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Organizing for Innovation:
An Examination of Collaborative Teams in Industrial Design

by

Christopher Reichert-Facilides

B.A. Liberal Arts
St. John's College, Annapolis, Maryland, 1986

Submitted to the Alfred P. Sloan School of Management and the School of Engineering
in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Management of Technology

at the

Massachusetts Institute of Technology

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MIT Alfred P. Sloan School of Management

7 May 2004

Certified by: ____________________________________________________

Michael A. Cusumano
Sloan Management Review Professor of Management
Thesis Supervisor

Accepted by: ____________________________________________________

David A. Weber
Director, Management of Technology Program

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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ABSTRACT

Why are some industrial design firms more successful than others in consistently producing high quality products and services? Do they hire more talented people, or are they organized so as to maximize the potential of their teams?

I begin this thesis with an examination of literature on teamwork, the dynamics of idea propagation, and the product development process itself. This is meant to extract some insights into successful teams across a broad spectrum of activities and what they did to generate a creative output. These examples include references to historically significant teams such as Thomas Edison’s Lab and the Manhattan Project. By using such extreme examples, I am seeking similarities in more common projects and organizations.

I use a workgroup framework to analyze the factors involved, including the context, the people on the teams, their task requirements and formal organization, group cultures that emerge, as well as the outcomes that define the success, or otherwise of a project.

I interviewed a number of professionals in the industry. These include professionals from IDEO, Design Continuum, Modo, and seven02design, as well as professors at the MIT School of Engineering, Media Lab, Sloan School, and Olin College of Engineering. The main focus is in analyzing the collaborative processes and methods of these sample organizations. My objective is to identify their methodology for organizing the creative process and how they maintain a high standard across projects, industries and over time.

Thesis Supervisor: Michael A. Cusumano
Title: Sloan Management Review Professor of Management
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Writing this thesis has provided me the opportunity to pursue in great depth an area of long standing interest. It also allowed me incredible insights into some of the companies that I admire the most.

I would like to thank:

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- Dennis Boyle at IDEO. To peek into a very center of creative industrial design is one thing. To have an hour with one of the industry’s leading lights is almost too good to be true. I left the meeting in Palo Alto and literally drove across the country with a stack of books and incredible insights to digest. I needed every one of the 60 hours on Interstate 80 to get my mind around it all.
- Ted Selker from the MIT Media Lab, who made me pass a test before he would let me interview him. Somehow I passed and our hour went far too quickly but was filled to capacity. How could I not learn from someone who invented the TrackPoint and a see-through notebook screen that I loved 10 years ago and still mourn its absence from the IBM line up? My thanks also go to his assistant Sarah Dionne for juggling schedules to fit me in and letting me loiter around her desk.
- Rick Lewis from seven02design. His newfound success with his own firm, built on years of excellent experience at Dreyfuss and IDEO reminds me of why I haven’t yet worked for a large company and wonder if I ever will.
- Daniel Buchner and Ellen DiResta from Design Continuum who let me record our conversation against their better judgment. The two hours spent together, and being able to ask questions of two consummate professionals, gave me so much valuable information that I am struggling to not leave out too much in the interest of length. I hope that I can continue the conversation again very soon.
- Jim Utterback who gave freely of his time, books, and writings. When I started to really think about changing topics one of his lectures on design to the MOT class sealed my decision.
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- My fellow MOT Ricard Huguet whose common sense, insights and organized mind kept me focused. If I can think of nothing else from my year at MIT, having him as a friend will be more than enough of a return on investment.
- Hillary Carey from Carnegie-Mellon who put me in touch with many people and ideas.
- My parents who instilled an appreciation for design and its fundamental role in my life. My father is right; design is my “stecken pferd.” Now to decide what to do with it.
- The MOT Class of 2004 – the final MOT class at MIT. You all taught me so much over this whole year.
- Finally, to my lovely fiancée, Vicky. You heard it all, backwards and forwards, and somehow didn’t lose faith that I would finish. I love you forever.
Biography of the Author

Christopher Reichert-Facilides obtained the degree of Bachelor of Arts from St. John’s College in Annapolis, Maryland, in 1986. After serving as Research Assistant at the Pennsylvania Economy League in Philadelphia, Christopher traveled extensively through South-East Asia, eventually settling in Sydney, Australia from 1989 until 2003. In Sydney, he joined a small information technology consultancy firm, M-TEC, becoming an equal partner and Managing Director in 1996.

While at M-TEC he successfully built the company into a full-service consulting firm providing outsourced technical services to a wide array of companies, including the top tier radio networks in Asia-Pacific. M-TEC also became the primary IT supplier for the second largest internet service provider in Asia-Pacific, handling the specifications, quality assurance, and purchasing of their server farm equipment, successfully managing this client’s growth needs from 40,000 users to over 600,000 users.

In 2003 he sold his share in the business enabling him to focus on earning an MS in Management from the Massachusetts Institute of Technology Sloan School of Management on May 2004. Starting in August 2004, he will attend the Kennedy School of Government at Harvard University, earning a Master in Public Administration.
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Chapter 1: Industrial Design Overview

What is Industrial design?

In researching this topic, I have discovered that the concept of "industrial design" is burdened with many conflicting definitions. One definition says, "a product concept is generally brought to life through decisions about physical form and appearance of the product. These decisions are part of an activity generally called industrial design."¹

As Christopher Lorenz discusses, the word design "conjures up an image of women's fashions, designer clothing, furniture, fabrics, and interior design, or even crafts. To some it embraces architecture, to others the creative side of engineering: design engineering. To very few does it suggest the activity which spans both the form and function of manufactured products – industrial design."²

Another broad definition comes from the International Council of Societies of Industrial Design (ICSID).

"Design is a creative activity whose aim is to establish the multi-faceted qualities of objects, processes, services and their systems in whole life-cycles. Therefore, design is the central factor of innovative humanization of technologies and the crucial factor of cultural and economic exchange.

Design seeks to discover and assess structural, organizational, functional, expressive and economic relationships, with the task of:

- enhancing global sustainability and environmental protection (global ethics)
- giving benefits and freedom to the entire human community, individual and collective

• final users, producers and market protagonists (social ethics)

• supporting cultural diversity despite the globalization of the world (cultural ethics)

• giving products, services and systems, those forms that are expressive of (semiology) and coherent with (aesthetics) their proper complexity."

Perhaps the broadest definition is that used by the Industrial Designers Society of America (IDSA), which says, "the professional service of creating and developing concepts and specifications that optimize the function, value, and appearance of products and systems for the mutual benefit of both user and manufacturer."³

It is generally acknowledged that industrial design is an important element in product development. As noted marketing and strategy expert Philip Kotler described it, companies must "seek to creatively blend the major elements of a design mix, namely performance, quality, durability, appearance and cost."⁴ "Product development is a deliberate business process involving scores of generic decisions."⁵ Even though customers evaluate products holistically on looks as well as performance for too long industrial design was an after-thought (the gift-wrapping), to be attended to after the technical features were determined. Simultaneously, the globalization of markets has dispersed the development of technologies and their manufacture. It is no longer adequate for any length of time to simply have the best technology.

As an industry that bridges aesthetic, ergonomic, engineering, manufacturing and marketing disciplines, industrial design is many things to many people. To a product manager, it may mean a commercially successful product. To an engineer, success may center on a product's functionality, whether in normal usage, or in times of repair. To a designer, it may mean a focus on ergonomics and aesthetics. To the end user it may mean affordability and durability. Quite often the most optimal design in industry is

the result of using engineering models in a process of trial and error.

For me the role of the industrial designer is to provide the most fertile environment for synthesizing the multiple processes of product development from conception to execution. Their skills and sensibilities should ideally be both a mile wide and a mile deep in order to understand historical contexts and grasp future uses. They need to merge the passions of "love at first sight" with the deeper emotions that result from a long term commitment. Their understanding of human nature should foresee things that the end-user has not even considered or has denied. They need to build networks and create new realities from ideas, people, objects and technologies that surround us all.

Clearly this is a tall order for any one individual. In this thesis I will be focusing on teamwork and the necessities of this collaborative work. I hope to provide some insights as how to optimize for innovation.

**The Industry**

Unlike many other professions where large companies dominate and therefore can impose definitions on many of the parameters of their industry, the industrial design industry is primarily composed of many small firms. According to the Design Management Institute, the majority of industrial design firms has between 6 and 25 employees, and has revenues of between $1M and $9.9M\(^6\). Even in large firms, with revenues of between $1B and $4.5B, the design practices within these firms tend to have between 6 and 25 employees. These figures are corroborated by a 1997 US Census Economic survey\(^7\). The industrial design services sector of the economy, defined as North American Industry Classification System (NAICS) #541420, employs 13,600 people, and has combined revenue of $1.3B. The employees per establishment numbers a statistically useful number: 10.3.

These statistics give an overview of the fragmented nature of the industry and its relative economic power compared to the output of industrial designers embedded within large manufacturing firms, such as in the automotive industry. To give some additional

\(^6\) The Design Management Institute, 1999 2000 North American Professional Profile & Salary Survey, p43.

perspective this same survey counts employees involved with manufacturing in the U.S. as totaling over 16 million, with a value of transactions of over $3.8 Trillion. Not all are related to design, of course, but the economic output of these manufacturing companies implies significant power.

Within the industrial design profession, there are a handful of large firms, such as IDEO and Design Continuum, which command a higher than average public profile in the industry. This profile provides ancillary benefits such as the ability to define their role within projects more greatly than other firms. Nevertheless, they still do not control resources nor broadly define the processes of the business, in the Porterian sense of the word.

**Why design matters — a financial perspective**

Numerous studies have been performed on the benefits of industrial design. Besides the fact that everything made by people has been designed in some fashion, studies of design’s value have ranged from counting awards and tabulating reviews to impassioned appeals to our aesthetics sensibilities. While this is good news for the overall acceptance of industrial design as an important shaper of consumer desire and behavior, very few have attempted to draw a direct link to the bottom line financial impact of design in a business endeavor. This is a crucial step towards ingraining design excellence as equally important to a business’s success as engineering, manufacturing and marketing excellence.

A 1994 study by Robin Roy of the Open University of Britain\(^8\) aimed to determine whether companies that produced well-designed products performed better financially than a random selection of competitors in the same industry. Acknowledging that design-related factors were particularly difficult to separate from overall company management, the author nevertheless started the process of initially defining successful companies by using available indicators of a company’s reputation, awards won, as well as the views of other companies in the industry. He cited the total number of British Design Awards, plus other leading awards, won by the company, the number of citations the product received in leading design publications, and the number of times a company

\(^8\) "Can the Benefits of Good Design Be Quantified?", Design Management Journal Vol. 5 No. 2, 1994
was mentioned by competitors. Industry reputation was weighted more heavily, under the assumption that having a positive reputation amongst one's peers was more reliable than more subjective and fickle industry association recognition.

The next steps involved measuring return on investment, profit growth, profit margin, sales, and turn-over growth as the key indicators of a company's success. By examining these factors for the companies recognized as having a design focus, and measuring against a randomly selected set of companies within the same industry but not recognized for their design prowess, Roy found a statistically significant difference in performance between the two camps in the plastics industry. This is shown in Figure 1.

![Bar chart showing performance on business indicators for different categories: Return on Capital, Profit Margin, Turnover Growth, and Capital Growth.]

- □ Representative sample (28 or 31 firms for which data was available with one major loss-making firm removed)
- ■ Design-conscious sample (8 firms)

**Figure 1: Business performance of "design-conscious" and "representative" companies in the plastic industry, averaged over seven years. Source: "Can the Benefits of Good Design Be Quantified?", Design Management Journal Vol. 5 No. 2, 1994**

The study then performed the same analysis on firms in the furniture, heating, and office electronics industries. As shown in Figure 2, these firms also showed a strong statistical correlation between return on capital and profit margin, but not in rates of turnover growth or capital growth.
Roy surmises that the weaker link in these industries to rates of turnover growth and capital growth indicates that other factors such as industry dynamics and the general management skills of the executive team are not surprisingly also important in a firm's performance.

Aha, "Good design is not enough", I hear the naysayer cry. True enough if you view design in an exclusionary vacuum. However, I want to stress the difference between companies which are known for "designer" products, as opposed to those which as known for having good design. This is a critical competitive advantage, particularly in recessionary times when discretionary spending is deferred with "designer" goods often the hardest hit.

It is important to bear in mind that neither this paper nor design professionals would claim that design is the single factor, or even the single most important, in the success of a business. What is clear from these studies, however, is that in order to gain a competitive edge in a given industry, competencies in the traditional business skills of finance, sales, marketing, and manufacturing are surely necessary. What is also
emerging more clearly is that excellence in at least one area, such as design management, is also important. Differentiation, erring on the side of design excellence, is the underlying message.

