

CREATING

BREAKTHROUGH

PRODUCTS

SECOND EDITION



**Revealing the
Secrets That Drive
Global Innovation**

BY JONATHAN CAGAN & CRAIG M. VOGEL

Praise for *Creating Breakthrough Products, Second Edition*

“Good ideas can come from anywhere, so innovation must start with keeping an open mind, then knowing how to make the most of what you’ve found. While easier said than done, in *Creating Breakthrough Products*, Cagan and Vogel offer examples, case studies, and inspiration to guide a new generation of open-minded, actionable innovation drivers.”

—**Jeff Weedman**, Vice President Global Business Development, Procter & Gamble

“To create profitable, breakthrough products that transform markets, you need real global innovation skills. Cagan and Vogel reveal how world-class companies leverage both to create impact through design.”

—**David Kelley**, founder of IDEO and the Stanford d.school

“Cagan and Vogel have outdone themselves in this highly readable and useful second edition of their book on creating breakthrough products. This new edition retains all the basic wisdom of the first but brings it up-to-date with fresh case studies that reflect the changing world of global innovation.”

—**Henry Petroski**, Aleksandar S. Vesic Professor of Civil Engineering; author of *To Engineer Is Human: The Role of Failure in Successful Design* and *To Forgive Design: Understanding Failure*

“This book has been the most influential integrated design book in China for 10 years, widely used by universities, companies, and designers. The case studies in the second edition demonstrate the great success in the use of the methods introduced in the first edition. This book will definitely serve as a guide for your design to become a leading global product and or service.”

—**He Renke**, Dean and Professor of School of Design, Hunan University, China

“In Cagan and Vogel’s widely referenced, landmark first book, they cracked the code and reached across disciplines to create a common understanding of useful, usable, and desirable products. This second edition adds a global view, services, and a look into healthcare, further establishing them as the grandmasters of the recipe for empathic innovation.”

—**Robert T. Schwartz**, General Manager, Global Design & User Experience, GE Healthcare

“The second edition of *Creating Breakthrough Products* is a brilliant book that will move your company to success with less wear-and-tear and lower risk for all involved in creating and managing products. Cagan and Vogel’s pioneering, time-tested research and product development methods captured in the book should be on the desk (or iPad!) of everyone at the C-level, helping them to guide the process to better products and services.”

—**Lorraine Justice**, Dean, CIAS, Rochester Institute of Technology; author, *China’s Design Revolution*

“*Creating Breakthrough Products* supercharges your design and development team. Embracing the framework introduced in this book enables your cross-functional design teams to keep their eye on the big market opportunities and focus on how to create the most disruptive industry shaping products and services. The analytical tools introduced address the most critical and difficult to get right part of the development process: the Fuzzy Front End. I wouldn’t dream of commercializing a new product or service without infusing the *Creating Breakthrough Products* design culture into my company and development teams.”

—**Eric Close**, President and CEO, RedZone Robotics, Inc.

“The first edition has been influential on the setting up of the Design School at Singapore Polytechnic and some initiatives at the DesignSingapore Council, such as the Design Thinking and Innovation Academy, which aims at infusing design thinking and design-driven innovation capabilities in private and public sectors. The new edition gives us more insights on creating breakthrough products (and services) through successful case studies in the world.”

—**Jeffrey Ho**, Executive Director of the DesignSingapore Council and
Former Director of the Design School, Singapore Polytechnic

“The book has been the core of the design and innovation course literature both in Finland and China. It is an insightful and inspiring look at innovation. The rich collection of case studies makes it especially valuable and engaging both for students aiming to become top design leaders and for experienced professionals. This book has helped greatly to expand the innovative use of design in many areas of industry.”

—**Yrjö Sotamaa**, Advisory Dean and Professor, College of Design and Art, Tongji University, Shanghai;
Executive Vice Director, Sino-Finnish Centre at Tongji University;
President Emeritus, University of Art and Design Helsinki

“The authors’ approach to product development is a useful complement to any company’s existing product development processes. The process unleashed the collective creative genius of our designers and engineers, and helped us move beyond a typical competitive benchmarking approach, or specification-driven design, to create something unique, appealing, and functional for our customers.”

—**Paul Prichard**, Innovation Ventures Engineering, Kennametal, Inc.

“Navistar has made strides in learning the iNPD techniques from this book and applying them to our everyday development process. We have made user research a mainstay of the early part of the development cycle, giving us insights that lead to better solutions for our customers. Better solutions for our customers then drives sales and profitability through brand equity and product demand.”

—**David Allendorph**, Director of Design, Navistar International Truck Group

Creating Breakthrough Products

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*Revealing the Secrets That Drive Global
Innovation*

Jonathan Cagan & Craig M. Vogel

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Genius is 1% inspiration and 99% perspiration.

—Thomas Edison

The same can be said of the development of new products. The challenge in developing new products is making the most of the 99%. The road from the patent office is strewn with good ideas that never made the leap from concept to market.

The light turning on is just the beginning. High-performance teams learn to break beyond the boundaries of the bulb to see things in new and fresh ways. Breakthrough products not only make the most of the 99%; they shatter the limitations of existing perceptions of what products can be.

During the last decade, it has now become clear that the light bulb can go on anywhere in the world. This development is complemented by the growth of consumer markets in every continent. Pace of technology advances shows no sign of slowing down. Products and services must now deliver value in a new interconnected continuum. Breakthroughs can occur at any scale—in a small, entrepreneurial startup, in non-profits, or in multinational corporations.

The ideas in this book can help to guide breakthrough thinking at any scale to meet the emerging needs, wants, and desires of consumers in every part of the world.

To DéDé Greenberg and Leslie Frank Cagan for their support and perseverance

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Foreword

It's hard to believe that this remarkable book is actually 11 years old and going into its second edition. It has been widely influential, having been used by many companies, universities, and other organizations in multiple countries. Such diverse leaders as Procter & Gamble, Kraft, Boeing, and Navistar have productively applied its concepts and approaches. So have other businesses, in countries ranging from Belgium, Finland, and the U.K. to China and Singapore. In fact, in Singapore, the ideas in the book were an influence that contributed to the design-driven innovation initiatives by its government-sponsored Design Council. *Creating Breakthrough Products* also plays a major role in the curricula of Carnegie Mellon University, the University of Cincinnati, and other leading institutions of higher learning around the world.

As the book's precepts are being proven in practice, Jonathan Cagan and Craig Vogel have refined them based on their resulting new insights and expanded them to address the growing importance of the service economy. This new edition includes new discussions of service design and interaction design, as well as product design in the United States and abroad.

These updates are welcome, but the book's essential message remains the same and is as timely as it was on its initial publication: Collaboration and integrated innovation is an essential process for creating successful new products and businesses.

Integration is an overused word, and few do it well. But it also is the secret sauce, by design or default, of most successful enterprises...Apple being the obvious exemplar. In the integrated, user-centered new product development approach Cagan and Vogel espouse, the disciplines of product design, engineering, and marketing blend to enable the creation of products that are both aesthetically appealing and functionally compelling.

I personally have been privileged, through my discussions with the authors, to see these ideas develop and grow—and also to advocate them at Navistar. Their practical value is summed up by the term *pragmatic innovation*, reflecting the continuous drive to understand customers' evolving requirements and deliver solutions that are beautifully packaged and delightfully functional.

This has been vividly brought to life at Navistar in our classic long-haul vehicle, the International LoneStar. As this new edition of *Creating Breakthrough Products* makes clear, this book's authors had a significant influence on the process by which this product was developed. Students under the authors' direction contributed many worthwhile ideas as well—and, beyond that, Navistar's product design, engineering, and marketing teams worked more closely together as a result of the authors' insights and delivered a much more compelling result than could have been produced using traditional product development practices.

Navistar also has taken the principles of integration and pragmatic innovation to heart by re-potting the essential execution elements of vehicle engineering, power train engineering, design supplier operations, and manufacturing, previously dispersed, into a new integrated product development center in Lisle, Illinois, that opened in 2012.

I happen to believe, along with many others, that the wealth and well-being of nations, including ours, the United States, rests on manufacturing complicated, consequential products that benefit commerce as well as provide good-paying jobs that raise standards of living. This book provides insights on how to do that. In no small way, when the President of the United States stresses the critical nature of manufacturing, he is, in essence, endorsing the integrated, multidisciplinary processes that lead to manufacturing leadership—processes for which Cagan and Vogel serve as strong advocates.

—Dee Kapur
President, Truck Group
Navistar, Inc.

Acknowledgments

We are indebted to many people and organizations in developing the second edition of this book.

To begin, we are honored to have Dee Kapur, President of the Truck Group at Navistar, Inc., write the Foreword to this book. We have known Dee for more than a decade, having worked with him when he was Executive Director at Ford and then President of the Truck Group at Navistar. Dee is a passionate, forward-thinking, practical innovator. In fact, he coined the term *pragmatic innovation* to highlight the balance between creating innovative solutions and making them profitable. Dee has been a major influence on our process, and his support allowed us to develop many of the ideas in this book.

We also acknowledge our colleagues at Carnegie Mellon and the University of Cincinnati. Peter Boatwright and Eric Anderson furthered our thinking about the process of innovation and collaborated in teaching the integrated New Product Development course at CMU. We would also like to thank and recognize Reneé Seward for the case study and support on interaction design at UC. Peter Chamberlain has been teaching integrated new product development for the last five years in the Live Well Collaborative helping to develop new methods for gaining insights into consumer value. Linda Dunseath, Executive Director of the Live Well Collaborative, has coordinated over 30 interdisciplinary projects in the last 5 years. Laurie Weingart from CMU collaborated with us in our research on perceptual gaps and team integration presented in Chapter 6.

We are grateful to Sepideh Shahi for her commitment to this project and her extraordinary diligence in assembling the figures and case studies in this new edition. Juan Islas Munoz (Antonio), Fei Xie, and Yingxue Zhao (Anne) did a fabulous job of creating the product sketches found in the book. Xie Fei designed the integrated cover for this edition. We are also grateful to Rebecca Pinn for her assistance in researching and developing several of the case studies. We thank Matthew Lovell, Hong Ding, and Kevin Armendariz for research into several other case studies, and Oscar Frias and Aseem Singla for their discussions on aspects of this work.

We feel fortunate to have been able to work with our editor, Jim Boyd, of FT Press, as we brought this manuscript to press. If there is an ideal editor, Jim is it. His energy, enthusiasm, and support for this project, along with his staff, helped to move this manuscript further to the Upper Right, and quickly to production. Jim has been committed to this book for more than a decade, working with us on the first and second editions.

Many individuals at various companies spent a great deal of time working with us to develop the case studies in this book. In addition to several listed earlier, we thank Dave Allendorph, Jeff Calhoun, Katie Clark, Sean Corcorran, Doug Dietz, Thierry Do, Ryan Eder, Sam Farber, Bob Fealy, Ramsey Ford, Jodi Forlizi, James Gallagher, Kate Hanisian, Jeffrey Ho, Jerry Kathman, Chris Kasabach, Brian Matt, Shane Meeker, Thomas Overthun, Alejandro Peña, Paul Prichard, Dr. Robert Reynolds, Bob Schwartz, Vanessa Sica, Jim Sloan, Ivo Stivoric, Sohrab Vossoughi, William Wu, and Xiangyang Xin.

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About the Authors

Jonathan Cagan is the George Tallman and Florence Barrett Ladd Professor in Mechanical Engineering at Carnegie Mellon University. Globally known for his rigorous and effective approach to product innovation, Cagan works extensively in research on innovation processes and tools, teaching and leading innovation teams, corporate consulting, and speaking engagements on the topic of innovation. With a focus on product strategy and innovation, Cagan has worked with a variety of companies, ranging from Fortune 100 to entrepreneurial start-ups such as Apple, P&G, GlaxoSmithKline, RedZone Robotics, Navistar International Truck, and Nissan. He also co-directs the Master of Product Development program at Carnegie Mellon. In addition to *Creating Breakthrough Products*, he is the co-author of *The Design of Things to Come* and *Built to Love*. For contact and further information, go to www.JonathanCagan.com.

During the last 30 years, **Craig Vogel**, FIDSA, FRSA, has been a consultant to more than 20 companies and advised and managed dozens of research projects and design studios collaborating with industry. He was recognized, in the 2008 and 2011 Design Intelligence publication listing of the best design and architecture schools, as one of the most admired design educators in the United States. He is cofounder and President of the Live Well Collaborative (LWC) a joint venture between UC and P&G. His education experience includes more than 30 years of teaching at all levels of undergraduate and graduate design education at the Institute of Design, IIT, The School of the Art Institute of Chicago, Carnegie Mellon University, and University of Cincinnati. His areas of expertise include Integrated New Product Development, Design Strategy, Design Foundation Studio, and Design History.

Preface

It has now been 20 years since we started to conduct research, work with companies, and experiment with methods for early phase innovation with students in corporate-sponsored projects and companies applying our methods. In the decade since the first edition came out, we have been able to work with companies and other educational institutions that have embraced our work and helped us further develop our ideas and new insights. One of the significant changes for us as a team in the last decade is the fact that we both no longer reside in the same place. Jonathan Cagan remains on the faculty at Carnegie Mellon University in Mechanical Engineering and co-director of the interdisciplinary one-year Master of Product Development program. Eight years ago, Craig Vogel floated down the Ohio River to Cincinnati. He is now Associate Dean in the College of DAAP at the University of Cincinnati. We have been able to experiment on our own and together in two different educational contexts and to work with new academic and corporate partners.

We are extremely proud and humbled by the reception of the first edition of the book in the corporate world and in academia, and by the global influence our book has had on the way companies work in the Fuzzy Front End early stages of innovation.

In addition to covering the ideas introduced in the first edition of this book, this second edition explores several new areas to complement the core ideas that have continued to be the basis of the integrated new product development (iNPD) approach. The new edition is still a combination of both a coherent structure for managing the Fuzzy Front End and methods that have been proven to ensure a high degree of success in producing innovative solutions. The case studies we are using reflect current Social,

Economic, and Technology (SET) Factor issues and support the idea that innovation drives competitive positioning and profit. The case studies reflect a wide range of products and services and include a broader global representation.

In addition to the flattening of global competition, there is a new opportunity and challenge in the evolving relationship of product, interaction, and service systems and the evolution of local and global brands. Although we briefly touched on these topics in the first edition, they play a more significant role in the current argument we provide. The interest in Design Thinking has also been a significant part of how companies seek to become more innovative. We place the topic of Design Thinking in a deeper context of the need to balance qualitative empathic thinking, methods, and systems with quantitative, rational approaches.

When Google talks about producing a digitally driven car and Ford introduces two new cars at the Consumer Electronics Show, we know that we are on the brink of a new paradigm of what is possible. The BRIC countries are now competing with the original G7 for global market domination. We discuss how Brazil, India, and China are not only catching up, but leading in several markets and how microstates such as Singapore are embracing change faster than everyone else.

When the first edition was published, consumers were optimizing all of their purchases based on their desires with seemingly unlimited resources. Since then, 9-11 and a significant global recession have taken place. Consumers have shifted to making tough choices about how they spend their money. However, they still expect great experiences and they still purchase products for those experiences, even though their needs, wants, and desires might have changed. Consumers around the world are asking for more for less, so the challenge to innovate and control costs in what Dee Kapur calls *pragmatic innovation* are still the key elements for business success. We show in the case studies in this second edition that it is possible to have both low volume/high profit and high volume/high profit. Reading the SET Factors and translating opportunity gaps into product value while managing brand equity are still the keys to driving innovation and provide the most effective long-term return on investment.

What to Expect from This Book

In this book, you will find some new ideas in product development. You will also find seasoned best practices used by large or small companies. We have integrated these different approaches into a logical framework that takes you from product planning to program approval. You can expect to gain an understanding of the following seven aspects of the new product development process:

1. A systems-level approach that integrates physical product and service design using the same research and product development methods
2. Methods to obtain insights into emerging trends in consumer and industrial markets
3. A means to navigate and control what is often called the Fuzzy Front End of the product development process, that portion of the design process in which the product and market are not yet defined and qualitative tools are needed to complement quantitative research
4. The use of qualitative research to understand the needs, wants, and desires of the customer
5. Techniques to assist in the integration of diverse team players, especially engineers, industrial and interaction designers, and market researchers and planners
6. A complete product development process that brings the product from its opportunity identification stage through to program approval and product patenting
7. An approach that connects strategic planning and brand management to product development

We provide case studies that demonstrate the successful use of the methods introduced in this book. We show that these methods apply to both products and services. We also include a selection of case studies across the globe, from the country level to the product level.

The book's logical flow is designed to provide a useful guide for anyone involved in the product development process. Readers can also use the book by first scanning and then focusing on the areas initially perceived as most relevant. In either case, we have tried to make sure that the book is interconnected and cross-referenced so that issues addressed in one part are referred to again in other parts.

The book is divided into three main sections. The first section (Chapters 1–4) establishes our main argument that the best new products are designed by merging style and technology in a way that connects with the lifestyle and values of intended customers. The second section (Chapters 5–7) presents a process for creating such products by integrating different disciplines with a focus on the needs, wants, and desires of the customers. The final section (Chapters 8–11) provides additional case studies as further support of our argument and its application to several product categories. Chapter 8, “Service Innovation: Breakthrough Innovation on the Product–Service Ecosystem

Continuum,” specifically calls out service and interaction design, and illustrates how the same tools and thinking are applied to navigate the Fuzzy Front End of the overall system as is used for the physical aspects of a product. Chapter 9, “Case Studies: The Power of the Upper Right,” includes case studies in U.S.-based products. This also includes a discussion on the potential for an open innovation process between open-minded companies and cross-collaborative universities. Chapter 10, “Case Studies: The Global Power of the Upper Right,” looks at the emergence of innovation across the globe, particularly in the BRIC countries and Singapore. Many of the products featured in the first edition have been retired. In Chapter 11, “Where Are They Now?,” we revisit many of those products to assess which are still active in the marketplace and which are no longer in production, and we use the SET Factors to understand how the marketplace changes.

Chapter 1, “What Drives New Product Development,” explains the forces that generate opportunities for new product development. This chapter introduces the process of scanning Social, Economic, and Technology (SET) Factors that leads to Product Opportunity Gaps (POGs) and new market segments. Four case studies of successful companies and the products or services they deliver illustrate this process: the Margaritaville Frozen Concoction Maker, the BodyMedia FIT System, the services provided by Starbucks coffeehouses, and GE Healthcare’s Adventure Series MRI for children.

Chapter 2, “Moving to the Upper Right,” outlines our major premise. To produce new products, a company needs to commit to “moving to the Upper Right.” This phrase represents an integration of style and technology through added product value based on insight into the SET Factor trends that respond to customers’ emerging needs for new products and services. This chapter introduces our Positioning Map to model and map Upper Right products.

