and this in turn promotes more radical design change. In absence of a competitive reference, teams are likely to modify designs only incrementally. This will be typical of an inertial tendency shown by say the winner of a series that does not have a competitive reference (rival it lost to!) though its self-aspiration is very high as it seeks to replicate its success in competitive performance in this series for the next series.

The baseline variable of generational experience is shown to inhibit design changes in all models reported in table 4.2. This is an indication that over time such experience allows teams to isolate features that work well in the contest environment and changes become increasingly focussed on a lesser set of design characteristics. This result is also a validation of our results from the preceding chapter where we found evidence for convergence to simplicity in experimentation.

We find considerable support for hypothesis 3 that against the baseline of generational experience inertia influences design changes. We argued that inertia may not necessarily inhibit design changes but may work to reduce the scope of such changes.

Our results show that inertia encourages design changes (table 4.2: model 4 to model 7) possibly by informing teams of what works and what does not when they make choices about altering design characteristics.

Inertia interacts negatively with self-aspirations (table 4.2: model 4) and with competitive-aspirations (table 4.2: model 4 to Model 7) providing substantial evidence for Hypothesis 4. Inertia works to moderate aspirations, thereby reducing the scope of design changes given past competitive performance and experience of contestant teams'. It tends to support the propensity to reduce scope, narrowing down to fewer incremental changes rather than radical changes that can address aspired performance in the future.

We do not find support for Hypothesis 5; aspirations by popular appeal do not seem to affect design change. However, there is a significant negative interaction between aspirations induced by popular appeal and inertia (table 4.2: model 5 to model 7) that influence design change. In conjunction with the evidence on reduction in design changes over successive generations of the contest series discussed earlier, this result provides for an interesting perspective on the role of popular appeal nomination in *Robot Wars*: Given that the objective of *Robot Wars* as a game show is to provide entertainment through deployment of novel and attractive designs in combat, and that novelty is likely to be reduced as changes and experimentation decreases, popular appeal through special award nominations may be an institutional mechanism implemented to encourage experimentation and produce greater diversity in designs.

Table 4. 2: Results of Regression Analysis [b]: Explaining the influences on Design Change in Contest Series (n+1)

	Model 1	Model 2	Model 3	Model 4	Model5	Model 6	Model 7
Generation: Gn	**-0.16****	**-0.16****	**-0.15****	**-0.16****	**-0.16****	**-0.16****	**-0.16****
(CONTROL)	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*
Self-aspirations: SA	-0.03	-1.65	-2.99	0.24	-0.95	-1.27	-1.04
	(0.65)	*(1.56)*	*(1.87)*	*(2.37)*	*(2.43)*	*(2.50)*	*(3.02)*
Competitive-aspirations: CA	**0.65****	-0.022	0.16	0.69	0.74	-0.67	-0.75
	(0.22)	*(0.63)*	*(0.64)*	*(0.68)*	*(0.68)*	*(0.69)*	*(0.89)*
Inertia: IN	-0.32	-0.27	3.52	**12.58***	**11.44***	**11.54***	**11.63***
	(0.63)	*(0.15)*	*(3.02)*	*(5.11)*	*(5.11)*	*(5.12)*	*(5.18)*
Aspirations by Popular Appeal: PA	-0.19	-0.19	-0.17	-0.17	0.19	-0.75	-0.88
	(0.15)	*(0.98)*	*(0.15)*	*(0.14)*	*(0.24)*	*(1.72)*	*(1.97)*
SA*CA		1.12	**2.02**$^{+}$	1.56	1.68	1.78	1.58
		(2.05)	*(1.20)*	*(1.21)*	*(1.20)*	*(1.22)*	*(1.96)*
CA*IN			-2.63	**-3.99**$^{+}$	**-4.37***	**-4.24***	**-4.34**$^{+}$
			(1.82)	*(1.9)*	*(2.12)*	*(2.13)*	*(2.26)*
SA*IN				**-12.70***	-7.11	-7.80	-7.68
				(5.9)	*(6.43)*	*(6.56)*	*(6.64)*
IN*PA					**-3.76***	**-3.44**$^{+}$	**-3.47**$^{+}$
					(1.93)	*(2.01)*	*(2.03)*
PA*SA						1.46	1.21
						(2.63)	*(3.25)*
PA*CA							0.35
							(2.64)
R^2	**0.11**	**0.12**	**0.13**	**0.15**	**0.17**	**0.17**	**0.17**
Change in R^2		0.01	0.01	0.02	0.02	0.001	0.0002
Adjusted R^2	**0.07**	**0.07**	**0.09**	**0.10**	**0.11**	**0.12**	**0.12**
Model F	**4.80****	**4.22****	**3.86****	**4.05****	**4.07****	**3.68****	**3.33****

[b] *Regression coefficients and standard errors (in parentheses) are reported in that order. Sample size: 191*

+ p <0.10, * p <0.05, ** p <0.01

4.7 Discussion

Our results suggest that the combined effects of past experience and past performance will encourage inertia: teams with longer experience and better performance are more likely to avoid major design change. Aspirations, in particular competitive-aspirations, had the opposite impact: encouraging design change. The interplay of these two forces clearly moderates convergence. While inertia by itself supports convergence, aspirations counter inertial tendencies by drawing attention to what can be achieved by change.

The gap between the rank achieved by a team, and the rank achieved by the competitor to whom it lost in the previous series, forms the basis of competitive-aspirations. Consequently, the higher is the team's own performance relative to rivals, the less design changes it will implement. At the same time, the greater the gap between a team's own performance and the performance of its victorious rival, the higher is the competitive reference to which it will aspire.

We also examined popularity of a team's design; based on the special award nominations it gets - in effect this may be regarded as 'critical acclaim' for a design much as one has critical acclaim in artistic performances (Eliashberg and Shugan, 1997). Popularity seems to reduce the inertial tendency of contestant teams. Our observation of the contest environment suggests that this opposition may have been induced by the performance mechanism of popular appeal due to a potential conflict between the contest goal of entertainment which is best served by encouraging design diversity. This also provides a partial perspective on interpretation of causality by engaging the idea of multiple rationales for performance assessment or rationales that guide reasons behind realised performance: combat performance and popular appeal.

The framework of inertia and aspiration provides a novel perspective to research in the area of strategic learning. The interplay of these two premises as the tension between behavioural and cognitive explanations for strategic learning also reflects on the interface between the dominant logics in organisational literature, that of ecology and strategy, the former favouring inert organisations, and the latter favouring flexibility and change (Baum et al., 2006). More importantly, this interplay shapes organisational sensemaking for generating actionable feedback to moderate convergence pressures that performance brings with it.

In the next chapter we examine Hollywood movie-sequels in the conventional industry settings of motion pictures. This is to provide external validity to our empirical model that posits interaction between inertia and aspirations as shaping strategic learning by moderating convergence in light of past performance and over time experience. In the quasi-experimental settings of *Robot Wars*, robotic designs deployed by teams are proxies for organisational strategic configurations: an analogy that has been frequented in research examining organisational learning (e.g. Senge, 1990; O'Brien and Buono, 1996; Ellerman, 1999; Edmondson, 1999).

We continue using this analogy in the following chapter, where we examine strategic learning in the non-experimental settings of sequential project systems of movie sequels. However, in comparison to *Robot Wars* they have much nuanced distinction between the team, and the design it deploys as a movie in the competitive arena viz. the market. This is an example of the influence of distinguishing characteristics that one is likely to encounter in real world business settings. Though in the next chapter we transcend from quasi-experimental settings to probably the other extreme, non-experimental settings of a creative industry, we keep our examination focussed on providing external validity to the model of strategic learning that emerged in this chapter.

Chapter 5

Learning from Strategic Experiences in Sequential Project Systems: The Case of Hollywood Movie Sequels

5.1 Introduction

In the previous chapter, we have modelled design changes as a function of performance based inertia and aspirations in the quasi experimental settings of *Robot Wars*. This we posit to be a manifestation of strategic learning, or learning shaped by interplay between inertia and aspirations to moderate convergence. In this chapter we examine the sequential project system of 'movie sequels' to provide external validity to the strategic learning model that emerged from the previous chapter. We examine consecution of learning over successive movies – each movie being subject to actions stemming from performance feedback of the previous movies that characterise a lineage of sequels. Strategic learning is shaped by the interplay of inertia and aspirations that affect changes in a movie's key design elements. These design choices relate to the movie's plot, and characters that enact the plot.

We first contextualise theoretical underpinnings to our examination of strategic learning in Hollywood movie sequels with theatrical release in the United States over the period 1960-2005. This is followed by a perspective on how movie sequels are shaped. After this, we develop hypotheses and provide an elaboration on the measures and analysis used to test the hypotheses. The penultimate section of this chapter discusses the results from analysis, and the chapter closes by a discussion on the implications of our findings.

5.2 Strategic Learning in Movie Sequels

A movie sequel can be understood as a work of fiction in film, that is produced after a completed work, and is set in the same universe but at a later time. It usually continues the elements of the first story, often with the same characters, although this is not always the case.

The latter part of this conceptualisation refers to a movie series or franchise that is a weaker form of a sequel in terms of continuation of the narrative. In the empirical study presented in this chapter we account for this aspect by controlling for the number of movies in a sequel-series and the time difference between successive movies. Furthermore, all 'sequelogies' (Sequelogue, 2005) are step-built i.e. the number of movies are not pre-planned nor shot before the release of the predecessor. This is a crucial distinction of 'sequels' from the conventional understanding of a 'series' like television soaps.

We have discussed that strategic learning as a process of knowledge formation enhances the ability of organisations to effectively foreshadow and manage future events. This is by moderating convergence from performance feedback to strike a balance between convergence and exploration to modify the strategic configuration. We have also asserted that the interpretation of experience and the actions such interpretation may lead to is both behavioural and cognitive in orientation. As discussed earlier in this dissertation, we postulate that interpretation of strategic experiences and their subsequent impact is shaped by two forces that capture these. The first is inertia, understood as the propensity to entrench or hold on to the same strategic configuration over time (Hannan and Freeman, 1977; Greve, 1988; Levinthal, 1997). The second is aspirations understood as the propensity to experiment with and change the strategic configuration (Starbuck, 1963; Cyert and March, 1963; Levinthal and March 1981; Haunschild and Sullivan, 2002).

Inertia and aspirations can be seen as specific manifestations of the enactment of strategic learning and realised changes in the strategic configuration are an indicator of strategic learning. We have argued that literature sees an inherent opposition between inertia and aspirations. In general, aspiration may be seen to describe a 'change prone' future orientation of individuals and organisations while inertia can be seen as working to reduce the scope of change, or ascribe to a 'retention prone' future orientation. The level of aspirations, unlike inertia, is less ingrained in over time emergence of rules, routines and practices. It is more fickle and is arguably a function of short-term performance.

For instance, a good box office performance of a sequel may conjecture an action to make minimal changes in a successful design that has emerged over time. Alternatively, it may provide the necessary confidence to risk alterations in design features in the expectation to improve performance even further in the next sequel. Further, an exceptional performance of another movie that rivalled a given feature in the same competitive space and time may result in a focus on changes to exploit design elements, like say, a car stunt in the rival feature that is a hit with the audience.

Thus, while inertia is overwhelmingly self referential, aspirations are both self and comparative. It suggests that though inertia and aspirations are inherently in opposition, when it comes to change in response to learning from past experiences, a comparative reference like that of a rival may also help in constraining change to only a few imitable characteristics. On the other hand, self-aspirations may induce more sweeping changes as they are not influenced by a competitive reference.

5.3 Shaping a Movie Sequel

In 1916 when the first Hollywood sequel *Fall of a Nation* hit theatres no one could have predicted that '*sequelogy*' (Sequelogue, 2005) was going to become such an adored Hollywood tradition to cash on success, or on unfulfilled expectations of returns from a feature. Typically, *Fall of a Nation* followed the landmark feature *Birth of a Nation,* characterised by 'path breaking innovations in editing, cinematography and narrative technique' (IMDb,2006), but did not make enough money to fulfil the aspirations of the makers who were expecting more returns for the innovations.

It is not uncommon to find movie sequels being characterised as being low on novel and creative content. This assertion is not always true, but may hold ground in cases where design changes are overtly constrained by trying to preserve attributes interpreted as contributing to the success of the original, and change is held to a bare mimimum to continue the narrative. However, in other cases, the dominant change mandate is to address any weaknesses in the original. For instance, the film *Star Trek: The Motion Picture* was criticised for being too tedious on the narrative. In reaction, *Paramount Pictures* got in shape a sequel that addressed the criticisms: *Star Trek II: The Wrath of Khan.*

There are script and character programming issues that are central to design of sequels. Sometimes, the original film deliberately has loose threads in the narrative that help shape a sequel. For example, in the movie *Spider-Man* the hero rejects the leading lady's advances and conceals his identity without explaining that this would protect her from his enemies. This ending is not really intended to be tragic but is a means to continue the narrative in *Spiderman II,* where the curtained relationship between the lead characters is at the core of the new plot.

In the movie *Jaws*, there are no loose threads in the narrative to latch on to for making of a sequel, and several have been been rather successfully made. Here, the family in the shark terror was cleverly labelled as 'jinxed' in the following movies. The original regular protective mom progressed over sequels to be a grandmother obsessed with the belief that her family was being targeted by a vengeful dark shadow in the waters. In franchise features like the *James Bond* movies, *Indiana Jones* and *Mad Max,* the character is the mainstay and the plot does not need to latch on its predeccessor's ending, or alternatively, create a nuanced connection between the plot and the character. The plot is fairly novel in terms of new challenges that confront the character albeit, with a generous retention of the attributes that define the character, whether it is the fancy *Bond* arsenal, his womanising, or even more subtle aspects like the famous *Bond* line 'shaken not stirred' .

In movies that commit in their 'labelling' to a character, sequel identity is locked with the character. For example, *Indiana Jones* movies, or less explcilty, movies like *Die-Hard* where *John McClane* remains a character movie-goers seem to expect in sequels. However, the scope for *Die-Hard* makers to replace *McClane* by another character remains much higher than replacing *Indiana Jones* 'in' *Indiana Jones* movies. This has important implications for how sequels are designed and the design space they have to fiddle with.

The movie cast that live the characters tend to follow the progressive narrative over sequels, for example, when the boy grows up in the sequel to become a man, or if someone (as per the script) ends up inside the shark as in the case film *Jaws,* it usually ends the possiblility of the character, and thus, the cast that played it, to find a place in the sequel. A change in casting may also be led by change in plot in the case of franchise sequels where continuation of the narrative is not central. For instance, the change in the casting of *James Bond* from *Pierce Brosnan* to *Daniel Craig* is led by a shift in the plot for the new *Bond* feature *Casino Royale* that finds *Bond* at the start of his career. Given the aging *Brosnan,* who has already been in four *Bond* features, the plot demanded a fresh face. Thus we make a case for a movie's design comprising the plot and characters as influencing one element of the movie team, namely casting.

However, team level dynamics in movie-projects have been examined in literature as significant influencers of design change, if not design elements themselves (Schwab and Miner, 2001; Shamsie et al., 2004). Entities comprising a movie project team are numerous, and extant literature suggests that the cluster comprising direction, cast, screenplay and roles, leads the list (e.g. Taylor, 1967; Paul, 1979; Lampel 2005; Simonton, 2002, 2004). Such research argues seamlessly between team composition and design of a movie based on the tension between creativity and financial risk, and associated shifting of the locus of project control in movie making, among other dimensions (e.g.Glynn, 2000; Lampel, 2005; Shamsie, 2005).

In this chapter we do not examine team level dynamics as the intention is to look at performance based inertia and aspirations in shaping design changes in movie sequels: design change being understood as changes in the movie as a product approximated by change in the plot and characters that enact the plot. Furthermore, this perspective is also ideal for external validity to our examination of strategic learning in the case of *Robot Wars* in the preceding chapters. There also, we do not engage team level dynamics and examine changes in the deployed robotic design. Understandably, it is the teams that learn, but the learning is manifested in the design changes they induce.