Roy persevered in order to further refine the impact of design management excellence. This second study entitled, "The Commercial Impact of Design", aimed to assess the risks and reward of professional design activities at the product and project level in the manufacturing segment. This measured various inputs into the project including the financial investment, resources and expertise in design, research and development. The study then measured the outputs in terms of financial return of the project, trade effects, and indirect returns such as awards. Finally it assessed the design management practices that had the most impact on the project.

While still not perfect data, the positive news is that 69% of all projects started (with some scrapped) and 94% of all projects that were eventually implemented paid back their investment within an average of 14.5 months, as shown in Figure 3. Graphic design showed the highest and most consistent rate of return however, most notably, the risk of financial loss on all projects was very low.

![Figure 3: Payback period on different types of implemented projects Source: “Can the Benefits of Good Design Be Quantified?” Design Management Journal Vol. 5 No. 2, 1994](image)

In a more recent study, performed in 2001, also published in the Design Management
Journal\(^9\), the authors performed a study of 51 companies using 12 measures of financial performance over a five-year period. They attempted to separate both the curatorial assessment of design's role in business success, as manifested by awards and magazine covers, and the merely assertive assessments of design advocates, for example, Thomas Watson, Jr.'s pronouncement that, "Good design is good business," from an empirical assessment. They set out to answer the question, "Is good design really good business?"

Their methodology involved choosing publicly listed companies from whom they could obtain a five-year financial history from Standard and Poor's COMPUSTAT\(^\circledR\) database. Then they narrowed the company choices to a list sorted by a nine-member advisory panel, which ranked their selections according to their familiarity with the company (and hence ability to choose more informedly) and the quality of its products, used a consistent set of criteria. These were then combined and averaged and sorted to account for the input of all advisors. The top half (26) were ranked as having more effective design groups, and the lower half (25) were ranked as having less effective design groups.

This selected list of companies was then examined in more detail. By cross-referencing data, as specified in Table 1, forty-eight types of comparisons were made, in four categories. Over forty-five of the instances indicated positive correlation between design management and the resulting excellence in design output and their financial performance.

---

Table 1: Twelve measures of financial performance grouped into four areas of financial performance.

The results show that the top half group with more effective design performed better than the lower half. Growth in net sales, net income and cash flows was statistically significant, as shown in Table 2.

Wary of the claim that overall financial performance on its own is not an accurate enough measure of a design's input the survey examined the R&D budget of these same companies in order to discern if any differences existed. Despite the crudeness of this tool, this approach was rationalized under the assumption that most designers worked on product development. This expense is traditionally incorporated under the auspices of the R&D department. The results, shown in Table 3 indicate a significant difference between the top tier companies and the lower tier companies. The top tier were between 19 and 34 percent higher in average research and development expenditures relative to net sales than the industry average, while the lower tier were between 11 and 30 percent lower.

<table>
<thead>
<tr>
<th>Year</th>
<th>More-effective design</th>
<th>Less-effective design</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>1.34</td>
<td>0.70</td>
</tr>
<tr>
<td>1996</td>
<td>1.27</td>
<td>0.82</td>
</tr>
<tr>
<td>1997</td>
<td>1.29</td>
<td>0.60</td>
</tr>
<tr>
<td>1998</td>
<td>1.19</td>
<td>0.86</td>
</tr>
<tr>
<td>1999</td>
<td>1.21</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Note: Differences between groups for all years are statistically significant beyond the .10 level.


**Why design matters – an aesthetic perspective**

No argument in favor of industrial design could exclude the most potent aspect of this
profession; the emotional element good design can bring to a product. Do we fall in love with the product? Does it stand out in a crowded marketplace? Do I associate myself with the product in terms of fashion or status? Does it sell more?

A study performed at MIT and discussed in Ulrich and Eppinger’s book “Product Design and Development,” assessed the impact of detail design decisions on a product’s success for a set of competing products. Admitting that it is inherently difficult to quantify the impact precisely, the study found a significant correlation between aesthetics and the retail price, but not between those same aesthetic values and manufacturing costs. Adding just $1 to the price of the products studied added millions in profits over their sales life. In other words, a beautifully designed product commanded a higher selling price, but not a higher manufacturing cost.

Ulrich and Eppinger continue, citing a second study from the Open University in England. This suggested that investing in industrial design yielded a positive return in 90% of all implemented projects. This agrees with the results I discussed earlier.

In product-based organizations the visual style of the organizations helps to position the firm within the market. The equity created can be a powerful attraction or deterrent. Through advertising, logos, packaging, and of course the products themselves, consumers create impressions of quality, reliability, and durability. Changing these perceptions takes time and consistency. Companies like Apple or Mercedes nurture these perceptions perhaps as much as they work with their own products. It is arguable that Coca-Cola’s value lies in their strong brand equity, from the shape of their early bottles, their logos and to the emotions they elicit through effective communications.

In attempting to determine some key qualitative aspects of industrial design, Ulrich and Eppinger compiled five categories that are affected by the industrial design process. They are:

- Quality of the user interface.

Do the features effectively communicate their operation? This is an area that Donald Norman spent an enormous amount of energy discussing in his book “The Design of Everyday Things.” He has countless examples of products which fail on this front from doors, to refrigerator temperature controls, to telephone systems. Norman strongly
urges that designers use "natural mapping" to bridge the gap between functionality and ease-of-use. While Norman's strong opinions and pragmatic ideas elicited many negative responses from designers who claimed that if his ideas were following explicitly the world would be very ugly, [his concept for the mapping of light switches is truly utilitarian] he does have many valid points on the functionality issue. He argued that designers should:

1. Use both knowledge in the world and knowledge in the head.
2. Simplify the structure of tasks
3. Make things visible: bridge the gulfs between Execution and Evaluation.
4. Get the mappings right.
5. Exploit the power of constraints, both natural and artificial.
6. Design for error.
7. When all else fails, standardize.

- Emotional Appeal

Is the product attractive? Does it excite a positive response? Does it express quality and pride in ownership? Does it evoke feelings of pride for the design and sales teams?

In her book entitled, "The Substance of Style," Virginia Postrel argues that the aesthetic imperative, balanced by true functionality, is here to stay and viscerally important to the success of a new product. "We may want mobile phones to sparkle, but first we expect them to work. We expect shops to look good, but we also want service and selection. When we decide how next to spend our time, money, or creative effort, aesthetics is increasingly likely to top our priorities."¹⁰

Postrel discusses GE Plastics' Selkirk laboratory where they believe that sensory and subliminal elements in a product are essential competitive tools. The multi-million dollar

facility develops new finishes and materials, 4000 at the time of the book’s writing yielding over a million color-sample chips in special freezers, for use in new products such as the Handspring Visor and Iomega’s Zip drive. To emphasize the emotional focus of this decidedly high-tech process, Postrel writes:

“Instead of just telling engineers and purchasing managers how cheaply GE can sell them raw materials, plastics managers now listen to industrial designers and marketing people “talk about their dreams.”

“The Selkirk plant will mix up a batch of any color you can imagine, and the company prides itself on turning barely articulated desires into hard plastic: “You know how the sky looks just after a storm? When it’s late afternoon? But right at the horizon, not above it? When the sun has just come out? That color.”

Donald Norman wrote in his book, “Emotional Design”, “what many people don’t realize is that there is a strong emotional component to how products are designed and put to use. I argue that the emotional side of design may be more critical to a product’s success than its practical elements.”

Norman continues by suggesting that there are three levels of the brain when it comes to emotional attributes, the visceral, the behavioral and the reflective. The visceral is the automatic and pre-wired. This is the instinctual level, and it is largely a response mechanism which quickly analyzes and responds. When we think of something as pretty, it is the visceral level that is judging.

The behavioral level is the part that controls everyday behavior. Norman suggests that this is subconscious. He gives the example of our ability to drive a vehicle while thinking about something else. The reflective level is the highest order. It incorporates information from the behavioral level and upon reflection can alter or adjust behavior as a consequence. We learn and change on the reflective level.

Through understanding these levels, and appealing to different levels, Norma suggests that a designer can achieve more effective designs. If the product is used under stressful circumstances a different set of visual maps and usability clues need to be

considered, compared to if it is used in a relaxed and enjoyable circumstance.

- Ability to maintain and repair the product

Is the maintenance process obvious? Is assembly and disassembly logical or is it time-consuming? Can you quickly self-maintain the product or does it take an “expert”? How easy is it to replace batteries? There is much discussion around “design for manufacturing” which involves not only the process of designing for initial manufacturability, and the related cost factors, but also for maintenance and repair procedures. Both cost and maintenance affect product success. This is what Norman was referring to when he wrote, “when all else fails, standardize.”

- Appropriate use of resources

This element rates the use of resources in meeting customer needs. Part of this equation includes avoiding “feature creep” and unnecessary inclusion of materials not expressly needed for the project. Was the product over- or under-designed? Were ecological factors considered?

- Product differentiation

This rates the uniqueness of the product and consistency with corporate identity. Will customers be able to distinguish this product and single it out because of its appearance? Will it be remembered in an advertisement? Does the product enhance the corporate identity and link with the “family” of products or services offered?

It is not entirely surprising that any company with a strong visual identity will go to great lengths to protect it. Mercedes sued Toyota for the perceived copying of the S-Class design in the Lexus LS400. Coca-Cola has copyrighted the use of the specific red of its products, as has Ferrari with its own red shade. The trademark kidney grill on the BMW hood sets this brand apart from other manufacturers even as they compete on a feature-by-feature basis on other fronts. Outside of the industrial design industry, distinguishing a Picasso painting from Jackson Pollack’s work is as much about likes and dislikes, as a stark visual differentiation.
Setting the Stage

My reasons for spending these pages on "proving" the value of design in a business' success has not been to bore the reader. Rather these findings set the stage for framing the fundamental importance of design in the overall strategic vision of a company. In the next chapter I will examine examples of teams that have been noted for their success. Through their example I will attempt to extract some important insights that they can teach aspiring teams and their companies for their own operations.
Chapter 2: Successful design – a literature review

Lone genius versus team effort

There are designers and design firms in the world that excel beyond industry norms. These successful design results do not just happen. As Darrel Rhea of Cheskin wrote, "rather than simply responding to the inputs that are thrust upon the development group, we need to create the process, time, and budget to do divergent thinking before we start filtering and prioritizing ideas and designing solutions."12 A rigorous process is needed to get the effort started and keep it focused. Leaders need to be developed, and encouragement and support provided. But how does this occur and who is best to be involved?

A persistent theme of the discussions in the book entitled Organizing Genius, by Bennis and Biederman, is the notion of a "Great Group." In story after story, a Great Group "can be a goad, a check, a sounding board, and a source of love." They consist of top quality people, a focused agenda, and plenty of room to fail. "In all but the rarest cases, one is too small a number to produce greatness."13

How do we reconcile the importance of groups versus the singular genius? This dichotomy would appear to contradict conventional wisdom which paints a picture of a lone genius toiling in splendid isolation until their personal "A-ha!" moment is achieved. The image of Michelangelo upside down in the Sistine Chapel is romantic and appealing, but hardly accurate. Historical records reveal that over a dozen assistants translated his vision into reality. What's more, Michelangelo had a thriving business producing art which bore his name. Biographer William Wallace once wrote an opinion piece in the New York Times entitled, "Michelangelo, CEO," highlighting his entrepreneurship.

Generally accepted lore tells us that Thomas Edison invented the light bulb. What is more, the tale suggests nearly instant recognition of the brilliance of the outcome and a

---

smooth transition to universal acceptance by a willing population. None of this is the truth. In Menlo Park, Edison built a lab and compiled a team that worked with many companies. Often they would work for 80 hours straight before punctuating their time with late night breaks of “pie, tobacco, and bawdy songs.”¹⁴ This sounds very reminiscent of stories from Internet startups or many of the Great Groups described by Bennis and Biederman. As further proof of Edison’s understanding of collaboration, many of his inventions were split 50-50 with Charles Batchelor, along with profits from resulting companies.

Despite this truth Edison actively promulgated the myth of lone inventor. He wrote, “When I start in to experiment with anything, I do not read the books; I don’t want to know what has been done.”¹⁵ Yet, in private, in his notes, he concurrently wrote, “1st. Study the present construction. 2nd. Ask for all past experiences...study and read everything you can on the subject.”¹⁶ This is quite a different story. Even today we persist with the theme of the loner. This obstructs important work that must be done to fully understand groups and their fundamental role in consistent innovation.