Chapter 3, “The Upper Right: The Value Quadrant,” focuses on consumer-based value and further refines product opportunities into what we call Value Opportunities (VOs). We have identified seven Value Opportunity classes—emotion, aesthetics, identity, ergonomics, impact, core technology, and quality—that each contribute to the overall experience of the product. The categories work for physical products, service-based products, and larger systems. The challenge is to interpret the VOs and their attributes and translate them into the right combination of features and style that match with current trends.

Chapter 4, “The Core of a Successful Brand Strategy: Breakthrough Products and Services,” discusses, through corporate and product branding, how to make moving to the Upper Right a core part of a company’s culture. Products and services are the core of a company’s strategic planning and brand strategy, and they should be driven by the

theme of user-centered interdisciplinary product development. Establishing a clear brand identity necessitates integrating customer values with company values in a way that differentiates a company and its products in the marketplace.

Chapter 5, “A Comprehensive Approach to User-Centered, Integrated New Product Development,” is devoted to planning product development programs through the presentation of an integrated new product development (iNPD) process for the early stages of product development (the Fuzzy Front End). Most product programs go through a stage in which the product opportunity is researched, prototyped, and evaluated. However, many companies do not have clear methodologies for this frequently underdeveloped stage of the product development program, which costs them significant resources. The process we have developed helps companies navigate and control this process by keeping focus on the user. The process is broken into four phases that take the development team from the stage of identifying opportunities to the program approval stage where intellectual property is identified and protected.

Chapter 6, “Integrating Disciplines and Managing Diverse Teams,” focuses on team integration and management. Effective interaction of disciplines is integral to the product development process. We describe how team members (particularly designers and engineers) can work in a context of positive tension where they use their different perspectives to a competitive advantage for the whole team. We also lay out a strategy for breaking down actual parts and components of the product and, by understanding their impact on customer lifestyle and complexity, determining where integration is required to effectively design them. The chapter concludes with insights on how to manage interdisciplinary teams.

Chapter 7, “Understanding the User’s Needs, Wants, and Desires,” focuses on developing a comprehensive approach to understanding the user’s behavior. We discuss the use of existing and emerging methods for understanding how consumers use products and translating that understanding into what we refer to as “actionable insights,” which become the basis for developing appropriate product characteristics. These approaches empower the product development team to translate customer preferences into appropriate style, ergonomics, and features.

Chapter 8, “Service Innovation: Breakthrough Innovation on the Product–Service Ecosystem Continuum,” is a new chapter that focuses specifically on service design, discussions on interaction and interface design, and the design of the larger product–service ecosystem, accounting for logical and empathetic perspectives. Although service design has become a discipline in and of itself over the past decade, the tools, methods, and thinking necessary to navigate the Fuzzy Front End of services are the same as for physical products and their larger system.

Chapters 9, “Case Studies: The Power of the Upper Right,” and 10, “Case Studies: The Global Power of the Upper Right,” highlight additional case studies of successful new product development, representing a range of product and service categories and types of product development teams. Chapter 9 is divided into two sections: U.S.-based products and open innovation between companies and universities illustrating the potential benefits of an authentic partnership for the creation of breakthrough products and the advancement of a new kind of educational program. Chapter 10 focuses on globally based products, with particular focus on the BRIC countries and Singapore. Chapter 10 illustrates the emergence of new sources of innovation across the globe.

Chapter 11, “Where Are They Now?,” describes the current state of products that are no longer relevant as case studies for this edition, yet were invaluable to the success of the first edition. In some cases, SET Factor changes or strategic choices in companies have caused them to no longer rate being considered as breakthrough. We felt it was important for readers to understand how fragile success is and how constant innovation is required to maintain lead positions in markets.

The Epilogue concludes with a look at the characteristics of future innovators and final thoughts on why companies should commit to using the iNPD process.

User’s Guide

Through our many interactions with industry, people have asked us questions that relate to their product development problems. We have answered many of them in this book. In this section, we list these questions, together with pointers to the chapters that answer them. Readers with a specific issue might want to begin the book here. They are divided into five areas: 1) how to get started; 2) how to become user driven instead of technology driven; 3) how to balance team, people, and discipline interactions; 4) how to commit the time, money, and people for an integrated new product development (iNPD) process; and 5) how to succeed in the marketplace.

I. How to Get Started

How do you learn a successful user-centered iNPD process?	The whole book
What is the Upper Right?	Chapter 1
What does it mean to design for fantasy?	Chapter 1
How do you jumpstart the process?	Chapters 1 and 5
What is the Fuzzy Front End?	Chapter 5
How do you develop a core competency that separates you from your competitors?	Chapters 5 and 7
Why is quality for manufacture no longer enough?	Chapters 1–4
How do you balance up-front research and development with downstream refinement in the product development process?	Chapter 5

II. How to Become User Driven Instead of Technology Driven

How do you know when you have a true product opportunity?	Chapters 1–3 and 5
How do you get beyond being tech driven?	Chapters 5 and 7
What is ethnography, and how do you use it?	Chapter 7
How do you determine the user value in different parts of a product?	Chapter 6
How do you design for a full sensory experience?	Chapters 3 and 5
How do you successfully use qualitative research to understand the needs of a user?	Chapters 5 and 7
How do you use psychometrics to determine what users want and what they will pay for it?	Chapters 3 and 7

III. How to Balance Team, People, and Discipline Interactions

How do you plan and manage an effective product development process?	Chapter 5
How do you prevent turf battles from having a negative effect on the product development process?	Chapters 5–6
How do you maintain an interdisciplinary approach that keeps different disciplines communicating effectively?	Chapter 6
How do you get team members to respect each other’s capabilities?	Chapter 6
How does team integration affect career development for individuals?	Chapter 6
How do you effectively partner with suppliers?	Chapters 6 and 9–10

IV. How to Commit Resources to an iNPD Process

How do you determine how much time, money, and personnel to commit to the iNPD process?	Chapter 5
How do you know how long it will take to address the Fuzzy Front End?	Chapter 5
How do you meet deadlines within the product development process?	Chapter 5
How do you integrate industrial, interface, and communication design into your company’s product development process?	Chapters 1, 5–6, and 8–10
How do you account for the larger system of physical product, service, and the integrated system?	Chapter 8

V. How to Succeed in the Marketplace

How do you create a product that reaches the majority of customers in the marketplace?	Chapter 5
How do you gain confidence that the product warrants the capital investment?	Chapters 1, 5, 9, and 10
How do you balance being cost driven and being profit driven?	Chapters 3 and 6
Have there been any successes from this approach?	Case studies throughout book, especially Chapters 1, 2, 4, and 8–11
How does the development of services differ from that of products?	Chapters 1 and 8
How can you develop a brand strategy that integrates your products and services with your corporate structure?	Chapter 4
How do you develop products for a global marketplace, and how do you account for global competition?	Chapter 10

How to Use the Case Studies

In this book, we discuss a variety of case studies of breakthrough products and services. As a set, they illustrate the range of applications of the tools and methods. Use them to better understand the teachings in the book, use them to better understand the SET (Social, Economic, and Technology) Factor trends, and use them to enjoy learning about experiences in new product innovation. To demonstrate the range and contrast of case studies in the book, we offer a brief glance at some of them here. They demonstrate the concept that form and function following fantasy is in the eye and mind of the consumer.

Apple iPhone and BodyMedia FIT System

Contrasting the success of the Apple iPhone series with the BodyMedia FIT System is interesting. One company has seen opportunity in integrating the latest handheld technology with all the potential for local and global connections and integration. The other company has done the same, but on a different scale. BodyMedia is defining technology-based personal health monitoring. As with iTunes and iCloud, it is trivially simple to use yet empowering to those seeking to lose weight.

Dallas, Never Big Enough, and Starbucks, the Third Place

Both Dallas Stadium and Starbucks provide an alternative experience that consumers want. Dallas Stadium is the new cutting edge in spectator experience, mixing real and virtual. It is a smart stadium with more than 500 monitors, 2 of which are the largest and most direct experience you can have. Starbucks is the opposite, the quiet escape of your third place. It is not about the crowd, but about you and finding the quiet moment in an atmosphere that is designed to promote relaxation, contemplation, or quiet conversation. In Starbucks, the technology is the invisible backbone of the service of delivering coffee. A Starbucks cafe is just as smart as Dallas Stadium, but the barista and daily updated chalk signs and trendy interior are what customers want to see.

Margaritaville, Laid Back Without a Care, and GE Adventure Series, Caring About How Children Lay Back

Jimmy Buffett's song *Margaritaville* has become an iconic message for thousands of Baby Boomers and the inspiration for a new powerful frozen drink maker. A mixer for alcoholic drinks and smoothies has allowed fans of the Buffett lifestyle to stay connected to the 1970s song and is selling like flip-flops in the Keys. The Frozen Concoction Maker has brought the professional mixer technology to a consumer price range and integrated the core technology with a unique ice flow system. The identity and aesthetic blends a combination of Key West, Williams-Sonoma, and Crate and Barrel with backyard barbeques and boating.

GE Healthcare created a fantasy experience to help children get through highly technical and formidable medical experiences that are scary and can require sedation. They created an empathic interface experience through the Adventure Series to allow technicians and nurses to use their highly effective technology help diagnose a child's condition. The staff feel better about their work, parents are relieved, and there is minimal impact on the child's psyche.

Function Drives Elegance, and Form Drives Fashion

Kennametal set out to design the best head for cutting titanium. The result—Beyond Blast—is an elegant design that optimizes parts integration with the functional needs of the product requirements for the technician controlling the metal-cutting experience. P&G's redesign of Herbal Essences allows its core technology shampoo to meet a functional need and help young women make their own fashion statement. The design of the

shampoo packages blends fashion and ergonomics, redefining the category and pushing the brand to number one in its category.

All these contrasting examples successfully defined the SET Factors in their markets and understood the opportunity they had to introduce new value into their respective markets. Then they translated that insight into highly refined executions that were just in time to connect with the consumers' emerging value expectations. They got it right in the beginning, in the Fuzzy Front End of the new product development process, and were able to keep the vision alive through to the introduction of the product in the market. In addition to discussing these and other case studies, this book gives you the steps to effectively structure your early product and service ideas to ensure that, when you get to the stage of high-quality execution, you will not have to make time and cost changes that might compromise your success.

Glossary of Acronyms and Terms

iNPD: Integrated new product development, an approach to product development that supports team integration based on fulfilling the needs, wants, and desires of customers and interests of other significant stakeholders.

iNPD phases: Four phases in the iNPD process, from product planning to program approval:

Phase I: Identifying the opportunity

Phase II: Understanding the opportunity

Phase III: Conceptualizing the opportunity

Phase IV: Realizing the opportunity

Perceptual Gaps: The differences in perspectives team members have that stem from discipline-specific thinking and prevent teams from developing an integrated, interests-based conflict-resolution process.

POG: Product Opportunity Gap, the gap between what is currently on the market and the possibility for new or significantly improved products that result from emerging trends.

Positioning Map: Style versus Technology; the Upper Right quadrant has the third dimension of Value and is where you want to be.

SET Factors: The changes in Social, Economic, and Technological Factors that produce new trends and create Product Opportunity Gaps (POGs).

Style: The psychological and sensory aspects that represent the aesthetic and human factors of a product or service.

Technology: The core function that drives the product, the resulting interaction components that are required to use the product, and the methods and materials used to produce the product.

Value: The level of effect that people personally expect from products and services represented through lifestyle effect, enabling features, and meaningful ergonomics, which together result in a useful, useable, and desirable product.

VO: Value Opportunity, the attributes of value (emotion, aesthetics, identity, ergonomics, impact, core technology, and quality) that make up the elements people assess in products.

VOA: Value Opportunity Analysis, the qualitative assessment of a single or comparison of two product concepts or opportunities, based on the VO attributes.

Part One

The Argument

- Chapter 1** What Drives New Product Development
- Chapter 2** Moving to the Upper Right
- Chapter 3** The Upper Right: The Value Quadrant
- Chapter 4** The Core of a Successful Brand Strategy:
Breakthrough Products and Services

Chapter One

What Drives New Product Development

Breakthrough products result from the appropriate combination of style and technology and help to create experiences that people find both rewarding and valuable. In this chapter, we focus on the first step in developing a breakthrough product: learning to interpret the interconnected factors of Social change, Economic trends, and Technological innovation, otherwise known as SET Factors. Interpreting these SET Factors leads to identifying Product Opportunity Gaps (POGs) in the marketplace. Converting product opportunities into breakthrough products requires a combination of vision and sound methodology. As highlighted in the case studies in this chapter, the comprehensive approach introduced in this book applies equally to the development of products, services, and product-service systems through the new integration of products, interaction, and service.

Redefining the Bottom Line

This book introduces ideas and methods for companies that want to be market leaders in developing breakthrough products. Breakthrough products create new markets or redefine existing ones, support the customer's experience in using the product and create a lifestyle fantasy about who that customer is, and generate higher profit for the company that produces them.

We have found the process of product development to be analogous to rock climbing, a challenging, invigorating, and empowering experience. To succeed at rock climbing, you need to have a set of appropriate tools, a good plan for the climb, and an interdependent team that works together to use the tools when appropriate. The climb is constant and well thought out, but the team has the training to adapt to issues that emerge along the way. Successful product development also requires a well-planned process using tools to help you negotiate difficult terrain. Teams of engineers, designers, and market researchers must work in unison to recognize promising product directions and work through the Fuzzy Front End of the product development process to create a product that meets the needs, wants, and desires of the customer.

Managing the Fuzzy Front End is an underlying theme in this book. The Fuzzy Front End is the part of the product development process that starts with the general goals of the program and covers the early stages of new product development. Making the most of the Fuzzy Front End is essential in creating breakthrough products. Companies that see the process as a climb see every part as essential and understand that the preparation and the climb have equal importance. The process

requires the skill and patience necessary to use the tools successfully to develop products that you are confident will succeed in the marketplace.

Many companies approach product development as if it were parachuting instead of rock climbing. They have a core technology (their plane) and capital (the parachute), and then they free fall through the Fuzzy Front End to quality programs for manufacturing, expecting a smooth landing. These companies think the free fall will take care of itself—or, in product terms, they quickly focus on one product concept that they think will become a marketable product if it meets manufacturing or production quality standards and is then branded by an ad agency. Product development in this way succeeds only by chance. Failing to maximize the Fuzzy Front End causes these well-produced products to fail in the market because they do not respond to customers' needs, wants, and desires. The result is a loss of brand equity, profit, time, and investor confidence.

New product development is a climb, not a free fall. The more prepared you are for the challenges of the terrain, the better the climb will be. This book helps you climb through the Fuzzy Front End of the product development process and gives you the tools that make your product more likely to succeed in the marketplace.

A number of challenges make it difficult for companies to maintain a leading position in a particular product category. These challenges are forcing companies to redefine the bottom line and the path to get there. The goal is to increase profits while simultaneously maintaining a healthy internal structure that balances innovation and continuity. So as companies are trying to realize their stated goals in sales and profit projections, they are also trying to resolve the following issues:

■ The goal is to increase profits while simultaneously maintaining a healthy internal structure that balances innovation and continuity.

- Finding the right opportunities for new products and appropriate innovation to improve existing products
- Maximizing front-end decisions to minimize downstream corrections
- Reducing cycle times without reducing innovation and quality
- Building and maintaining brand equity through a strong product
- Integrating design, marketing, and engineering by reducing “perceptual gaps” and producing products that are considered useful, usable, and desirable by the customer
- Appropriately positioning the role of technology in product development

■ Form and function must fulfill fantasy.

- Recognizing the significance of industrial and interaction design in the product development process
- Attracting, preparing, and retaining the best people

To successfully meet these challenges, a shared vision must flow from top management through middle and lower management down to individual members of product development teams. Although an opportunity for new products can be identified at any level, the vision of the product potential must be shared and championed at all levels. Not only do successful products help customers create maximum experiences in their everyday lives, but the process of developing the products themselves must be an equally powerful and rewarding experience for the product team. Developing products should be a form of serious fun. If everyone on the team is enjoying the process, it usually means that everyone in the company profits from the experience.

Positioning Breakthrough Products

Consumer demand for better products has been continually increasing during the last few decades. During the 1980s and early 1990s, quality development programs, reengineering, and concurrent design were the initiatives that drove companies worldwide to constantly improve their products. At the beginning of a new century, the emphasis shifted from the back end to the front of the product development process. It is increasingly harder to find the right product concept and the time and processes needed to bring that concept to market. Technological innovation and maintenance of manufacturing standards are still intrinsic parts of developing successful products. However, if a product does not connect with the values of consumers, it will fail.

People use products to improve their experience while doing tasks. They relate these experiences to their fantasies and dreams. Successful products fulfill a higher emotional value state, whether it is the security of a child relaxing during an MRI experience, the comfort and effectiveness of cooking in the kitchen, the relaxation and escapism of sipping coffee in a coffeehouse, or the empowerment of a person taking control of the weight loss experience using a body-monitoring device. The mantra that form follows function is no longer relevant; we are now in a period where *form and function must fulfill fantasy*.

What makes some product programs fail and others succeed? How did Kennametal reinvent the machining of titanium to support the manufacture of Boeing's Dreamliner while making the process more economical and better for the environment? How could GE Healthcare make the frightening MRI experience fun and calm for kids? How could Jarden introduce the Margaritaville brand to bring Jimmy Buffett's Key West lifestyle fantasy to Baby Boomer consumers for less than \$300? How could BodyMedia, a small upstart company, pioneer the industry for consumer self-care through technology? How does Starbucks, initially a small coffeehouse in Seattle, continue to remain innovative, building on its ability to reinvent how Americans drink coffee while refining its process and products and even experimenting with new nonbranded stores? How could Navistar's International Truck Division rejuvenate its brand and redefine the long-haul truck industry with the introduction of a big rig that pays as much attention to the driver when he is not working as when he is? How could UPS redefine the package delivery industry to one of logistics positioned for the Internet age?

In evaluating the value impact of all these products, we found that they were all highly successful in communicating value in the key categories that connected them to their customers and moved them ahead of their competition. If you look at most positioning maps, the optimum quadrant is usually the upper right, where each positioning attribute is maximized. In this book we introduce a Positioning Map (see Figure 1.1) that charts style against technology through added value. The Upper Right, with integrated style and technology, and the only place with significant value, is where a company must move and be positioned to best differentiate itself from the competition and to succeed. All of the breakthrough products just mentioned are positioned in that quadrant. Getting there is not easy because of the third dimension, which acts as a cliff that needs to be climbed. As mentioned previously, product development is akin to rock climbing. This Sheer Cliff of Value is the rock that the product development team must climb to succeed. Every progressive company sets its strategy to move there, but it often fails to find the methods to achieve the goal. This book helps you get there. We call this approach *moving to the Upper Right*.