5.4 Hypotheses

Performance of a theatrical release is central to shaping a future sequel: whether it will be radically altered, or just enough, to keep the narrative going. Such performance can be looked at in two main ways: the commercial success by way of box-office performance, and critical success that stems from awards and nominations a movie gets whether at film festivals or other award ceremonies.

Over time, box-office performance of movies in a sequelogy is likely to embody a belief about some attributes of the script and characters as being central to the identity of the sequels and also, to the audience appeal for the sequelogy. This belief may work to reduce the scope of design changes. This gives us the following hypothesis:

Hypothesis 1: Strategic learning in movie-sequels will be influenced by inertia based on over time (average) box-office performance of prior movies in the sequelogy

Box-office performance of a movie is also a basis for movie-makers to aspire for even better returns from a sequel. We have argued that in contrast to inertia, aspirations stem from short-term performance. Thus, these tend to result in actions that lie outside the trajectory propounded by embedded routinues and practices, and by extension, focus attention outside the confines of the existing strategic configuration to explore new inputs. They are likely to influence change to build on the success through such exploration, or alternatively, address failure by radical changes. This gives us the following hypothesis:

Hypothesis 2: Strategic learning in movie-sequels will be influenced by self-aspirations based on box-office performance of the preceding movie in the sequelogy.

On the other hand, inertia based on performance over time is likely to distil a belief that risks entailed in changing a sequel design beyond the limited scope required for continuation of the narrative, will have an adverse impact on the identity of the series. For instance, a very successful movie will be seen as having some central features that appeal to the audience in particular. In the case of *Star Wars* movies, the spaceship battles and *Jedi Knights* may be seen as crucial to sequel identity. Dabbling to reshape such elements is high risk and is likely to contribute to inertia. However, on the other hand, given that performance is seen as tangible evidence that one can do even better, these same elements may make movie makers aspire for even better performance, for instance, develop with plot concept around *Jedi Knights* in *Star Wars* sequels. This argument of an interaction between self-aspirations and inertia gives us the following hypothesis:

Hypothesis 3: Strategic learning in movie-sequels will be influenced by an interaction between inertia and self- aspirations based on box-office performance of prior movies in the sequelogy.

Unlike inertia, aspirations are also comparative. Box-office comparison is likely to be benchmarked with the performance of a movie with a comparable budget that opens around the same time -ideally the same weekend, in a given market. This comparative reference is likely to focus attention on those design elements of the thus, arguably rival movie, that made significant inroads into attracting audiences: whether it be attributed to a comic charater or a particular plot sequence. This argument gives us the hypothesis:

Hypothesis 4: Strategic learning in movie-sequels will be influenced by an interaction between inertia and comparative-aspirations based on box-office performance.

We assert that superior box-office performance of the comparative movie is likely to influence imitation of plot sequences and character profiles in a movie-sequel (Staiger, 1985; Lampel and Shamsie, 2003) . This tendency may tend to be at odds with aspirations stemming from own performance that strive to build the identity of the sequel around central characters and plot sequences of the preceding feature. Furthermore, artistic egos in creative settings may amplify the self-creation premise. This gives us the following hypothesis

Hypothesis 5: Strategic learning in movie-sequels will be influenced by an interaction between self- aspirations and comparative-aspirations based on box office performance.

Performance by way of critical recognition is manifested in awards and nominations received by a movie. Film festivals and other award ceremonies are not only portals to launch new artists and recognise emerging talent, but are platforms where even established industry talents in all areas of film making strive for peer recognition. An award or nomination recognises novelty and creative input associated with a movie's design and thus may affect changes that are introduced for the next movie in the sequelogy. This gives us the hypothesis:

Hypothesis 6: Strategic learning in movie-sequels will be influenced by aspirations based on critical recognition.

Movie projects are driven by two main motivations. One is the commercial motivation depicted by box-office performance and the other is the critical recogntion for creative excellence at peer portals like film festivals and other award ceremonies. While sequels generally tend to be made for the commercial appeal they hold, critical acclaim is also much sought after for the 'creative egos' that characterise creative industries like motion pictures. This posits a need to balance the movie's design between the over arching studio goals of profitability and the aspirations of the creative team led by the movie director for critical recognition. Often these are complementary and tend to augment each other, but at the other times, they compete for shaping the design of a movie.. This gives us our final hypothesis:

Hypothesis 7: Strategic learning in movie-sequels will be chracterised by an interaction between aspirations based on box office performance and aspirations based on critical recognition.

5.5 Data and Variables

5.5.1 Data

Our analysis is based on a sample of 181 movies in 51 sequelogies with theatrical release in the United States over the period 1960-2005. The earliest sequelogy in the sample ends in 1973 and the latest ends in 2005 as on 1st of April, 2006. This sample is not exhaustive as we have been constrained by lack of data on several sequels that has made us exclude a potential 29 more sequelogies from our sample. Furthermore, lack of data on the comparative reference movies made us exclude another 19 sequelogies. Movies with peculiarities that brought them in conflict with the conventional understanding of a sequel were also omitted, for instance, *Lord of the Rings* movies have been omitted from the sample because the movies were shot at the same time with only the release of the movies being sequential. Each sequelogy comprising 'n' movies contributes 'n-1' observations or design transitions to the analysis. The total number of observations is thus: N: 181-51= 130 design changes over successive movies.

Archival data from web-based sources has informed our analyses. The main sources are the *Internet Movie Database (IMDb),* and the web portals: *Film Box-office Data Base, Box-office Mojo* and *The Numbers* (*Nash Information Services).* In addition we also examined reviews from numerous sources like *BBC-films, New York Times, and* other less known but active portals like *Rotten Tomatoes* and web magazines like the *11th Hour* to understand the main elements of design change in a sequel. We also viewed movies in 21 of the 51 sequelogies in our sample. This allowed us to make sense of coding that uses, for example, a certain number of top characters to contribute to our design change variable. Design change and other variables in analysis that have been operationalised using the aforesaid data are described in the following section.

5.5.2. Variables and Measures

5.5.2.1 Dependent Variables

Design Change (DC_{s+1}) in the next sequel (s+1): We have argued that design of a movie can be seen as the plot and characters that make up the movie. Thus we propose two variables for design change one using the change in characters as an indicator of design change, and the other using change in plot as an indicator of design change.

DC_Characters: Our observations from viewing of movie sequels in the sample indicate that at least four fifths of a movie's footage seems to be consumed by the top five roles in credits order. Given this, we code for a change in the top five characters in order of credits:

The lead character change is scored as 6 and then 5,4,3,2 in reducing order of credits to arrive at a sum of scores indicating change. The maximum change score possible is thus 20. If there is no change we code it as 1 for methodological and conceptual reasons. A movie sequel is a unique project and there are inevitable changes that impact on the profile of characters and their presentation. Thus, change from one to the other cannot be 0.

If a character is retained but is positioned at a different level then the scores are accordingly adjusted. The sum of scores is coded as a proportion of the maximum possible. For example, a change in the lead character (6) and the third character in credits order (4) is scored as 10 and the score is: (10/20) =0.5.

DC_Plot: We code for the proportion of new plot keywords over successive sequels as an indicator of plot change. These keywords are generated on Internet Movie Database (IMDb) *by its expert panel and amended based on suggestions of registered users numbering nearly fifty thousand.* We take plot change as a proportion of new keywords listed to total keywords listed for the later sequel in the pair over which design change is being examined. The keywords have a wide spread in picking upon notable plot features like for example, 'car chase', 'alcoholic', and 'killer doll', among others. This measure provides for an approximation of both audience and expert opinions on change in plot.

5.5.2.2 Control Variables

Different movie sequelogies are characterised by a different number of films and by a spread in the time period between different pairs of successive movies therein. These differences are also likely to impact upon shaping of design changes for making of a sequel feature. For instance, a higher gap between films may result in more changes in the design given changing audience preferences. Alternatively, it may result in a great deal of retention in the design so that the identity of the sequel can be linked to its predecessor that is far back in time. The number of movies *preceding a given sequel* may also have an impact on the extent to which variations in design are considered important to maintain audience interest. In our analysis of design change, we control for both: the *number of movies in a sequelogy (Cn)* and; the *time gap between successive movies (Ct)*.

First week screens have been indicated in empirical studies to have a significant relationship with box-office performance (Chang and Jung, 2005; Simonton, 1994) and distribution strategy (Puttnam, 1997; Lampel and Shamsie, 2000). Thus we include number of *opening weekend screens for the preceding sequel movie (Sm)* and *comparative reference movie (Sc)* as controls in explaining design change over sequels. A log transformation has been done on the number of screens given the wide range in screens on which movies in the sample were found to have been released.

5.5.2.3 Independent Variables:

Inertia based on average box-office performance (IN): We have argued that over time performance with a given strategic configuration makes it difficult to change strategic direction and thereby inhibits change. The '*average revenue /average budget*' of preceding movies in a sequelogy is used as an indicator of inertia based on box- office performance.

Self-aspirations based on box-office performance (SAP): Aspirations have been posited as a function of short-term performance, and unlike inertia, are not embedded in routines and practices that emerge over time in response to performance. Thus, the box-office performance (*Revenue / Budget)* of the preceding movie in the sequelogy is used as a measure of self-aspirations based on box-office performance; carried forward to influence design changes for the next feature in the series.

Comparative-aspirations based on box-office performance (CAP): Movies released around the same time in a given market compete for audiences. A comparative reference movie to a given movie is ideally: released on the same weekend as the reference movie; is in the top-grosser list with a better box-office performance to the sequel and; has the closest possible budget to the sequel movie.

Obviously, these criteria were frequently difficult to combine. In some instances more than one movie competed for a comparative reference to a sequel and in several other cases, no realistic comparative reference could be found. We resolved these issues on a case by case basis to assess which movie would be a better comparative fit, if at all. In cases where there was no reliable comparative reference we had to discard a potential sample unit.

Furthermore, we ignore genres for creating a comparative frame of reference because of their obscure and interwoven manifestation: any given movie is found to be a mix of genres like drama, mystery, and comedy, to name a few. Arguably, comparisons should also be contextualised based on the difference between when a movie was canned, to when it was eventually released, but information on the former is rarely available. Under these constrains, we code comparative-aspirations as:

Opening weekend performance of the comparative movie / [divided by] *opening weekend performance of the preceding sequel movie in the pair over which design change is being examined.*

Aspirations based on critical recognition: We code for two different measures of critical recognition: Number of awards won by the preceding movie in the pair of movies over which design change is being examined ***(ACA)*** and; number of nominations received awards won by the preceding movie in the pair of movies over which design change is being examined ***(ACN).***

Comparative-aspirations based on critical recognition were not operationalisable for reasons of complexity in institutional mechanisms that impart such recognition. Firstly, there are different competitive levels a movie progresses through: several hundred potential nominees to a handful of movies that get nominated, of which, a still fewer number get awards. Secondly, the awards are given for different categories making it impossible to have a comparative reference movie. For example, if a sequel movie was to be nominated and the five awards were taken by other movies, which movie should be taken as the comparative reference movie for the sequel? Furthermore, in addition to a range of award ceremonies, film festivals are included in the total count of award and nominations. Festivals tend to be mutually exclusive in selection of films, further reducing any possibility of generating a comparative reference. For instance, a film with nominations at *Cannes* cannot be compared with another with a nomination at *Venice*.

5.6 Analysis and Results

We use correlations and hierarchical regression analysis to test the hypotheses. We ran two sets of regression analysis for each of the dependent variables we associate with design change over successive movie sequels. The first is change in plot, and the second is change in characters. In each set of analysis, simultaneous regression was done for the control variables and the main effects. This was then expanded hierarchically by including interaction effects to yield the full model. Table 5.1 provides summary statistics for all variables included in the study.

Table 5.1: Descriptive Statistics and Pearson Correlations

	Variables	**Mean**	**StdDev**	**Pearson Correlations [a]**										
				1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1	***Dc_Ch:*** Design Change as change in Characters	0.68	0.26	1.00										
2	***Dc_Plot:*** Design Change as change in Plot	0.77	0.11	0.12	1.00									
3	***Cn: Number of movies made before in the sequelogy***	3.17	3.72	0.01	0.01	1.00								
4	***Ct: Years since preceding movie in sequelogy***	4.08	3.87	**0.28**	0.05	-0.14	1.00							
5	***Sc: Number of opening screens for the preceding movie***	2.98	0.52	0.00	**-0.19**	0.09	0.01	1.00						
6	***Sm: Number of opening screens for the comparative movie with reference to the preceding movie***	2.96	0.56	0.11	-0.02	0.04	0.10	**0.45**	1.00					
7	***IN:*** Inertia based on average box office performance of the previous movies in the sequelogy	0.49	0.36	-0.13	0.15	**-0.18**	0.06	**-0.39**	**-0.35**	1.00				
8	***SAP:*** Self-aspirations based on box office performance of the preceding movie	0.58	0.47	**-0.20**	**0.21**	**-0.27**	0.12	**-0.28**	**-0.28**	**0.81**	1.00			
9	***CAP:*** Comparative-aspirations based on relative box office performance of the comparative and preceding movies	0.88	0.52	-0.06	**-0.14**	0.06	-0.06	**-0.47**	**-0.43**	**0.41**	**0.34**	1.00		
10	***ACA:*** Aspirations based on critical recognition: awards received by the preceding movie	4.93	6.53	-0.07	**0.21**	-0.20	0.06	0.06	0.11	0.14	**0.22**	**-0.23**	1.00	
11	***ACN:*** Aspirations based on critical recognition: nominations received by the preceding movie	11.88	13.83	-0.06	**0.18**	-0.15	0.02	**0.17**	**0.22**	0.08	0.11	**-0.37**	**0.87**	1

[a] *Correlations at 0.15 or higher are significant at the 0.05 level. Sample size: 130*

Change in characters is significantly correlated with the number of years since the preceding movie. Given that audience preferences change, and audience memory of the last movie in the sequelogy becomes weaker with time: the greater the time gap, the greater is the possibility of changing even the main characters, often inexplicably intertwined with the identity of the sequels.

Change in characters also shows a negative correlation with self-aspirations based on box-office performance of the preceding movie. This suggests that a downturn in box-office performance is associated with a higher possibility of change in characters. Interestingly, the correlation of self-aspirations with change in plot as an indicator of design change is positive. The indication here is that higher the box-office performance of the preceding movie greater is the confidence in the movie-project team to explore creative inputs in the plot for the next sequel. Unlike change in character, change in plot is also found to be significantly correlated with aspirations based on critical recognition, indicating motivating influence of such recognition on exploring creative inputs in the plot for the next sequel.

The dichotomy of results for change in characters and change in plot continues in regression results reported in Tables 5.2 and 5.3 respectively. Upfront, the much richer influence of performance feedback on change in plot supports our earlier assertion that while changes in the plot are readily influenced by performance in movie sequels, change in characters is much more rooted in the identity of the sequel. For instance, as illustrated before, many of the sequels especially the franchises are shaped around characters, whether it is *Spiderman*, *Indiana Jones,* or *Superman*, to name a few famous ones. Plot identity of the sequel exists but usually with less constrained connotations, and with a generous leaning towards the characters, for example, the *Die Hard* and *Matrix* movies, where lead characters are critical to the identity of a sequel. Thus, a significant change in the plot is more likely from performance feedback than a radical change in lead characters. This lends support to the difference in results over the two sets of regression analysis where the predictors are performance based inertia and performance based aspirations.