As for the light bulb, it was invented nearly 80 years before Edison improved it. His contribution can be more accurately described as understanding the overall system that was required and implementing it. As Hargadon writes, “Edison’s advantage lay not in his ability to build something out of nothing but rather his ability to exploit the network”¹⁷ that he envisaged to make use of the potential of the bulb. Even in that race he nearly lost out to another standard, AC, versus the standard he was promoting, DC. As a formidable technology broker, Edison was able to bridge networks and brought together people and ideas in ways that others did not consider. All great groups used this to their advantage.

This section will examine in more detail features of successful projects and the teams involved. Assuming the premise that good design means good business to be true, it

would seem reasonable to suggest that within firms where design excellence as a part of their ethos, we should find examples of how they integrate the overall design management process into their business activities. Their prowess could be instructive to other firms seeking a similar competitive advantage. Not all situations can be easily transferred to every project, but perhaps by examining the essences of their transcendence, these insights can be utilized in novel fashions.

In exploring this theme in various publications, much has been written on the organization of successful and innovative teams. So much has been written that it seems valid to ask why more teams are not successful. One theory, particularly apt for situations where discovery has been accidental, like penicillin, posits that serendipity plays a vital role in innovative, more so that planned structures. Thomas Edison subscribed to this school of thought. He actively created as many opportunities for serendipitous discoveries as possible in his Menlo Park laboratory through the layout of his staff and activities.

**The Design Context**

Before focusing on the industrial design teams themselves, it is worthwhile to mention the larger context in which they operate. These are the environmental parameters which affect a team’s ability to control the innovation process. Based on a literature review, in 2001, Krishnan and Ulrich devised a decision perspective of product development. Their table shows four common perspectives in the design and development community. These are: marketing, organizations, engineering design, and operations management.

The table is instructive in that it shows both the common and different choices the four perspectives make during development. My focus will be on the engineering design team. In their research, Krishnan and Ulrich identified about thirty decisions that companies make during the product design and development process in establishing an organizational context and in development planning. Some of these decisions are listed on Table 4.

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Table 4: Comparison of perspectives of the Academic communities in Marketing, Organizations, Engineering Design, and Operations Management

<table>
<thead>
<tr>
<th>Perspective on Product</th>
<th>Marketing</th>
<th>Organizations</th>
<th>Engineering Design</th>
<th>Operations Management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A product is a bundle of attributes</td>
<td>A product is an artifact resulting from and organizational process</td>
<td>A product is a complex assembly of interacting components</td>
<td>A product is a sequence of development and/or production process steps</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical Performance Metrics</th>
<th>&quot;fit with market&quot;, Market share, Consumer utility (sometimes profits)</th>
<th>&quot;project success&quot;</th>
<th>&quot;form and function&quot; Technical performance</th>
<th>&quot;efficiency&quot; Total cost, Service Level, Lead Time, Capacity Utilization</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Example decision variables</th>
<th>Product attribute levels, price</th>
<th>Product development team structure, incentives</th>
<th>Product size, shape, configuration, function, dimensions</th>
<th>Development process sequence and schedule, Points of differentiation in production process</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Critical Success Factors</th>
<th>Product positioning and pricing. Collecting and meeting customer needs</th>
<th>Organizational alignment Team characteristics</th>
<th>Creative concept and configuration. Performance optimization.</th>
<th>Supplier and material selection, Design of production sequence, Project Management</th>
</tr>
</thead>
</table>

Within a specific project Krishnan and Ulrich further divided decisions into four categories: concept development, supply-chain design, product design, and production ramp-up. It is during these four categorizations that critical parameters are set which affect the overall design and development process. From an organizational perspective, the team characteristics, bearing in mind the marketing, engineering and operations criteria, are critical. Throughout my interviews and readings, the makeup of the team, the member dynamics, team management, morale, sources of inspiration, all affected success or failure in equal measure as the extra-team influences.
The Design process

In examining the design process in detail, Urban and Hauser broke the process into consumer and managerial components. Industrial design teams need to be aware of and integrate with the overall process in order to contribute meaningfully. Figure 4 shows these processes in more detail.


Starting on the top left, the first managerial process is to examine and identify opportunities. Once the target market and target consumers are chosen, the process of idea generation is undertaken. These ideas are presented to consumers to gauge their responses. Early measurement serves to understand the consumer from both qualitative and quantitative perspectives. The qualitative seeks to understand motivations and consumer views on the market. The quantitative research serves to seek a deeper reaction and to mitigate the risks involved in product development. This phase would include extensive interviewing.

From that stage, a model of the consumer is drawn. These models provide an even
deeper perspective on the consumer. They identify design features and product characteristics that make the greatest impact and that are most likely to succeed in the marketplace. The challenge for the design team is to balance consumer wish lists with realistic price points in which the maximum number of features can be accommodated. “All are improvements, but what are the key improvements?”

An important next step is to predict market behavior, which is an aggregation of many individual predictions. As Urban describes the process:

- The consumer measurement model develops measures of how each segment of consumers perceives the existing products in the market.

- The perception models predict how the new product will be perceived by each consumer.

- The preference model will predict how consumers will compare the new product to the existing products.

- The choice model predicts the probability that any given target consumer will actually buy the new product.

Returning to the managerial step, in the evaluation stage, there is a “Go/On/No Go” decision to be made. “Go” moves the process to the next phase, “No Go” means back to the drawing board as its present form is not appropriate. An “On” decision means that with some modifications the product could proceed to the next phase.

In the “On” decision, the product is refined according to information from the consumer models. If the modifications are minor, the resulting reactions could potentially be predicted from the previous consumer responses, depicted as the A and B arrows. If the modifications are major, the process may be restarted, to involve new consumer feedback and input.

The goal of this highly iterative process is to have enough information to actually build a product. This product needs to be shown to consumers to gauge reaction, whereupon

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the process is repeated until enough of the goals are achieved.

By describing this process in such detail, it illuminates the complexity of the overall design process. This lengthy process is designed to mitigate the risks of significant financial investment. For teams to work through this process effectively, they must have internal procedures which do not hasten or avoid crucial steps. It is also a reminder to companies that wish to rush to market and in the process bypass crucial steps.

**Success factors**

What are some attributes of successful teams and their successful projects? I'll begin by referring back to the 1994 study by Roy,\(^{20}\) where he wrote that “it was not surprising to find that teamwork for the whole product development process was more common in the benchmark overseas companies than in the typical British ones, and that project teams of inter-departmental development committees were the most common method of coordinating product development in the fastest growing companies from all countries.”\(^{21}\) This reveals that those companies which took greater care in drawing up a comprehensive design brief at the beginning of a product design process enjoyed greater commercial success. When the overseas benchmark companies were examined more closely, it was revealed that their brief process was a group responsibility. This contrasted with the British firms surveyed where the brief process was typically headed by a single department or an individual.

**Team development**

In 1965, Dr. Bruce Tuckman published a model of teamwork which included the following stages: forming, storming, norming, and performing\(^{22}\). In the forming stage, there is a great dependence on the leader to provide direction. This is an information gathering and disseminating stage. In the storming stage there is much vying for position in an effort to set roles and social rankings. Cliques form and there may be power struggles. It is important for the nominal leader to keep the focus on goals rather than interpersonal matters. In the norming stage, roles are defined, and processes

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\(^{20}\) Can the Benefits of Good Design Be Quantified?”, Design Management Journal Vol. 5 No. 2, 1994

\(^{21}\) Ibid.

gain prominence as goal achievement becomes the focus. Leadership is somewhat shared, and interaction amongst members spreads to social and ritualistic activities. In the performing stage, the team knows what it is doing and how to do it. There is a high degree of autonomy, with highly cooperative interaction amongst team members maintaining a focus on the goals.

In 1975, Dr. Tuckman added an adjournment stage. This stage occurs when a group has completed its role and is disbanding. This is an important stage for a management team to be sensitive to, particularly if the group performed exceptionally. Feelings of insecurity, or threat from change, need to be addressed, particularly as an investment in the next project, as in small companies there will be a need to work together again. If many of the team members have already engaged in stages of the Tuckman model in previous groups, there could be some opportunity to accelerate the process in a newly formed group.

**Team Characteristics**

Erran Carmel, in the book entitled “Global Software Teams,” has a list of characteristics, which I believe apply to design teams as well. He wrote, “a real team:

- Is perceived to be a team by its members
- Is recognized as a team by non-members, (ie: it has a boundary, people know who is a member and who is not.)
- Has a collective responsibility for its products
- Shares responsibility for managing its work
- Has a common goal or set of tasks
- Works together on tasks that are interdependent
- Demands peak performance from all its members (rather than just some)
- Shares its rewards
From a higher level view, Krishnan and Ulrich discuss that product strategy and planning involves decisions about target market, company product mix, prioritization, resource availability, and the inclusion of certain technologies in the selection. These result in mission statements and a plan or roadmap for the development. This structured approach agrees with Roy’s study, in that knowing where to head is perhaps more important than merely knowing how to head in any particular direction. However, Krishnan and Ulrich add, as a parting comment, “we believe that [the] loose connection between models and practice implies that the product development research community could benefit from stronger adherence to the scientific method, and proceed only a short distance ahead of empirical validation.”

This seems to imply that on the one hand we have theories and on the other hand practice. The two apparently don’t often meet. In the absence of a comprehensive catalogue of research from which to conclusively draw, I have chosen to integrate my own observations and interviews with a workgroup framework derived and customized from Michael B. McCaskey’s Framework for Analyzing Work Groups.

In addition to the work group framework, I will incorporate elements from Bennis and Biederman who chose seven extraordinary teams to examine for clues and commonalities. Their group analysis is a concise summary of many other similar findings in my readings, and the team dynamics are consistent with information gathered in my interviews as well. Some elements seem intuitive, such as the excellence of the team members, but other aspects are not obvious. Creative freedom is often cited, as is youth for its energy and delusional confidence born from lack of exposure to failure. Other key features include trust, limited time scope, and little-to-no turf wars. In all, their book describes a number of key insights that great groups share.

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25 Ibid.


**Work Group Framework**

The work group framework is shown in Figure 5. In the appendix I have included a larger version. This diagram gives the links between elements. I will examine each factor in some detail now and follow with insights from my readings and interviews.

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**Figure 5: Workgroup Framework for industrial design team collaboration**

**Context**

Based on the particular context of the project within a larger company, or as a project in a smaller company, decisions will be made as to how to create the team. Of primary consideration is the purpose of the project, whether major or minor within the context of the organization. That is, will this require many resources? Will this project be long term or short term?

The context also affects whether a team is located close to others, or separated for privacy or to avoid distraction. In this regard, it is worth considering on one extreme, a project such as The Manhattan Project, and on the other, a revision to an existing product. In a design firm, the confidentiality requirements of clients will often dictate elements of this decision. Design firms need to consider the best ways to balance their own optimal creative processes against the confidentiality needs of clients.

**People**

Bennis and Biederman’s first rule is to start with excellence in your talent pool, which seems fairly obvious but difficult to achieve. At Xerox PARC, Bob Wilson, the leader at the peak of this group’s excellence, used to say, “You can’t pile together enough good
people to make a great one.\textsuperscript{27} Just about every great organization and team understands this. However, since there are relatively few great groups, it is worth restating this feature.

Andrew Hargadon focused on technology brokering in his recent book, “How Breakthroughs Happen”. He wrote that, “the pursuit of innovation requires patiently and humbly building a network of people, ideas, and objects around the original innovation. That’s why technology brokering entails not just the ability to bridge small worlds, but also the ability to build new worlds from the best pieces of the old ones.” An excellent book on this topic is “The Tipping Point” by Malcolm Gladwell. He separates people into Mavens, Connectors and Salesman.

Eric von Hippel refers to Mavens as Lead Users. These are the databanks of new ideas. They do not aim to persuade, but rather are resources for others to refer to when seeking information. The Connectors are those who bring together people and ideas more effectively than others. They are the social glue, spreading and linking all the time. Finally there are the Salesmen. They are the persuaders, the ones who act as the final tipping point when most people are wavering. Their skill is not so much in arm-twisting, but rather in answering and deflecting doubts, but always with credibility.

In looking at the requirements for a team, it is important to get the balance right between the different personalities, goals, and aspirations of the internal effort and your eventual target market. That is, you have to motivate within effectively in order to produce the best outcome. Understanding individual dynamics as discussed above is a critical factor for the team leader. Having a mix of mavens, connectors and salesmen is one good approach.

\textbf{Team Size}

A component often mentioned in my readings and interviews is the size of the teams. This varies by project and company, however, I have rarely read of an ideal core team size exceeding ten people. While some projects are much larger, (eg: Manhattan


Project) the suggestion is to further break the teams into small sub-groups within the larger context.