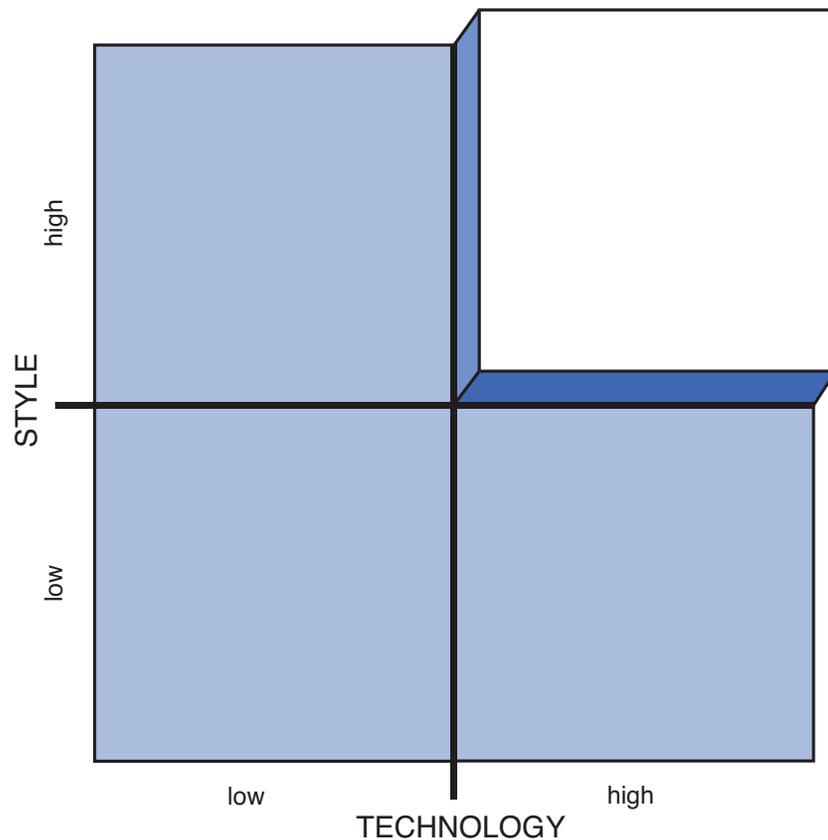


Figure 1.1 Positioning Map of style versus technology; great products are value driven and found in the Upper Right.

Products, Services, and Product-Service Ecosystems

This book focuses on products in a general sense; physical products, services, software, and integrated systems are all *products*. All of the tools and methods introduced in this book apply equally, and have been successfully been applied, to each of these types of products. Products succeed when they play a major role in creating optimal experiences for customers. This is true for physical products and service companies as well. We recognize that the development and realization of products and services require similar approaches. To succeed, both approaches must integrate a number of areas of expertise and have a solid understanding of customers and their desired experience.

In this new edition of *Creating Breakthrough Products*, we specifically address service design. Chapter 8, “Service Innovation: Breakthrough Innovation on the Product-Service Ecosystem Continuum,” directly maps the tools for innovation to

the service industry. However, products and services are intertwined. Even physical products alone directly provide a service that enhances human experience; it is always part of a company that provides a service to its customers. That is why Xerox became “the document company” (and then the technology/document management/consulting company). The service it provides is the production of documents, which it does by producing printing and copying equipment. A service is an activity that enhances an experience; it often requires an array of products to deliver its core activity. If your company is a Web service provider, you use and produce products to provide that service. If your company produces automobiles, the service you provide is transporting people and things. The auto industry produces automobiles; however, one of the highest-profit areas for GM is financing automobile purchases, which is a service. Where would UPS, a delivery service, be without its brown trucks, jets, and information-management products?

We discuss both products and services in this book, for the issues that make a product or service successful are the same. However, the intertwining of products and services is a still-emerging opportunity for companies. In Chapter 8, we bring together the methods in this book to address what we call product-service ecosystems: The products produced and the systems that deliver intangible benefits work in concert. The interaction between the physical products and services is delivered through interfaces—Web-based, human-based, artificial intelligence-based. Both products and services and their ecosystem are connected through understanding the experience that the end customer wants and then translating that understanding into a product or service that enhances a particular interaction with objects, environments, and/or other people.

It sounds simple, but understanding customers and then translating customer understanding into products and services is extremely difficult. In general in this book, *when we refer to a “product,” we refer to both the physical product and the service, and the system that delivers both.* An enormous number of people and resources must be brought together to produce a successful product. The complexity of this task explains why so many product attempts fail. In larger companies, by the time a customer buys a product, hundreds or thousands of people and thousands of person-hours have gone into the identification, planning, development, production, distribution, and sales. A large company can easily lose understanding of the customer in the product development programs as secondary factors come to dominate decisions about cost, features, and form. Small companies have a better chance of keeping the customer in the loop throughout the process, but they often lack the balance of disciplines necessary to generate the research and development

of product characteristics for the market. No matter what the size of the company, all of the people involved are stakeholders in the product development process, and the success of the product depends on the coordinated involvement of all of them.

We also see products and services as the core element of a company's brand (discussed in detail in Chapter 4, "The Core of a Successful Brand Strategy: Breakthrough Products and Services"). If all elements of a brand are effective, they all play a roughly equal role. The interaction of a customer with the product or service is the heart of the brand delivery. Corporate mission, strategic planning, advertising, and identity programs are all essential, but they cannot offset weak, noncompetitive products or services.

■ For products to succeed, they must have features and forms that consumers quickly recognize as useful, usable, and desirable.

We have found that four key factors must be present to guarantee the highest potential of success:

- First is the ability to identify product opportunities. As cultures continue to change, opportunities emerge for new products. These products do not just solve existing problems; they also create possibilities for new experiences.
- Second is a heightened understanding of customer needs translated into actionable insights that define attributes. These attributes serve as a guide in developing the product's form and features. For products to succeed, they must have features and forms that consumers quickly recognize as *useful*, *usable*, and *desirable*.
- Third is a true integration of engineering, industrial and communication design, and marketing. Merely putting teams together in a multidisciplinary context is not sufficient. They must be supported and managed effectively in an atmosphere where each discipline respects and appreciates the perspective of the others.
- The fourth factor involves understanding the connection between products and services and the role that interaction touch points play in that relationship.

Failure to achieve success in any one of these areas can significantly jeopardize the success of a product, yet most companies are fortunate to be good in even one area. The successful companies have found ways to incorporate the product development quality trends of the 1980s and '90s into new ways of developing products by including deeper consumer insight and better integration of teams. These companies have strategically "moved to the Upper Right."

Many companies claim to use a customer-centered interdisciplinary approach, but they have failed to make a total company commitment to this approach. Their management structure encourages a turf mentality through a vertical, or “silo,” reporting structure. Customer characteristics are often generated by mass-marketing methods that provide limited insight because they are based solely on highly quantitative surveys. These companies are often hammers looking for nails as they seek new ways to package or repackage impressive but inaccessible technologies. For companies to succeed, they can no longer afford to be either marketing, technology, *or* design driven. To stay competitive, they must integrate the way designers, engineers, market researchers, and market strategists work. Corporations can no longer rely on large statistical surveys, search for applications for promising technologies, or create products that are attractive but not meaningful. Instead, qualitative research tools have proven to be an excellent source for deeply understanding the potential customer and product opportunities. This approach means that companies should plan technological innovation around an insightful understanding of consumer trends and the constant changes in the needs, wants, and desires of the customer. Companies must learn to identify opportunities for the potential of products before they think in terms of concrete product concepts.

Identifying Product Opportunities: The SET Factors

Identifying product opportunities should be the core force driving companies that manufacture products, supply services, and process information. A product opportunity exists when there is a gap between what is currently on the market and the possibility for new or significantly improved products that result from emerging trends. A product that successfully fills a Product Opportunity Gap (POG) does so when it meets the conscious and unconscious expectations of customers and is perceived as useful, useable, and desirable. No one asked for a body monitor that integrated into daily activity before BodyMedia introduced the FIT System, and no one asked for an alternative hangout to a bar before Starbucks provided the coffeehouse as “your ‘third place.’” Successfully identifying a POG is a combination of art and science. It requires a constant sweep of a number of factors in three major areas: Social trends (S), Economic forces (E), and Technological advances (T) (see Figure 1.2).

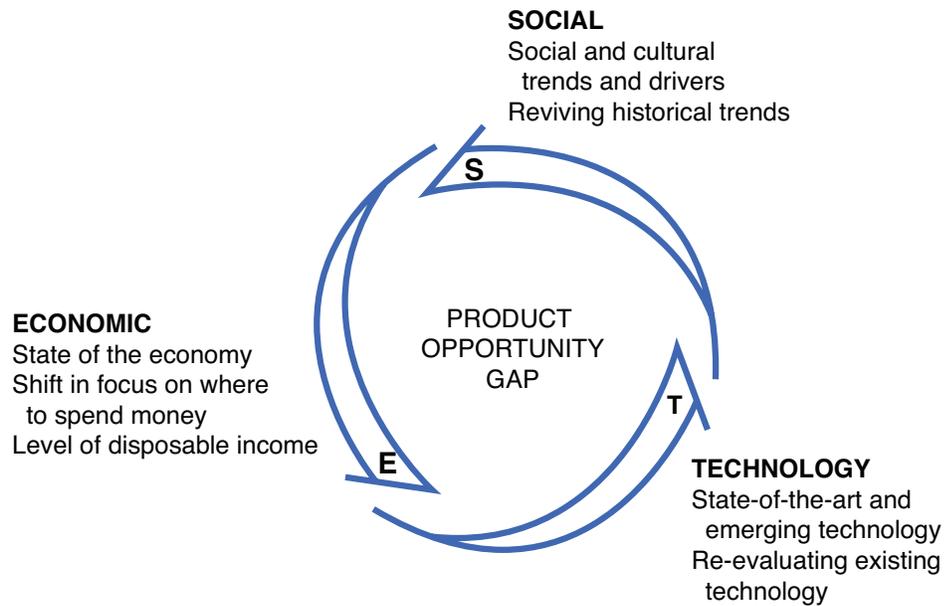


Figure 1.2 Scanning SET Factors leads to POGs.

The social factors focus on culture and social interaction and include these:

SOCIAL FACTOR: ENTERTAINMENT

Some of the most powerful trends in the country come from the entertainment fields. Entertainment is all about fantasy and desire. Movies can vary from pure diversion to infotainment or documentary; however, to succeed, every film must hold a person's attention. Entertainment has all of the factors needed to make it a trendsetter: rapid turnover of products, access to investment capital, and a constant need to find the next story or special effect. Movie producers require a global distribution to maximize profit. They use powerful marketing techniques to get consumers into theaters and to buy or rent videos for their homes. The actors, clothing, activities, sets, and special effects create trends that lead to a variety of new aesthetic influences. The technology used in films has as much trickle-down or tech transfer as NASA and military research. The scenarios created through science fiction set expectations for new technologies and space exploration.

- Family and work patterns (for example, the number of single parents with two jobs or the number of double-income households with flexible hours)
- Health issues (for example, people living longer with more active lives)
- Use of computers and the Internet
- Political environments
- Successful products in other fields
- Sports and recreation (for example, Gen-X snowboarders creating a new “loose-fitting grunge wear” fashion aesthetic and lifestyle)
- Sporting events (for example, the emergence of new, retro, or ultramodern state-of-the-art facilities and the athletes who perform in them)
- The entertainment industries, including film and television
- Vacation environments (for example, the fantasy fulfillment provided by Disney World, Las Vegas, and Club Med)

- Books (for example, Oprah’s Book Club)
- Magazines
- Music (from hip-hop to new classic-chic)
- Environments at work (that raise quality of workplace standards)

**ECONOMIC FACTOR: THE '90s
BOOM AND BUST**

The economic boom in the 1990s created multimillionaires overnight through IPOs, stock options, and individual investment in the stock market. Excess disposable cash resulted in a void in material goods that these young, geeky, intelligent, socially responsible, technology oriented—and rich—new group of consumers sought. Lifestyle-oriented products, at times excessive, that filled this void include recreational SUVs, clothing, tech products, PDAs that connect through the Web for constant stock price monitoring, and the proliferation of coffeehouses.

Then 9-11 and the eventual great recession of the twenty-first century ensued while environmental concerns moved to the forefront. As the economy went through a downturn, people’s attitudes about spending shifted. Smaller cars, including a new class of electric-based vehicles (see Chapter 9, “Case Studies: The Power of the Upper Right”), have replaced SUVs. Smartphones and tablets have evolved to keep people connected 24/7, especially through social media channels and from their home, where smart shoppers can look for good bargains without leaving their living room. But some things have become a seemingly permanent part of culture, with the local coffee shop still stepping in when Internet chatting—and dating—are not enough and people want to talk face to face.

The second major SET Factor is Economics. The economic factors focus on real or perceived excess income that gives people purchasing power. This results in a state we call *psychometrics*: the spending power people believe they have to buy the products and services they believe will enhance their lifestyle. These factors are influenced by the overall strength of and forecast for the economy, fuel costs, raw material costs, loan rates, availability of venture capital, the stock market and its forecasts, and real disposable income. Other economic issues that influence product development come from understanding who has the income, who is doing the purchasing, and for whom the purchasers are buying. As social factors change, where people spend their money changes.

The Technology factors focus on direct and imagined results from new scientific discoveries in corporate, military, and university research and the implied capabilities stemming from that research. These factors include the amazing growth in computing power predicted by Moore’s Law (Intel co-founder Gordon Moore’s prediction in 1965 that the number of transistors per square inch on integrated circuits would double every year) and the analogous reduction in physical size of peripherals and supporting functions; new material and manufacturing advances; electrical, mechanical, and chemical innovations; aerospace and military technologies; film and sports entertainment technologies; and micro-, nano- and biotechnologies. The capability for sensors within products to consistently connect to external systems in real time has generated a plethora of new product service options.

TECHNOLOGY FACTORS: COMPUTERS TO GENETICS

Fifty years after the first computers cranked out calculations to help the U.S. win World War II, the always-increasing power and speed of each month's latest PC chip has brought computing into every part of modern life, from the home PC, to the car transmission, to the oven, to the stereo, and now to everyone's smartphone, iPod, and iPad. The latest technologies, from microelectromechanical systems (MEMS) in automobile airbags to layered manufacturing technologies creating structures for tissue growth, will lead to the emergence of new industries and applications. The first genetic fingerprint of the human species in the year 2000 and the first cloning of Dolly the sheep in 1997 have already begun to open up a new century of technological advancement, new products, and new—and potential—lifestyle influences.

The SET Factors generate opportunities for producing new products that can have an effect on the way people live their lives at any given moment. The goal is to create products and services by identifying an emerging trend and to match that trend with the right technology and understanding of the purchasing dynamics. The window of opportunity is often small—a product that comes out either too early or too late can fail even if the opportunity existed initially. For example, in the 1970s, AMC introduced the Pacer, a shorter, wider car with a larger window area to maximize the internal sense of space. Many of the attributes that the Pacer incorporated became the goal of all car manufacturers in the two decades that followed. As another example, the Apple Newton was an early PDA with many of the attributes of smartphones today, but cost and size compromised its appeal beyond the lead users and early adopters.

Perhaps the most salient example of introducing products too late is the U.S. automotive industry's failure to

understand the potential growth in small, well-made, fuel-efficient cars, which allowed Japanese car manufacturers to dominate the four- and six-cylinder-engine car market for decades. American car manufacturers generated their profits from small trucks and SUVs rather than the smaller fuel-efficient vehicles, partly leading to their collapse through the economic bust of the 2000s. The American car companies apparently have read the SET Factors and are introducing a wide variety of smaller, more efficient, and more intelligent vehicles, coupled with a leaner, more efficient approach to production.

■ The goal is to create products and services by identifying an emerging trend and to match that trend with the right technology and understanding of the purchasing dynamics.

Successful new products become necessary once they hit the market. Most consumers are not even aware they need the product because they are immersed in the trend. If the company hits the trend at the point it is just catching on, the product will become instantly desirable. The length of a trend, combined with the product's attributes of use and usability, determines the lifetime of the product. Las Vegas has continued to be successful by complementing the fantasy and dreams of gambling with the characteristics of a family amusement park; Disney World has extended its market by creating vacation programs and packages for adults as well as kids. Coca-Cola has been able to maintain its position as the leading soft

SET FACTORS: GM IN THE 1950s

The post-World War II economic boom, cheap gasoline, the creation of the suburban lifestyle, and the look of jets and rockets were the SET Factors that created the opportunity for large eight-cylinder cars with sizable tail fins that dominated the auto industry during the 1950s. Harley Earl, head of styling and color for GM, saw the opportunity and introduced fins on the rear of cars, starting with the low-end Chevy all the way up to Cadillac. The 1957 Chevy and the 1959 pink Cadillac are two cars that epitomize car design of that era (see Figure 1.3). By today's standards, those cars are viewed as totally impractical gas-guzzling vehicles, and the look of fins no longer fits with the current trend for organic aerodynamic bodies with aluminum frames.

drink for an entire century; contrast it with Tang (the drink of astronauts), which was a hit when NASA was a major cultural influence but has now been replaced by Gatorade. Gatorade has responded to the SET Factors and evolved into the G Series, with a range of products and sports stars to promote the system of products. Barbie has lasted decades and American Girl has become a successful option for parents and children; the frenzy surrounding Cabbage Patch Dolls, on the other hand, lasted only a few years.



Figure 1.3 1957 Chevy and 1959 pink Cadillac. (Reprinted with permission of General Motors)

Changes in the SET Factors produce Product Opportunity Gaps (POGs). After identifying a POG, the challenge becomes translating the POG into the development of a new product or the significant modification of an existing product. In both cases, these products are a hybrid combination of a new aesthetic and a set of features stemming from the possibilities of new technology that match emerging shifts in consumer preference. An example of a product hybrid that successfully filled a gap was the first Apple iMac. Integrating the monitor and CPU, and using translucent plastic combined with a variety of bright candy colors, made the iMac easier and more fun to use than other computers. The iMac evolved with and continued to define the aesthetics of offices and homes, which look sharp with an iMac on the desk. Setup was a breeze, and cable-management issues virtually disappeared. The Apple desktop has continued to use the integration concept and is now an elegant thin, soft-cornered rectangle with a minimal aluminum base.

You might not find that all of the products and services included in this book are ones that you would buy. This is an important point to make. The products that we include are highly successful within their intended markets. Understanding how your views differ from the users' views is critical to the development of successful products. The SET Factors identify POGs for a targeted user group—that target might not be you.

POG and SET Factor Case Studies

The remainder of this chapter examines four case studies that illustrate how the SET Factors and resulting POGs have led to successful products in the marketplace. The case studies also give a brief introduction to the issues laid out in the rest of the book, and we refer to them often. These examples from the Upper Right represent simple and complex products and services. These four products join a comprehensive collection of case studies appearing throughout the book. Although all products in this book are on the market at the time of this writing, some have recently been introduced and others have established an impressive run of market success.

The Margaritaville Frozen Concoction Maker

If you are a Parrothead, you want your backyard party to have the atmosphere of a Jimmy Buffett concert in Key West. You have had the music and the shirts since the 1970s, but the last part of the fantasy experience that was missing was the

perfect margarita. Now it is possible to waste away to the music with the perfect “solution.” When Jarden Consumer Solutions acquired the licensing rights to use Margaritaville on products, it turned to Altitude to help decide what products to start with and how to design them. After considering many alternatives derived from an ideation session, a connection to Buffett’s iconic song *Margaritaville* rose to the top. The result was the Margaritaville Frozen Concoction Maker, meeting the value expectations of Parrotheads everywhere.