Our results show that inertia based on average box-office performance inhibits plot change (table 5.3: model 3 to model 11). This provides support for hypothesis 1. We also find some support for Hypothesis 2 as self-aspirations influence design change both for change in characters (table 5.2: model 1 and model 2), and change in plot (table 5.3: model 1, model 3, and model 6 to model 8). However, in the case of the former self-aspirations tend to inhibit change in characters while, in the case of the latter, self-aspirations tend to encourage change in plot.

This is in line with our arguments about the dichotomy between change in characters and change in plot from performance feedback: characters relate to the identity of a sequelogy, and by extension, a superior performance is likely to inhibit changes in this design component as reinforcing the faith in the sequelogy. On the other hand, plot changes stem from the need for new inputs into the next sequel, and superior performance is likely to lead to encouragement for engaging in such exploration.

We find weak support for hypothesis 3. Inertia and self-aspirations do not show any significant interaction for change in plot and only a marginally significant negative interaction for change in characters (table 5.2: model 3). One reason for this may lie in the internal benchmarking with own past performance that characterises self-aspirations. Interpretation of one's own past performance is more subjective, and thus fickle, relative to when the benchmark is external as in the case of comparative-aspirations.

We find strong results for positive interaction between inertia and comparative-aspirations in the case of plot change (table 5.3: model 3 to model 11). This supports hypothesis 4 in indicating that externally benchmarked aspirations tend to narrow focus to changes that imitate the rival movie's success attributes, as manifested in its plot: a car chase sequence, or even, more blood and gore in a horror movie, as may be applicable. A weak significance also characterises this interaction in the case of change in characters (table 5.2: model 3): externally benchmarked aspirations seem to be disposed towards encouraging change in characters. With reference to change in characters, this marginal result suggest that: if at all, comparative movies are imitated for change in characters, it results in sweeping changes given that many of the sequels tend to be shaped around character identities.

We find some support for Hypothesis 5 for change in Plot (table 5.3: model 7 to model 8). This negative interaction between self-aspirations and comparative-aspirations indicates a conflict between internal and external benchmarking of aspirations. It also supports our earlier results that show an opposition in how they interact with inertia.

Results also indicate that aspirations based on critical recognition through awards encourage change in plot (table 5.3: model5, and model 7 to model 11). However, there is a negative interaction between self-aspirations based on box office performance and critical recognition through awards (table 5.3: model7, model 10, and model 11). Also, over the model 9 to model 11 of table 5.3, self-aspirations from box-office performance are not significant while aspirations from critical recognition (awards) are.

This indicates that in the case of movie sequels, there may be a case for conflict between informing change from these two different kinds of performance mechanism aft seen as complementary in the industry. By extension, there also may be a suggestion here that the self-aspirations of the project team led by the movie director are also driven by critical recognition than only by box office success. On the other hand, studios may want the creative and commercial tension to go more in favour of the commercial. Alternatively, the interpretation of the interaction result could also be more intuitive: the impetus to change would come only if either box-office performance or critical recognition are lacking, if both are high, there may be reduced motivation for changing even the plot beyond the required to generate a new albeit marginally different sequel movie.

Finally, the control variables support our assertions about change in character, and change in plot. The extent of time that passes before a subsequent sequel is shaped affects the possibility, and probably the need, to modify characters given changing audience preferences and fading memory of the last movie (table 5.2: model 1 to model 11). In the case of plot change, number of movies made before in the sequelogy increases the need to modify the plot to maintain the novelty of the next sequel (table 5.3: model 1 to model 11).

Table 5. 2: Results of Regression Analysis [b]: Explaining the influences on Change in Characters as an indicator of Design Change

Dependent Var : Design change as Change in Characters	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11
Cn: *Number of movies made before in the sequelogy (control)*	-0.001	-0.001	-0.001	-0.002	-0.002	-0.001	-0.001	-0.0007	-0.0007	-0.0007	-0.0007
	(0.006)	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*
Ct: *Years since predecessor in sequelogy (control)*	**0.02****	**0.02****	**0.02****	**0.02****	**0.02****	**0.02****	**0.02****	**0.02****	**0.02****	**0.02****	**0.02****
	(0.006)	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*	*(0.006)*
Sc: *Number of opening screens for predecessor (control)*	-0.04	-0.05	-0.07	-0.08	-0.08	-0.07	-0.07	-0.08	-0.08	-0.08	-0.08
	(0.05)	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*
Sm: *Number of screens for the comparative movie (control)*	-0.034	-0.034	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05
	(0.05)	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.05)*
IN: Inertia based on box office performance	0.08	0.08	0.05	0.008	0.13	0.22	0.12	0.20	0.20	0.20	0.20
	(0.11)	*(0.11)*	(0.13)	*(0.16)*	*(0.16)*	*(0.2)*	*(0.27)*	*(0.3)*	*(0.3)*	*(0.3)*	*(0.3)*
SAP: Self-aspirations based on box office performance	**-0.18***	**-0.11***	-0.09	-0.11	-0.09	-0.19	-0.09	-0.14	-0.14	-0.14	-0.14
	(0.06)	*(0.06)*	(0.10)	*(0.10)*	*(0.16)*	*(0.19)*	(0.25)	*(0.3)*	*(0.3)*	*(0.3)*	*(0.3)*
CAP: Comparative-aspirations based on box office performance	0.002	0.002	-0.12	-0.11	-0.06	-0.07	-0.05	-0.04	-0.04	-0.04	-0.04
	(0.06)	*(0.06)*	*(0.07)*	*(0.09)*	*(0.09)*	*(0.09)*	*(0.11)*	*(0.12)*	*(0.12)*	*(0.12)*	*(0.12)*
ACA: Aspirations based on critical recognition: awards	0.0001	0.0001	0.001	0.009	-0.01	-0.009	-0.009	-0.01	-0.01	-0.01	-0.01
	(0.007)	*(0.007)*	*(0.009)*	*(0.009)*	*(0.01)*	*(0.01)*	*(0.02)*	*(0.02)*	*(0.02)*	*(0.02)*	*(0.02)*
ACN: Aspirations based on critical recognition: nominations	-0.0008	-0.001	-0.001	-0.002	-0.01	-0.002	0.011	0.01	0.01	0.01	0.01
	(0.003)	*(0.003)*	*(0.007)*	*(0.007)*	*(0.008)*	*(0.008)*	*(0.008)*	*(0.009)*	*(0.009)*	*(0.009)*	*(0.009)*
IN *SAP		-0.10	**-0.17**+	-0.13	-0.01	-0.13	-0.13	-0.14	-0.14	-0.15	-0.15
		(0.1)	***(0.08)***	*(0.1)*	*(0.1)*	*(0.1)*	*(0.15)*	*(0.11)*	*(0.11)*	*(0.11)*	*(0.11)*
IN * CAP			**-0.23**+	0.20	0.01	0.20	0.07	-0.1	-0.1	-0.1	-0.1
			(0.12)	*(0.13)*	*(0.13)*	*(0.13)*	*(0.13)*	*(0.22)*	*(0.22)*	*(0.22)*	*(0.22)*
IN * ACA				-0.01	0.03	0.04	0.05	0.05	0.05	0.05	0.05
				(0.003)	*(0.04)*	*(0.04)*	*(0.05)*	*(0.06)*	*(0.06)*	*(0.06)*	*(0.06)*
IN * ACN					**-0.03**+	**-0.03**+	**-0.03**+	-0.03	-0.03	-0.03	-0.03
					(0.016)	*(0.016)*	*(0.016)*	*(0.02)*	*(0.02)*	*(0.02)*	*(0.02)*
SAP * CAP						0.10	0.06	0.11	0.11	0.11	0.11
						(0.17)	*(0.17)*	*(0.20)*	*(0.20)*	*(0.20)*	*(0.20)*
SAP * ACA							-0.012	-0.03	-0.03	-0.03	-0.03
							(0.06)	*(0.06)*	*(0.06)*	*(0.06)*	*(0.06)*
SAP *ACN								-0.004	-0.004	-0.004	-0.004
								(0.03)	*(0.03)*	*(0.03)*	*(0.03)*
CAP* ACA									-0.004	-0.004	-0.004
									(0.02)	*(0.02)*	*(0.02)*
CAP* ACN										0.0001	0.0001
										(0.009)	*(0.009)*
ACA* ACN											0.0001
											(0.0001)
R2	**0.148**	**0.156**	**0.177**	**0.188**	**0.210**	**0.212**	**0.218**	**0.219**	**0.219**	**0.225**	**0.225**
Change in R2		0.008	0.021	0.010	0.022	0.002	0.006	0.001	0.000	0.006	0.000
Adjusted R2	**0.08**	**0.08**	**0.09**	**0.1**	**0.11**	**0.11**	**0.11**	**0.10**	**0.10**	**0.10**	**0.10**
F	**2.31***	**2.21***	**2.31***	**2.25***	**2.37****	**2.22***	**2.13***	**1.98***	**1.98***	**1.91***	**1.91***

[b] *Regression Coefficients and standard errors (in parentheses) are reported in that order. Sample size: 130*

+ p <0.10, * p <0.05, ** p <0.01

Table 5. 3: Results of Regression Analysis [b]: Explaining the influences on Change in Plot as an indicator of Design Change

Dependent Variable : Design change as Change in Plot	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**	**Model 10**	**Model 11**
Cn: *Number of movies made before in the sequelogy (control)*	**0.005^{+}** *(0.002)*	**0.005^{+}** *(0.002)*	**0.004^{+}** *(0.002)*	**0.004^{+}** *(0.002)*	**0.004^{+}** *(0.002)*	**0.004^{+}** *(0.002)*	**0.005*** *(0.002)*	**0.005*** *(0.002)*	**0.004*** *(0.002)*	**0.005*** *(0.002)*	**0.005*** *(0.002)*
Ct: *Years since preceding movie in sequelogy (control)*	0.0001 *(0.002)*	0.0001 *(0.002)*	-0.0001 *(0.002)*	-0.0001 *(0.002)*	-0.0003 *(0.002)*	-0.004 *(0.002)*	-0.004 *(0.002)*	-0.0008 *(0.002)*	-0.0003 *(0.002)*	-0.0001 *(0.002)*	-0.0001 *(0.002)*
Sc: *Number of opening screens for the preceding movie (control)*	**-0.07**** *(0.02)*	**-0.06**** *(0.02)*	**-0.07**** *(0.02)*	**-0.08**** *(0.02)*	**-0.07**** *(0.02)*	**-0.07**** *(0.02)*	**-0.07**** *(0.02)*	**-0.07**** *(0.02)*	**-0.07**** *(0.02)*	**-0.07**** *(0.02)*	**-0.07**** *(0.02)*
Sm: *Number of opening screens for the comparative movie with reference to the preceding movie (control)*	0.005 *(0.02)*	0.003 *(0.02)*	-0.0007 *(0.003)*	-0.0007 *(0.003)*	-0.003 *(0.003)*	-0.006 *(0.02)*	-0.002 *(0.01)*	-0.006 *(0.01)*	-0.002 *(0.02)*	-0.0006 *(0.02)*	-0.001 *(0.02)*
IN: Inertia based on average box office performance of the previous movies in the sequelogy	-0.02 *(0.04)*	-0.04 *(0.03)*	**-0.15*** *(0.09)*	**-0.14*** *(0.09)*	**-0.17*** *(0.09)*	**-0.24**** *(0.1)*	**-0.34**** *(0.1)*	**-0.29**** *(0.1)*	**-0.26*** *(0.1)*	**-0.24*** *(0.1)*	**-0.23*** *(0.1)*
SAP: Self-aspirations based on box office performance of the preceding movie	**0.07*** (0.04)	0.05 *(0.04)*	**0.07^{+}** *(0.04)*	0.06 *(0.04)*	0.06 *(0.04)*	**0.13^{+}** *(0.07)*	**0.22*** *(0.08)*	**0.18^{+}** *(0.09)*	0.13 *(0.09)*	0.11 *(0.09)*	0.09 *(0.09)*
CAP: Comparative-aspirations based on relative box office performance of the comparative and preceding movies	**-0.07**** *(0.03)*	**-0.07**** *(0.03)*	**-0.15**** *(0.04)*	**-0.15**** *(0.04)*	**-0.16**** *(0.04)*	**-0.16**** *(0.04)*	**-0.14**** *(0.04)*	**-0.15**** *(0.04)*	**-0.11*** *(0.04)*	**-0.10*** *(0.04)*	**-0.09*** *(0.04)*
ACA: Aspirations based on critical recognition: awards received by the preceding movie	0.002 *(0.005)*	0.002 *(0.005)*	0.002 *(0.005)*	0.004 *(0.005)*	**0.009^{+}** *(0.005)*	0.009 *(0.005)*	**0.012*** *(0.006)*	**0.014*** *(0.006)*	**0.02*** *(0.006)*	**0.02*** *(0.006)*	**0.02*** *(0.006)*
ACN: Aspirations based on critical recognition: nominations received by the preceding movie	-0.0002 *(0.002)*	-0.0001 *(0.002)*	-0.0002 *(0.002)*	-0.0003 *(0.003)*	-0.0003 *(0.003)*	-0.0003 *(0.003)*	-0.0003 *(0.003)*	-0.005 *(0.003)*	-0.13 *(0.003)*	-0.006 *(0.003)*	-0.005 *(0.003)*
IN *SAP		0.04 *(0.06)*	0.002 *(0.05)*	0.015 *(0.05)*	0.015 *(0.04)*	0.015 *(0.04)*	0.015 *(0.04)*	0.034 *(0.04)*	0.11 *(0.04)*	0.02 *(0.04)*	0.02 *(0.04)*
IN * CAP			**0.14**** *(0.07)*	**0.15**** *(0.07)*	**0.15**** *(0.07)*	**0.15**** *(0.07)*	**0.15**** *(0.08)*	**0.22**** *(0.08)*	**0.16**** *(0.08)*	**0.16**** *(0.08)*	**0.15**** *(0.08)*
IN * ACA				-0.003 *(0.02)*	-0.015 *(0.01)*	-0.015 *(0.01)*	-0.015 *(0.01)*	-0.013 *(0.01)*	-0.005 *(0.01)*	-0.001 *(0.01)*	-0.004 *(0.01)*
IN * ACN					0.007 *(0.007)*	0.008 *(0.006)*	0.008 *(0.006)*	-0.0004 *(0.006)*	-0.03 (0.006)	-0.03 (0.006)	-0.02 *(0.006)*
SAP * CAP						-0.08 *(0.06)*	**-0.12^{+}** (0.06)	-0.08 *(0.09)*	**-0.17*** *(0.09)*	-0.03 *(0.06)*	-0.02 *(0.06)*
SAP * ACA							**-0.1*** *(0.02)*	-0.03 *(0.02)*	-0.02 *(0.02)*	**-0.04^{+}** *(0.02)*	**-0.04*** *(0.02)*
SAP *ACN								0.009 *(0.009)*	0.04 *(0.009)*	0.04 *(0.01)*	0.04 *(0.01)*
CAP* ACA									-0.03 *(0.007)*	-0.002 *(0.007)*	-0.001 *(0.008)*
CAP* ACN										-0.005 *(0.0035)*	-0.005 *(0.0035)*
ACA* ACN											-0.0001 *(0.0001)*
R2	**0.198**	**0.206**	**0.254**	**0.261**	**0.269**	**0.278**	**0.305**	**0.312**	**0.335**	**0.346**	**0.350**
Change in R2		0.008	0.048	0.007	0.008	0.009	0.027	0.007	0.028	0.011	0.004
Adjusted R2	**0.13**	**0.13**	**0.18**	**0.18**	**0.18**	**0.18**	**0.20**	**0.20**	**0.22**	**0.23**	**0.23**
F	**3.2****	**3.09****	**3.66****	**3.45****	**3.23****	**3.17****	**3.34****	**3.21****	**3.32****	**3.27****	**3.12****

[b] *Regression Coefficients and standard errors (in parentheses) are reported in that order. Sample size: 130*

+ p <0.10, * p <0.05, ** p <0.01

5.7 Discussion

The empirical examination of strategic learning in movie sequels in this chapter provides external validity to our earlier examination of the phenomenon in the quasi-experimental settings of *Robot Wars*. Results from strategic learning in *Robot Wars* find validation. Strategic learning is a function of an interaction between inertia and aspirations. This interaction represents the inherent tension between exploitation of past certainties and exploration of new possibilities (March, 1991) and thus moderates convergence as a consequence of performance feedback.