Bearing in mind that the number of possible communication links in a group follows the formula \( n^2 - n \), the larger the group, the more effort must be spent on maintaining effective communications, rather than on the initial task. See Figure 6 for a visual representation of these links in a group of nine people. This visually shows that it is desirable not to add more team members than what is truly necessary given the increased complexity involved.

Figure 6: The number of communication links in a team of 9 members. (Source: Carmel, E., "Global Software Teams: Collaborating across borders and time zones", (1999))

**Skills, Interests, Working Styles**

With humans displaying a huge variety of characteristics, the issue of balancing skills and interests is very important. This affects productivity, motivation and morale, and ultimately the viability of the team itself. Some prefer to work alone, others in close collaboration. Some prefer to learn by doing a task, others prefer to analyze before acting. If some expect strong leadership, alternatives could introduce uncertainty.
A good summary of the different types of styles that leaders need to be aware of is shown in Table 5. To complicate matters, many people shift between styles depending on who they are working with and the politics, good or bad, of their association.

Table 5: Styles of team members

<table>
<thead>
<tr>
<th>Profile</th>
<th>Style</th>
<th>Focus</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take-charge style, exerts strong influence to get things done, focuses on results.</td>
<td>Driver or Controller</td>
<td>Results and accomplishments</td>
<td>Get things done. Determined, thorough, decisive, efficient, direct</td>
<td>In-attentive behavior when listening to others. Dominating, unsympathetic, demanding, critical, impatient</td>
</tr>
<tr>
<td>Emotions are controlled and gets results through expedience.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A social specialist, expresses opinions and emotions easily; prefers strong interaction with people.</td>
<td>Persuader or Enthusiast</td>
<td>Involvement and enthusiasm (positive ideas and responses)</td>
<td>Involves and works with others. Personable, stimulating, enthusiastic, innovative</td>
<td>Hard time following systems or processes. Opinionated, undependable, reactionary</td>
</tr>
<tr>
<td>Emotions are responsive and gets results through expedience.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likes to be well organized and thought out; prefers specific project and activities; enjoys putting structure to ideas.</td>
<td>Analyzer or Theorist</td>
<td>Precision and accuracy (actions will be documented)</td>
<td>Great at organizing, industrious, persistent, serious, orderly, methodical</td>
<td>Can have trouble when action needs to be taken immediately. Indecisive, uncommunicative, critical</td>
</tr>
<tr>
<td>Emotions are controlled and gets results through processes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adaptive specialist, high concern for good relationships, seeks stability and predictability, wants to be part of larger picture.</td>
<td>Organizes or Affiliates strongly</td>
<td>Relationships and stability (loyal)</td>
<td>Builds relationships. Cooperative, supportive, dependable, helpful</td>
<td>Does not want to change. Conforming, uncommitted, hides true feelings</td>
</tr>
<tr>
<td>Emotions are responsive and gets results through processes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Leadership Preferences

As is shown in Table 5, an individual preference for variety in the work or team members is important to consider not only for the incentives you wish to emphasize, but also for the outcomes. Some prefer a strongly delineated structure with defined tasks, while others prefer loosely structured associations, with ad hoc task assignments.
The challenge, for the leader in particular, when faced with these and other variables, is to remain flexible and willing to adjust in the face of potential strife without yielding to whimsy.

Bennis and Biederman approach this issue by suggesting that great groups and great leaders create each other. As was often the case in these most celebrated projects, and indeed in real life, there is no script for the future. No one fully understands the direction that must be chosen. Ambiguities abound and morale can be severely undermined without a singular vision keeping everyone on track. Complicating matters, a command-and-control model would not work. The talented team needs to know what to do, but certainly not how to do it.

During the creation of Snow White and the Seven Dwarfs, Disney who publicly perpetuated an image of lone genius, privately acknowledged the importance of his team. This was a project with a level of complexity hitherto unseen in the animation industry, encompassing advancements in all aspects movie making, including technical and artistic. In 1939 Disney gathered his group together and launched into a battle speech about the hurdles they would face. He exhorted the team to move far beyond simple characterizations, imbuing the new characters with emotional subtleties reserved for human actors.

In order to express the richness of his vision for the movie, one evening Walt Disney gathered his artists, who were struggling to focus on the movie’s essence, and acted out the entire story alone on stage. This was not a simple dry recitation. Disney, working to instill as real a sense of the as-yet-untold story, brought every character to life, including the personalities of each dwarf, the Wicked Witch, even down to the final kiss that brought the heroine back to life. Grown men perched on folding chairs apparently cried.

What is most important is that they finally understood Disney’s vision, and came together as a group centered on this vision as "Disney’s vision". That is, a middle-aged man was able to rise to the challenge of expressing emotions of dwarfs, princesses, and Wicked Witches without a script. The animators repeatedly referred to this vivid rendition when finally creating the visual characterizations. Disney was the final arbiter of the "right" character, whether through express declaration, or more often through the image he had painted on that evening.
productive and seemingly random, experience has shown that these unrealistic ideas can instigate a process which quite often leads to the beginnings of a solution.

Unlike the traditional product development process, normally depicted as a funnel, starting from a wide mouth and narrowing, the design research and idea generation stage should initially widen to involve divergent thinking first, followed by the narrowing convergent thinking. This idea is shown in Figure 7 below.

![Diagram of Divergent and Convergent Thinking]

**Figure 7: Divergent and Convergent Innovation process.**

A major part of the design process is to allow many ideas to be propagated early in the design schedule, allowing many more iterations to be considered, as discussed in the prototyping section below. Conversely, and equally important is for the project and its team to have discipline and focus.

**Novelty**

As design firms become more skilled in particular areas, it is common for more of the same work to flow to the firm. As teams become proficient in efficiently producing required solutions, the potential for predictability and boredom creeps in to the process. It is incumbent upon the team leaders, and the overall management to understand the
Task Requirements

Required activities and interactions, Interdependence

There are many factors which help determine the success of a team, and hence the product that is the result of their work. A major element in team design is to determine those tasks which are required to be performed by the team members within and outside of their own microcosm. That is, who needs to relate to who, and how much their activities are interdependent on others for completion.

The amount of variety in activities that is discouraged or encouraged is also important, as is the amount of routine imposed, such as those which tie in to the formal organizational requirements. An example would be if team members are required to attend and meetings outside of their group, or even how they exchange information within the group. Many of these interactions will be defined by individual expertise and depends largely on the project itself.

Many of the companies I interviewed with mentioned the need to protect the team from outside annoyances, such as memos and forms, but not deadlines. By having a bureaucracy free environment their experience indicated that a higher performing team was the outcome.

The time span (and secrecy) of the project will help determine how independent and insular the group is to extra-group influences and interactions. Generally, longer-term projects will by nature be less able to be kept separate from mainstream company activities. People will become bored and will seek variety at some point. How this interaction is managed is important for the leader to consider prior to its occurrence.

Project Discipline

When companies create creative groups, their methods do not guarantee success. However, they can encourage a fertile environment for creative outlet by reducing inhibitions and encouraging the airing of ideas which do not strictly fit any “solution.” These methods are designed to allow individuals to draw upon their own experiences, not matter how seemingly irrelevant, and apply these to problems in the hope that a novel solution will eventually appear. The key word is “eventually”, meaning that the solution need not be apparent in the initial stages. While this seems initially counter-
best ways to combat boredom and prevent team from becoming complacent. In small firms this is potentially a source of employee dissatisfaction and cause for higher turnovers.

**Prototyping**

Frequent prototyping for industrial design groups has always been critically important for realizing a team’s potential. As Michael Schrage wrote, "the prototype plays a more influential role in creating a team than teams do in creating prototypes. In world-class companies, an interesting prototype emits the social and intellectual equivalent of a magnetic field, attracting smart people with interesting ideas about how to make it better. The most important role a prototype can play is often to creatively limit the scope of a proposed innovation rather than to broaden functionality beyond a point of diminishing returns."  

The prototyping task requirement needs to be included in the group role, although experience shows that while prototyping is desired and engaged in regularly by industrial design groups, the challenge may in fact be to draw the line as to when enough prototyping has occurred, and when the design is solidified in anticipation for engineering refinement and production. Another danger of early prototyping is to become overly focused on an initial design, or more awkwardly, to have a client or outside decision-maker become enamored of an exploratory design. As Schrage writes, "the single most important element of prototyping culture is, without question, who gets to be a part of it and why."  

The longer the gap between the initial prototype and a showing to top management, the more top management is being asked to approve rather than become involved in new product creation. Who manages this process and how is an important decision for a team.

However, notwithstanding those potential pitfalls, the benefits of frequent prototyping in an iterative process have been shown to override the potential downsides. Figure 8 shows the iterative process as often used by design teams. According to Schrage, as a general rule, the more prototyping that is performed the more technically polished the

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30 Ibid. p.87
final product will become. Only a handful of companies complete more than five prototype iterations in a given year, with tradition and cost often cited.

![iterative design process diagram](image)

Figure 8: The iterative design process

**Formal Organization**

**Structure and formal reporting relationships**

With creative teams performing tasks that are essentially new, and therefore associated with a high degree of uncertainty, imposing formal aspects of the organization onto the team has to be handled very carefully. The “management by walking around” method works for some teams and organizations, but at other times a certain discipline needs to be imposed. If the project is complex there is often little choice but to impose methods to track team progress. This includes discussion lists, project management systems, whether through software or a lower tech solution, and task lists.

Bennis and Biederman discuss this issue and suggest that while every great team has a strong leader, they do not micromanage. In a personal example, I recall that my father, an architect, often spoke about his role in a project as telling people what he wanted, not how he wanted it. By respecting the brick layer’s ability to build a good wall, he ensured that a reciprocal respect was offered to him when he pushed him to build an even better or more unusual wall.

This is one of the paradoxes of the dynamic between having supremely talented and
independent members who need focus, and having a leader who can’t necessarily perform the tasks of each individual. The balancing act of allowing the creativity of members to flourish without cramping their individualistic styles through the necessities of collaboration falls most heavily on the leader. The leader can make or break the team. Typically since they choose the members they have an initial ability to direct early initiatives. However, given the uncertain nature of the work, it is imperative that they have both a strong vision for the project as well as the personality to be able to make sometimes awkward decisions without offending the team members.

The book entitled “Global Software Teams” by Erran Carmel, writes that in many company cultures where communication and the decision-making process is driven up or down the hierarchy, the team leaders handle inter-team or inter-company communications. He continues that in professional environments where tight supervision is inappropriate, funneling decisions and knowledge through a formal hierarchy is not effective. A more appropriate method is to use a lateral method, where not only does the team leader share information with other team leaders, but that team members communicate across, and up and down the hierarchy. “[Lateral communications] creates effective integration of tasks and fully and quickly addresses task problems that crop up. [It] is more flexible, makes for better decisions, and does wonders for motivation and feelings of empowerment by all members of the team.”

Often this communications method is encouraged through a flat organizational structure.

**Reward Systems**

With a creative team, performing work that requires collaboration, it is virtually impossible to ascribe a singular value to any individual effort. It is important to reward teamwork in a global sense, rather than individuals. Specific incentives need to be implemented to in order to promote activities which engender cooperation and group cohesion. Rewards can also be in a non-monetary form. Often creative people are motivated by alternatives to cash. Tailoring rewards to their individual interests may provide an even better incentive to perform at an elevated level.

In terms of base compensation, industry norms, seniority (as reflected by title rather than

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age), and company policies will play leading roles in this decision.

Recruitment and Selection Systems

Bennis and Biederman write that leaders love talent and know where to find it. They have the confidence to hire people who are better than them. Without this critical mass, no group will rise beyond mediocrity. The old rule of thumb that a chain is only as strong as its weakest link applies here.

To help in this regard, a leader has to be well connected in order to know where to find the best people. "Great groups often start with great Rolodexes." Oppenheimer knew through conferences and publications who was the best in their professions when he sought members for the Manhattan Project. Excellent schools attract top talent, as do vibrant cities. An example often mentioned is Seattle, where the best of a certain musical style invariably migrated and gave rise to best-of-breed bands.

Conversely, it is critical for potential team members to be known in order to be included in great groups. Andrew Hargadon discusses this networking point when he wrote that people and firms that move among many worlds "increase their chances of seeing how the people, ideas, and objects of one world might be useful in another." Ford's modus operandi exploited these links. He worked across disciplines.

Unless a company is fairly large with a diverse population from which to choose, the recruitment process in most design firms for a specific project is driven by who is available as much as who is best for the particular project. This means that it is even more critical for firms to hire an appropriate mix of skills and temperaments so as to build an optimal pool from which to choose. This factor as mentioned repeatedly in my interviews as requiring a high level of attention on an on-going basis.