At the core of the Margaritaville fan base, Parrotheads are the Baby Boomer fans who have followed Buffett since the 1970s. The original Parrotheads are now parents and have handed down the fanaticism to the next generation. Buffett has a transgenerational fan base and a great market opportunity. Parrotheads In Paradise Inc. is a network of 200 clubs in the U.S., with additional clubs in Canada and Australia. It is a not-for-profit organization dedicated to the laidback lifestyle exemplified by Jimmy Buffett and his music. In the last decade, the Parrotheads have raised more than \$26 million for charity, logging almost 3 million volunteer hours. At the same time, the Buffett enterprise has included the Margaritaville restaurant chain and a similarly named chain of stores selling Jimmy Buffett–themed merchandise, encompassing clothing, accessories, cocktails, beverages, food, and home appliances. The SET Factors set the stage with a great POG for Jimmy Buffett–inspired products for the Baby Boomer fan base (see Figure 1.4).

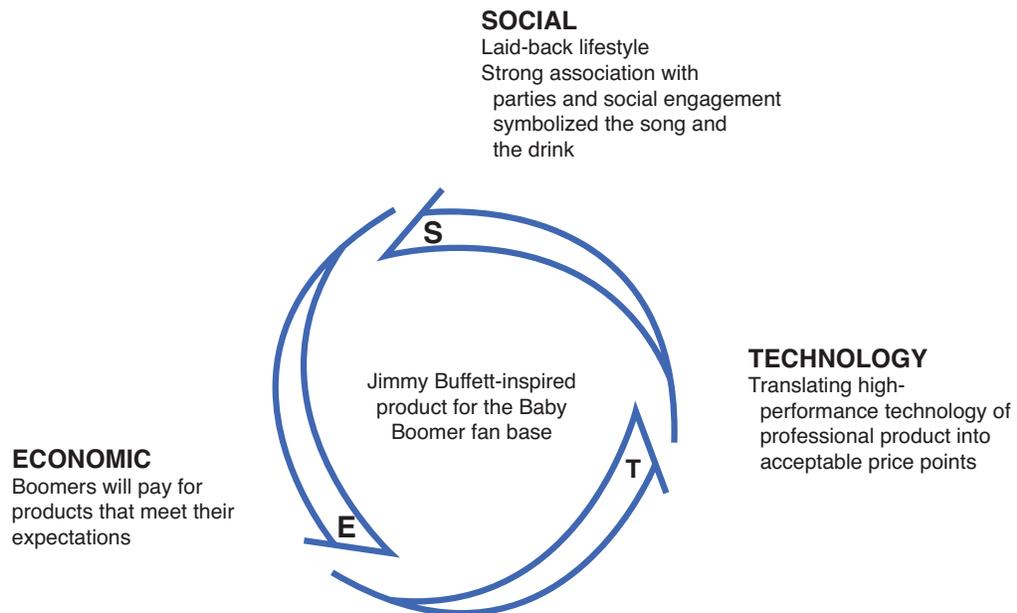


Figure 1.4 SET Factors for Margaritaville Frozen Concoction Maker.

It's interesting to contrast the Buffett enterprise with another 1970s musical group with a fanatical following, the Grateful Dead. Similar to the Parrotheads with Buffett, Deadheads followed the Dead from city to city, enjoying the Dead experience. Unlike Buffett, however, the Dead never saw the potential for developing and merchandizing their brand. Only in later years did Jerry Garcia's art end up on ties that Boomers could wear after they gave up their Birkenstock sandals for a suit and tie and a 9–9 job.

When Jarden Consumer Solutions brought the opportunity to create a margarita mixer to Altitude, founder and CEO Brian Matt realized what needed to be done. The team had to develop an empathic understanding of the Margaritaville subculture. According to Matt, his team at Altitude immediately conducted “extensive research into the atmosphere, activities and social models of party settings and communal dining restaurants.” A small team at Jarden worked closely with Altitude, participating in the research process and working together to “develop the DNA of what Margaritaville meant as a durable product,” according to Alejandro Peña, Senior Vice President and General Manager of Global Appliances at Jarden. They then focused on developing a strategic approach to conceiving a set of products and determined that the first product would be the Margaritaville Frozen Concoction Maker (see Figure 1.5). This was the first of five versions now on the market. The final design of the first product combined engineering insights to produce the perfect shaved ice with a mechanism that would allow the product to come in at the right price point. Extensive experimentation on the part of Altitude's engineering team perfected the precision choreography of shaving the ice and blending the ingredients.

To determine the visual brand characteristics—the right look and feel—the firm conducted additional consumer ethnographic research. The final design merges the rugged quality of commercial equipment with the approachable character of a small home appliance. As customers have described it in their reviews, the mixer has a “power tool” vibe that all men appreciate. Details such as brightly colored accents and maritime-inspired markings evoke relaxed afternoons by the pool or on the beach.

Interestingly, no similar product was on the market. Competitors were either low-end consumer blenders or high-end commercial drink mixers for restaurant use. The commercial mixers were too large, expensive, and heavy duty to be used at home. The typical blenders used at home did not have a strong motor capable of crushing ice consistently and easily burned out after a few hardcore ice-crushing cycles. In addition, they were chopping ice rather than shaving it, which made the

drink watery and inconsistent. The team identified this opportunity as an unfulfilled market and approached it with a new solution.

The unprecedented functionality and distinct look of the drink maker makes it enormously appealing and easy to operate (see Figure 1.6). This mixer is equipped with two motors: one is located on the top and is responsible for shaving the ice into a silky mixture (which stays silky even as it melts); the second motor is placed in the lower part and simply blends the shaved ice and liquid ingredients in an automated sequence while placing very little stress on the motor. The other innovative aspect of this mixer is a reservoir located on the back. The water from melted ice is channeled into this reservoir, so as to not be mixed with the drinks. This results in thick and consistent drinks every time the device is used.

Users need only fill the ice in the top compartment, pour their desired drink into the pitcher, turn the dial to the appropriate drink selection, and choose the number of drinks to prepare. The device automatically shaves the ice, pours it into the pitcher, and then blends the ingredients. Although the entire process can be done automatically, the mixer has options for manual control of shaves and blends, to add a personal touch for users who want control over the final outcome. The product was an instant hit with both Parrotheads and Parrothead wannabes, the far larger group of people who enjoy the fantasy of the Buffett lifestyle without visiting Key West or traveling city to city to see a Buffett concert.



Figure 1.5 Margaritaville Frozen Concoction Maker. (Courtesy of Altitude and Jarden)

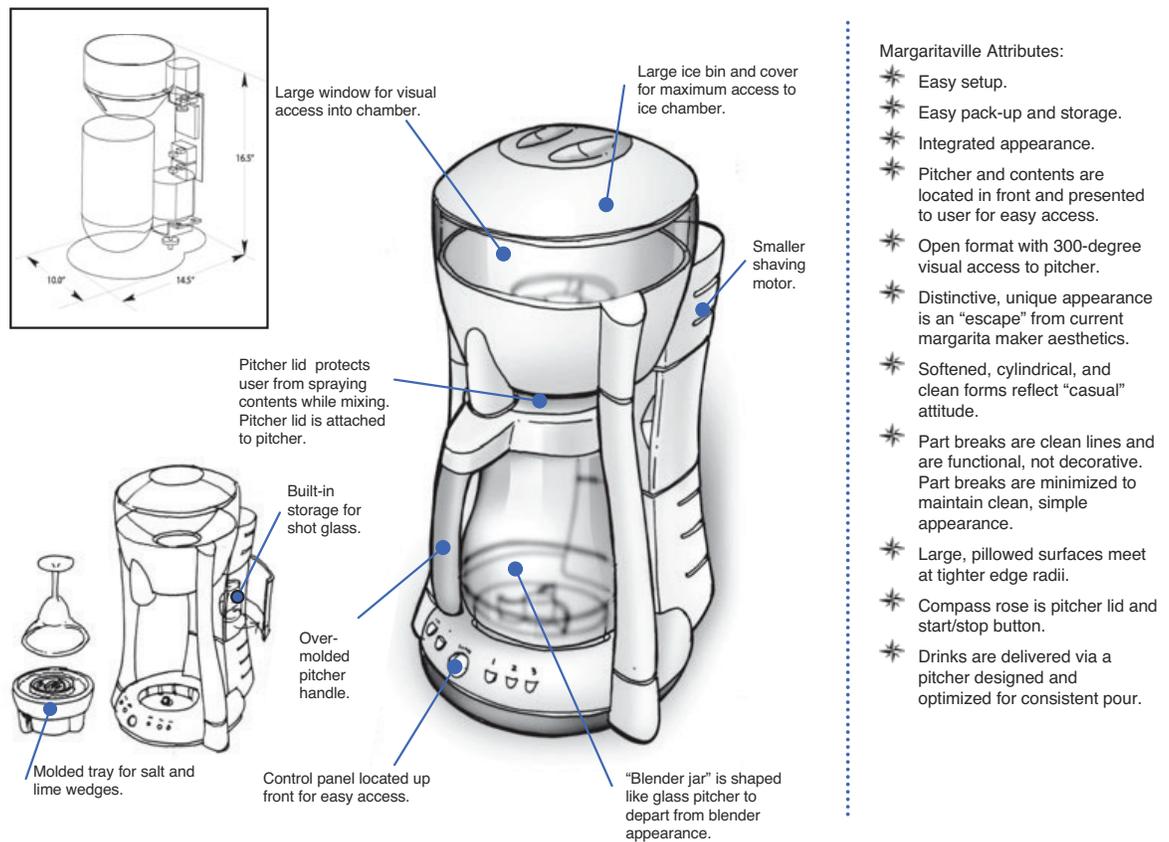


Figure 1.6 Concept sketch indicating features of ergonomics, manufacturing, technology and styling. (Courtesy of Altitude and Jarden)

The product gave Jarden both a presence in the backyard entertainment consumer market and a new product that was a top seller overnight. According to Peña, the decision for Jarden to develop and produce the Frozen Concoction Maker was a risk: The company had previously only dealt in mass-merchandized products for stores such as Walmart and Kmart. Making the decision to develop a luxury durable good paid off handsomely. In the first six years of production, the Frozen Concoction Maker resulted in more than \$100 million in sales for the company. It also changed the culture of the company, indicating to employees that they could be innovative and that such innovation would pay off.

The BodyMedia FIT System

BodyMedia is an excellent example of a company that studied and leveraged the SET Factors in developing high-technology, user-interactive products. The company actually read the SET Factors twice—once while forming the company to introduce a product in the clinical and research space, and then again while extending the company's technology into the consumer market. BodyMedia is a pioneer in

developing and marketing wearable body monitors that equip consumers with information they can use to make meaningful changes to their own health and wellness, beginning with weight management and soon to include management of other conditions affected by lifestyle choices.

BodyMedia's initial product was to compete with high-tech clinical services in the area of energy expenditure (a.k.a., calories burned) analysis. The growing cost of healthcare was partly caused by the prices of maintaining and using medical facilities. In sleep labs, people spend the night with many leads attached to their skin, monitoring their physiological functions while at rest. Metabolic carts also measured energy expended both while at rest and while active. Both of these approaches required the subject to be in the lab facility, using large pieces of technology—the sleep lab with EEG leads to capture brain functioning and ECG leads to capture heart information, among other details, and the metabolic cart with tubes in the subjects' mouths to capture and analyze ECG, pulse-oximeter, breathing, and other functions.

BodyMedia introduced an alternative, a product with state-of-the-art but lower-level, low-cost, and low-power sensors specifically designed to track body functioning during activities or rest. The device wrapped around the upper arm and captured information that was then downloaded to the computer. Instead of being invasive, or at least annoying, BodyMedia introduced a simple, comfortable device that could be used at home and continuously throughout the day, the SenseWear System. The company had expertise in wearable technology and understood how to integrate sensors into that technology. However, it also had to develop the ability for sensor fusion, or the ability to use accelerometers, galvanic skin response, temperature, and heat flux sensors in an integrated way to provide highly accurate, useful, and affordable feedback, based on an external skin interface. The approach required integrating engineering, design, and computer science including advanced machine learning methods that were brought into this new field. The company founders also had a background in industrial design and recognized that, even in the clinical and research markets, ergonomics for comfort and attention to style would improve compliance and long-term use.

The SenseWear System (see Figure 1.7) demonstrates an effective effort to integrate style and technology in a clinical environment. Healthcare clinicians and researchers made sense as the target to introduce the product because they tend to be early adopters who have the financial resources to try new technologies. They were also willing to work with the technology supplier, providing feedback and working to improve the treatment's effectiveness. Integrating four sensors into a small, light, and robust form factor was challenge enough. Recognizing that the look of the product was also critical to its compliance if people were to wear it in

public or at home made for an even larger task. And as a startup with limited funds, the company had to develop the product in parallel with bringing it to production, furthering the challenge for success. However, because the company was able to read the SET Factors and anticipate the emergence of both information technology and people’s desire to learn about and take care of their health (see Figure 1.8), the product became an initial success. Today the clinical market continues, and the SenseWear System serves as a means for new data collection internationally, giving healthcare professionals and researchers new insights into patients’ bodies and their lifestyle behaviors.



Figure 1.7 Original SenseWear System from BodyMedia. (© Image courtesy of BodyMedia, Inc.)

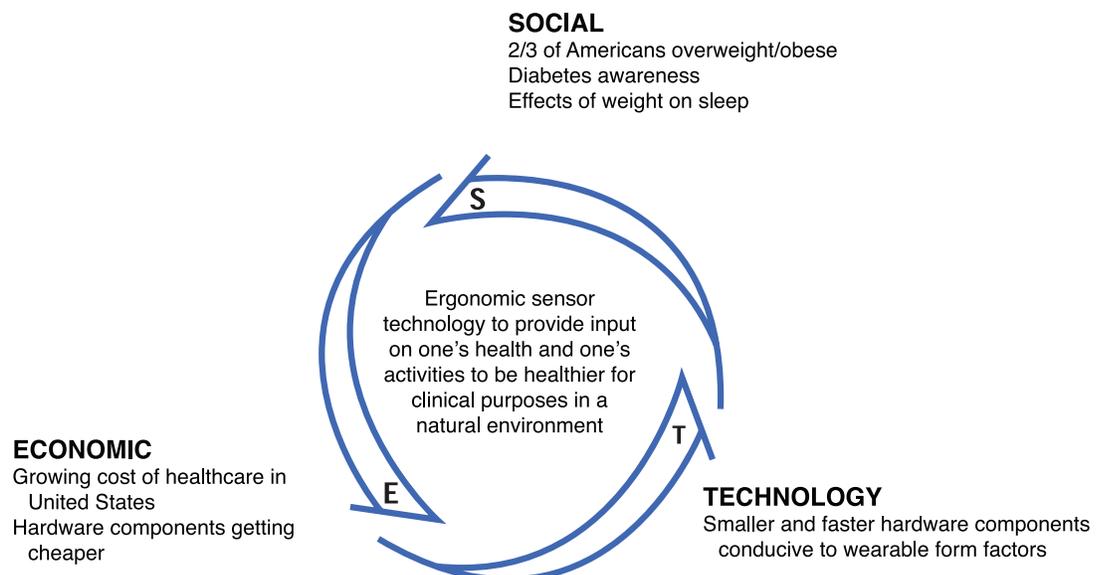


Figure 1.8 SET Factors for BodyMedia clinical product.

Although the clinical market continues for BodyMedia, the bigger goal was to cross the chasm into the consumer market. As cofounder Chris Kasabach tells it, the company followed a mantra that “people knew more about their cars than their bodies; could the company make a dashboard for the body so that people could take care of themselves?” The company again read the SET Factors, an extension of those in 1999 for the consumer market (see Figure 1.9). Americans were becoming more aware of their health, particularly diabetes and other effects of being overweight. Two thirds of Americans were obese or overweight. People were willing to spend money to improve their health. Technology also had advanced; sensors were getting smaller, and the company had gained one of the world’s leading capabilities in externally sensing body functions. Of course, people would be pleased to lose weight, but they preferred to do so their own way and at their own pace. Emerging communications technology via low-power wireless protocols, more prevalent Internet in people’s homes, and larger server capabilities meant obtaining and processing data was easier.

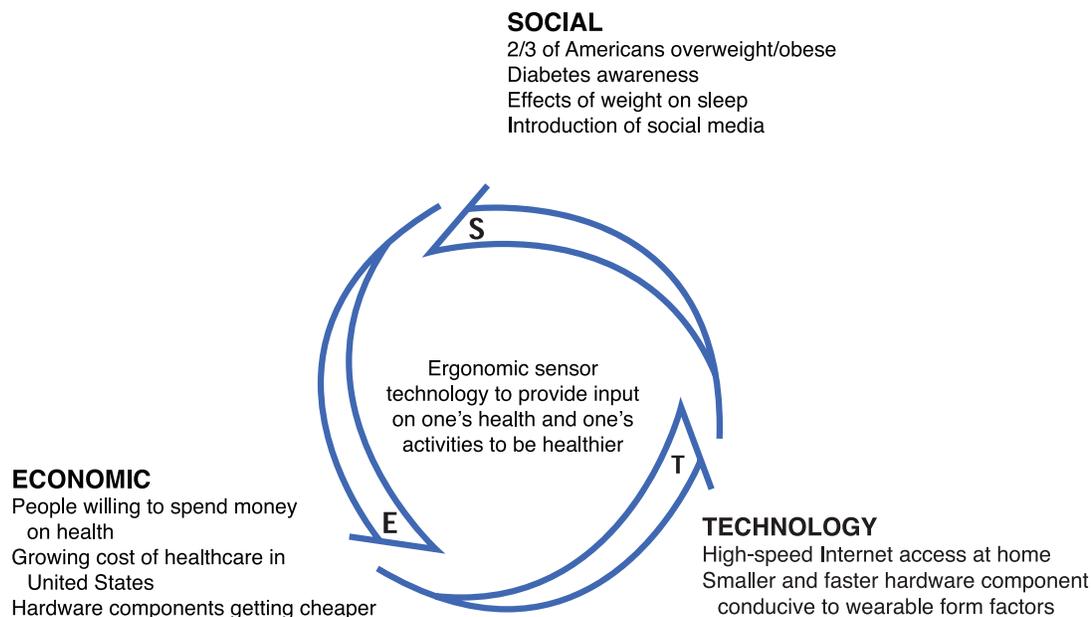


Figure 1.9 SET Factors for BodyMedia consumer product.