Here we examine design changes over successive movie sequels as an indicator of learning from performance feedback to shape actions for future events by striking a balance between inertia and aspirations. This balance is an indicator of moderating convergence as a consequence of learning that we have argued before to be at the heart of this dissertation. This is because such learning is crucial for survival and adaptability in competitive situations.

We argue that performance feedback shapes inertia and aspirations to inform design changes for successive sequels. These forces capture the inherent tension between over time cohesion in strategic configurations and demands of responding to competitive pressures in a dynamic environment.

In the motion picture industry, assessing the performance of a movie is contingent on both critical recognition, and box office performance. Alongside our assertion from extant literature that inertia is largely self referential, while aspirations are both self and comparative, we develop a range of variables representing the interaction between inertia and aspirations as a function of past performance.

Our results show that aspiration from box office performance moderate inertia that is inherent in successive sequel movies; inertia stemming from the need for identity with the series. Comparative-aspirations tend to narrow the focus of changes to what worked best with rival movies and are in congruence with inertia. On the other hand, self-aspirations, in absence of an external reference are more exploratory and seem to reduce inertial tendencies in design change. However, self-aspirations tend to be more fickle and difficult as predictors of change than comparative-aspirations, given that they are internally benchmarked: evaluating one's own performance tends to be much more subjective.

Results for aspirations stemming from performance based on critical recognition indicate some peculiarities of creative industries, the genre to which the movie industry belongs. The most notable of these is the role of peer recognition in encouraging design exploration. Though making of movie sequels is widely seen as dominated by commercial motivations in our results, there is an indication of the 'creative –commercial' tension in shaping a movie design. This maps on to the issue of multiplicity of goals and actors that engage in strategic experiences, a finding, that also characterised the quasi-experimental settings in the previous chapter.

Our research site of movie-sequels as sequential project systems has provided a useful phenomenon for examining strategic learning. Usually, how a project is shaped in relation to its predecessors stems from interpretations of multiple past project experiences that have a cumulative impact on organisational 'sensemaking' (Weick, 1995). By extension, associating a given project experience to future actions is obscured in this collective feedback and feed-forward process. However, in cases like movie sequels, a generational sequence between successive projects is discernable. Thus, the link between outcome of a past project experience and an action to modify routines and practices for delivering future projects is less ambiguous. The examination of strategic learning is supported by the relative ease of linking two events in time for generating actionable performance feedback.

Chapter 6

Conclusions

6.1 Concluding Thoughts

The entire argument about reasons for learning in research and practice boils down to two fundamental motivations: one is to adapt to the changing environment and the other is to outperform competitors, by changing the way one engages in such competition. The sources of learning are events and experiences that individuals and organisations contextualise for making sense of the need for change, and the extent of disruption that such change may bring to established ways of doing things.

When such experiences are strategic in nature, or in other words, have significant consequences for adaptability and survival, effective learning from performance feedback becomes crucial. Balancing pressures to converge to what works best, as against, seeking new sources of competitive advantage in light of such experiences, underpins our understanding of 'strategic learning' in this dissertation. This dissertation has examined strategic learning, a concept that is still in relative infancy in strategy literature, by seeking answers to the following two questions:

How does performance feedback from prior outcomes affect subsequent actions?

and;

What factors moderate this link?

Robotic design contests and thereafter movie sequels as research sites have been used to inform these questions over three empirical studies. These sites have facillitated an examination of strategic learning primarily by virue of their characteristic of being repeat event systems. This feature has been central to addressing one of the major bottlenecks in strategic learning research, that of establishing a link between two strategic event-experiences across time for generating actionable feedback.

The dissertation comprises three empirical studies followed by a review of extant literature on learning to examine the moorings of strategic learning in research. The constructs explored in this review provide a conceptual backdrop to operationalising strategic learning.

The *first study* was conducted in the context of a quasi experimental research site of a robotic design contest called *Robot Wars*. The study investigated the impact of competitive performance on convergence. The study posits a tension between creating new sources of competitive advantage versus searching for the competitive edge in the constrained envelope of a few design features that are seen as critical to performance. Based on the simplicity theory (Miller, 1993), we examined this tension which inherently resonates with the classic continuum between exploration of new possibilities and exploitation of past certainties (March, 1991). We find that striking a balance between simplicity in experimentation and variety in experimentation, or in other words, moderating the propensity to converge from performance feedback is key to successful performance.

The *second study* examined inertia and aspirations as factors whose interplay shapes strategic learning. Inertia as a propensity to maintain status quo supports convergence as organisational efforts in response to past performance tend to be characterised by reducing the scope of changes. On the other hand aspirations tend to unlock this mindset towards convergence and promote exploration of new possibilities to inform the strategic configuration.

Our empirical results also provide a rationale for the existence of different performance assessment mechanisms that characterised the research site of *Robot Wars*. Combat performance in a clear win-loose based progression in the tournament style contest made teams converge to certain design features that were seen to be critical to superior performance. This was because in general, the influence of inertia clearly dominated the influence of aspirations when it came to affecting convergence.

In contrast to contestant objective of winning in combat, the contest objective was entertainment through deployment of nascent and novel designs. Competitive performance provided impetus for convergence that reduced novelty. This thus required moderation, if the contest was to remain entertaining. The need for preventing overt convergence was manifested in special award nominations. Such nominations tried to draw attention to teams that did not necessarily do well in combat but added to the entertainment by being distinctively novel in design, or being distinctive in the way that they engaged in combat.

This perspective on multiplicity in levels, goals and partial contexts posits them as important issues in shaping actionable feedback from past performance.

The *final study* has been conducted using a non-experimental research site: the motion picture industry, with the motivation to provide generalisability to the examination of strategic learning in quasi-experimental settings in the prior chapters. We successfully validate our central finding by providing empirical evidence for interplay between inertia and aspirations in shaping strategic learning as manifested in change in design of movies in a sequelogy. We also provide some insights into the peculiarities of the creative milieu that characterises the motion picture industry, and contextualise different performance assessment mechanisms.

6.2 Contributions to Research

At the onset of this dissertation we discussed the opportunity repeat event systems offer in examining learning as a process of generating actionable feedback from past performance. In examining such event-experiences that have significant consequences across time, and are thus strategic in nature, we have assessed knowledge transfer from one experience to the other as an enactment of strategic learning. The central contribution of this dissertation in context of this enactment is to provide empirical evidence for: (a) strategic learning in repeat event systems; (b) the effect of performance feedback on convergence and; (c) the factors that shape strategic learning for moderating such convergence.

Repeat event systems in controlled settings of a design contest, and then movie sequels, have been examined to provide such evidence and external validity to the study respectively. In the process, we have accounted for many of the methodological challenges that impact research in the area of strategic learning. Our findings support the assertion that effective strategic learning to moderate convergence pressures distinguishes winners from the 'also-rans'. We have also shown that cognitive and behavioural orientation of organisations, as aspirations and inertia respectively, interact to shape strategic learning to moderate such convergence.

We posit that relationship between strategy and performance is mediated by learning. The more effective the learning, the better is the balance between searching from amongst past certainties, and exploring creative impetus to wrong foot competitors, establish new rules of competition, and radically reshape business models. This balance is crucial for sustainable competitive advantage. In light of seminal events that have significant consequences it matters even more as organisations often find themselves 'in times of profound change ......' (Hoffer, 1955) and learning becomes crucial for survival. This reiterates the thought from Eric Hoffer that this dissertation began with.

Learning has a reinforcing nature and when organisations fail to counter this they are often said to be characterised by 'competency traps' and 'organisational myopia' (Radner, 1975; Levinthal and March, 1993). The 'preoccupation with a single goal, strategic activity, department, or world view' (Miller, 1993) is an inevitable consequence of past performance. Inherently, simplicity is not detrimental to performance but when this becomes a limiting factor that results in a 'lock in' to inhibit exploration by limiting 'the range and variety of action' it leads to organisational decline (Miller, 1993). This dissertation has contributed to this strand of thinking by examining learning as a means to moderate convergence and looking at factors that shape such learning

6.3 Implications for Managerial Practice

Implications for managerial practice from this study are two fold. The first is about managerial orientation towards sensemaking of performance feedback. The other relates to the potential of the emerging phenomenon of design contests, which enables firms to lower their risks through market free experimentation. Design contests are also important commercial opportunities, for instance, in cases where participating in them has implications for organisational visibility in nascent industries.

Managerial response to performance feedback is usually that of being able to evaluate and narrow down to critical parts of the strategic configuration. This process over time tends to be self-reinforcing. The inward looking orientation keeps increasing to a point where an incompatibility of the strategic configuration with the environment finally manifests itself in organisational crisis.

One example that illustrates this is the sequence of projects in the National Aeronautical and Space Administration's (NASA) Apollo programme that spanned seventeen project generations. This succession extended the objective of 'landing a man on the Moon and returning him safely to Earth' (Kennedy, 1961) from a simple touchdown on the moon to lunar exploration.

Apollo 13 as a case of design failure is one of the most discussed missions in this series of projects. Launched with an objective to perform a manned lunar landing in a specified region it ran into unforeseen difficulties. The landing had to be abandoned following an explosion in one of the oxygen tanks crippling the command service module, forcing the astronauts to use the lunar module as a lifeboat. The crew risked being lost out in space due to navigational problems that ensued. However, improvisations were made to make sure that despite the unprecedented problems, the astronauts returned home safely.

The episode had a seminal impact on changes in managerial perceptions about what till then was a tried and tested and thus, best way of designing mission vehicles and terrestrial control systems. However, it took Apollo 13 to happen before the realisation that aspirations of performance had come to odds with the over time embedded routines that guided mission design.

While simplicity may make it easier to motivate managers as they clear see a dominant goal and a dominant way of working, but it may also 'fixate a single of way of seeing and doing things' (Miller, 1993, p.122; Lumpkin and Dess, 2006). This dissertation suggests that simplicity being the dominant paradigm in strategising may be inevitable, but it needs to be moderated by a conscious effort to create and not only search for solutions to deliver competitive advantage.

The ability to quickly arrive at the important factors at hand to improve performance is sub-optimal. The ability to deploy a perspective on looking farther than the factors at hand needs to form an integral part of the managerial mindset. An example of breaking away from the simplicity mould is seen in the move away from the idea of 'best practices' in how organisations strategise for the projects they do. Organisations like BP explicitly emphasise the need to explore the idea of 'good practices' that is by nature less inertial (Collison and Parcell, 2001). It seeks to open up both the existing, and the new ways of working on projects to sensemaking for actionable feedback

The growth in the realm of design contests also holds managerial implications. This is because such contests are portals where nascent technologies can be tested and developed in competitive settings. Though usually these are an inadequate representation of industrial competition, in their controlled settings, they are arguably less risky portals to experiment in than real business settings. Aside from institutions like the army that are trying to develop unmanned military vehicles through such contests, business organisations like Google with its *Doodle 4 Google competition* seem to have alternate uses for such contests. In the *Doodle 4 Google* competition they are promoting the *Google* brand by encouraging creative graphics from school children.

Google had also recently organized an international search engine placement contest which had important implications for how web pages are ranked, an issue central to its dominance as the premium search portal. That the contest explored inputs from outside the *Google* mindset about 'what mattered for such ranking', provided new directions to how *Google* could sustain its competitive position. Managerial role in promoting such cognitive fusion through contests is clearly a useful moderator for convergence to a narrow set of business paradigms in response to performance

The kind of possibilities design contests it opens up is probably not fathomable at this stage. That managerial sensemaking keeps tab on this phenomenon for both commercial opportunities as participants and experimentation opportunities as sponsors is likely to be crucial for contributing to the shaping of strategies in the future.

For instance, the *Virgin Galactic and New Mexico spaceport agreement* that stemmed from the *Ansari Xprize* contest has launched the space industry by seeking to enable private spaceflights by 2007. Clearly this has tremendous implications for both the participants and the sponsors. The $15 million prize tag for the first tickets is surely just as unrealistic as the idea of design contests emerging so rapidly some years ago. Still, those who dare to aspire and have resources to match have bought it: both the ticket and the idea for the next generation!

6.4 Limitations

One of the wider issues in strategy research remains the scope of data and size of sample that can be deployed for empirical analysis. Despite the design dependent issue of 'what is a small sample?' use of small samples and secondary data dominates strategy research, while the view that large samples make empirical analysis more robust also holds true (Phelan et al., 2002; Lampel and Shapira, 1995). In comparison to secondary data, primary data to inform strategy research is frequently confronted by access issues as it tends to be sensitive and located at multiple levels in organisations.

While this dissertation has tried to negotiate the bottlenecks that characterise strategy research, we have used archival data to examine convergence as a consequence of performance feedback, and to create proxies for aspirations and inertia based on performance. Without a doubt, primary data from contestant team members in *Robot Wars* would have also been a very rich source to inform such behavioural and cognitive constructs. However, though an amateur setting with low access barriers relative to business organisations, here also primary data access poses limiting problems, especially when generating data points contingent upon: tracking of and repeat access with teams in the contest over successive series and; contestant teams being able to reflect back on a series in the past without biases that stem from subsequent performance.

In providing generalisability to our findings from the quasi experimental site, we also examine movie sequels as repeat event systems where also, we use secondary data to inform our measures for empirical analysis. We do not engage team level dynamics given that we juxtapose the design of a movie and its performance as in the examination of strategic learning in *Robot Wars*, where also, we do not examine team level dynamics. The scope of the empirical examination thus remains limited to design changes as manifestation of performance feedback: machine specifications in the case of *Robot Wars*, and correspondingly, plot and character changes in the case of movie sequels.

Data limitations have affected our sampling in the case of examining strategic learning over successive movie-sequels. For instance, we have been required to drop a substantial number of sequels from analysis for data sufficiency reasons, and reduce the scope of our criteria for generating movies to benchmark comparative-aspirations of sequel movies.

In the case of *Robot Wars* though archival data is extensive, the sample omits some participant team designs. This is because there were several instances of missing design information on some contestant teams and in other cases; the identity of the machine was in doubt. The latter was due to change in the label/name of the machine and drastic reshaping of the contestant teams that sometimes had break away members who deployed a different machine in the next series.

6.5 Implications for Future Research

The study of project based sequential systems to examine strategic learning in the motion picture industry encourages such examination in 'project-based organisations', and in industries characterized by a high degree of 'project orientation' (DeFillipe and Arthur, 1998; Turner and Peyami, 1996; Lampel and Jha, 2003). The element of heredity in project portfolios may be rather nuanced to establish in most cases however, operationalising it would surely bring strategic learning research closer to implications for practice.

Sequential competition in industries like computers and aircrafts is another realm where strategic learning's implications for practice can be taken forward relatively easily. In these industries, new generation of technologies start a series of contests to exploit the technology till a new technology, or a technology that matures after a certain period in incubation, shifts gear to a new phase of such contests. The transition from the piston engine to the jet engine over the mid 20th century is but one example of this phenomenon. Strategic learning from performance feedback from such generational iterations of competition could inform actions that lead to more successful and sustainable competitive designs (Lampel and Jha, 2005).

We have also referred to 'causality' (Hedberg et al., 1976), or the nature of reasons behind performance as a promising construct in extant literature that could contribute to the study of strategic learning. This could be a fourth, explanatory dimension to add to our study that engages cognitive, behavioural and hereditary explanations for strategic learning in repeat event systems.