Infrastructure

As with any project, a high performing team needs to have the necessary tools to accomplish their tasks. Clearly the fundamentals of technology, such as CAD and CAE systems, and prototyping mechanisms are the minimum. Beyond these core tools, what constitutes the optimal environment seems to be largely up to individual company culture. There is much interest in the bold and whimsical offices of IDEO. With bicycles hanging from ceilings and modular spaces created with a speed unknown in the staid
traditional venues of most corporations, chaos is as much an element as is the underlying tools that they keep at their disposal. But is this an appropriate model for industrial design in general?

My readings and interviews show widely varying definitions of what constitutes the best tools for designers. The adage, “horses for courses” comes to mind. Each company has its own culture, learning methods, and work processes. David Kelley from IDEO says office space is the final frontier - it is the most powerful tool for affecting culture. Physical space is a very powerful tool. Dreariness from the reception area to the research lab destroys the spirit. However many incredible products have been produced in conditions that were not ideal in the traditional sense. The underlying principle is that for environments to promote interaction and the freedom to experiment without fear of failure.

A recent article in the Boston Globe Magazine highlighted this phenomenon. On the MIT website is a section discussing the new Ray and Maria Stata Center for Computer, Information, and Intelligence Sciences. It replaced the more simply named, Building 20, also known as the “Magical Incubator.” It is telling to include fulsome text describing this building and its effect on its occupants.

"Initially, Building 20 housed the Radiation Lab, and it was there that MIT engineers and scientists refined radar and thereby helped win the war. Since then, an amazing assortment of laboratories, organizations, student groups, and offices has taken shelter in the wings of Building 20.

Building 20's "temporary" nature permitted its occupants to abuse it in ways that would not be tolerated in a permanent building. If you wanted to run a wire from one lab to another, you didn't ask anybody's permission — you just got out a screwdriver and poked a hole through the wall.

This building cast a spell over those who worked in it. Many former occupants have noted the magical power of the building to bring out the best from those in it, and the very real feeling that this was a special, even a unique, place. At the same time, it served as a breeding ground, or incubator, of many research areas, of the minds of its students, and of new organizations. Many MIT laboratories and centers had their origins in Building 20 or else were formed by people who
had spent years there".32

What concerned the writer in the Boston Globe was whether a specifically designed building could be similarly conducive to creativity and interaction, particularly in its new state, when its occupants would perhaps be most conscious of not detracting from the building's "perfection." This story of cramped and uncomfortable conditions producing great results is repeated many times by Bennis and Biederman in their book, "Organizing Genius." At Disney, the Edison Laboratory, Lockheed, even Los Alamos, conditions were substandard and uncomfortable.

**Group Culture**

**Emergent Activities and Interactions, Norms, Roles and Social Rankins, Language Conventions**

Bringing excellent people, who can be often centered upon themselves, together into a team committed to open communication, is critical to its success. This leads to another insight from Bennis and Biederman, that great teams are filled with talented people who can also work together. Team members must feel that they can state their opinions, thoughts, and feelings without fear, with listening considered as important as speaking. Differences of opinion are valued and methods of managing conflict are understood. Through honest but not aggressive feedback, members are aware of their strengths and weakness as team members. There is an atmosphere of trust and acceptance and most vitally a sense of community.

One of the most common methods to encourage interaction is by imposing certain rules at certain stages of interaction. By putting aside practical issues, and setting ground rules such as not allowing criticism, and encouraging others to improve initial ideas by adding or changing, without suggesting that the original idea was flawed, creates an environment of trust.

Many methods for fostering creativity and idea generation have been proposed. One of the most popular interaction methods is the "brainstorm". IDEO calls theirs the Deep

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32 http://web.mit.edu/buildings/statacenter/
Dive. Urban\textsuperscript{33} lists the common features of these methods as:

- Establish openness and participation
- Encourage many and diverse ideas
- Build on each other's ideas
- Orient towards problems
- Use a leader to guide discussion.

A healthy culture in a group will allow divergent and convergent thinking processes to develop good ideas that can proceed to the iterative design process, shown in Figure 8, leaving plenty of room for play in the design process. As Stephan Thomke writes, "The faster the experimentation-failure cycle, the more feedback can be gathered and incorporated into new rounds of testing. Experiments that result in failure are not failed experiments. In fact, it was Edison, again, who noted that the "real measure of success is the number of experiments that be crowded into twenty-four hours."\textsuperscript{34} A number of texts went to great lengths to differentiate between stupid failures and noble failures, with the latter a part of the discovery process.

The cohesion of the group is reflected not only in the environment in which they operate but also the culture within the group. A common culture, either developed organically, or through activities goes a long way in creating cohesion. This is not easy to achieve. Teams, as opposed to groups, have an esprit that shows a sense of bonding and camaraderie. This esprit forms the spirit, soul, and state of mind of the team. It is the underlying consciousness of the team that a person identifies with and feels a part of. When there is this esprit, Individuals begin using "we" more than "me."

Kick-off meetings are mentioned in my literature reviews, and in interviews, as critical to getting cohesion in the thinking of the team members, if not in their actions yet. An interesting diagram in the book Global Software Teams, shown here in Figure 9,

displays the drop off in trust and communication that occurs during the life of a project. While surely not as smooth a transition as depicted here, the point is well made about relationships needing constant maintenance to remain at a peak performance level.

Figure 9: Trust fluctuations over time

Rituals, Stories, Sagas

Other techniques mentioned for creating a team that can perform at maximum efficiency include creating opportunities for common experiences. At MIT, the MOT program spends the first day away from campus, undergoing an Outward Bound experience involving team activities in a sociable setting. This retreat generated excitement about the upcoming year, and served to create common stories for use later in discussions. Rituals fall into the categories of formal and informal. The kick-off meeting is one formalized ritual, as is the celebratory event at the end.

For stories to be effective at team binding, they need to be commonly shared and not disrespectful to any one individual or culture. That is not to say that they do not highlight the foibles of a certain individual or sub group, but only in an endearing fashion. They
should not create conflict, but rather are an effective means for diffusing conflict.

In my literature review, there were many stories of groups which created rituals that would seem bizarre to outsiders, and this is exactly how the teams like it. From nighttime desert raids in Los Alamos, to fanciful hats given to newcomers at Netobjects, these events served to bind the group.

**Outcomes**

**Measuring productivity**

“Real artists ship” was apparently an oft-repeated mantra of Steve Jobs during the development of the Macintosh. This highlights a key feature of a successful group: they have deadlines.

As with many professions that have a significant subjective component to their “product,” the industrial design profession struggles with defining the best outcomes. Since often the output is handed to the client for further development into a product, meshing with manufacturing and marketing efforts, it is difficult to conclusively trace the success or failure of a product to the industrial design phase. Rare is the case with IDEO and the “eyemodule”. Designed by a team led by Dennis Boyle, it went from idea to shipping product in less than seven months and became the top add-on for the Handspring PDA.

Perhaps the most commonly mentioned measure of success is industry recognition. This could be in the form of awards, publications, or references. Other commonly mentioned measures of successful outcomes in more mundane projects include team satisfaction and individual team member growth through new experiences. These are important criteria for maintaining motivation among the team members, and relate to Dr. Tuckman’s adjournment phase in group stages. If a team is satisfied with its output, the members will be happier to work together again.

From a company perspective, productivity measures include happy clients with the potential for repeat business. High profile projects also introduce the potential for new clients to approach a firm. This was the case with IDEO, in 1999, when ABC’s Nightline program broadcast a special segment on the product development processes used in the firm, using a shopping cart as the test case. The audiences reached and their reaction generated significant business opportunities for IDEO.
Many companies also expressed an interest in the knowledge gained or skills added to the company's repertoire as important factors in both choosing business, and measuring its success for the firm.
Chapter 3: Industry Interviews

As part of this thesis preparation, I met with a number of industrial design professionals as well as sought academic input. This chapter presents the interpretation of the interviews I conducted between February and April 2004 with a sample of prominent concept generation and product development firms in the US. From these interviews, I extracted information regarding the current practices with regard to collaboration and product development in these firms. The objective of doing the interviews was to balance academic theory with the real methods that these firms use to capture, create and deliver in their promise of innovation.

Interview with Dennis Boyle, Studio Head, IDEO

IDEO was founded in 1991 as a result of a merger between David Kelly Design, ID2 and Matrix. It is considered one of the world’s leading design and development companies. IDEO is based in Palo Alto California and has offices in Palo Alto, San Francisco, Boston, London, Chicago, and Munich. The company has roughly 350 staff members compounded by industrial designers, engineers, artists, manufacturing specialists and experts on “human factors”. IDEO is a small company that operates as an independent part of a large company, called Steelcase.

IDEO’s product development services include the contributions of Innovation Strategy Consulting, user research, product line strategy, Industrial design, Mechanical and Electrical Engineering, Software design, Manufacturing consulting, Interaction design, and Environmental design.

IDEO has developed products like the first mouse for Apple, the Palm V PDA and the customer experience interface of the Amtrak Acela bullet train. Dennis Boyle has been with IDEO for over 20 years, and lead the team that developed the Palm V, among other successful products.

Group Culture

Our interview started with a discussion of the power of collaboration. Dennis recently made it a center point of IDEO’s internal strategy. His focus in on radical collaboration. That is, he wants IDEO to take the process beyond a team’s comfort environment with IDEO acting as a catalyst and not a driver. Dennis would like more innovations to occur
at the client’s end, with it difficult to pinpoint a person who invented the result. He wants
teams to mesh as one, between client and IDEO. The best examples in his experience
are when it is virtually impossible to tell who is part of the client and who is part of IDEO.
In his opinion, this reduces the problems of the “not invented here” syndrome. This
moves the process into the realm of shared invention.

Context

An area that IDEO likes to avoid is when a client arrives with a tight brief. Dennis feels
that if the process is so constrained IDEO isn’t really adding too much value. IDEO can
do this type of work, but he and the staff much prefer the “mind-meld” where companies
are seeking input from outside their system. The highest value that IDEO can bring to a
client is in inventing business models, often involving products, services, and their
physical space. In Dennis’s experience, more companies are outsourcing their design in
an attempt cover as many bases as possible, and have a balanced product portfolio.

One of the reasons that IDEO is chosen is the depth and breadth that they have
amassed which far exceeds what any one client could gather on their own. IDEO looks
to them for the specialized knowledge that can be leveraged as part of the process. As I
heard on my tour, and again from Dennis, IDEO is “crazy” about its process. They are
constantly experimenting and evolving it.

In recent years, Dennis thinks that with the emergence of cross-company teams that
IDEO is begin seen as a strategic partner, not just a hired gun. Most realize that they
cannot cost-cut their way to greatness. As with most businesses the answer to most of
their problems is to innovate, with IDEO at the ready. As Dennis put it, no matter what
state you are in your business cycle, you need to innovate to either get out of a bad
place, or innovate to stay in a good place, since there will surely be another business
who will “eat your lunch” if you do not innovate. Top management is always trying to
stay ahead of the power curve, reinventing the business. An adage that IDEO and many
of its clients adhere to is, “If it ain’t broke, break it.” An element of good CEOs is that
they are always shuffling the deck. They are collaborators and often lead from behind,
motivating others to achieve greatness.

Perhaps only partially in jest, in response to a question asking for his opinion of the
IDEO business model, one of the founders of IDEO said,” It sucks!” He admitted that
they suffered like most professional service firms in that they sell people’s time. In order to earn more they need to work longer. Having said that they were at pains later in my discussion to emphasize that they were more interested in having a balanced work force, unlike my example of the Manhattan Project in which some team members literally achieved a career peak from which they never recovered. IDEO wants long term staff productivity, not meteoric rises with equally precipitous falls.

**Team Dynamics**

When discussing the process of product development, Dennis mentioned that if the client puts the right people on the team, and IDEO does the same, a real chemistry can occur. Sometimes IDEO encounters defensive people who want to hold on to many facets of the process, and put limits on where the project can roam and what is off-limits. IDEO looks for team players who want to recognize each other’s strengths. Sometimes IDEO needs to show the client that if they relinquish some controls that they will see that a better product will result. This can be a tense time.

In Dennis’s experience, when projects don’t go so well it is often due to team dynamics. If the team is not working well together, it shows in the end product, where corners were cut, and avenues that could have resulted in a more comprehensive solution were missed. Fortunately through their varied experiences and noted success, IDEO’s clients self-select themselves. As Dennis put it, “the Peter Principle does not apply at IDEO.” As a leading firm, IDEO has somewhat more power than smaller firms in directing the overall process.