In 2004, a culmination of circumstances took place. BodyMedia had developed a smaller, comfortable, and ergonomic sensing band that consumers could use. Downloading data and receiving information on progress toward a health goal was easy. *The Biggest Loser*, a reality TV competition between obese people to lose the most weight and become healthier, became a hit. The movie *Super Size Me* was released, illustrating the negative effects of fast food on obesity and its link to diabetes. People were actively using the Internet to search for information about

health concerns. And Facebook was launched, allowing people to readily connect about health issues. BodyMedia correctly read the SET Factors and was well positioned for this growing and eager market.

At that time, a partnership with 24 Hour Fitness developed. After winning the IDEA Gold Award in clinical science in 2002, the company began its foray into the consumer market with several partnerships, including Apex Fitness, a supplement manufacturer (owned by 24 Hour Fitness). The company then could begin to interact in the consumer market in a controlled fashion. BodyMedia developed its consumer-focused product, now called the BodyMedia FIT System¹, focused on tracking calories (see Figure 1.10). Apex branded the product as bodybugg, but BodyMedia maintained a cobranding much like Intel does with “Intel inside.” Soon the company became established in the consumer market. 24 Hour Fitness was a sponsor of *The Biggest Loser*. The participants in the show started using the bodybugg and several times even spoke about the product on the show. Talk about national exposure! The product, eventually under the BodyMedia FIT System name, became available at retailers across the U.S. in stores such as Dick’s Sporting Goods, technology retailer Best Buy, membership warehouse Costco, and online at Amazon.com. A business model made the product affordable to the masses by selling the physical armband under \$200 but requiring a monthly subscription starting at \$7 to process the data and provide feedback to the user. New partnerships with popular weight loss provider Jenny Craig and the Jillian Michaels exercise program further aided reach into the consumer market. In 2012, more than half a million people had used a BodyMedia system.



Figure 1.10 The BodyMedia FIT System. (© Image courtesy of BodyMedia, Inc)

The FIT sensor device elegantly integrates the multiple sensors into the small device (see Figure 1.11). However, the FIT System is an illustration of the blurring between physical product and services. Without the FIT armband, there can be no service. Likewise, without the service of obtaining, storing, processing, and interpreting the data over time, the drive toward better health is cumbersome and far less effective. The symbiotic relationship between the physical product and service product is prominent in today's new product innovation, a characteristic we see throughout this book.

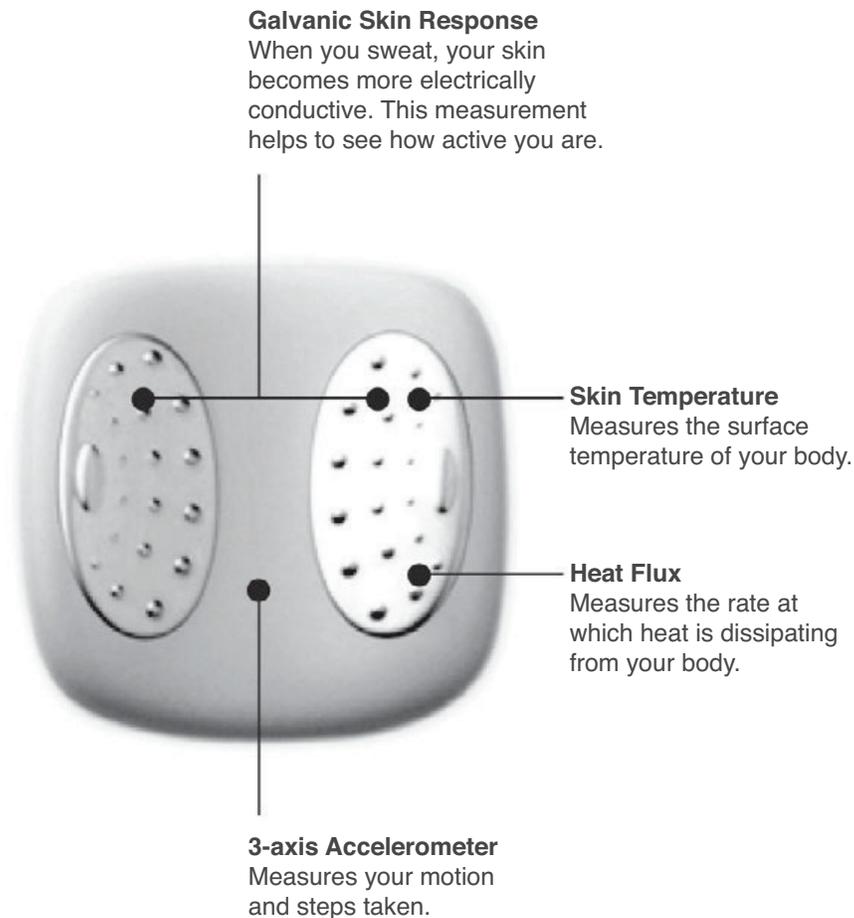


Figure 1.11 Product details of FIT, showing technology integration. (© Image courtesy of BodyMedia, Inc)

Starbucks

Starbucks is an example of a service company that provides an optimal experience to the customer. Starbucks recognized the possibility of combining a core part of the American culture with the style and attitude of an Italian cafe. The act of drinking coffee has been transformed from a quick, mindless experience into a major form of cultural interaction and entertainment. Starbucks is an interesting hybrid between a product company and a service company. The core product that Starbucks provides is coffee. The service it provides is serving coffee using a range of options and complementary products in a comfortable environment that significantly enriches the experience of drinking coffee and enhances the beginning, middle, or end of your day.

Starbucks filled a POG that started in one city, Seattle, and then spread exponentially across the U.S. and internationally. It has had the same effect at the turn of the twenty-first century that Coca-Cola had at the turn of the twentieth century and McDonald's had at mid-century. What factors allowed Starbucks to become the last great food specialty retailer of the last century? If you have ever traveled to Seattle, you will notice a city with some unique attributes. The city not only started the new coffee culture, but it also helped to start the new beer culture with the development of microbreweries. Seattle has a gray, cloudy climate and stays fairly cool throughout the year. Many people commute using the ferry system and then drive or walk to work. Americans, in general, rarely have time to eat breakfast before they leave the house; breakfast on the run is a common experience. Early morning fatigue is also common for most commuters, especially in Seattle's climate. Drinking coffee is customary for many Americans to ramp up for the day, maintain momentum during the day, and relax at the end of the day. Seattle is also one of the primary new centers of the Information Age and, as home to Microsoft and Amazon.com, is the land of expendable income. Howard Schultz, the visionary and CEO of Starbucks, saw the POG after experiencing the espresso bars in Milan. Given the Social (S) and Economic (E) factors that are both highlighted by Seattle inhabitants and more recently shared by the rest of the U.S. and the world, it is not surprising that Starbucks started in the Great Northwest and spread to the rest of the country and beyond (see Figure 1.12). It is now possible to get a cafe latte in local neighborhoods, on university campuses, on turnpikes, and in Taipei, London, Istanbul, and even Sri Lanka (see Figure 3.13). Now that is what we call a global brand!

In lower Manhattan, Canal Street separates Little Italy from Chinatown. Both areas are favorite sites for both New Yorkers and tourists. For a long time, guests have ordered espresso and dessert at many little restaurants in this area, often after

eating dinner in Chinatown. This concept had never expanded outside of Little Italy, except in other Italian neighborhoods in other big cities.

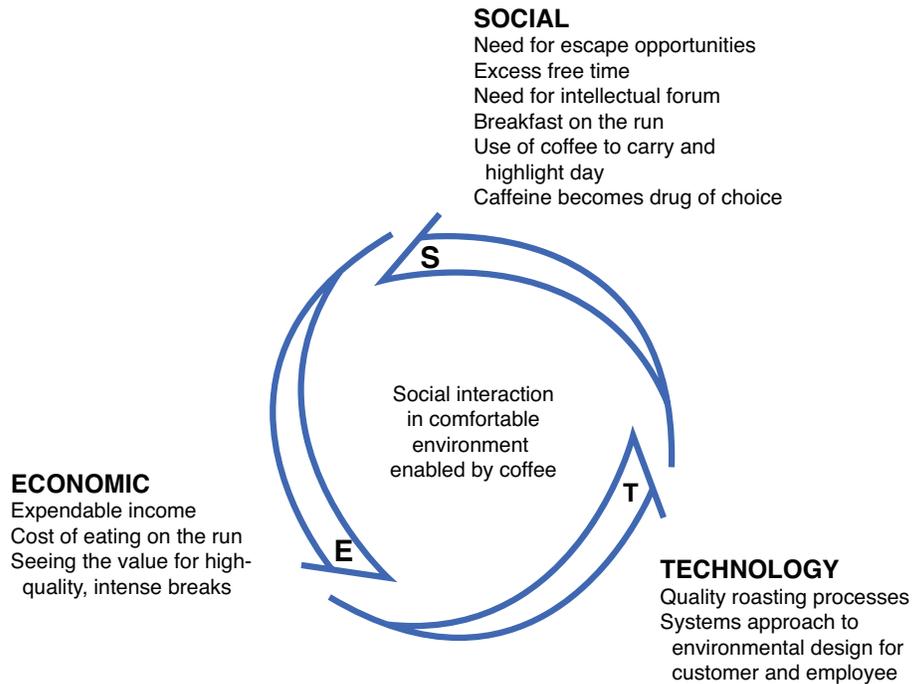


Figure 1.12 SET Factors that led to Starbucks' success.



Figure 1.13 Starbucks' global positioning shown through unique mug designs from international cities: London, New York, Taipei, Vancouver, and Boston.

Berkeley, California, home of UC Berkeley and the 1960s revolution, has for years had coffeehouses in which students and faculty pontificated, studied, and hung out. Peet's Coffee began there in 1966 and preceded Starbucks. In fact, Alfred Peet trained the founders of Starbucks in the art of roasting arabica coffee beans. An addiction of locals, Peet's is well known to anyone who has lived in or visited Berkeley. Once, before Peet's expanded outside Berkeley, a Berkeley resident rented a ski chalet in the Swiss Alps; it turned out that the chalet owner had lived in Berkeley and regularly mail-ordered Peet's coffee all the way to Switzerland.

Why didn't one of the restaurants in Little Italy become the original inspiration for Starbucks? Even though eventually Peet's became the coffee of choice for some chains, why wasn't Peet's Coffee the first to expand across the country? The SET Factors were not right in New York, and no one in the Bay Area either saw or acted on the potential that Starbucks' visionary Schultz saw in Seattle. Not only do the SET Factors have to be right, but they also have to be scanned, interpreted, and developed with a vision.

Part of the technology of Starbucks lies in the machines used to prepare the coffee. The best machines for producing hot or cold coffee (and now tea) drinks are used and promoted along with the sounds they produce. Each Starbucks is a retro factory, hissing and steaming away, producing espresso and lattes at a constant rate. Other aspects of technology include special water-filtration systems in each store and sophisticated roasting facilities. Their investment and partnerships in R&D have led to innovations such as a process to extract the essence of their coffee for use in products such as Frappuccino and ice cream.

The interiors of Starbucks stores have been designed to transcend the original concept of an Italian brasserie and to combine the global nature of coffee bean production with a comfortable old college coffeehouse, with sophisticated contemporary colors, graphics, and furniture. A Starbucks store is inviting to walk into as an individual or with others. When you are in Starbucks, you are not just drinking coffee—you are having a mind-altering experience. Even if you order a drink to go, you can leave with a sense of the store experience while holding on to a cup with a protective corrugated holder that clearly states it was made from recycled paper. It doesn't get any better than that. Starbucks has developed a flexible brand identity (discussed in Chapter 4) that uses a consistent color theme that allows for variation in secondary graphics for packaging, products, and store interiors. The response to Starbucks has been equally impressive, with the emergence of a number of national, regional, and local competitors fighting for their share of this lucrative market. As traditional coffee makers have responded to the trend, Starbucks has countered by extending its products into grocery chains, offering dark arabica

coffee beans and even a range of ice cream flavors. Using new technologies, they revisited and reinvented the freeze-dried coffee made famous by Nescafe.

In his book *Pour Your Heart Into It*,² Schultz chronicles the evolution of Starbucks. Starbucks is a company that epitomizes the characteristics found in a company in the Upper Right. The company sees its product as the coffee, the people who work for the company, and the experience of buying and drinking coffee in the stores. Starbucks maintains a high standard of values, from the CEO to each employee, and connects to the values of its customers. These values are clearly articulated in a corporate mission statement. The company sees its people as core to its brand, in parallel with its coffee, and recognizes that its long-term success depends on high standards for both. Each employee of the company is called a “partner” and is given stock options. Even part-time employees are given full healthcare benefits. Starbucks initially relied on the power of its experiential brand, loyally conveyed by its customers, to promote the company, and it fell back on advertising only once the company was well established. As Schultz says, “Starbucks built up brand loyalty one customer at a time.” Finally, the company is constantly looking for the next new product to “surprise and delight” the customer, from new coffee drinks, to Frappuccino, to ice cream, to jazz CDs.

Both Dunkin’ Donuts and McDonald’s countered Starbucks, but in different ways. McDonald’s began to offer coffee with arabica beans and introduced the McCafé with a variety of lattes, cappuccinos, and more. Dunkin’ Donuts took a different approach, leveraging its popular coffee to create the counterculture to Starbucks: the coffee for the everyday working person.

Upper Right products, services, and companies merge style and technology in a way that creates strong customer value and promotes a positive user experience. Strong brand, corporate values, and connection to customer values lead to both short-term and long-term customer satisfaction. Many breakthrough products stay in the Upper Right through the constant injection of useful, usable, and desirable features for the customer. The end result is greater profits to shareholders.

The GE Healthcare Adventure MRI Series

This is a case study that focuses on interface design. However, in this case, the interface makes the difference between a CT scan medical procedure with relaxed and engaged kids as patients lying still, and a stressful procedure often requiring multiple scans or even sedation for success. GE Healthcare, led by designer Doug Dietz, sought to create a new type of CT scanner to address anxiety in children.

The question was how to transform a cold, sterile environment with a large piece of medical diagnostic equipment that literally engulfed a child into an experience that was fun and changed the child from patient into participant. In a study conducted by Pittsburgh Children’s Hospital UMPC from 2006 to 2007, the staff found that standard, nondecorated CT scan rooms stressed children to the point that many needed to be sedated before they would lie still. In the study, hospital staff decorated a CT scan room with an underwater theme, replete with a video player, life-size mermaids, and music. They found that the decorative addition significantly reduced anxiety in children and their families, and decreased sedation rates.

The SET Factors (see Figure 1.14) highlight the increased cost of medical care, especially the wasted resources for ineffective studies and the potential costs for sedation. The technology of the product is state-of-the-art and will not change. What will change is the social impact of a new product that results from an empathetic approach to medical care for children and thus their parents, along with the ability to make an anxiety-producing experience more calming. The result is the POG to humanize medical technology for children.

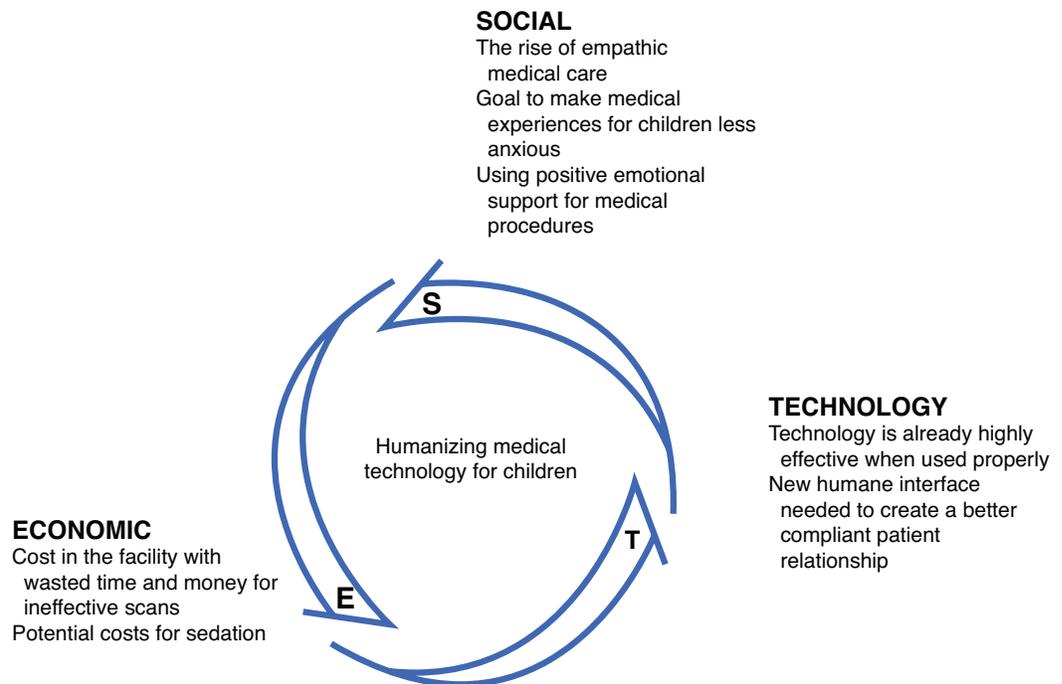


Figure 1.14 SET Factors that show the opportunity for an empathetic medical product for children.

Fulfilling this opportunity required integrating play into a medical process by enabling a child to relax while not compromising the procedure. At GE Healthcare, Dietz felt highly motivated to design this transformational space as a

result of observing the children, who, while already traumatized by a serious illness, were asked to submit to a procedure that scared them. He saw the potential for play in what is at times a traumatic event. He partnered with staff at UPMC Children's and with GE engineering and manufacturing. He recognized that nurses, empathetic to the patient, often know what types of intervention could help better than designers alone. Working with designers, they provided insights to generate more sophisticated and comprehensive solutions. Another breakthrough came from choosing an atypical advisor and resource to understand the nature of play and how museums create play experiences. GE sought help from Milwaukee's Betty Brinn Children's Museum for guidance, pointing to its interactive exhibits and educational resources that promote the healthy development of children in their formative years from birth through age 10. From this interaction, designers learned theories of play and how museums keep kids engaged.

The resulting design was a breakthrough in thinking that led to fusing an Adventure Land ride at Disney with a medical procedure. Dietz and his team integrated medical knowledge with a Disney Imagineering approach to break a paradigm. This approach is part of a new way of thinking referred to as *empathic innovation* in medical care.

In creating this new interface, a global design team at GE, in conjunction with the hospital and museum advisors, began to imagine a scan procedure with less anxiety and fear. The first step was to gain invaluable insight that children's hospitals face every day: Kids have specific challenges and a unique set of needs, especially when it comes to imaging. Next, observational research was conducted by visiting leading children's hospitals to analyze and dissect imaging processes and best practices. Finally, targeted focus groups that included kids were conducted. At that point, the children expressed themselves with pictures and personal stories. The findings were enlightening. Most children view big imaging equipment as scary, but the machines were especially scary for those between the ages of 4 and 9 because they lack the cognitive reasoning skills to understand what is happening and why. The team discovered simple details that often get overlooked. For instance, some of their most effective insights came from kneeling and looking at rooms from the height of a child. The team was pushed to think in terms of what kids see and how they relate to the world. After the research, the concept behind the pediatric imaging began to materialize.