References

A

Almor T., and Hashai, N. (2004) Competitive Advantage and Strategic Configuration of Knowledge-Intensive Small and Medium Sized Multinationals: A Modified Resource Based View. *Journal of International Management*, 10: 479-500.

Ambrosini, V., and Bowman, C. (2005) Reducing causal ambiguity to Facilitate Strategic Learning. *Management Learning*, 36(4):493-512.

Amburgey, T. L., and Miner, A. S. (1992) Strategic Momentum: The effects of repetitive, positional and contextual momentum on merger activity. *Strategic Management Journal*, 13: 335-348.

Amburgey, T. L., Kelly, D., and Barnett, W.P. (1993) Resetting the clock: the dynamics of organisational change and failure. *Administrative Science Quarterly*, 38(1): 51-73.

Amburgey, T.L., and Rau, H. (1996) Organisational Ecology: Past Present and Future Directions. *Academy of Management Journal*, 39: 1265-1288.

Anderson, P.W., Arrow, K.J., and Pines, D. (1988) *The Economy as a Complex Evolving System*, Addison-Wesley, Redwood City, California.

Anthony, W. P., Bennett, R. H. III, Maddox, E. N., and Walter, J.W. (1993) Picturing the future: Using mental imagery to enrich strategic environmental assessment. *Academy of Management Executive*, 7 (2): 43-56

Argyris, C. (1986) Reinforcing organisational defensive routines: An unintended human resource activity. Human Resource Management, 25 (4): 541-555.

Argyris, C. (1992) Why individuals and organisations have difficulty in double loop learning. In C. Argyris (Ed.), *On organisational learning*. Oxford: Blackwell.

Argyris, C., and Schon, D. (1978) Organisational *Learning: A theory of action perspective*, Addison-Wesley, Reading MA

B

Baldwin, J.M. (1896) A new factor in evolution. *American Naturalist*, 30: 441-451,536-553.

Barney, J. B (1999) "How a firm's capabilities affect boundary decisions", *Sloan Management Review* 40(3): 137–145

Basalla, G. (1988) *The Evolution of Technology*. Cambridge, MA: Cambridge University Press: 136-137.

Bateson, G. (1973) The logical categories of learning and communication. In G. Bateson (Ed.), *Steps to an ecology of mind: Collected essays in anthropology, psychiatry and epistemology*. London: Paladin.

Baum, J. A. C., and Berta, W. B. (1999) Sources, timing, and speed: Population-level learning by organisations in a longitudinal behavioural simulation, in A. S. Miner and P. Anderson, (Eds.) *Population-level learning and industry change, Advances in Strategic Management*, Stamford, CT: JAI Press, 16: 155-184.

Baum, J. A. C., and Singh, J.V. (1994) *Evolutionary dynamics of organisations*. New York: Oxford University Press

Baum J. A.C., Stanislav D. D., and Witteloostuijn, Arjen van, (Eds.)(2006) *Ecology and Strategy Advances in Strategic Management*, Vol. 23

Bauman, Z. (1989) *Modernity and the Holocaust*, Cambridge, Polity Press.

Beckman, C., and Haunschild, P.(2002) Network learning: The effects of partners' heterogeneity of experience or corporate acquisitions. *Administrative Science Quarterly*, 47:92-124.

Belew, R.K. (1990) Evolution, learning and culture: Computational metaphors for adaptive algorithms. *Complex Systems*, 4: 11-49.

Berger, P., and Luckmann, T. (1967) *The Social Construction of Reality*. Middlesex, GB: Penguin Press

Bickhard, M. H., and Campbell, D. T. (2003) Variations in Variation and Selection: The Ubiquity of the Variation-and-Selective Retention Ratchet in Emergent. Organisational Complexity. *Foundations of Science*, 8(3) : 215-282

Bijker, W. (1995) Bicycles, bulbs and Bakelite: Towards a theory of technological change. Cambridge MA: MIT Press.

Bobbitt, H.jr., and Ford, J.(1980) Decision maker choice as a determinant of organisational structure. *Academy of Management Review*, 5:13-23.

Bruderer, E., and Singh, J. (1996) Organisational evolution, learning, and selection: A genetic-algorithm based model. *Academy of Management Journal*, 39(5):.1322-1350.

Burgelman, R.A.(2002) Strategy as Vector and the Inertia of Co evolutionary Lock-in, *Administrative Science Quarterly*, 47: 325-357.

Burns, T., and Stalker, G.M. (1961) *The Management of Innovation*, London, Tavistock.

Buzzell, R.D., and Gale, B.T. (1994) *The PIMS Principles*. New York: Free Press

C

Camp, R.C.(1989) *Benchmarking The Search for Industry Best Practices That Lead to Superior Performance.* ASQC Quality Press, WI.

Campbell, D.T. (1960) Blind Variation and Selective Retention in Creative Thought as in Other Knowledge Processes, *Psychological Review*, 67(6): 380-400.

Campbell, D.T.(1965) Variation and Selective Retention in Socio-Cultural Evolution in H.R. Barringer, G.I. Blanksten, and R.W. Mack (Eds.) *Social Change in Developing Areas: A Reinterpretation of Evolutionary Theory* (Cambridge, MA: Schenkman Publishing Company): 19-49.

Campbell, D.T. (1969) Variation and Selective Retention in Socio-Cultural Evolution. *General Systems*, 16: 69-85.

Carmines, E.G., and Zeller, R.A. (1979) *Reliability and validity assessment.* Beverly Hills, CA: Sage Publications

Chinander, K.R., and Shapira, Z. (2005) Strategic Learning Under Turbulent and Recurring Conditions: The Effect of the Costs of Anticipated Consequences on Hurricane Evacuation Decisions. *Presented at European group for Organisation Studies 21st Colloquium,* Berlin.

Child, J. (1972) Organisational Structure, Environment, and Performance: The Role of Strategic Choice. *Sociology*, 6: 1-22.

Cohen, M., and Bacadayan, P. (1994) Organisational routines are stored in organisational memory: Evidence from a laboratory study. *Organisation Science,* 5: 554-568.

Cohen, M.D. (1991) Individual learning and organisational routines: emerging connections, *Organisation Science*, 2:135-139.

Collison, C., and Parcell, G.(2001). *Learning to Fly.* Oxford: Capstone Publishing

Comte, A. (1838) *The Positive Philosophy of Auguste Comte*, London, Bell, 1896

Crozier, M. (1964) *The Bureaucratic Phenomenon*, London, Tavistock.

Cyert, R.M., and March, J.G. (1963): *A Behavioural Theory of the Firm.* Englewood Cliffs, NJ

D

D'Andrea-O'Brien, C.,and Buono, A.F.. (1996) Building effective learning teams: lessons from the field. *SAM Advanced Management Journal*, 61(3): 4-16.

Daft, R.L., and Weick, K.E. (1984) Toward a Model of Organisations as Interpretation Systems. *Academy of Management Review*, 9(2): 284-296.

Day, R.H., and Chen, P. (1993) *Nonlinear Dynamics and Evolutionary Economics*, Oxford University Press.

Dearborn,D., and Simon, H.(1958) Selective perception: The identification of executives.*Sociometry*,21:140-144.

DeFillipi, R., and Arthur, M. (1998) Paradox in Project Based Enterprise: The Case of Filmmaking. *California Management Review*, 40(2): 125-139

Dixon, N. (1994) The organisational learning cycle: How we can learn collectively. Maidenhead: McGraw-Hill.

Doz, Y.L. (1996) The Evolution of Cooperation in Strategic Alliances: Initial Conditions or Learning Processes? *Strategic Management Journal*, 17: 55-83.

Dutton, J.E., and Ashford, S.J. (1993) Selling Issues to the top management team. *Academy of Management Review,* 18(3) 397-428.

E

Easterby-Smith, M.P.V (1997) Disciplines of organisational learning: contributions and critiques. *Human Relations,* 50(9), 1085-114.

Edmondson, A. (1999) Psychological safety and learning behaviour in work teams. *Administrative Science Quarterly,* 44(2):350-383.

Eliashberg, J., and Shugan, S.M. (1997) Film critics: Influencers or predictors? *Journal of Marketing,* 61(2): 68-79.

Ellerman, D.P. 1999. Global institutions: transforming international development agencies into learning organisations. *The Academy of Management Executive,* 13(1):25-35.

F

Fiegenbaum, A., and Thomas, H. (1995) Strategic groups as reference groups: Theory, modelling and empirical examination of industry and competitive strategy. *Strategic Management Journal,* 16 (6): 461-476.

Fiol, C. M., and Lyle, M.A. (1985) Organisational Learning. *Academy of Management Review,* 10 (4): 803-813.

Ford, J.D. (1985) The Effects of Causal Attributions on Decision Makers' Responses to Performance Downturns. *Academy of Management Review,* 10 (4): 770-786

G

Garratt, B. (1994) *The Learning Organisation,* , Harper-Collins

Garvin, D.A. (1993) Building a learning organisation. *Harvard Business Review*, July-Aug :78-84.

Ginsberg, A., Larsen, E.R. and Lomi, A. (1999) The Organisational Ecology of Strategic Interaction, in A.S. Miner, and P. Anderson (Eds.) *Advances in Strategic Management: Population Level Learning and Industry Change* 16 : 81-112, JAI press

Gioia, D.A., and Mehra, A. (1996) Sensemaking in Organisations: Book Review. *Academy of Management Review* 21 (4): 1226-1229

Glynn, M.A.(2000) When cymbals become symbols: Conflict over organisational identity within a symphony orchestra. Organisation Science, 11:285-298

Glynn, M.A., T.K. Lant, and Milliken, F. (1994) Mapping learning processes in organisations: A multi-level framework linking learning and organizing, in C. Stubbart, J. Meindl, and J. Porac (Eds), *Advances in Managerial Cognition and Organisational Information Processing*, 5: 48-83. JAI Press.

Grant, R.M. (1996) Toward a knowledge-based theory of the firm. Strategic Management Journal, 17: 109-122.

Greenberger,D., and Strasser, S. (1984) Personal control in organisations. Paper presented at the annual meeting of the Academy of Management, Boston.

Greve, H. (1988) Performance, aspirations, and risky organisational change. *Administrative Science Quarterly*, 43: 58-86.

Grundy, T. (1994) *Strategic Learning in Action- How to Accelerate and Sustain Business Change.* London McGraw-Hill

H

Hamel, G., and Prahlad, C.K. (1989) Strategic Intent. *HBR 67* May June: 63-76

Hamel, G., and Prahlad, C.K. (1993) Strategy as stretch and Leverage. *Harvard Business Review*, March-April: 75-84.

Hammer, M., and Champy, J. (1993). *Reengineering the corporation: A manifesto for business revolution*. New York: HarperBusiness.

Hang, Byeng-Hee., and Ki, Eyung-Jung (2005) Devising a Practical Model for Predicting Theatrical Movie Success: Focusing on the Experience Good Property. Journal of Media Economics 11(4): 247-269

Hannan, M. T., and Freeman, J. (1977) The population ecology of organisations. *American Journal of Sociology*, 82: 929-964

Hannan, M.T., and Freeman, J. (1984) Structural inertia and organisational change. *American Sociological Review*, 49(2): 149-164.

Hannan, M. T., and Freeman, J.H. (1989) *Organisational Ecology*. Cambridge, MA: Harvard University Press

Haunschild, P., and Sullivan, B.N.(2002) *Learning from complexity: effects of Prior Accidents and Incidents on Airlines' Learning*. Administrative Science Quarterly, 47: 609-643.

Hedberg, B. (1981) How organisations learn and unlearn, in P.C. Nystrom and W.H. Starbuck (Eds.), *Handbook of organisational design*. London: Cambridge University Press.

Hedberg, B., Nystrom, P., and Starbuck,W. (1976) Camping on seesaws: Prescriptions for a self-designing organisation. *Administrative Science Quarterly*, 21:41-65

Hedstrom, P. (1992) Is Organisational Ecology at an impasse? *Contemporary Sociology.* 21: 751-753.

Hoffer, E. (1955) *The Passionate State of Mind.* New York: Harper and Row

Holland, J. (1975) *Adaptation In Natural and Artificial Systems.* The University of Michigan Press, Ann Arbour

Holland, J., Holyoak, K., Nisbett, R., and Thagard, P. (1986) *Induction: Processes of Inference, Learning, and Discovery.* MIT Press, Cambridge, Massachusetts.

Howson, C., and Urbach. P. (1988) *Scientific Reasoning: The Bayseian A:roach.* Open Court.

Hsu.,C., and Knoblock, C.A. (1995) Estimating the Robustness of Discovered Knowledge. *Proceedings of the First International Conference on Knowledge Discovery and Data Mining,* Montreal Canada

Huber, G.P. (1991) Organisational learning: The contributing processes and literatures. *Organisation Science.* 2(l): 88-115.

J

Jain, L., Johnson, R., and Van Rooij, A. (1996) Machine Perception and Artificial Intelligence, *World Scientific* 26.

Jenkins, M., and Floyd, M. (2001) Trajectories in the Evolution of Technology: A Multi-level Study of Competition in Formula 1. *Organisation Studies,* 22(6) : 945-970.

Johnson, D.R., and Hoopes, D.G. (2003) Managerial Cognition, Sunk Costs, And the Evolution of Industry Structure. *Strategic Management Journal,* 24(10): 1057-1069.

K

Kaplan, S., and Kaplan, R. (1977) The experience of the environment. *Man-Environment Systems*, 7: 300-305.

Karnøe, P. (1996) 'The social process of competence building', *International journal on Unlearning and Learning*, 11, 7/8: 770-789.

Kelly, D., and Amburgey, T.L. (1991) Organisational inertia and momentum: A dynamic model of strategic change. *Academy of Management Journal* 34 (3): 591–612.

Kelly, H.(1967) Attribution theory in social psychology. In D. Levin (Ed.), Nebraska Symposium on Motivation (Vol. 15) Lincoln, NE: University of Nebraska

Kennedy, J.F: (Speech: January 9, 1961): City Upon a Hill Speech. Address before the Massachusetts General Court of the Commonwealth of Massachusetts. Massachusetts State House, Boston, MA

Kogut, B., and Zander, U.(1992) Knowledge of the firm, combinative capabilities and the replication of technology. *Organisation Science*, 3: 383–397

Kogut, B., and Zander, U.(1996) What firms do? Coordination, identity, and learning. *Organisation. Science*, 7: 502–518

Kolb, D., Rubin, I.M., and McIntyre, J.M. (1973) *Organisational psychology: A book of readings*. Englewoods Cliffs: Prentice-Halls.

Kuwada, K. (1998) Strategic learning: The continuous side of discontinuous strategic change. *Organisation Science*. 2(6): 719-736.

L

Lampel, J., and Shamsie, J (2000) Critical Push: Sources of Strategic Momentum in the Motion Picture Industry Journal of Management 26 (2): 233-257

Lampel, J., and Jha, P.P. (2003) Reflective and Genetic Strategic Learning in Project-based Organisations: *Presented at OKLC, Barcelona, and at European group for Organisation Studies 19th Colloquium,* Copenhagen

Lampel, J., and Jha, P.P. (2005) Strategic Learning in Technology Design Contests: The Case of Robot Wars. *Presented at European group for Organisation Studies 21st Colloquium,* Berlin.

Lampel, J., and Jha, P.P. (2004) Models of Project Orientation in multi-project organisations, in J.K. Pinto, and P.W.G Morris (Eds.), *The Wiley Project Management Resource Book,* New York: Wiley

Lampel, J., and Mintzberg, H (1996) Customising Customisation. *Sloan Management Review,* Fall: 21-29

Lampel, J.(2005), The Genius Behind the System, in, J. Lampel, J. Shamsie, and T.K. Lant (Eds.), *The Business of Culture,* Lea Publishers, London

Lampel, J., Lant, T., and Shamsie, J. (2000) Balancing act: Learning from organizing practices in cultural industries. *Organisation Science,* 11(3) 263-269.