IDEO brings both a cachet of prior success and the freshness of “newbies” when they start new projects. That is, often when they first connect with a client they see that the client wants to break from old habits. IDEO provides that avenue. However, even with senior management buy-in IDEO has to get the same from the workers with whom they will spend the most time with. If they do cooperate, and most do see that the ultimate goal is the success of the project, you can cut through most politics.

IDEO gets its inspiration from non-conventional avenues, from fringe areas, from analogies, particularly in new situations where there are no observable users. They like people who break the rules, both in how existing products are used, and for insights on what new products could be developed. This is where a cross-pollination and
collaboration takes place. In their observations, you begin to see where frustrations or problems exist. It is in those that solutions exist, and this is where IDEO pursues them. It is not uncommon for IDEO to have developed solutions where markets do not yet exist. Their brainstorming process can produce ideas that are too far ahead of their time, not that this is a bad thing.

People

Since most IDEO staff members have not come from large companies they do not have agendas including promotions and status. They tend to focus on the project, to push it through and get on with the task. Bigger clients appreciate this approach.

When IDEO recruits they look for “T-shaped” people. They have a real depth in one aspect of their skills, such as a great designer. But they also have a broad interest base. Quite often the recruiting is done through word of mouth, and internships, since it is a small industry. As a big fish in a small pond, IDEO admits to getting an avalanche of people want to work in the firm. One recent example included a Japanese designer sending a bound book with his designs, and offering to work for free!

Task Requirements

As an example of the cross disciplinary nature of IDEO’s structure, in the shop area designers and engineers use the equipment. They purposely muddy the waters between the skills. The goal is to prevent staff from seeing solutions from a set perspective. The old adage, “if you have a hammer the world’s a nail” is what they want to avoid. “There are a lot of talented people here. You have to let people work and play hard. It is just the best thing for everyone involved.”

Having said that, in terms of required interactions, meant to retain focus on the projects’ goals, every Tuesday morning we have a meeting of 20-30 people to see what are the new projects, and how to put the best team around them. This is a constant process since projects are always beginning and ending.

Group Culture

Perhaps in some jest, Dennis added that they get inspiration from some fairly straightforward sources, such as caffeine, sugar and food. He added that a fun place, where staff members enjoy conversations that are had around the coffee machine or
lunch table, with an open culture, creates opportunities for creativity. IDEO encourages the free flow of ideas, with the highest honor to be invited to a brainstorming session. To be known as the person with the coolest ideas is about the highest title IDEO can bestow.

Different teams are separated by project and discipline. For example, the toy department lives in a loft space, designed and customized by the team, and having its own buzz. A staff member would normally start on a team. As time progresses and they gain more experience, and show some leadership, they become team leaders, then finally after more projects, and with mentoring of staff, the might end up leading a studio. After this they might go to another location as a leader, and then maybe on to a major client, like Proctor and Gamble. People get as much responsibility as they can take. As with client relations, the Peter Principle works internally as well.

**Learning Mechanisms**

An innovation introduced by Dennis is the Tech Box. This is a collection of objects, categorized and documented on an intranet linked across the various IDEO locations. It is meant to inspire designers. They key to this box is that anyone can walk up to it and play with things. Items include smoke ring guns, memory metal which returns to a particular shape depending on heat levels, and non-battery flashlights. As Dennis put it, “if you have kids, you know that flashlights are just a place to store dead batteries!” The principle is to have a whole bunch of interesting things that can be experienced out of their normal context. In brainstorming sessions you might find a use for them if you know their capabilities.

**Summary of IDEO Interview**

In many ways, IDEO plays a very public role in defining what many people think of when they think of industrial design. As IDEO will admit, what they do has many similarities to what other firms also do in their businesses. Given IDEO’s size, and role within the industry as a fount for many other smaller design firms who spawn from IDEO’s ranks, this is perhaps not surprising.

However, the advantage IDEO holds over many of its competitors is their sheer size giving them a breadth and depth of clients and staff and experience from which to draw upon for new projects. With this size comes the additional challenge of staying fresh.
and innovative and not succumbing to structure and rules. Their culture seems to be holding up even during these lean last few years.

**Interview with Daniel Buchner and Ellen DiResta from Design Continuum**

Design Continuum (Continuum) is one of the largest independent design firm in the world. Unlike one of their chief rivals, IDEO, Continuum is not part of a larger organization. Founded in 1983 by its current president Gianfranco Zaccai, and Jerry Zindler, this company specializes in the design of ideal user experiences. Continuum has offices in Boston, Milan and Seoul.

Continuum’s services range from concept generation to manufacturing consulting and are organized into overlapping practice areas:

- **Strategy**, which guides the design process;
- **Product**, translating the strategy into products that tap user’s needs and create unique experiences, and;
- **Brand**, helping to differentiate the product and client’s offerings in a crowded and competitive marketplace.

Continuum follows a six-stage process described as “understand, analyze, envision, translate, create, and deliver.”

In my interview, I followed the workgroup framework as closely as possible in order to get their specific thoughts on the subject of teams.

**Context**

Continuum works on a fixed rate. It is incumbent upon the company to know and understand the profession and the job role in order to not cause financial problems. This is one of their strong points. There are some rare times when they will engage in a royalty payment plan, but rarely and unless they know the product and market.

Once a job is started, one of the earliest activities the program developers will do, possibly with a design head or project manager present, is visit the client’s office. Daniel
and Ellen agreed that you can gather lots of unspoken information about the company, whether hierarchical, progressive, or “sleeping.” Continuum engages senior staff prior to the design phase for various reasons. Firstly, it is to ensure that the client is both serious about the project, and aware of the process. They will ask the initial questions regarding why they want this new project, how the company has performed development in the past. A key objective is to resolve who makes decisions so that as the project evolves, the proper milestones are signed off by people with the authority to do so. Continuum needs to know who really makes the decisions, despite what one person may be saying. This avoids surprises late in the process when a hitherto unknown person at the client objects to a facet of the project, and has the authority to do so.

**Task Requirements**

Continuum has key designers who manage a project and direct it. It is their responsibility to maintain the project on a track, on budget, and meeting the goals. If they feel that it needs fresh inputs they can and do call for brainstorming sessions to infuse fresh perspectives, gather new ideas or new methods. The point of these meetings is to have assumptions challenged and directions questioned. They are not meant to be polite coffee klatches.

There needs to be some direction to start looking, however, it is critical that process does not hinder adjustment as new information is gathered and assumptions change. It is not uncommon for the designer or project to start off in one direction and end up in another place. This can be particularly tricky if the client is heavily engaged on Continuum’s site. Sometimes the teams ask the client to stay away for a certain critical development phase so that their preconceptions on where the project needs to head and what it needs to avoid do not limit the process. After all, they argue, the client came to Continuum for a fresh perspective, not to limit the process due to external pressures.

There are also fairly regular design reviews by peers. These are ad hoc, and called by a project manager of discipline lead. These serve to spread knowledge across the firm and potentially introduce new ideas. Continuum believes strongly in the power of serendipity, but there are also times when the teams are shielded from distractions or further input. Some times they need to soak and other times they need interaction. Deciding when enough prototyping is enough is up to the design team. Often they will decide this point, and it is very subjective.
As in most industrial design firms, prototyping is an important tool in the development process. Sometimes, however, Continuum makes a conscious effort to avoid prototyping too early. They also are careful not to have too high fidelity a prototype too early in the process in case the client becomes too attached to one form.

**Formal Organization**

Continuum has two structures, functional where disciplines sit together, and project teams, which are very network structured like little companies going on their own. Overall the disciplines are scattered with loose clustering depending on needs, such as confidentiality, noisiness, and who is available.

One of the challenges for a firm of Continuum’s stature is to maintain an optimal team structure. Staffing limitations, other work commitments, and availability of specific skills sets makes juggling projects a constant issue. However, Continuum suggested that having the best of the best on each team may not necessarily produce the optimal result. Ellen DiResta used analogy that, “there is this idea of growing the perfect most beautiful flower. But do a bunch of these make the perfect bouquet? Maybe not!” Client relations need to be considered.

For team management, Continuum has formal and ongoing project management training that talks about how you formally setup, monitor, and control projects, maintain budgets and high quality output. This is a major emphasis at Continuum. These are tactical processes that Continuum watches in order to create better team performances.

They have a formal process called DCQC, where every two weeks Daniel and Ellen will sit in a room and have project managers come through and talk about their projects, how it is progressing, how the client relations are being handled, whether there are any issues with the next milestone or if the budget is over or under the target. Continuum is proud of its managers as a result, calling them some of the best in the business, effective at trading off business results, the team dynamics, and the quality of the deliverable.

When assessing a project in a post-mortem review, one of the elements that are considered are whether or not the manager pushed the bounds into a new area, or simply followed the prescribed job description. Bonus points go the former, with
innovation celebrated.

People
The size of teams at Continuum depends on the project in question, as is to be expected. An optimal size of between 6 and 8 was mentioned, and if the project warranted more staff, there was an effort made to break them up so as to retain a small size.

One of the challenges for Continuum is to match their internal staff skills with those of their clients. Often times the structure of Continuum and their clients are significantly different, requiring deft people skills to manage. Continuum needs to structure a team that can relate to both the internal requirements as well as the client-side requirements. While they have noticed that some teams work better than others, and who works well together, it is hard to measure, but something that they would love to be able to measure in order to optimize the experience for both staff and client.

Continuum engages in projects that may not be profitable but which extend the skills of the staff and company. This leads to more varied work. It is a constant balancing act. In hiring staff they purposely seek lead users who embrace new ideas, but who come with definite skills in the profession. This is not unlike IDEO’s T-shaped staff. They encourage staff to seek new sources of information, like art opening, magazines, trade shows.

Group Culture
In any given environment, there are people who are there for the work and those there for the climbing opportunities. At Continuum, most staff members are there for the work. Despite people arriving with specific sets of skills, such as engineering, or designing, the implementation of those skills is not limited to the educational background of the user. That is, designers can have engineering ideas, and vice versa. There is very little turf stuff, but there is respect for the skills of each other. When people arrive for group meetings, it is not as if they need to be told to leave their functional hat at the door. Boundaries are unclear and purposely left vague.

If there is a skill Continuum feels it could use more if is empathy for the client. It is hard for a designer who has never worked in a large company to understand why the client asks certain questions, or presses in certain areas. Designers can tend to under
appreciate the external pressures that the client faces from within their own organization. This can cause friction.

Unlike the neat system that Eppinger and others write about, in Continuum’s experience the process is messy and much less structured. Daniel laughingly mentioned that he seeks to inspire more creativity by banging his fist on the table and demanding it! In a more serious tone, he said that despite the fun shown on Nightline’s profile of IDEO, we should not assume that it is always this jovial. There is significant hard work involved, despite the casual atmosphere. The closer the project is to being manufactured, the more it needs to be codified for reproducibility.

In terms of working space, Continuum is Boston is housed in a large but essentially non-descript building. Internally signs of creativity abound, from the use of vellum to shroud the fluorescent ceiling lights, to the artful layout separating the public from the private work areas. When asked if there was any merit to the notion that many great groups have worked in substandard space, their response was to suggest that light was of utmost importance. Daniel also suggested that while some firms focus too much energy on their own space to the detriment of their work, he was sure that ugly space was not the answer. A cube farm was definitely rejected.

Outcomes

In contrast to some other pronouncements, Daniel commented that almost all ideas are bad. The question is how to get to the good ones fast. This is Continuum’s competitive edge.

In answer to my question, “How do you know when you are successful?” the response varied from ensuring the project itself is profitable for Continuum initially, to more esoteric criteria. Client satisfaction featured high on the list, as did the client’s success with the product or project. Did the company get any other referrals? Was the team happy? Would they work with the team leader again? Did the product meet the needs of lower cost, or higher profile or market share, or even did the product create a new category in the market? Did Continuum meet the client’s criteria for success?

They acknowledged that some factors they could not control once the project left their immediate control, making a fulsome answer difficult.
Summary of Design Continuum Interview

Continuum is a very professional firm, with a pragmatic approach to the design process. As they put it, we are about design for business results. They described the firm as a great place to work, with very talented people who don’t feel boxed in by what an industrial design firm should look or act like. It is an industry, not unlike the film industry, where you are only as good as your last project, and where you only have enough work for the next three months. You are always on the edge.

Continuum successfully balances the practical aspects of running a business, with the creative aspects required to innovate consistently. Through the rigorous application of their six stage process, Continuum is able to innovate across a wide range of industries and clients.

Interview with Bob Marchant, CEO of Modo, Inc.