In developing new products, it is critical to understand the stakeholders who most influence the success of a potential product (see Chapter 7, "Understanding the User's Needs, Wants, and Desires"). In this case, three categories of stakeholders were identified: children, their parents, and the nursing and technician staff, who,

as mentioned, identified the problems of keeping kids still and calm. Parents have high expectations when a child's health and well-being are on the line. They expect quality healthcare and an experience that puts their child first. When families go out of their way to choose children's hospitals over local alternatives, they look for "kid-friendly" care.

For kids, the proposed solution must provide a setting that not only keeps a child still during the imaging process, but also makes the child feel more relaxed and engaged with the MR radiation technologist so that the scan can be performed. Furthermore, it must address the way kids perceive the world around them: through colors, lights, sounds, materials, temperature, and smells. Storytelling is also highly effective. So if an imaging experience were to be truly fun instead of scary, these elements needed to somehow be incorporated.

Through their research, the GE team identified anxiety points or aspects of the experience that were hard for a child to understand, such as the noise of the machine, the hospital smell, and the need to remain still. They thought of imaginative ways to make sense of these anxiety points from kids' perspectives, and they tried to distract kids through visuals, appropriate lighting, reduced anesthetic smells, and props when they came into the room for imaging. The intention was to make them feel as if they were on an adventure and had no need to panic; patients then could leave the room with a positive feeling after the procedure.

The result was eight room themes, called Adventure Series (see Figure 1.15), developed to use sensory tools to create an imaging experience that children find more welcoming. The rooms employ sensitivity tools to help soothe and reduce a child's anxiety along the way. Examples of room themes were a jungle, a pirate island, a coral city, a campsite, and a sunset safari adventure; their names associated an adventure with the medical procedure, as in X-Ray Fluoroscopy Cub River Falls Adventure, CT Pirate Island Adventure, and MR Space Adventure. Each one of these themes could distract kids' attention from anxiety points by using different techniques. For example, the MR room's space theme was specifically chosen to target the MR scanner's noise. In this room, where the scanner is disguised as a spaceship, children do not have to understand why the MR scanner makes noise because they can imagine a spaceship rumbling through space. Another example is the Cub River Falls Adventure: The table is a raft, so children do not have to understand why the fluoroscopy table may move—instead, they can imagine riding the rapids.

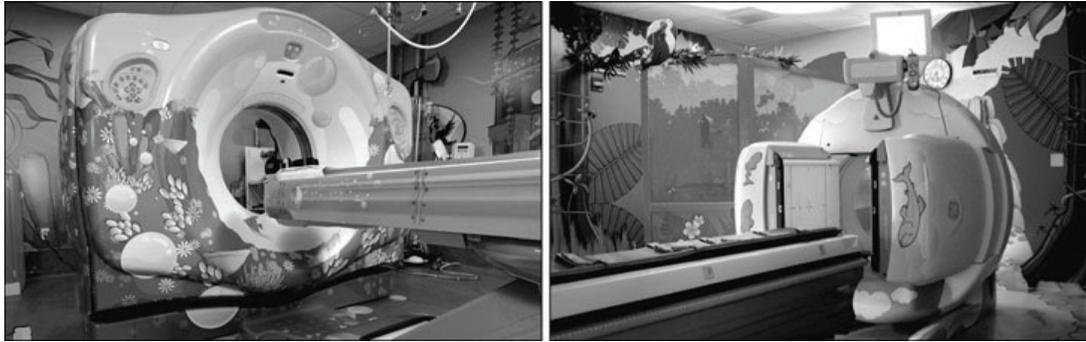


Figure 1.15 The GE Adventure Series CT scan. (Courtesy of GE Healthcare)

OXO GOODGRIPS

The OXO GoodGrips was a major feature of the first edition of this book. The case study is now found in Chapter 11, “Where Are They Now?” The OXO story is a classic example of success by design. The OXO peeler resulted from the insight that older people with arthritis have difficulty peeling vegetables yet also want a product that is not stigmatizing. This desire for enabling yet augmenting lifestyle is a theme of the Baby Boomer and led to the GoodGrips peeler that revolutionized the kitchenware industry. Figure 1.16 shows the integrated features that merge style and technology, resulting in a peeler that enables the user and defines a new aesthetic for the kitchen. A bit more than a decade later, OXO has more than 850 products based on the mission of merging enabling ergonomics, appropriate leading aesthetics, and quality functionality. OXO finds insights by looking in a new way at products that have existed for some time, recognizing that the SET Factors have changed and that innovation can come from rethinking the solution to problems that were solved in an earlier time period. Although the extended case study, including a discussion on the innovative OXO salad spinner, is found in Chapter 11, we refer to OXO often throughout the book as an example of what is possible in breakthrough innovation.

In addition to developing the Adventure Series room themes, the GE design team created a set of friendly characters to accompany the child through the scan process. These characters, with their own personalities, are playfully integrated into the room themes to ease the potential for anxiety of both patients and parents. A hands-on coloring book explains the procedure from a child’s perspective, while field guides assist staff in weaving the adventure into the scan procedure.

Working with the UPMC team also allowed the process to be tested and assessed for effectiveness; there was a significant reduction in the number of children who needed to be sedated for this type of scan with the Adventure Series. Children do not go to a hospital because they want to be part of an adventure. Instead, Adventure Series is about acknowledging patients and their needs beyond medicine, elevating them beyond just another patient, and addressing their needs as individuals.

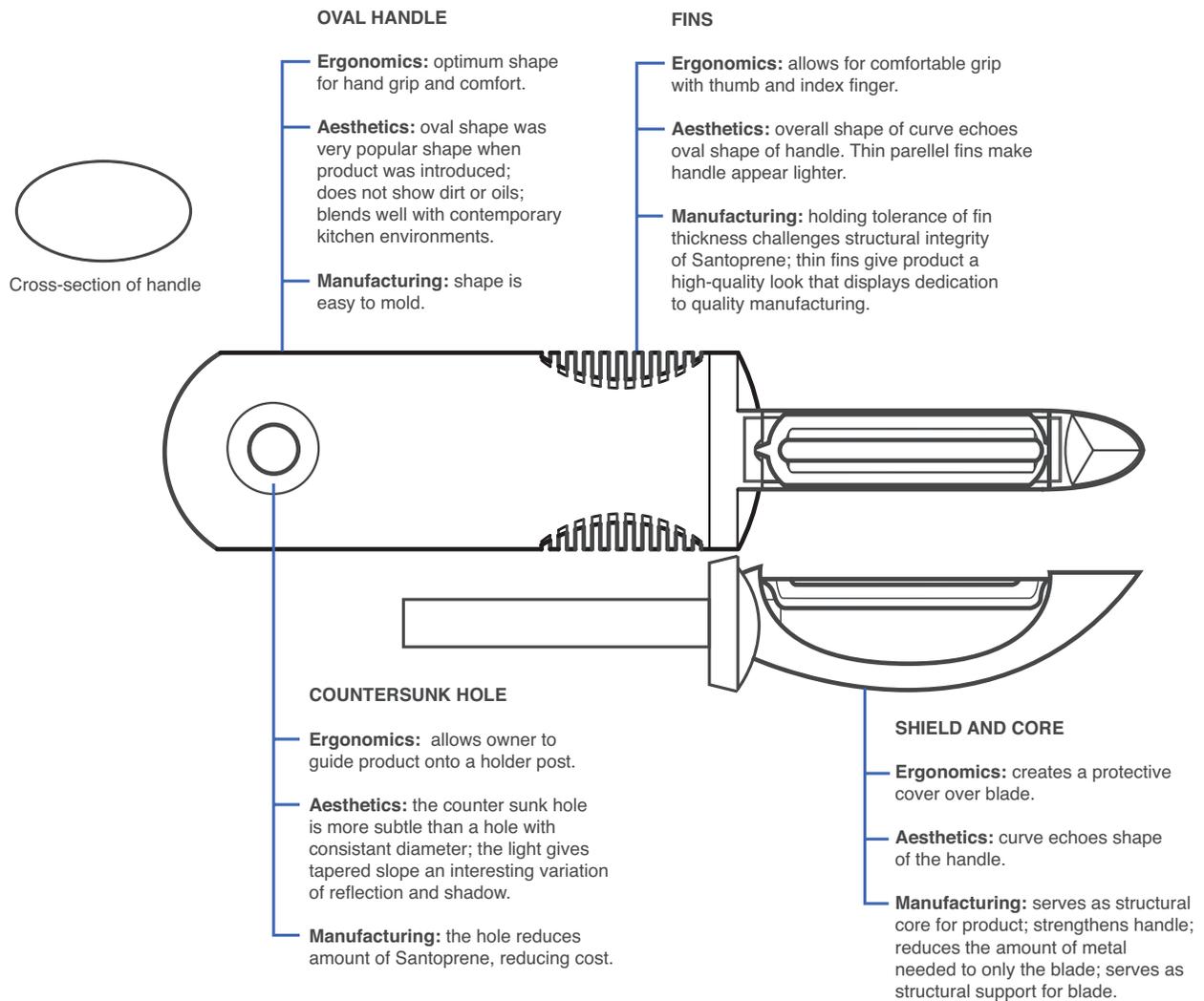


Figure 1.16 Product details of OXO peeler, showing integration of style and technology.

Summary Points

- Social, Economic, and Technology (SET) Factors lead to Product Opportunity Gaps (POGs).
- Breakthrough products merge style, technology, and value.
- A combination of vision and sound methodology is necessary to successfully develop breakthrough products.
- These ideas and methods apply to both tangible products and intangible services.

Notes

1. The product is known as the BodyMedia FIT System by BodyMedia. For brevity, we refer to it as just “the FIT” or “the FIT system.”
2. H. Schultz and D. J. Yang, *Pour Your Heart Into It* (New York: Hyperion, 1997).

Chapter Two

Moving to the Upper Right

This chapter introduces a Positioning Map, which shows how breakthrough products are differentiated from the competition. The Upper Right quadrant of the map integrates the attributes of Style and Technology and adds a third dimension: Value. Each remaining quadrant contains products that emphasize only style, technology, or low cost. By integrating the attributes represented in the Upper Right, breakthrough products meet the needs, wants, and desires of customers, resulting in increased sales, profit, and brand equity.

Integrating Style and Technology

■ We call the successful integration of style and technology “moving to the Upper Right.”

The last chapter presented four case studies as examples of how companies can develop successful products that differentiate themselves from their competition through style, technology, and added value. GE Healthcare’s Adventure Series, Jarden’s Margaritaville Frozen Concoction Maker, BodyMedia’s FIT System, and Starbucks demonstrate a range of products and services. Additional case studies are presented throughout the book. We call the successful integration of style and technology “moving to the Upper Right.” This integration results in the creation of breakthrough products that are perceived as having high value. Although technology- or style-driven products do have some value, it is limited—and so are their markets.

At this point, establishing the definition of style and technology is important. Although we realize that these terms mean many things and can be interpreted differently, we are using them in a specific way.

Style refers to the sensory elements that communicate the desired aesthetic and human factors of a product or service. The style of a product must respond to a consumer’s expectations. It also produces the identity of the product. Style is the measure of how well a product responds to the lifestyle of the people who are the core of the intended market. The look, feel, and sound are all attributes that fit into style. Ergonomic issues, including comfort, ease of use, and safety, must complement the aesthetics.

Technology refers to the core function that drives the product, the interaction of components that are required to use the product, and the methods and materials used to produce the product. The core functionality can be mechanical, electrical, electromechanical, chemical, digital, or any combination of these. Interaction with core technology can require merely one button or a complex set of buttons and screen or voice commands. The choice of materials and manufacturing must be appropriate to the projected cost, must fulfill the requirements of internal components, and must complement the style requirements of the product.

We define value in more detail in the next chapter. In essence, a product is deemed of value to a consumer if it offers a strong effect on lifestyle, enabling features, and meaningful ergonomics and interaction, resulting in a useful, usable, and desirable product.

Marketing, engineering, and industrial and interaction design are required to blend style and technology and produce products that will be perceived to be of value. The challenge is getting these groups to work in a cohesive way.

The Positioning Map shows how different products in the same category can be located in a matrix with Style and Technology as the two axes (see Figure 2.1). This map has a third dimension, Value (see Figure 2.2), which primarily exists in the Upper Right quadrant (and is only represented there), where companies make a concerted effort to integrate style and technology by responding to the needs of consumers. All of the companies that we highlight in this book realize that the playing field is three-dimensional. Although this approach can lead to increased cost in production, that cost can often be easily returned with interest by establishing a higher price for the product (along with higher margins), increased sales, increased interest in the company's product lines, or established or reaffirmed brand recognition. People pay more for value and quality if they feel that a product connects to their goals and aspirations. Furthermore, products in the Upper Right have clearly recognized high levels of quality and value achieved through the appropriate articulation and integration of features and style.

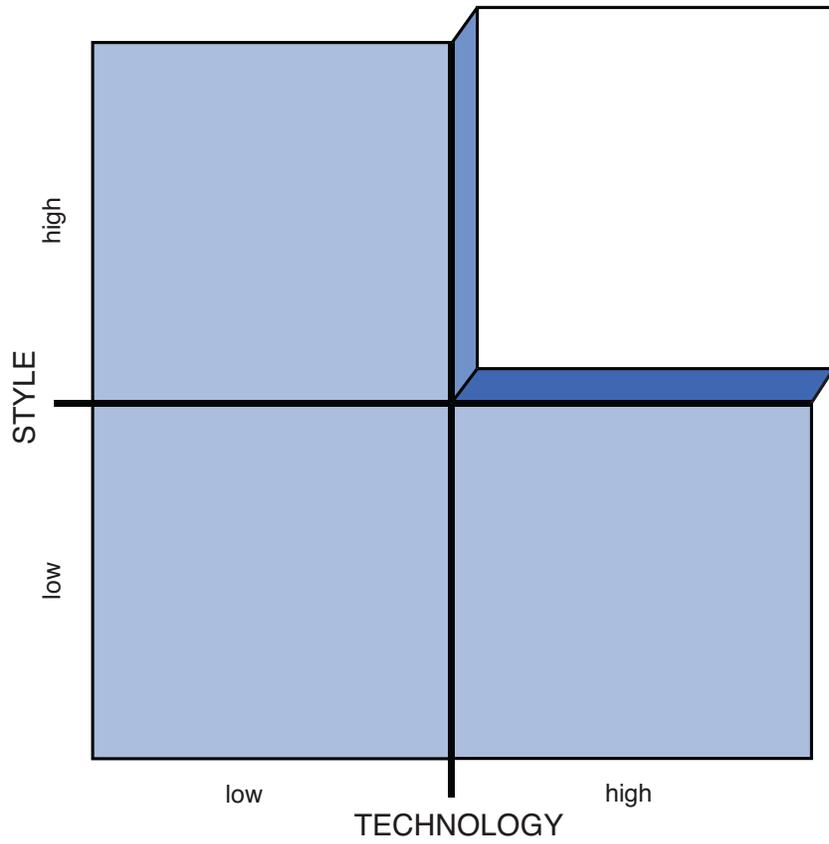


Figure 2.1 Positioning Map of Style versus Technology.

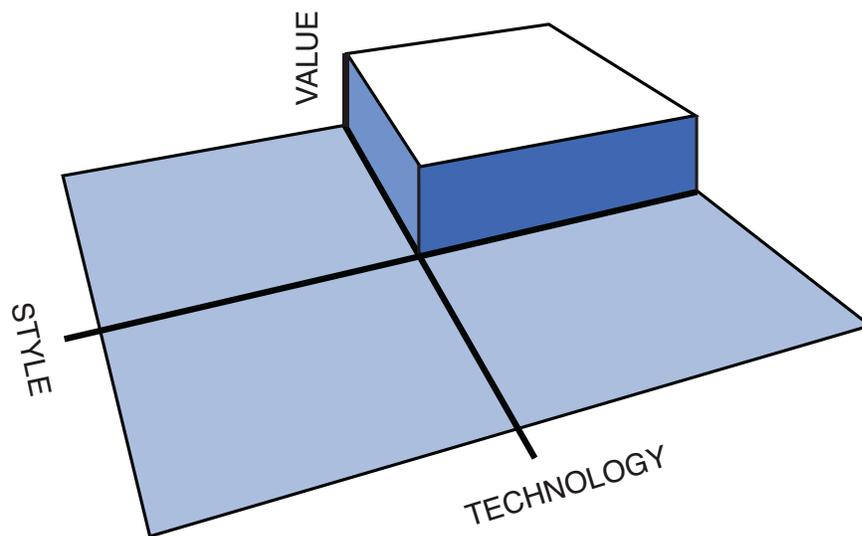


Figure 2.2 3-D Positioning Map—Value, the third axis found primarily in the Upper Right.

■ No one buys everything to match their lifestyle, but everyone buys something that does.

With the growing sophistication of consumer awareness, customers do not perceive products that lack an integration of style and technology to be valuable. For most of the twentieth century, *value* was defined as the most features for the lowest price—namely, value based on price, not value based on customers’ insight into what they value. The generic vegetable peeler pre-OXO is perhaps the symbol of this phenomenon. This view of value is changing. Although people are price sensitive in many of their purchases, certain purchases are driven by lifestyle compatibility. The higher the lifestyle compatibility, the less important price is in determining purchase. In the old era of mass marketing, purchasing tended to be consistent along taste and economic lines. In the new era of “demassification,” purchasing is highly variable. A person can live in low-rent housing but drive a Mercedes. Another person might own the most expensive climbing equipment and dress in only jeans and T-shirts. No one buys everything to match or project a certain lifestyle—but everyone buys something that does. Even after going through a down economy, people purchase what they value, even if what they value shifts.

Style Versus Technology: A Brief History of the Evolution of Style and Technology in the Nineteenth and Twentieth Centuries

In this section, we provide a short overview of the evolution from the century of invention driven by technology, to the beginning of the consumer value-driven economy. A change in the SET Factors early in the twentieth century in Western Europe and after WWI in the United States created the beginning of market segments with different expectations, requiring the integration of style and technology.

In the Beginning

The historical integration of style and technology into products has been a slow and uneven process. The two primary factors that people valued were cost and emerging technology. During the late nineteenth century and most of the twentieth century, companies and inventors developed new products based primarily on technological innovations. For the period 1850–1950, handmade production methods were changed to mechanical and electromechanical ways of doing things. The challenge became making things that worked and that could be produced in large quantities at low prices, not making things that were beautiful to look at or even easy to use. Because these advances were new, the public had no way to compare products, and many people were eager to embrace the labor- and time-saving devices. The Arts and Crafts movement attempted to offset this trend. The emphasis on craft

versus mass manufacture did little to stem the inexorable trend of invention and change over aesthetics and refinement. Aesthetics and human factors were always secondary or nonexistent in the development of products. The phrase “form follows function” was often used to an extreme to support the development of ugly, underdeveloped products that were only tech driven.