Lampel, J., and Shapira , Z. (1995) Data scarcity and the limits of falsification in strategic management. *Advances in Strategic Management,* 11A, 113-150.

Lant, T. K. (1992) Aspiration Level Adaptation: An Empirical Exploration, *Management Science,* 38:623-644.

Lengnick-Hall, C.A. (1992) Innovation and Competitive Advantage: What We Know and What We Need to Learn. *Journal of Management.* 18(2): 399–429

Levinthal, D.A. (1997) Adaptation on Rugged Landscapes, *Management Science,* 43(7): 934-950

Levinthal, D.A., and March, J.G. (1993) The Myopia of Learning. *Strategic Management Journal,* Special Issue, 14 (8): 95-113.

Levinthal, D.A., and March, J.G (1981) A model of adaptive organisational research. *Journal of Economic Behaviour and Organisation,* 2: 307-333.

Levitt, B., and March, J.G. (1988) Organisational learning. *Annual Review of Sociology,* 14: 319-340.

Lomi A., and Larsen, E.R (1996) Interacting Locally and Evolving Globally: A Computational Approach to the Dynamics of Organisational Populations *Academy of Management Journal* 39 (4): 1287-1321

Lumpkin, G.T., and Dess, G.G. (2006) The effect of 'Simplicity' on Strategy-Performance relationship: A Note* *Journal of Management Studies* 43: 7.

M

March, J,G., and Simon, H.A. (1958) *Organisations.* New York: Wiley

March, J. G., and Olsen, J.P. (1979) *Ambiguity and choice in organisations.* 2nd edn. Bergen: Universitetsforlaget.

March, J.G. (1991) Exploration and Exploitation in Organisational Learning. *Organisation Science* 2(1): 71-87

March, J.G., and Shapira, Z. (1992) Variable Risk Preferences and the Focus of Attention, *Psychological Review*, 1992, 99(1): 172-183.

Martins, L., and Kambil, A. (1999) Looking back and thinking ahead: Effects of prior success on managers' interpretations of new information technologies. *Academy of Management Journal*, 42: 652-661

McDermott, R.1999. How to build communities of practice in team organisations: Learning across teams. *Knowledge Management Review*, 2(2):32-36

Merton, R.K. (1957) *Social Theory and Social Structure*, New York, Free Press.

Meyer, A., and Starbuck, W.H. (1991) Organisations and Industries in flux: The interplay of rationality and ideology. *Working paper*. University of Oregon, Eugene

Mezias, S. J., and Lant, T.K (1994) Mimetic Learning and the Evolution of Organisational Populations, in J. Baum, and J. Singh (Eds.), *Evolutionary Dynamics of Organisations* : 179-193, Cambridge: Oxford University Press

Miles, R., and Snow, C. (1978) *Organisational Strategy, Structure and Process*. New York, McGraw-Hill Book Company

Miles, R.H. (1982) *Coffin nails and corporate strategies*. Englewood Cliffs. NJ: Prentice Hall

Miller, D .(1993) The Architecture of Simplicity, *Academy of Management Review*, 18: 116-138.

Miller, D. (1990) *The Icarus Paradox: How exceptional companies bring about their own downfall*. New York: Harper Collins

Miller, D., and Chen, M-J.(1996) The Simplicity of Competitive Repertoires: An Empirical Analysis, *Strategic Management Journal*, 17: 419-440

Miller, D., and Friesen, P.H. (1984) *Organisations: A quantum view.* Englewood Cliffs, NJ: Prentice-Hall

Miller, D., and Shamsie, J. (1999). Strategic responses to three kinds of uncertainty: product line simplicity at the Hollywood film studios. *Journal of Management,* 25(1): 97-116

Miner, A. S., and Anderson, P. (1999) Industry and population level learning: Organisational, inter-organisational and collective learning processes, in Anne S. Miner and Philip Anderson (Eds.) *Advances in Strategic Management: Population Level Learning and Industry Change.* Stamford, CR: JAI Press

Miner, A.S., and Haunschild, P.R. (1995) Population Level Learning. Research in Organisational Behaviour, 17: 115-166.

Mintzberg, H (1979), *The Structuring of Organisations,* Englewood Cliffs, NJ: Prentice-Hall

Mintzberg, H., Ahlstrand, B., and Lampel, J. (1998) *Strategy Safari: A guided tour through the wilds of strategic management,* The Free Press, New York, 1998

Morgan, C.L. (1896) On modification and variation. *Science,* 4: 733-740.

N

Nelson, R.R., and Winter, S.G. (1982) *An Evolutionary Theory of Economic exchange.* Cambridge MA: Belnap.

Newell, A., and Simon, H.A.(1972) *Human Problem Solving* Englewood Cliffs, NJ: Prentice Hall

Nickerson, J.A., and Zenger, T.R. (2002) Being efficiently fickle: A dynamic theory of organisational choice. *Organisation Science,* 13(5): 547-566

Nonaka, I. (1994) A Dynamic Theory of Organisational Knowledge Creation. Organisation Science, 5 (1):14-37.

Nonaka, I., and Takeuchi, H. (1995) *The knowledge creating company.* Oxford: Oxford University Press

O

Ouchi, W. (1978) *Theory Z: How American Business can meet the Japanese challenge.* Reading, MA: Addison-Wesley.

P

Paoli, M., and Principe, A. (2001) The Relationships between Individual and Organisational Memory: Exploring the missing Links, mimeo SPRU.

Paul, W. (1979) Hollywood Harakari, in A.apra (ed.), *Hollywood 1969-1079* Marsilis:Venezia.

Peteraf, M. A. (1993) The cornerstone of competitive advantage: A resource based view. *Strategic Management Journal* 14: 179-191

Pettigrew, A.M.(1973) The politics of organisational decision making. London: Tavistock.

Phelan, S.E., Ferreira, M., and Salvador, R.(2002) Research Notes and Commentaries: The first twenty years of th strategic management journal. *Strategic Management Journal,* 23: 1161-1168.

Pondy, L. R., and Mitroff, I. I. (1979) Beyond open systems models of organisation, in L. L. Cummings, and B. M. Staw (Eds.) *Research in Organisational Behaviour,* Vol.1, Greenwich, CT: JAI Press

Porac, J. F., Howard, T., and Baden-Fuller, C. (1989) Competitive Groups as Cognitive Communities: The Case of Scottish Knitwear Manufacturers. *Journal of Management Studies*, 26 (4): 397-416.

Porter, M. E. (1985) *Competitive Advantage.*, Ch. 1: 11-15. The Free Press. New York.

Power, J., and Waddell, D. (2004) The link between self-managed work teams and learning organisations using performance indicators. *Learning Organisation*, 11(3): 244-259.

Prahalad, C. K., and Hamel, G. (1990) The core competence of the corporation. *Harvard Business Review*. 68 (May-June): 79-91.

Puttnam, D. (1997) *Movies and Money*. New York: Vinatge Books

R

Radner, R. (1975). A behavioural model of cost reduction. *Bell Journal of Economics*, 6:196-215.

Reason, J.(1997) Managing the Risks of Organisational Accidents. Sydney, Australia:Ashgate

Resnick, L.B. (1991) Shared Cognition: Thinking as Social Practice. In L. Resnick, J. Levine and Teasley, S. *Perspectives on Socially Shared Cognition*: 1-22. Hyattsville, MD: American Psychological Association

Revans, R.W. (1971) *Developing effective managers*. London: Prager Press.

S

Sahal, D. (1981) *Patterns of Technological Innovation* Reading, Massachusetts: Addison Wesley): 15-40

Schulz, M. (2001) The Uncertain Relevance of Newness: Organisational Learning and Knowledge Flows. *Academy of Management Journal*, 44 (4): 661-681

Schwab, A., and Miner, A.S.(2001) Organisational learning and short-term collaboration: Patterns in the U.S. Movie Industry, 1930-1940. *Academy of Management. Washington D.C. August*, 2001.

Seligman, M. (1975) *Helplessness: On depression, development and death.* San Francisco: Freeman

Senge, P. (1990) *The Fifth Discipline: The Art and Practice of the Learning Organisation* New York: Doubleday Currency

Shamsie, J. (2005) Skating on Thin Ice: Confronting Knowledge Ambiguity in the U.S. Motion Picture Industry, in J. Lampel, J. Shamsie, and T.K. Lant (Eds.), *The Business of Culture* Lea Publishers, London

Shamsie, J., Miller, D., and Greene, W. (2004) Deriving value from dispersed knowledge: A study of U.S. film production firms, *European group for Organisation Studies*. Lublijana, Slowenia.

Shibata, G. TSE. D., Vertinsky, I., and Wehrung, D. (1991) Do norms of decision-making styles, organisational design and management affect performance of Japanese firms? An exploratory study of medium and large firms. *Managerial and Decision Economics* 12(2): 135-146.

Shrivastava, P. (1983) A typology of organisational learning systems. *Journal of Management Studies*, 20(1): 135-146

Simonton, D.K. (2002) Collaborative aesthetics in the feature film: Cinematic components predicting the differential impact of 2,323 Oscar-nominated movies. *Empirical Studies of Arts*, 20:115-125

Simonton, D.K. (2004) Group Artistic Creativity: Creative Clusters and Cinematic Success in Feature Films. *Journal of Allied Social Psychology*, 34(7): 1494-1520.

Snowden, D. (2002) Complex Acts of Knowing: Paradox and Descriptive Self-Awareness. *European Conference on Knowledge Management*, Dublin, Ireland.

Snyder W.M., and Cummings, T.G. (1998) Organisation learning disorders: Conceptual model and intervention hypotheses. *Human Relations*. 51 (7): 873-895.

Snyder, W., and Wenger, E. (2000) Communities of practice: the organisational frontier. *Harvard Business Review*, Jan-Feb, 2000, 139-145

Spencer, H. (1876-96) *Principles of Sociology*, New York, A:leton

Spender, J.C. (1996) Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, 17: 45-62.

Stacey, R. D. (2001) *Complex responsive processes in organisations: Learning and knowledge creation*. London: Routledge.

Staiger, J. (1985) The Hollywood mode of production to 1930, in D. Bordwell, J. Staiger, and K. Thompson (Eds), *The Classical Hollywood Cinema: film Style and Mode of Production to 1960*. New York: Columbia University press

Starbuck, W. H. (1963) Level of aspiration. *Psychological Review*, 70: 51-60

Starbuck, W.H., Greve, A., and Hedberg, B. (1978) Responding to crisis. *Journal of Business Administration*, 9:111-137

Starbuck, W.H., and Baumard, P. (2005) Learning from Failures: Why it Doesn't Happen *Presented at European group for Organisation Studies 21st Colloquium,* Berlin.

Stone, B. (2001) Attack of the Battle Bots; Now gearheads really have an outlet for their aggressions, thanks to cable TV's latest craze. *Newsweek*, (May 28): 40.

Stone, B. (2003) *Gearheads: The Turbulent Rise of Robotic Sports*. Simon and Schuster.

Sweeney, M.T. (1991) Towards a Unified Theory of Strategic Manufacturing Management. *International Journal of Operations and Production Management*, 11(8):6-22.

T

Talbot, C., and Harrow, J. (1993) Sharing or Withholding Knowledge? An Exploration of Changing Values in Managerial and Organisational Learning. Paper for *British Academy of Management Conference*, Milton Keynes.

Taylor, T. (1967) *People Who make Movies*, Garden city Ny: Doubleday and Company, Inc.

Teece, D.J. (1986) Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, 15: 285-305

Thomas, J.B. Sussman, S.W. and Henderson, C. (2001) Understanding Strategic Learning: Linking Organisational Learning, Knowledge Management, and Sensemaking. *Organisation Science*, 12(3): 331-345.

Tisdell, C. (1996) *Bounded rationality and Economic Evolution*, Edward Elgar, Cheltenham, U.K.

Turner, R., Peyami, R. (1996) Organizing for Change a Versatile A:roach. *The Project Manager as a change Agent*, Composed JR Turner, KV Grude and L Thurloway (ed.), McGraw-Hill, Chapter-4: 62-75

Tushman, M., and Romanelli, E. (1985) Organisation Evolution: A Metamorphosis Model of Convergence and Reorientation. *Research in Organisation Behaviour*, 7: 171-222.

Tushman, M., and Romanelli, W. (1986) Organisational evolution: A metamorphosis model of convergence and reorientation, in L. L. Cummings and, B. M. Staw, (Eds). *Research in Organisational Behaviour*. Vol. 7. JAI Press, Greenwich, CT.

Tushman, M., and Anderson, P. (1986) Technological Discontinuities and Organisation Environments. *Administrative Science Quarterly*, 31: 439-465.

U

Utterback, J. (1994). *Mastering the dynamics of innovation*. Boston, MA: Harvard Business School Press

W

Weick, K.E. (1979) *The social psychology of organizing*. 2nd Ed. New York: Random House

Weick, K.E. (1995) Sensemaking *in Organisations*. Newbury Park, CA: Sage

Wernerfelt, B. (1995) The resource-based view of the firm: Ten years after. *Strategic Management Journal*. 16 (March): 171-174

Wenger, E. (1998) *Communities of Practice: Learning, Meaning and Identity.* Cambridge: Cambridge University Press.

Whittington, R. (1993) What is strategy and does it matter? London: Routledge

Wright, G., and Goodwin, P. (1999) "Future-focussed thinking: Combining scenario planning with decision analysis", *Journal of Multi-Criteria Decision Analysis,* 8: 311-321.

X

Xiong, N. (2001) Evolutionary learning of rule premises for fuzzy modelling. *International Journal of Systems Science,* 32(9), : 1109-1118.

Z

Zollo, M., Reuer, J.J., and Singh, H. (2002) Inter-organisational Routines and Performance in Strategic Alliances. *Organisation Science,* 13(6): 701-713.