Modo is the world’s largest original equipment manufacturer of medical carts, growing at 20% per year since 1997, according to Inc. magazine which featured the company on its October 2002 cover. It supplies carts to GE, Siemens, and Philips Electronics. Modo has also designed non medical carts for Epson.

Bob Marchant started on his path of incorporating design in his products when he was CEO of Pro Forma selling a copy of the Soloflex home-gym system. Realizing that he could not simply compete with a parity product, he hired a young designer named Sohrab Vossoughi who transformed the product from drab chrome and ugly welds, into bright colors and cloth seats. The success of this product brought a major account with Sharper Image and the company’s eventual purchase by Nike.

Marchant moved to Nike for three years, until 1987, when he left to start Modo. Modo originally manufactured “computer equipment for yuppies” until 1997 when Marchant’s board of advisors suggested he narrow the focus. Marchant chose the medical carts. Referring to a quote from baseball legend Wee Willie Keeler who said, “hit ‘em where they ain’t,” Marchant chose design as his competitive edge. Sensing that by bringing the design function in-house, Marchant could differentiate from his manufacturing competitors, and truly inculcate design as Modo’s ethos.
Context

According to Marchant, since Modo works in a very narrow market, its skills are pulling ahead of even the leading firms such as IDEO and Continuum who cover a wider range of products and experiences. In the medical carts arena Modo defines market directions rather than following the lead of others.

Modo will often make initial contact with a client at a trade show, which is followed up with a portfolio. A salesman will visit the client to frame the project. At this point they are selling a dream about what the companies can achieve together. The goal is to establish a shared understanding of what carts can and can’t do.

In Marchant’s view one of Modo’s strengths is that they are important but non-essential to their clients. “Our lives are so great because we are not in anyone’s path to success. While we are something nice to have, we are not something you necessarily need. On the other hand, there is little incentive for clients to replace us or take the design in-house” since Modo does its work so well. Over the sixteen years of its existence, Modo has only lost three customers. Of those three, two returned almost immediately.

We tend to have cheerleader not clients. They send us photos from far off hospitals so we can see both our products and those of our competitors in use. We call these people, “Friends of Modo.” They do this of their own initiative. We certainly appreciate their role and we listen, which is perhaps why they keep sending us photos.

Despite these cheerleaders, Modo’s profile is relatively low. This is especially true given its niche position. Marchant prefers it that way. In this way he can stay focused on Modo’s core strengths, while not being distracted.

People and Group Culture

As a relatively small firm, located in Oregon, not in a large East or West Coast city, Modo is very careful in its hiring process. Throughout the design process, he and his teams are watchful for bad behaviors, such as strong opinions too early which can quash good interactions.

When Modo made the transition from using Vossoughi and his team at Ziba to an in-
house team, Marchant faced one of his biggest challenges. He was warned by Vossoughi that “you’re going to lose hair and put on weight.” Marchant recalls that he struggled to manage people he had admired from afar, noting that designers are fantastic at creating value but bad at capturing it. He realized that his challenge was to channel the creativity. Modo’s job is to produce the best carts, but in an environment where staff can grow and be happy.

The company changed from standard office space to open plan. Thai food replaced pizza, Beetles outnumbered Saturns. “You only had to spend a day or two in a studio to appreciate that design is a unique blend of business and school vacation.” The staff members were all involved in design, from the reception to the CEO. Over time Marchant balanced the structure, but recently feels that the business is too efficient; there is not enough fun. He always wants to pierce the cohort, to inject diversity. Like the oceans receiving river water, it is important to always have fresh inputs. He is pleased with the transition from Ziba, who they still use, to a largely in-house design team. Modo now has developed a distinctive style.

**Task Requirements**

Each project is scoped in terms of how fundamental the creative effort will be. In some cases Modo is asked to revise an existing product, or comply with an existing product language, thereby limiting the opportunity to start totally afresh. Modo classifies each project at the outset, matching expectations and targets, not just respond to their need.

It is not unusual for Modo to get inspiration or a detail from an unrelated object, like a child’s toy. Marchant views this as a treasure hunt. Team members are regularly asked to bring back some interesting details/opportunities/approaches that can be potentially applied to the process.

Marchant views design as a tension between definition and exploration. Modo balances agreement on the project with exploring as many avenues as possible to reach that goal. One of their main goals is to ease the transition from diagnosis to treatment for doctors by using natural mapping. By making the machines clear and logical, a doctor can use

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36 Ibid.
them without hesitation. Modo attempts to provide a conceptual bridge from the past to the future, so that new products can put both doctors and patients are more ease.

**Formal Organization**

Internally, Modo uses a system called MOPED – Modo Project Engineering and Design. It is part recipe, part formula, part database. It is a resource which provides a pathway for managing the resources and scope of the project. It is an evolving platform, with steps added and removed as lessons are learned. Moped tracks who does what and when to eliminate duplication. It makes sure that no opportunity is missed or detail overlooked.

MOPED is a flexible process model, involving a series of linked steps that need to take place in order to properly define the project. Tasks include the standard brainstorming, competitive benchmarking, affinity product analysis to see if there are common or related products, or even if there are unrelated products to see if common attributes can be shared.

MOPED is an important tool in the design process. As information is entered, and tasks are performed, unless a major issue arises, it is clear to all what the stages the project is up to simply by referring to MOPED. Importantly, MOPED does not drive the process which is punctuated by negotiations, but rather it responds and tracks the process which is particularly useful for keeping a project on track.

In addition to MOPED, Modo has another system called OYSTER. This is an expert system, which captures, codifies, and categorizes all of the nuanced details of designing and manufacturing medical carts. It contains, for example, the optimal diameter of a handle, the distance between hospital beds in Japan, info on machining details, like which color works best with which process. All of this accelerates each project and keeps Modo from repeating too many steps. The designers are free to concentrate on the innovative steps, rather than the mundane.

In terms of reward and appraisals, Marchant indicates that these review steps are done anecdotally at the moment. He works hard not to single out people with specific rewards, fearing that they will start to act for the reward, rather than the activity that generates the reward. He is, however, at pains to acknowledge contributions, noting
that recognition is a big deal. He shares accomplishments, creating a culture of mutual
respect across the company, so that people understand the talent that is in their midst.
Modo also pays well, with key staff participating in the profits of the company.

**Outcomes**

Marchant admitted that they are currently too busy to engage in full project reviews.
With two projects per month, he can’t find the bandwidth to stop and review. He is
counting on MOPED and OYSTER to buttress at least one part of the information
retention.

However, one example he is proud of involved the design of an ultrasound device for a
leading firm. The existing product was large and heavy, and was in many pieces. Modo
redesigned the product into a cheaper and smaller item, setting the trend for this
segment, and of course making the client very happy.

Profit is of course another measure of the firm’s success. Modo has been profitable
since 1990, for which Marchant is proud. However, he does not however, let the profit
imperative rule the company. It is not unheard of for Marchant to be swayed by a
particularly “magical, visual” modification, at the expense of some profit.

**Summary of Modo Interview**

Modo represents a firm that has used design to focus its team members on core
company values. This includes inculcating the importance of design in everything from
their products and services, to their fax and order forms and office space. According to
Marchant, the clarity of the order form has resulted in its return two or three days quicker
than the previous form. Marchant believes that the essence of design is making decisions
on the options of the environment

With numerous design awards that compete directly with output from IDEO and
Continuum, Modo has decided to stay narrow but function at a very deep level. The
choice of staff and the choice of focus means that Modo is not the type of place for those
with impatience and desire for new and different work with each project. However, the
focus that Modo is able to bring to its chosen field means that it can compete with a
slight advantage against larger and more diverse design firms.

Modo has honed the entire process from concept generation to be part evolution and
part revolution with a bit of theatre thrown in at the end. Marchant was fond of telling how, when debuting a new product at a client's site, he keeps the new product under a sheet, building suspense, until the moment of release, generating greater impact, or at least more interest.

Modo has developed two very powerful project and knowledge management systems, MOPED and OYSTER. These form a core around which projects evolve from concept to execution. OYSTER provides a knowledge transfer mechanism beyond the capabilities informal exchange. It will undoubtedly prove to be a valuable resource as the company expands operations and add staff members.

_Interview with Ted Selker from the MIT Media Lab_

Ted Selker heads the MIT Media Lab's Context-Aware Computing group. His research has contributed to products ranging from notebook computers to operating systems. He is best known for the design of the "TrackPoint III" in-keyboard pointing device used in notebook computers, including IBM, Compaq, Fujitsu, HP, and other computers. Of particular interest to me was to discover that Ted was responsible for the design of the IBM 755CV notebook computer which doubled as an LCD projector. This was a notebook I used many times in my own company.

While at IBM, Selker built the User Systems Ergonomics Research, or USER, which is known for creating dozens of product visualizations in the form of prototypes and products yearly. His inventions have received more than 30 awards from publications including PC Magazine, Business Week, and BYTE.

Prior to joining MIT faculty in 1999, he worked at IBM's Almaden Research Center, where he became IBM Fellow in 1996, and has worked at Xerox PARC and Atari Research Lab. He has held teaching positions at Brown, Hampshire College, UMASS Amherst, and Stanford. He is the author of 17 patents and 20 papers in refereed journals and conference proceedings.

In my discussion with Ted we reviewed his experiences at IBM with creating the Track Point III, as well as the LCD projector-enabled IBM notebook, in the context of the work group framework. These are his thoughts.
Context
Shepherding innovative products is tough. Organizations do not like to start new projects. When at IBM, one project in particular took nearly a year to be officially sanctioned. Nevertheless in true skunkworks fashion, Ted persisted by borrowing many items, scavenging where necessary, and generally staying below the radar of those who could affect the project negatively.

He learned the skill of protecting his projects, his team members. He didn’t rub anyone’s nose in his successes, nor did he push too far too fast in order to avoid push-back from those that were threatened.

People
At MIT Ted is most interested in training students that you have to see things from an ergonomic, engineering, and design perspectives to achieve anything truly innovative. One of his approaches is to bring in outside perspectives and different people to change the thinking. This is one of the benefits of using a firm like IDEO or Continuum. By virtue of their existence outside of your normal frame of reference, they should be able to introduce some new thoughts if permitted.

The optimal team size for Ted is 3-4 people. “I’ve seen groups of 3-4 do the work of a hundred less optimal people.” Keeping them together over the life of a project is difficult. The Track Point took ten years. When asked about ideal core members in a team, Ted suggested that they should have omnivorous commitment. One of his most senior researchers, who IBM had already shunted out to a less involved role, stayed almost the entire time out of commitment and interest in the project.

The ability to learn, and teach themselves, was another key facet of a good team member. This is an aspect that Richard Feynman referred to when he talked about a team on the Manhattan Project. In his example, one team was purposely being left in the dark about WHY they were being asked to perform a task. Their results were less than stellar. Feynman argued that he needed to inform the team as to WHY they were performing this task. When permitted, he sat with the group, gave them as much information as he could gather. Thereafter the team performed at a level that played a critical role in the overall project, often times pushing the bounds of the knowledge far beyond even what Feynman expected.

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Task Requirements

Whenever Ted prototypes during a project he makes a minimum of three versions. They have to compete with each other. They are three different ideas, and the best ideas rise out of this process. "I use totally different approaches to make me question and ask myself to improve the first idea."

As Ted says, making a prototype gets you invested in the process. Having mock-ups, a vision, giving it to others, all increase investment and provide much needed data. At this stage, some details don't matter. You are comparing what existed before with what can exist in the future.

He does not believe in listening to people, saying, "I want to watch them". The process needs to be followed religiously. As soon as you "cut and run" you lose valuable data.

In team collaborations, Ted tries to foster creativity by allowing ideas to flow freely, and not necessarily stopping to write them down comprehensively. "There is so much difficulty surrounding creativity. People will say, OK, what are we going to do about creativity. So I say, OK, let's do it right now...and they say, "But wait, can't you give me a list?" I say, "No, I think we should try something. Tell me a problem."

It is amazing how easy it is for people to shut down the process either by stopping it, or by stopping the evaluation of ideas as they are formed. So, what happens is that the ideas get written down as they come out of someone's mouth, and get put away. So you have to figure out, there is something about taking the ideas seriously, and it isn't stopping new ones from coming but it isn't putting them away either."

Somehow you have to keep them alive in the conversation, and there are lots of different techniques. One Ted likes is to ask the quietest person in the room. He says he has gotten a lot of good things in this way. Another technique is to ask for four more ideas. People apparently groan, but what Ted has found is that in those four new ideas people consciously struggle to differentiate from all the previous ideas. The constraints of being at the very least difference from the other ideas, if not better, often results in the best ideas of the day. Ted often finds that the best ideas happen after the official meeting is over, when the brain is limbered, and the subconscious has been allowed to ponder the issue.
Group Cultures

Ted subscribes to a strong group culture, and wholeheartedly believes in it. "I think people have to love each other, and care about each other and work together and want to help." Ted gives little gifts, little “chatchkas”. Part of this is to compensate for his highly critical manner.