During the nineteenth century, mass-produced products and an industrial/service economy replaced the agrarian lifestyle and craft manufacture. Major milestones in this period include the development of Morse’s telegraph, the continental railroad system, Edison’s creation of an electrical distribution system, Eastman’s camera and celluloid film, Ford’s assembly line and the Model T, and the Wright brothers’ development of powered flight. Technology during the Industrial Revolution made products and services available to the emerging industrial urban middle class at an unprecedented rate. The camera, phonograph, refrigerator, VCR, computer, and microwave are all the results of product opportunities that stemmed from the major basic SET Factors that evolved in the late nineteenth and early twentieth centuries. Several factors made this possible: time (both the speed of doing things and the concept of free time), disposable income (the ability to have income or the ability to establish the credit to purchase things on time), increased literacy and other social reforms, and, finally, rapid advances in science and technology that created a plethora of new product opportunities.

The Growth of Consumer Culture

The technological advances of mass production met the growing appetite for mass consumption. As work hours decreased and wages increased, free time and excess income created the need for more products, services, and forms of entertainment. A variety of product opportunities emerged as office workers and homemakers looked for more efficient ways to work at the evolving speed of business and save time for more enjoyable activities in the home.^{1, 2} Many early versions of products resulting from new technological advances were ugly, crude, and dangerous. As the telephone became standard business equipment, telephone wires filled the streets of most cities; early powered farm equipment was extremely dangerous; early home appliances caused burns and electrical fires; and children were often hurt by exposed mechanisms, burnt by toasters and ovens, or shocked by outlets.

The word kluge was invented to describe underdeveloped technology-based products. The advantages these products provided in speed, power, and communication far outweighed the danger and visual clutter at first. Products were difficult to use, but, as Donald Norman has observed, humans often adapt to new products and blame themselves for their own ineptitude instead of blaming the manufacturer.³

This human trait of adaptation combined with a huge influx of cheap immigrant labor, the need for work at any cost in any condition, and the lack of unions and government standards to ensure reasonable working conditions.

During the late nineteenth and early twentieth centuries, progress and change were more important than refinement and human factors. The developers of new technological products often neglected craft finish as a waste of time or rejected any hint of sophistication in favor of an extreme “form follows function” approach that could more accurately be described as form resulting from the limitations of manufacturing and the nonhuman elements of function. For instance, the early Model T was designed to be produced inexpensively, in a series of steps on an assembly line; little attention was paid to issues of ergonomics and style. As another example, an airplane propeller was designed strictly for the function of creating thrust and did not interact with human beings. For much of the early twentieth century, technology alone was enough to drive the development of products for consumer purchase. It took roughly a century for consumers to start to demand more from new products. As competition grew in consumer and certain industrial markets, companies started to use human factors and visual style as a way to differentiate their products from their competitors’ and give them a more up-to-date look. To create a major impact in an industry today, style and technology must be merged from the beginning. Products must change to respond to an ongoing set of factors that determine what customers expect. The tide is turning. While Norman’s observation was right for those raised in the Depression era and World War II, Baby Boomers and their children now expect products to conform to their needs, not the other way around.

The Introduction of Style to Mass Production

In the United States, the integration of style and technology did not occur until the mid- to late 1920s. American industrialists were inspired by the Decorative Arts Exposition in Paris in 1925 and wanted to bring that level of sophistication to American products. In 1926, Henry Ford was caught completely off guard by GM’s introduction of market segmentation and styling under the direction of Harley Earl. The Model T had dominated auto sales for 20 years, and Ford felt that it could continue for another 20. He did not see the product opportunity that the Roaring Twenties provided, but GM did. Earl brought style and color to GM cars. During the 1930s, trains were redesigned in the emerging streamlined style when railroad companies realized that the growing aviation industry posed a significant threat to their hold on public transportation (see Figure 2.3). Bus lines soon followed suit; the Greyhound bus company did a thorough overhaul of its vehicles in

the 1940s. Manufacturers used large, bent sheet metal to cover appliances, to separate internal technology both visually and physically from consumers and their families. Companies put windows in washers and dryers to enable consumers to watch their machines do their work. Vacuum cleaners were made more efficient, lighter, and easier to move.

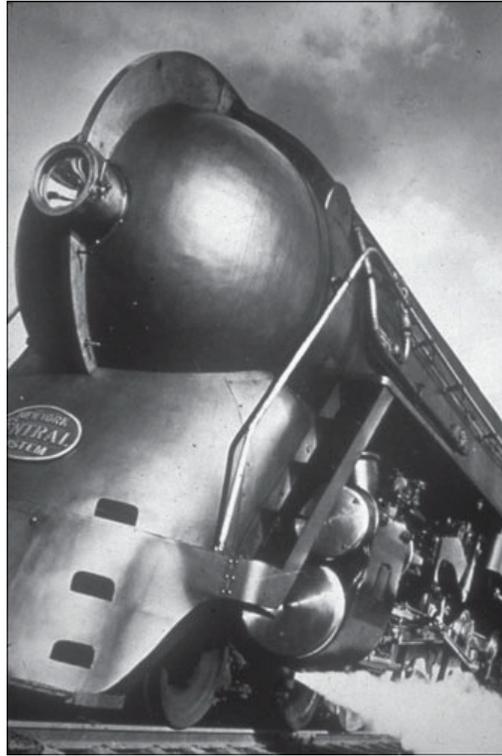


Figure 2.3 NY Central Hudson Locomotive, by Henry Dreyfuss, 1938. (Reprinted with permission of Henry Dreyfuss Associates)

The 1935 Sears Coldspot Refrigerator (see Figure 2.4), developed with the input of designer Raymond Loewy, dramatically improved the style and function of the refrigerator. The product got a clean new look, and the cooling unit was covered with sheet metal. The doors were easy to open even when a person's hands were full of groceries. The interior metal shelves were replaced with aluminum, to prevent rusting. The resulting dramatic increase of sales was an early example of success through the integration of style and technology. When the 1934 Coldspot was introduced, sales went from 65,000 units per year to 275,000.⁴ Even the advertisement for the Coldspot, shown in Figure 2.4, had a view of “value” that would emerge again as relevant today: “By Value we don't mean just a lower price.... Forget the price for the moment and consider this Coldspot purely in terms of Quality. Study its Beauty. Check its features. Analyze it strictly in terms of what it offers you....”



Figure 2.4 Sears Coldspot Refrigerator, by Raymond Loewy, 1934. (Reprinted with permission of Loewy Design)

Other examples of the merger of style and technology at the time include the design of a new telephone for AT&T, aided by design consultant Henry Dreyfuss. The new design had an integrated, elegant new look and increased ergonomic comfort of the headset and base. It quickly became the standard for both the workplace and the home, as discussed further in Chapter 7, “Understanding the User’s Needs, Wants, and Desires” (and shown in Figure 7.10). The 1939 World’s Fair also celebrated the future of America as a land of prosperity with endless product options for the home and business.

Post-World War II Growth of the Middle Class and the Height of Mass Marketing

Initially, high-end products for the upper class were well designed, but products for the middle and lower classes were not. Not until after World War II did the merging of style and technology start to appear in products available to all economic levels. The United States’ involvement in the war resulted in American

companies achieving maximum manufacturing capacity and fostered the development of new technologies. Three major examples were the computer, the jet engine, and the nuclear bomb. The combination of manufacturing capacity, the return of career- and family-oriented GIs, and the subsequent Baby Boom generated a tremendous market for new products. The design of cars in the 1950s reflected the exuberance of the era—cars sported fins of all types and sizes. This “supersonic” style, combined with eight-cylinder engines, mass production capability created by the retooling after World War II, and low gas prices, epitomized the integration of style and technology of the era. The cost of low-end cars became affordable to many more people. Buyers could identify a brand that connected to their lifestyle and could buy their way from Chevy to Cadillac or Ford Fairlane to Lincoln.

During the late 1950s and early '60s, IBM and Westinghouse developed comprehensive brand identity programs that merged their state-of-the-art products with the emerging International style. Graphic identity, products, work environments, and architecture were all subjected to rigorous guidelines under the direction of external consultants Elliot Noyes and Paul Rand.

This post-war boom era lasted until the oil embargo of the 1970s. It was a time when mass manufacturing potential was met by mass consumption. Consumers behaved in consistent patterns of purchasing and could be grouped into large mass markets.

The Rise of Consumer Awareness and the End of Mass Marketing

By the 1970s, consumer patterns started to change. The age of consumer awareness evolved as Ralph Nader attacked the lack of safety and quality of American products. This type of product evaluation gave rise to a variety of consumer protection groups (such as state public interest research groups), publications (such as a modified *Consumer Reports* and *Consumer's Digest*), and legislation (such as the Americans with Disabilities Act). Consumer groups started to split into smaller niches defined by age, geography, education, and income. This new consumer awareness led to the trend of demassification, or the breakup of 50th-percentile-based marketing into a smaller cluster of markets, which became known as niche marketing. A break occurred between the generation that had survived the Depression and World War II, and the Baby Boomers, who had only known prosperity and wanted peace at all costs. Civil rights, women's rights, and environmentalism created entirely new types of consumers. They expected more from the products they bought and had both very particular demands and a new range of interests that exceeded their own personal needs, wants, and desires.

■ Technology alone did not sell the Mac, iPod, iPhone, and iPad to the masses. The added usability and style sold the devices.

When IBM tried to transfer its business machine mainframe mentality and austere modern corporate identity to the design of personal home computers, it had trouble “crossing the chasm” from lead users to the early majority.⁵ Although the company’s use of a Charlie Chaplin imitator was the right image in commercials for the ordinary guy, its computer was not for the average person: IBM could not escape the cold design and poor interface of its business machines. The first Macintosh computer had a new look and interface that consumers responded to. Apple beat IBM in the emerging home computing era of the 1980s. The Mac was user friendly, and the product looked cute, not technological. The mouse was an easy-to-use peripheral product that added an additional friendly form to this new technology. Although the overall idea was developed at Xerox PARC, Steve Jobs was the one that saw the POG and acted on it. The software was easy to learn to use, allowing people to start up quickly and become functional users. The technology alone did not sell successfully to the mass public; the added usability and style, along with the technical capabilities, sold the computer. This feat was re-created when Jobs rejoined Apple and saved the company by introducing the iMac—it succeeded for exactly the same reason that the first Mac did. The success of the iPod, iPhone, and iPad followed the same approach: Technology alone was not enough.

The same was true in other industries as well. The U.S. auto industry was caught completely off guard by the oil embargo of the 1970s, allowing Japan to take over the U.S. small car market with low-cost, fuel-efficient, and eventually near zero-defect cars. People’s needs, wants, and desires had changed. However, the U.S. auto industry hadn’t recognized the need for change. Xerox lost its once-dominant control of the copier industry by failing to recognize that consumers wanted copiers that were more reliable. Xerox had been able to get incomplete technology into the market by backing it with excellent service. Japanese companies saw this gap and filled it with copiers that did not need service and looked better in the office environment.

The Era of Customer Value, Mass Customization, and the Global Economy

At the beginning of the twenty-first century, the concept of product development has changed in all markets at all economic levels. Companies are now competing globally in more diverse and demanding markets. In the current global market, a small, previously unknown Finnish company (Nokia) can effectively compete against a giant (Motorola) in the design of cellular phones. Consumers today no longer behave in large, predictable groups. They do not follow simple, consistent patterns of purchasing. With the iPhone, Apple introduced a highly successful

approach to mass customization. Through the millions of apps available, every customer can create a unique product, not through different physical products, but by creating individualized functionality by choosing a particular selection of apps.

We are now in the era of information, with segmented markets and consumers that can research and buy their products through a number of media channels. The access to cultural patterns of change is higher than it has ever been. Almost everyone in industrial nations can watch television, see movies, surf the Web, read magazines and newspapers, and listen to the radio. Many people do a number of these things simultaneously.

All consumers are searching for a sense of integrity and their own version of value and quality that can help them fulfill their lives. Today's consumers have a much clearer sense of their own identity and who they want to connect with (market segment), and they are also well aware of the range of products available. Customers are looking for products that are well made, that are safe, and that match their lifestyle. Everyone has a number of product categories, where they expect a product to make a statement about who they are and how they want to live their lives.

■ Moving to the Upper Right means committing to style, technology, and value.

Products can no longer simply provide a service, nor does simply styling a product work. Integrating style and technology through features is the only way to be competitive and maintain a customer's loyalty. Moving to the Upper Right means committing to style, technology, and value.

Positioning Map: Style Versus Technology

We can compare how products differ in their use of style versus technology by placing them on a Positioning Map, as shown in Figure 2.1. The four quadrants represent differences in the amount of style and technology that is designed into the product. The Upper Right quadrant is the one to be in if your goal is to be a leader in the marketplace and you want to maximize your profit. The products in the Upper Right exhibit an integrated approach with a balance of both style and technology. In the Upper Right, balance is achieved through the use of the third axis: understanding the value systems of the intended market (see Figure 2.2). These products maximize lifestyle impact, features, and ergonomics. The third axis, value, is not integrated into the products placed in the other three quadrants. Note that, in the 2-D version of the map shown in Figure 2.1, the Upper Right is separated from the rest of the map. We do this to emphasize the third dimension of value in that quadrant. We now examine each of these quadrants in more detail.

Lower Left: Low Use of Style and Technology

Products in this quadrant are typically generic, designed with established technologies and minimal styling. As shown in Figure 2.5, they have minimal lifestyle impact, features, and ergonomics. These unrefined products sell to consumers who do not seek out value but instead are driven primarily by low price: functionalism at low cost. These products might have been innovative early in their existence, but they have failed to respond to change and have become obsolete on a number of levels. Products in this quadrant establish the baseline of the product category. They are usually manufacturing and materially driven—that is, they rely on minimal use of material, quick cycle time, and minimal assembly time, and they keep a low cost per unit to make a profit. These products have few, if any, distinguishing features to differentiate them from other similar products. This approach was the classic for mass production and mass marketing and is still an approach that can work for commodities that have little value potential. Their undistinguished, low-cost design demands a minimal price, resulting in low profit per item produced.

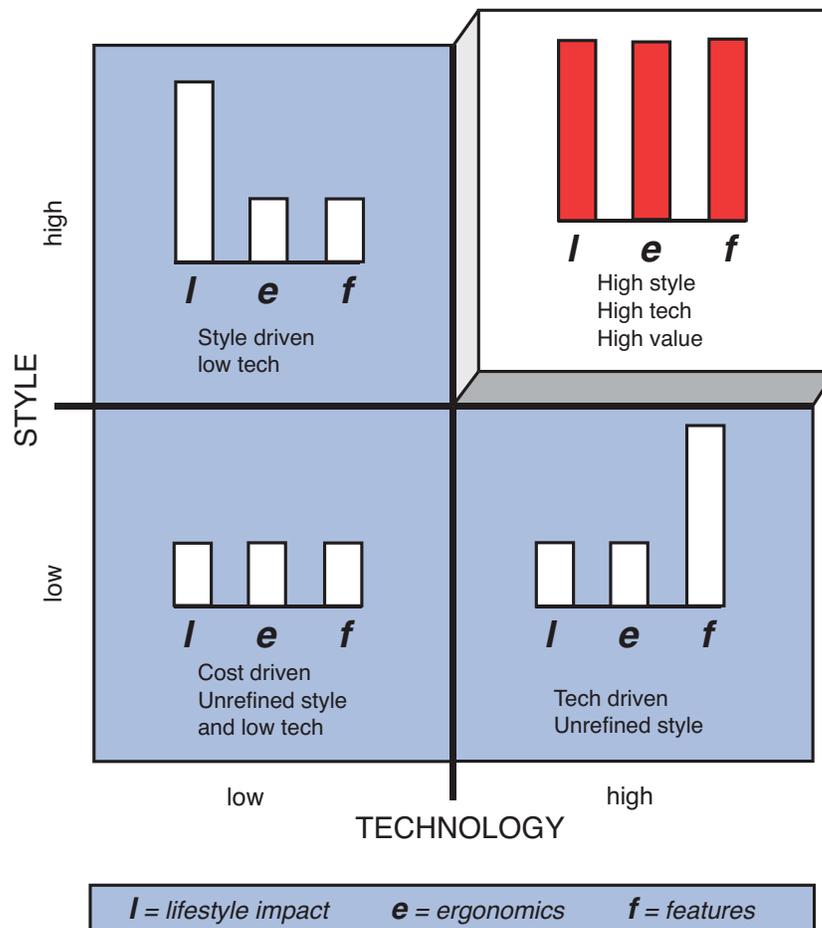


Figure 2.5 Positioning Map indicating effectiveness in lifestyle impact, features, and ergonomics.

A generic potato peeler, paper clips, a blender, the standard first-class business letter delivered by the U.S. Postal Service, and a cup of coffee in a coffee shop are all examples of generic products. In this quadrant, companies and customers seek value in the mass marketing sense. The product is made as cheaply as possible and distributed as widely as possible. Profit is made by high volume and low profit margin per item.

Lower Right: Low Use of Style, High Use of Technology

Products in this quadrant are driven by technology, with an expectation of sales based only on the added technological advantage or originality of the product. They maximize features but almost ignore lifestyle effects and, generally, ergonomics (see Figure 2.5). These products are often the first of their type and thus offer technological advance as their major competitive advantage. These products also work well in professional applications where style and ergonomics are not as important from a competitive standpoint. The same is true for military applications, even though attention to ergonomics might be more salient. Both cases, however, require a skilled user who is willing to overlook ease of use for performance. Profit in this quadrant is based on technological innovation, and the primary market is lead users and early adopters. They are willing to pay a premium to be the first with the new technology. However, this profit margin and early success does not continue past these aggressive segments. As Geoffrey Moore states in *Crossing the Chasm*,⁵ the early success of lead users is a false positive that does not translate to more conservative consumers who are interested in ergonomics and style. Although these products can achieve greater profit margins than those in the Lower Left, they usually have a limited market growth and must move to the Upper Right if they want to compete in consumer markets.

Manufacturing equipment, business-oriented computers and peripherals, and professional-quality service products all succeed in the Lower Right. Hewlett-Packard has been one of the most successful companies operating in the Lower Right. Their testing equipment, medical equipment, and plotters were standards in the professional markets. However, to compete in consumer markets, they have had to move to the Upper Right. The Windows operating system is far less user friendly than the Mac OS. However, Windows dominates through its position as the primary software for the Wintel PC and the one most used in business. As such, the PC, still in the Lower Right, is a product driven by more features for less money than the higher-cost, more usable alternative. High-end manufacturing tools typically find themselves in the Lower Right, with the expectation that customers care only about their performance. The Beyond Blast technology by Kennametal, discussed in

Chapter 9, “Case Studies: The Power of the Upper Right,” illustrates the opportunity for such technology-based tooling to move to the Upper Right.