Archival Data Sources

11th Hour from (now closed) http://www.the11thhour.com/ retrieved, January 2006

Battle Bots, retrieved April 2004, from http://www.battlebots.com/

BBC-films from http://www.bbc.co.uk/film/ retrieved, January 2006

Box-office Mojo from http://www.boxofficemojo.com/ retrieved, January 2006

Defense Advanced Research Projects Agency, retrived May 2004, from http://www.darpa.mil/

Fighting Robots Association, retrieved April 2004, July 2004 from http://www.fightingrobots.co.uk/

Film Box-office Data Base from http://www.boxofficeguru.com/film.htm retrieved, January 2006

G4techtv, retrieved February 2004, from http://www.g4techtv.com/show.aspx?show_key=49

Houghton, P. (2002-2004) Robots Rule, retrived, January 2004, July 2004, from http://www.btinternet.com/~patricks.web/robots/home.htm

Internet Movie Database (IMDb) from http://www.imdb.com/ retrieved, January 2006

Love Films accessed for movie downloads over November 2005 to March 2006 from http://www.lovefilm.com/am.php

Mentorn Barraclough Carey Production Ltd (2002). Extracts from the BBC television series 1997-2002: Robot Wars Collectors Edition, U.K [DVD]

Mountjoy, D. (2001-2003) Tectonic robot wars UK, retrieved, January 2004, from http://www.tectonic.force9.co.uk/

New York Times from http://movies.nytimes.com/pages/movies/index.html retrieved, January 2006

Rotten Tomatoes from http://uk.rottentomatoes.com/retrieved, January 2006

Run Amok, Combat Robotics (2001-2004), retrieved, March 2004, from http://www.open.org/joerger/robotica.html

Sequelogue (2005), retrieved April, 2005, from http://www.sequelogue.com/

Smentowski, J. (2004), Fighting Robots.com, retrieved, March 2004,from http://www.robotcombat.com/creator.html

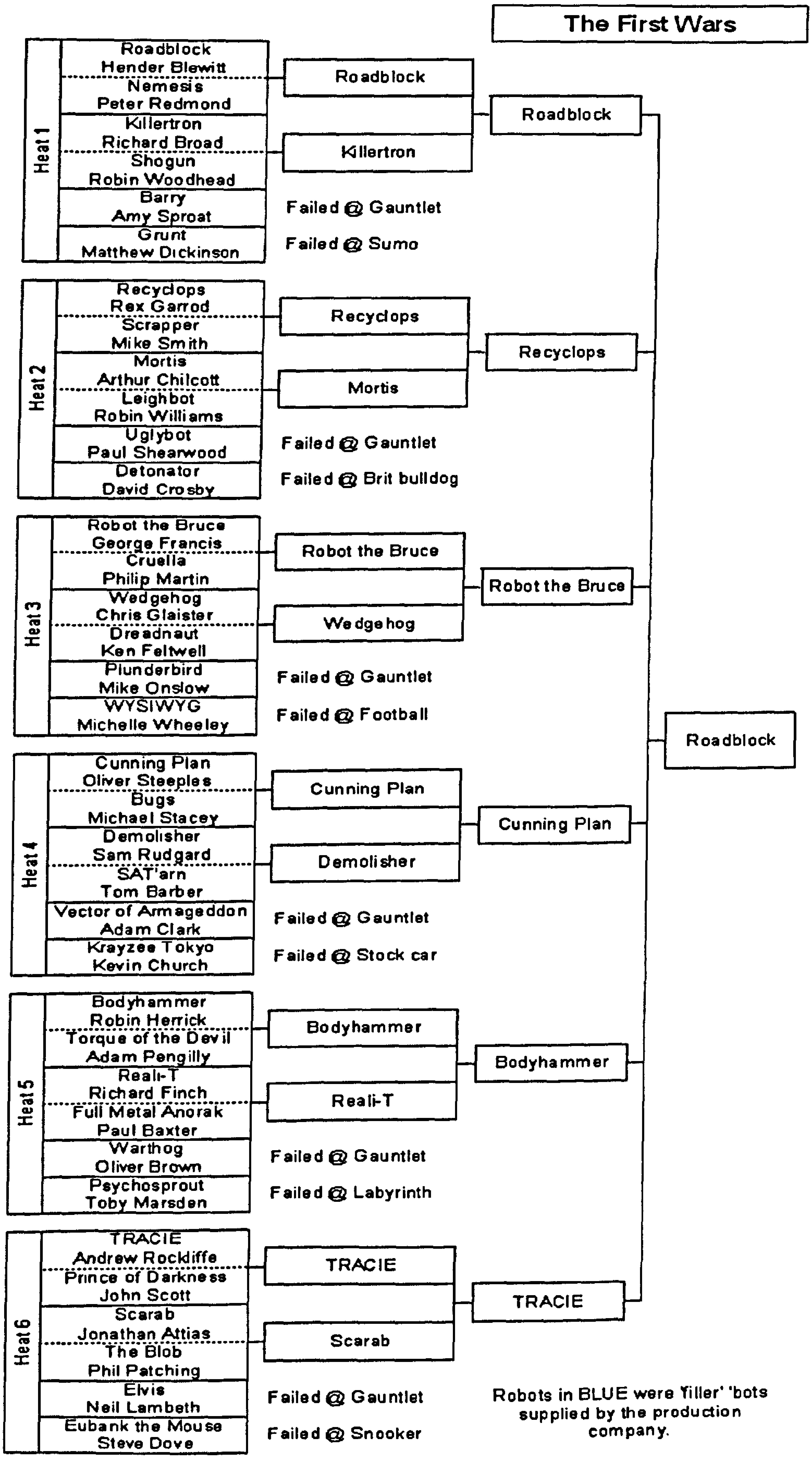
Stone, B. (2003). "Gearheads: The Turbulent Rise of Robotic Sports" Pub: Simon and Schuster. Excerpt retrieved, February 2004, from http://www.gearheadsthebook.com/

The Numbers by Nash Information Services from http://www.the-numbers.com/index.php retrieved, May 2006

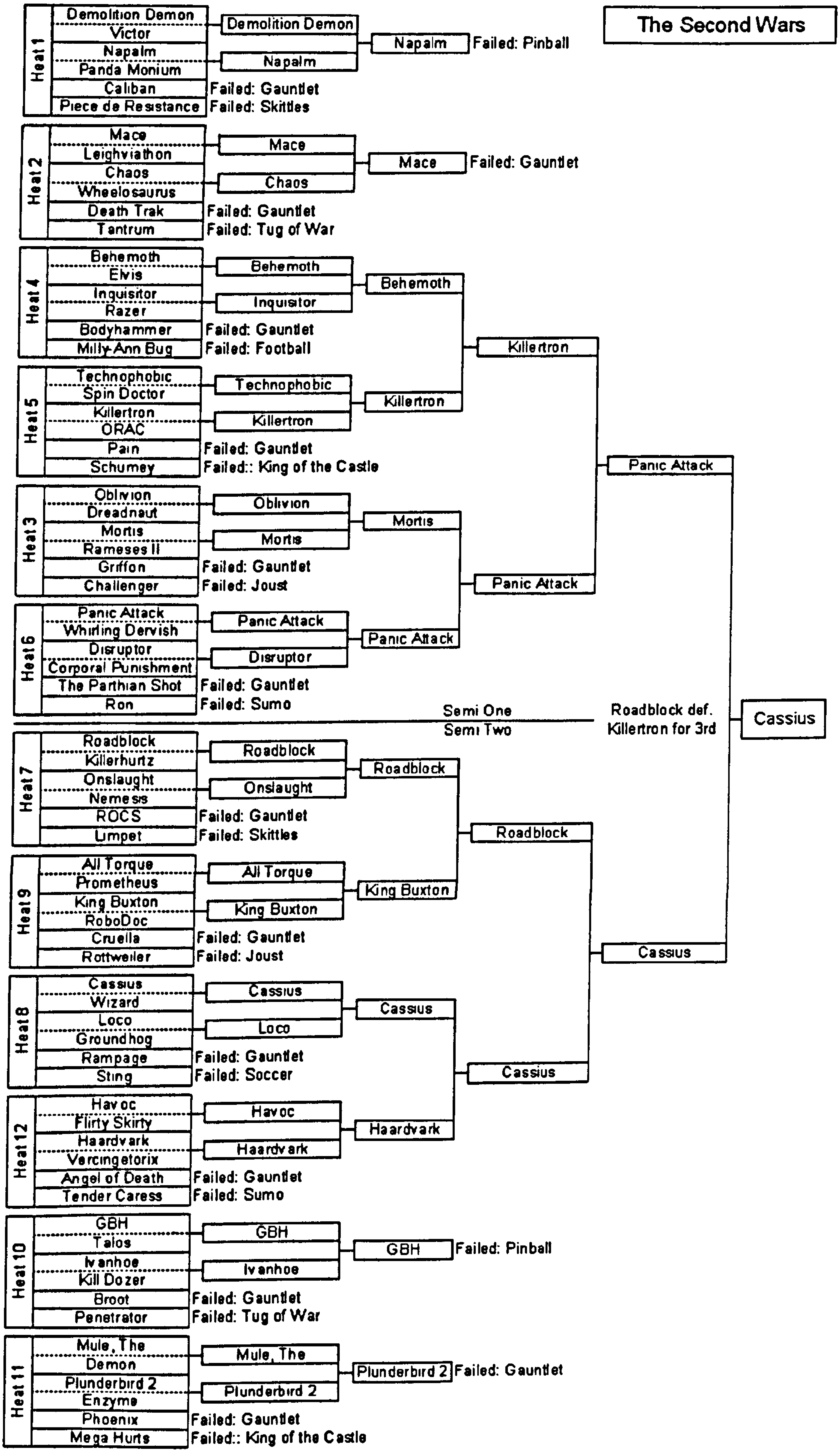
Tornado Robot wars Forum (2000-2004), retrieved, Feburary 2004, from http://www.teamtornado.co.uk/rww08.htm

Appendices

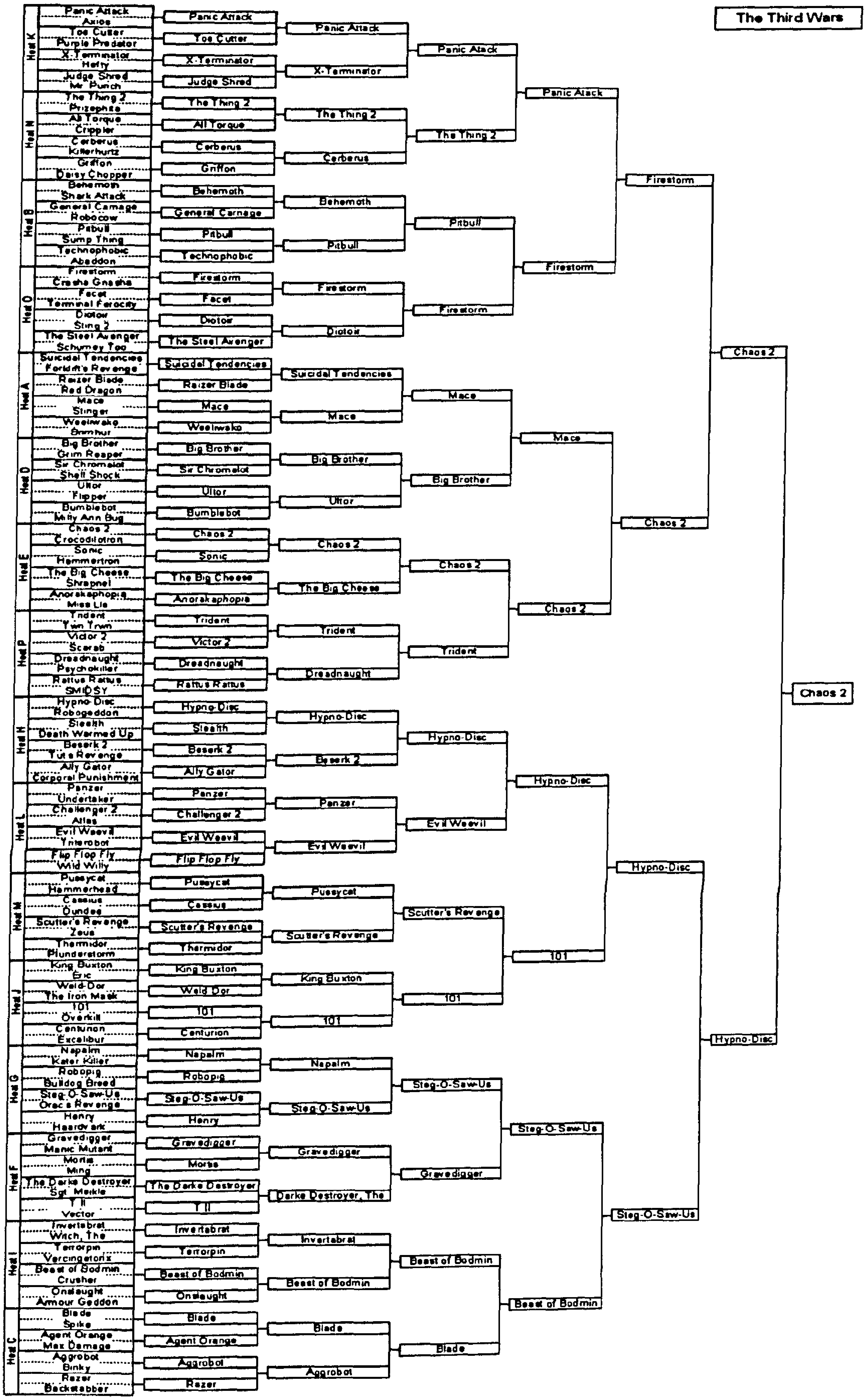
Appendix A: Robot War Series Progression Charts



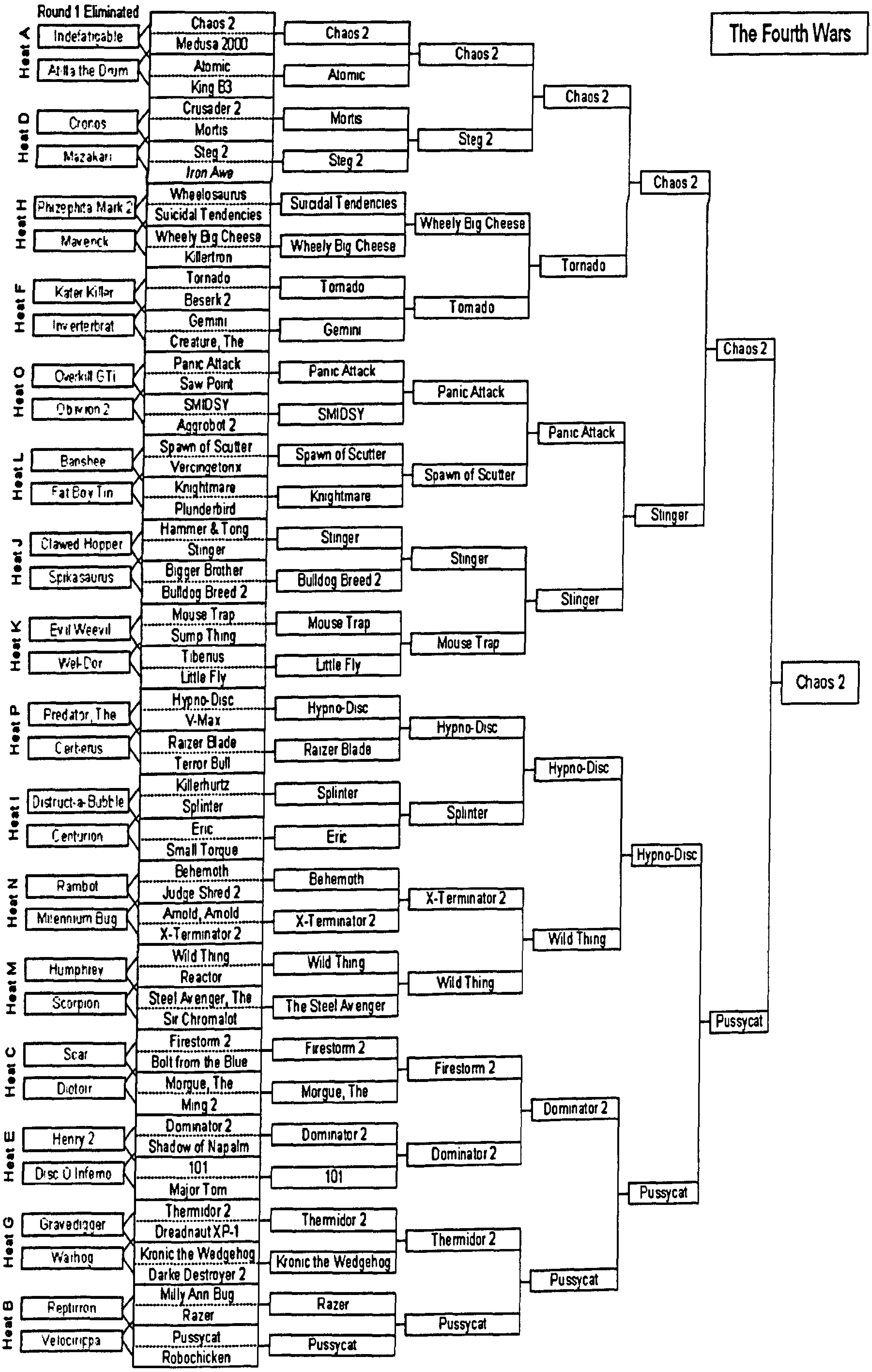
Appendix A : Robot Wars Series Progression contd...