It is Ted’s belief that organizations which exist around a product or suite of products become more conservative as time goes by. This is because companies exist to support and shepherd products since they produce revenue.

At IBM, with the ThinkPad, Ted started with a forward-looking manager who was then replaced with a manufacturing guy. After 18 months a controller came in, and finally it shifted to a sales manager. The good news was that it was a success, generating $6B in revenue as a product. The problem is that inside an organization, the people who get control to keep shepherding revenues, get to believe that they are in that role because the know how to manage a company. But all they really know how to do is shepherd a revenue stream. The problem is that in any technical organization, any given revenue stream is under pressure and is bound to drop simply through the nature of evolution and market maturation. This creates a pressure from sales oriented people for the R&D to get their act together and produce another winner now!

One way companies try to rein in a strong group culture is by not letting the groups or individuals, get the notoriety they deserve. Ted challenged me to name three designers at IDEO. I was also reminded of Disney’s and Edison’s approach. Disney never gave official credit to his animators in the cartoons. Edison was also insistent that all inventions from his lab appear to be the work if Edison himself.

Outcomes

Ted admits that he is becoming curmudgeonly about what he counts as successful measure of his work. All the regular measures of success mentioned, such as inner satisfaction, client happiness, pale in comparison to Ted’s three most important measures: “Patents, Press and Products.” After so many years of being suppressed within larger organizations, with only the passing glimmer of recognition outside of his immediate circle, Ted openly admits to loving attention.
"I'll tell you what makes me happy...my secretary shows up with this, a magazine with two facing pages of my stuff. This is the best that can happen. This [Metropolis] is a better magazine than Rolling Stone, and I am on the front cover."

**Summary of Interview**

Innovating is hard and thankless within a large organization. The constant struggles to get resources, team members, and bring it to production take their toll. On the other hand, Ted admits that this hazing process tends to produce better overall solutions. But it takes huge amounts of courage at critical moments to survive the vetting process.

Ted prefers small teams, of 3 to 4 people, and looks for a high degree of commitment in his team members. In return he rewards them with honest feedback, and an opportunity to work on ideas that they are passionate about.

The creative process is misunderstood by many people in positions of power and responsibility. They want to schedule creative time in much the same way that you schedule a doctor's appointment. This ignores the capricious nature of creativity, as well as the hard work that is required to fully develop and implement an idea.
Chapter 4: Synthesizing Data and Conclusions

Chapter 2 reviewed some of the published literature pertaining to collaborative teams in industrial design. Chapter 3 summarized the responses of my interviews conducted around success and failure factors of internal venturing. This chapter will attempt to draw some conclusions. It is not the intention of this thesis to present a recipe that can be slavishly followed in order to create successful collaborative teams. Rather, it has attempted to highlight characteristics of successful firms and how their practices relate to both their own success and to observations as described in literature. I will also leave the reader with some new thoughts on how the design profession could benefit through some innovative teaching methods, as discussed by Chris Heape.

Commonalities

In discussing the process of concept generation and product development in my interviews, it is clear that no single methodology works best for all companies. There are however distinctly similar elements within all the companies that are worth highlighting. While I realize that my sample is not large enough to precisely indicate the critical nature of each characteristic, since it is based on my interview cross-section and not on real monitoring of the practices at these companies, these results clearly identify many of the most common practices across these organizations.

All of the companies:

- Are limited in their expansion potential due to the personalized nature of the business and the talents required to successfully integrate personal skills with group processes.

- Maintain flat and relatively unstructured organizations in order to facilitate interaction between as wide a variety of staff members as possible. Part of the flat structure is designed to empower staff to take on lead roles.

- Subscribe to the concept of serendipitous discovery. By encouraging cross-pollination within the company, and in interactions with external forces, novel solutions are promoted.
• Make great efforts to generate contact with external influences. These include reading extensively, attending conferences, and visiting new environments including art galleries, retail establishments, and university campuses. All agree that exposure to fresh stimuli is paramount in keeping pace with changing needs and desires of clients and end users.

• View their expertise as synthesizing stimuli in a manner that their clients cannot compete with by virtue of the client’s more traditional or structured environment.

• Encourage innovation and creativity by actively removing the fear of failure. This is a delicate balance between not condoning failure, per se, but rather allowing projects to experiment with as many ideas as possible, with the understanding that some, if not most will fail. The idea is to learn through doing rather than ossifying through inaction.

• Resist cosmetic design until conceptual and functional issues are extensively discussed and resolved.

• Engage in extensive prototyping to move discussions away from the purely theoretical and into the realm of the possible.

• Choose projects that allow the company to grow in expertise and introduce new skills to staff. They are also keen to maintain a level of client interaction that encourages and in some cases insists that the design firm’s input is expressly not limited to visual design activities to the exclusion of functional issues and concept generation. That is, they are not interested in a project that is “thrown over the fence and needs a pretty skin.”

• Don’t just listen to the customer but actively engage in observing the customer to synthesize spoken cues with activity-based cues.

• Strongly feel that their internal culture is a critical asset and key to their ongoing success. Most consider their processes and interactions easy to observe but hard to duplicate.

• Are interested in people from a variety of backgrounds in order to infuse the organization with unconventional approaches to problem solving.
Towards a broader definition of the design process

In trying to synthesize the various factors that define the successful team, and the firms that promote these teams, one of the most interesting discussions I had for this thesis was with Chris Heape, Senior Researcher at the Mads Clausen Institute for Product Innovation with the University of Southern Denmark. Mr Heape’s focus is on design research and design learning.

In our discussion, Mr. Heape emphatically broadened my definition of design to include the entire chain of interactions from concept generation to the eventual users of the end result. He contends that if you establish a set of values other than beauty you set a benchmark that infuses the entire process, from concept creation, to the prototypes, to the manufacturing, to the installation and use. The process needs to consider the entire chain that makes of the existence of that item.

Mr. Heape contends that the word design is far too commonly misappropriated. If you limit design to factors that implicitly exclude certain voices, you will by definition get only part of the picture. If the design process is approached from the perspective to include a broader chain, you have the opportunity to involve people from all sorts of levels. The end result is much more nuanced. While it is critical that the aesthetic and functional elements be included, it is equally important for maintenance, installation and other less obvious factors to be considered. He used the example of a control unit for a refrigerator. The designer, purchaser and the user are different sets of people. Furthermore, the initial purchaser, that is, the person making the buy decision, and the eventual end user is not the primary set of people who will interact with this product; it is the installed and repairer. Yet, it is not uncommon for these last-in-the-chain voices to not be heard until it is too late.

I was particularly intrigued by his perspective on teaching the design process. I will attempt to do it justice here.

Design as the Construction and Negotiation of Meaning

In explaining the multi-dimensional components that comprise the design process, Mr. Heape included a reference to German philosopher Hans-Georg Gadamer and the study
of hermeneutics. While a fulsome discussion of hermeneutics is far beyond the scope of this paper, what I found relevant about this philosophy for this paper is that hermeneutics is an attempt to clarify the conditions in which understanding takes place. For Gadamer, understanding is bound and embedded in the historical contexts which each person carries into who they are today. This is defined as their effective-history. In a design context, the various team members bring into the process a set of preconceptions, historical interpretations, and effective limitations of their understanding. The result of these limitations is to constrain, or at the very least direct, the innovation process.

Knowing this, the challenge is to overcome these limiting factors and come together on a common understanding in a common space. Mr. Heape referring back to Aristotle who had lengthy discourses on the subject of aesthetics, describes this as a series of elements which include techné, poiésis, praxis and phronésis. Each of these elements builds on the previous to form key ingredients for innovation.

Techné is the intellectual, rational knowledge of how to do something and that can be repeated. Poiésis, through techné, is the formation of an external thing; it is the action of the creation. Intellectually above these two is the human capacity for motive. Praxis forms man as a political and moral being. It decides whether our interaction will be open to adventurous thinking or will revert to a safer and potentially easier closed thinking model. This factor is affected by each individual’s capacity for uncertainty, and culminates in the wisdom of the individual, the phronésis. This is the capacity to overcome personal biases and meet in a common place.

Chris Heape suggests that, “instead of thinking of the design process as a linear process of sequential series of events, one can consider a design project in its entirety as a conceptual space that represents a space of possibilities within the dimensions of a design task.” This is shown in Figure 10. Task goes in one direction and learning in another, if they are not related and linked. Another way to consider this space is to say that an engineering focus is above the task line, and the exploration and investigation is below the learning line. If they do not interact, there is a gap in the process.
Figure 10: The Design Space - Task and Learning phases

But with the design process having both learning and task orientations, it is important for the teams not to rush too soon past the learning phases and into the task phase. As I mentioned previously, if this process is rushed the outcome lacks depth and nuance. The point is to shift the emphasis on creating and model a design object and focus on the collaborative process, as shown in Figure 11. In this figure, engineering and learning are engaged and in a dialogue over time.

Figure 11: The Design Space - Task and Learning and interaction and exploration

Finally, the teams work towards a common goal, narrowing the gap with each of the iterations. If the product or process is truly innovative, you really don’t know where you are headed. You have to teach the team members to live with this uncertainty. If you are dealing with people who like structure and do not like uncertainty, the challenge will
be to avoid a regression into a stage gate process just to complete the task. Industrial
design firms need to control this stage of the process, given their experience and
comfort with high degrees of uncertainties. This process should be in a learning mode,
driven by openness and patience, as opposed to a doing mode, in order to arrive at the
optimal outcome, as shown in Figure 12. By maintaining a learning frame of mind and
visualizing the space of possibilities, that is the design space, the goal will eventually
become clearer. The eventual and necessary jump from a learning orientation to a task
orientation will have less conflict. The task will be well-grounded in the learning stage
and the task stage becomes entirely appropriate.

![diagram](image)

**Figure 12: Narrowing the gap between Task and Learning**

**Freeing Embedded Knowledge**

Viewing the design space as a common venue for interaction, the team that develops fit
the definition of a community of practice; a group of professionals informally bound to
one another through exposure to a common class of problems and common pursuit of
solutions. What is valuable about these teams is that they embody a store of knowledge.
Many design firms emphasized this aspect of their culture and how it differentiated them
within the profession.

What is perhaps confusing is that much of this knowledge is formally unmanaged after
the fact. When a new product is developed, there are really two products that are being
developed. There is the one that goes out the door, and there is one that stays behind
in the company in the form of knowledge that is generated. In most R&D departments,
often the knowledge management that occurs is a product description that is filed and often forgotten. This is partially because new teams often want to approach a project in their own way, rather than being burdened by previous constructs.

However, it is argued repeatedly in my literature review and in my interviews, that in a design context and in most other contexts as well, communication is critical. Thomas Edison emphasized this is his lab design. Andrew Hargadon discussed this in his book entitled, “How Breakthroughs Happen, when he wrote, “these entrepreneurs and inventors are no smarter, no more courageous, tenacious, or rebellious than the rest of us - they are simply better connected.”37 A persistent theme throughout my conversations and readings is that the most effective teams exploited a networked landscape, “making connections between people, ideas, and objects from across the broad landscape.”38 Innovation requires not just many good ideas, but also the joining of talented people willing to take a chance, given the opportunity to fail and succeed in equal measure. Creating this environment once is a challenge. As I have seen in writing this thesis, inculcating it as an ethos is what separates good teams from great teams, from surviving companies to thriving companies.

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38 Ibid.
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Work Group Framework

Context
- Purpose of project
- Time Span for Project
- Physical Setting of Team
- Industry Competitors

People:
- Team Size
- Skills and Interests
- Creativity
- Working Styles
- Values, Assumptions
- Preference for Variety

Task Requirements
- Project Discipline: Required activities and interactions
- Interdependence
- Variety
- Learning Mechanisms - Particularly project-based.
- Novelty
- Prototyping

Formal Organization:
- Structure and formal reporting relationships
- Control and Measurement Systems
- Reward Systems
- Recruitment and Selection Systems
- Infrastructure

Group Culture:
- Emergent Activities and Interactions
- Norms
- Roles and Social Rankings - basis?
- Sentiments
- Rituals, Stories, Sagas, Language Conventions

Outcomes:
- Productivity - how is it measured?
- Satisfaction
- Individual Growth
- Company
- Regeneration/New Business
- Industry
- Recognition
- Knowledge Growth
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