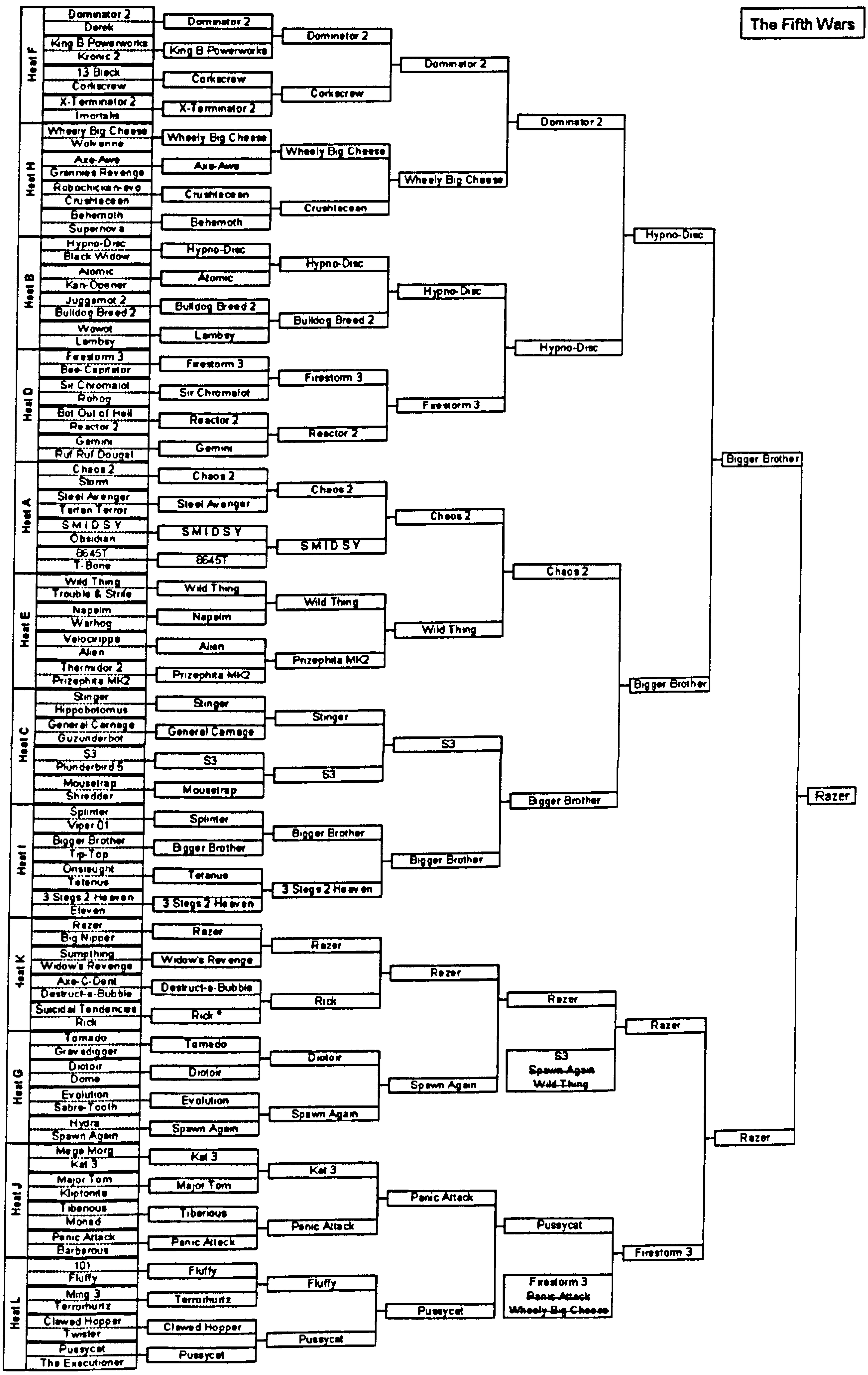


Appendix A: Robot Wars Series Progression contd...



Appendix A: Robot Wars Series Progression contd......



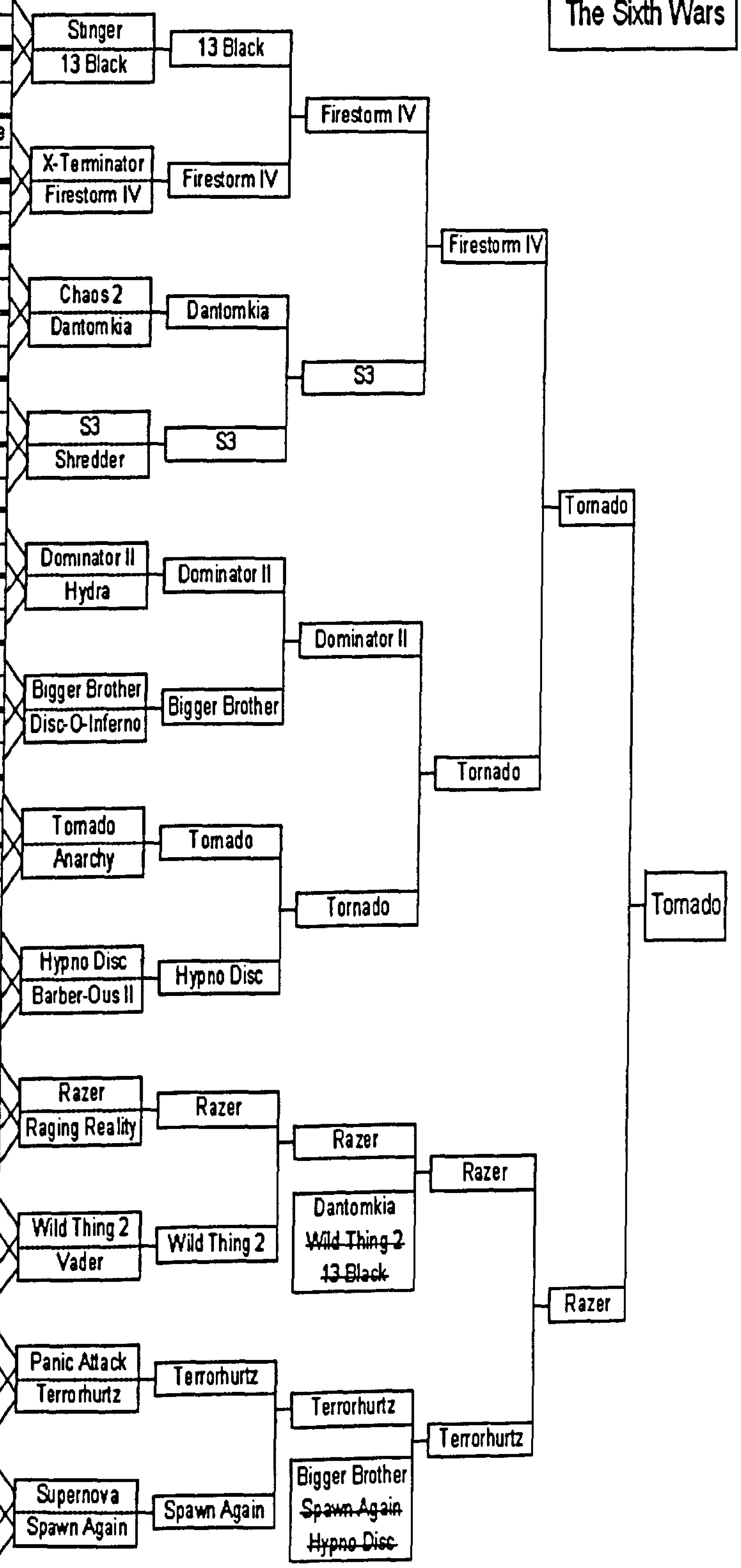


* Rick was reinstated after Suicidal Tendencies broke down

Appendix A: Robot Wars Series Progression contd...

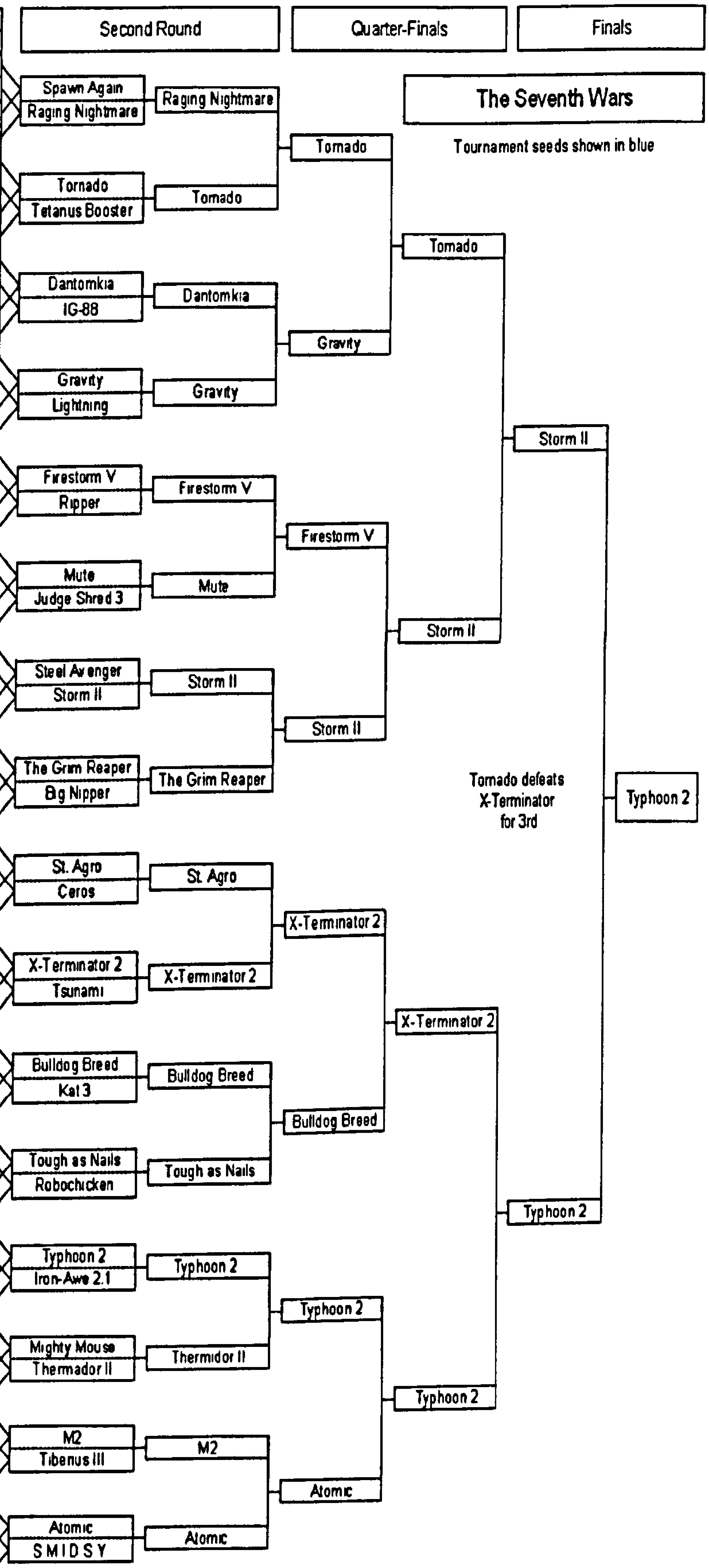
The Sixth Wars

	4-Way Melee Round	
	Eliminated	Through
Heat F	Thermidor II	Stinger
	Chompalot	13 Black
	Kan-Opener	Fluffy
	Demolition Man	Double Trouble
Heat B	Robochicken	Barbaric Response
	Spirit of Scorpion	X-Terminator
	Cedric Slammer	Firestorm IV
	Colossus	Mega Hurts 2
Heat C	Iron-Awe 2	Chaos 2
	Destructosaur	Mighty Mouse
	Doctor Fist	Crushtacean
	Mr Nasty	Dantomkia
Heat D	Armadrillo	S3
	Roobarb	Shredder
	ICU	Sir Chromalot
	GBH2	The Alien
Heat J	Sumpthing	Dominator II
	Axe-C-Dent II	Hydra
	Warhog	S.M.I.D.S.Y
	St Agro	Comengetorix
Heat L	Major Tom	Bigger Brother
	Riptilion	Killer Carrot 2
	Tridentate	Behemoth
	Derek 2	Disc-O-Inferno
Heat G	Terror Bull	Tornado
	Edge Hog	Inshredable
	Judge Shred 2½	Thor
	Revolution 2	Anarchy
Heat K	Granny's Revenge II	Hypno Disc
	4X4	Barber-Ous II
	Rev. of Trouble & Strife	Bulldog Breed
	Spin Doctor	Kat 3
Heat A	Brutus Maximus	Razer
	W.A.S.P	Raging Reality
	Weld-Dor 3	Cyrax
	Ruf Ruf Dougal	Tetanus II
Heat E	Infernal Contraption	259
	Infinity	Aggrobot 3
	UFO	Wild Thing 2
	The Stag	Vader
Heat I	Corkscrew	Panic Attack
	R.O.C.S	Kronic 2
	Sabre Tooth	A-Kill
	Reptirron The Second	Terrorhurtz
Heat H	Hot Pants	Ming III
	The Hassocks Hog	SPAM
	Tiberius III	Supernova
	Short Circuit	Spawn Again



Heat	4-Way Melee Round: Eliminated	4-Way Melee Round: Through
N	Chip	Spawn Again
	NEATer Machine	Revenge of T&S
	The Executioner	R.O.C.S.
	Topbot	Raging Nightmare
E	Sawpoint 2	Tornado
	Devastator	Ewe 2
	Barber-ous 2'n a Bit	Leveler 2
	Thunderpants *	Tetanus Booster
C	Rick	Dantomkia
	Hassoks Hog 2	King B Powerworks
	Tomohawk	Scorpion
	The Stag	IG-88
D	Herbinator	13 Black
	The Alien	Lightning
	Hydra	Gravity
	Hodaf the Bad	Thor
P	Black and Blue	Firestorm V
	Bamm Bamm	Daisy Cutter
	Aggrobot	Repternon 2
	Zorro	Ripper
L	Demolition Man	Mute
	Corkscrew 2	Judge Shred 3
	Crushtacean	Behemoth
	Tartarus	UFO
I	Supernova	Rhino
	Mayhem	Storm II
	Sub-Version 1.1	Steel Avenger
	Shredder Evolution	Trax
B	Kan-Opener	The Grim Reaper
	Barbaric Response	Big Nipper
	Terrorhurtz *	Gyrobot
	KillerKat	Jackson Wallop
H	Metallis	Scraptosaur
	Ming DieNasty	Ceros
	Mega Hurts LT	St Agro
	The Scrapper	Revolution 3
F	Major Tom 3	X-Terminator 2
	Diabolus	Tsunami
	Fluffy	Killer Carrot 2
	Scarey-Go-Round	Constrictor
K	Jabber	Bulldog Breed
	Infernal Contraption	Mantis
	T-Wrecks	Hard
	Velocirippa	Kat 3
M	Spindoctor	Panic Attack
	Edge Hog	Mega Morg
	Disc-O-Inferno	Tough as Nails
	Blades of Destruction	Robochicken
O	Colossus	Typhoon 2
	Un Rotating Object	Bigger Brother
	Disconstrictor	Hammerhead 2
	Xenomorph	Iron-Awe 2.1
J	Mobot	Mighty Mouse
	8645T	Thermidor II
	Pinser	The Wedgehog
	Cobra	The Kraken
A	Twister	Pussycat
	Brutus Maximus	Roobarb
	Vader	M2
	Shell Shock	Tiberius III
G	Terror Turtle	Atomic
	Cygnus (x3)	S.M.I.D.S.Y.
	Araknia	Hellbent
	1 Bot One Beta	Mean Streak

* Did not fight



Appendix B: Floor Plan of the Robot Wars Battle Arena