Upper Left: High Use of Style, Low Use of Technology

Products in this quadrant are driven only by style. Their products have high profit margin but limited market potential of total sales. Some companies that live in this quadrant explore the boundary of aesthetic experimentation (lifestyle impact) and usually fail in the application of human factors (ergonomics) and core technology (features)—see Figure 2.5. Examples include Alessi products from Italy, which often end up as decorative elements in high-end kitchens or offices. Some designers such as Philippe Stark develop products that push the boundaries of form, material, and tactile experience. Designers often look to these progressive ideas as a point of departure for future designs that can flow back into other, more complex and mainstream products. Profit in this quadrant is the result of either a market seeking out image and art or a company tricking consumers into believing that the highly styled look of these products is backed by competent ergonomic and technology design. This cosmetic approach usually fails for the opposite reasons that a high-tech product fails. Consumers quickly realize that these products are a compromise and that they rarely perform as anticipated. These companies are often looking for niche markets willing to sacrifice usability for expression alone.

Upper Right: High Use of Style and Technology

The Upper Right quadrant contains products that integrate style and technology and add the final factor that makes them successful: value. Here lifestyle impact, features, and ergonomics or general interaction come together to enable personal expression, cutting-edge capabilities, and usability (see Figure 2.5). This combination allows products to differentiate themselves from the competition and define the state of the art for their market. How to successfully move to the Upper Right is the focus of this book. We have already discussed examples of breakthrough products in the Upper Right in Chapter 1, “What Drives New Product Development,” including the BodyMedia FIT System, the Margaritaville Frozen Concoction Maker, the GE Healthcare Adventure Series MRI, and Starbucks. Sometimes these products and services cost more to design and produce than those in the other quadrants, but consumers are willing to pay a premium for them. At other times, the resourceful and meticulous effort it takes to create an Upper Right

product allows for a more efficient use of materials, technology, and manufacturing processes, resulting in a higher-profit product that costs no more to produce. Producing such an Upper Right product might even cost less because it includes only the features that people want, with no wasted technology (and its costs).

The goal is for new products to move to the Upper Right, or end up with a product in the Upper Right quadrant, as shown in Figure 2.6. Mapping your products and your competitors on the Positioning Map enables you to understand the scope of your competition and also how to differentiate yourselves from that field. You can then use that understanding to plan a strategy to move to the Upper Right. The process is not as simple as merely putting together an industrial designer and an engineer. The process is deep and intricate. We devote the remainder of this book to understanding the way products in the Upper Right differentiate themselves from the rest of the field.

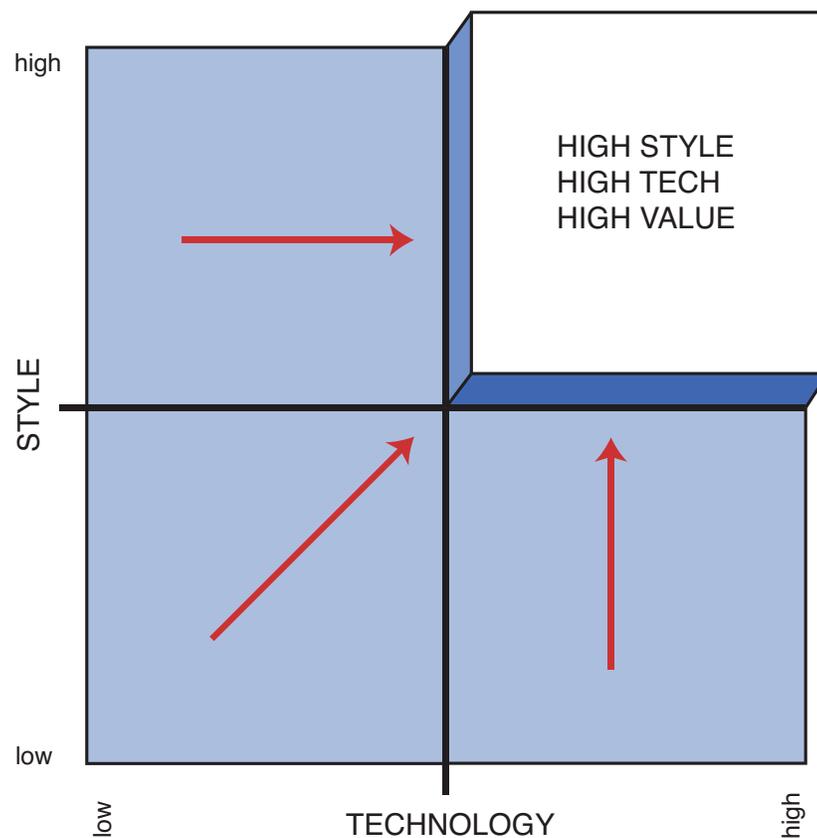


Figure 2.6 Moving to the Upper Right.

POSITIONING ALUMINUM SEATING

Using the same material in a variety of ways in product development results in positioning in different quadrants of the Positioning Map. Consider the aluminum chair. For many years, the inexpensive portable beach chair was made from an aluminum frame, as seen in the Lower Left of Figure 2.7. The high-tech but low-style version in the Lower Right includes an older office chair that used emerging manufacturing technology to deliver functional task seating. In the Upper Left is artistic-oriented seating, as in the stunning museum chair by Marc Newson, which is made of aluminum but is clearly not at all comfortable to sit in. Finally, an Upper Right example that integrates style and technology in a timeless design is the Aluminum Group chair, by Charles Eames; designed in the 1960s, the Aluminum Group chairs made by Herman Miller are still considered high-end, timeless, and comfortable seating for the office or home. These different chairs come from different eras and were developed under different SET Factors. Choice of material is but one differentiation of these chairs, but the example shows how different decisions with the same material can result in very different design outcomes.

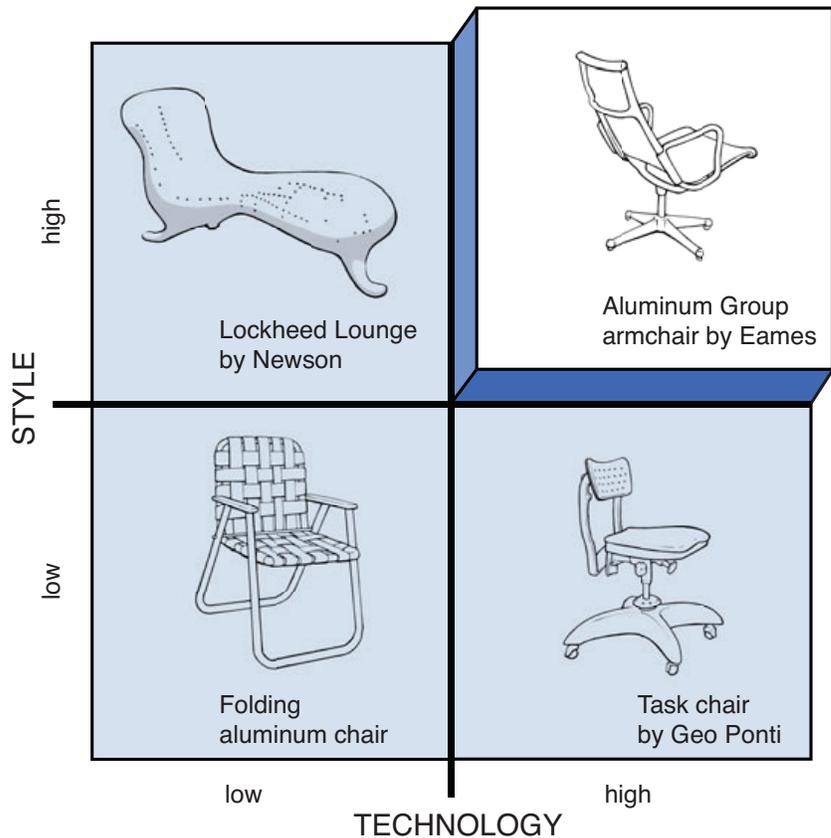


Figure 2.7 Positioning Map of aluminum seating.

Positioning Map of Margaritaville Frozen Concoction Maker

The Positioning Map for the Frozen Concoction Maker (see Figure 2.8) shows the Upper Right opportunity for and delivery of the product. In the Lower Left is the standard blender that crushes (or melts) the ice but does not blend it into a smoothie. In the Lower Right is the high-end ultra-expensive professional mixer used in bars and restaurants. The Upper Left includes a stylized version of the blender, not different in performance than its Lower Left cousin. The Upper Right is where the Frozen Concoction Maker and high value lie, a combination of technology that mimics the performance of the high-end mixer, but at a fraction of the cost and with the lifestyle component to excite the target market of Baby Boomers, the broader market of Jimmy Buffett fans and wannabes, and frozen margarita fans alike.

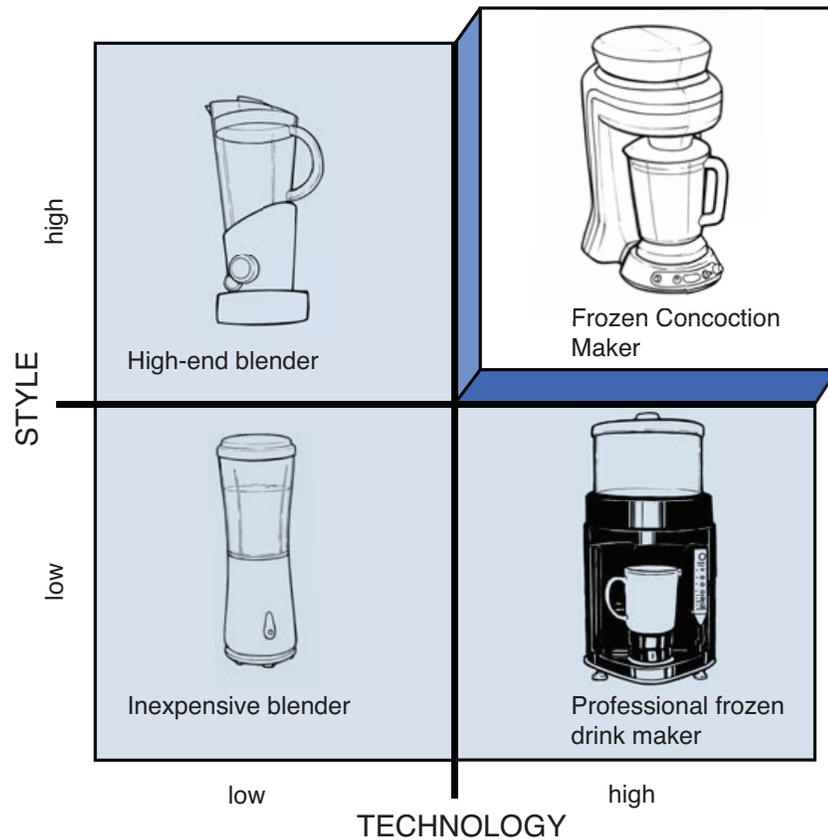


Figure 2.8 Margaritaville Frozen Concoction Maker Positioning Map.

Positioning Map of BodyMedia FIT System

BodyMedia has two Positioning Maps, one for the clinical SenseWear System (see Figure 2.9a) and the other for the consumer FIT System (see Figure 2.9b). When the company started and introduced the SenseWear System to the clinical market, the only competitors were the low-style, high-technology medical devices; the polysomnography (sleep lab) and VO2 (the metabolic cart). As already described, these clinical systems are cumbersome, requiring leads attached to the skin and tubes for the mouth. Furthermore, they require the patient to be in a lab instead of in their home or out doing activities. No attention to style is given; these are function-driven systems. In the medical field, no high-style products without function exist. In the Lower Left, generic products emerge only for very mature technologies that did not yet exist in this clinical domain (although the sleep lab and metabolic cart technologies were already routine). The SenseWear System was uniquely positioned in the Upper Right, adding value to the user through ergonomics and style integrated with new technology for mobile and comfortable multisensing capabilities.

When the company decided to introduce a product in the consumer market, the Positioning Map looked totally different. In the consumer world, no high-value competitors existed. In the Lower Left were a selection of pedometers, able to provide information only on the number of steps a person had taken. Some of these were quite generic; at one point, McDonald’s introduced an adult Happy Meal with a “toy” pedometer. Others of these were higher tech but still limited in providing information only on steps taken. In the Lower Right was the activity-monitoring watch, which, at the time, was a clearly clinical product that attempted to chart activity monitoring, but using only an accelerometer. Again, because people were interested only in products that delivered meaningful information, no high-style but low-technology competitors existed (except for any pedometers that attempted to add a level of color or a better interface). The BodyMedia FIT System brought style and technology together into a high-value product, not only through the physical device but through the service that analyzed the data and provided guidance on how to improve weight loss.

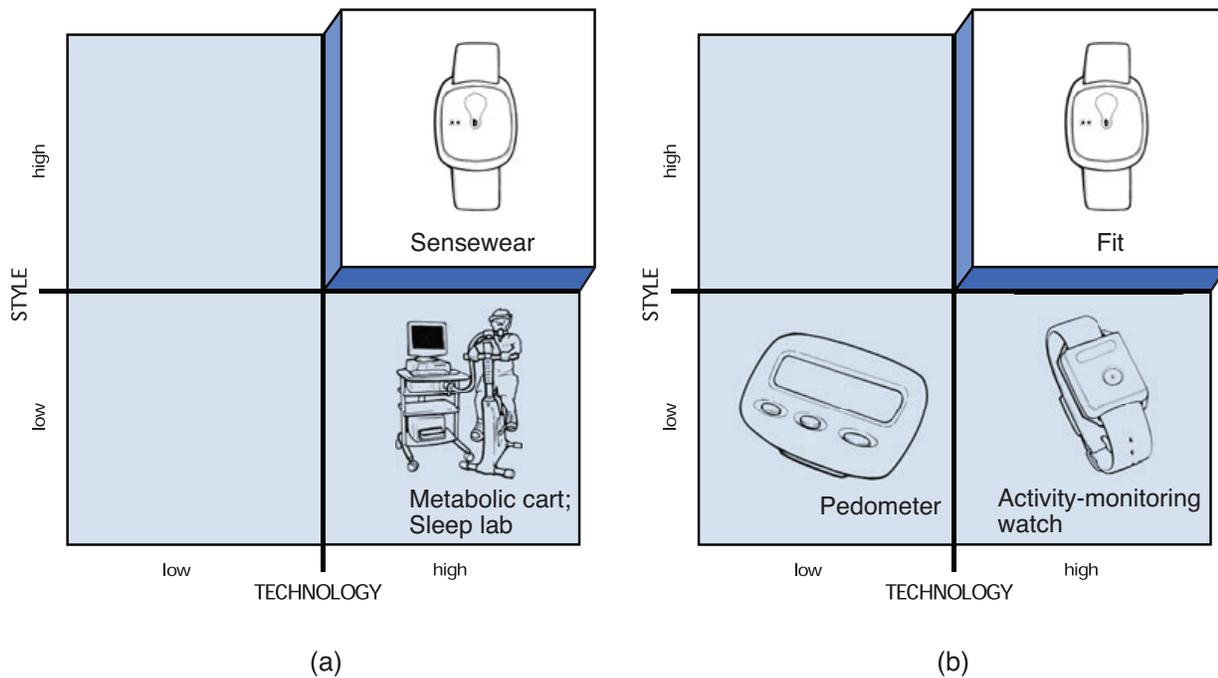


Figure 2.9 Positioning Maps for the clinical SenseWear System (a) and consumer BodyMedia FIT System (b).

In some ways, the success of the FIT System in the consumer market is similar to the success of the iPod for Apple. Because Apple could integrate MP3 technology with the iTunes service, making the transfer of songs easy and the purchase of new music even easier, the iPod device coupled with the iTunes service reached the consumer market and redefined the music industry. In the case of BodyMedia, the technology was state-of-the-art. But because the service allowed the company to control the data, it could process it and provide the feedback that consumers sought, without them needing to put in the effort to do so. BodyMedia brought the technology to the background, allowing nontechnical users to participate.

More than a decade later, BodyMedia is still the leader, having pioneered the space of technology-based self-care. Competitors exist and continue to try to match the capabilities of the FIT System. However, because BodyMedia has multiple international utility and design patents, name recognition, and a technological know-how advantage, competitors have found it difficult to move into the space defined by BodyMedia. One aspect of these patents includes the use of multiple sensors to assess physiological well-being, generally designating competitors to settle with only one sensor and, thus, limited information. Design patents also protect their aesthetic, which has defined the industry (and the brand, as seen on *The Biggest Loser*). The company actively enforces its intellectual property (IP), enabling it to retain its position in the Upper Right of value.

Positioning Map of Starbucks

Our arguments can also be applied to Starbucks, a service-based company (see Figure 2.10). Before Starbucks, the most popular group meeting place was a coffee shop or diner (Lower Left). People met for business, discussion, and, of course, coffee. Minimal service and customer turnover meant profit (low profit per person but high volume); the idea of hanging out with a laptop and sipping a cup of Java was an opportunity that most people did not see. For people seeking out the quick and reliable cup of coffee, Lower Right fast food restaurants had the technology to deliver a consistent, though not necessarily enjoyable, brew in a (usually) stark atmosphere. Upper-end restaurants (in the Upper Left) provided an inviting atmosphere but without a guaranteed consistent brewing quality.

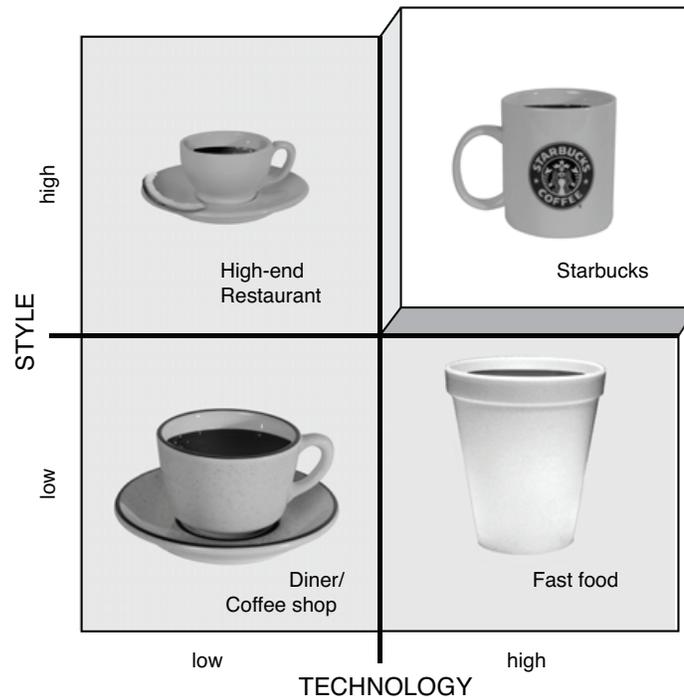


Figure 2.10 Starbucks Positioning Map.

Starbucks introduced and brought into the American mainstream the concept of a European cafe integrated with a West Coast contemporary look and feel. Starbucks, clearly in the Upper Right, combines technology through roasting and brewing with style through the upscale retail environment. Starbucks' first store opened in 1971. Not until 1984 did Starbucks open its second store in Seattle. By 1999, the company had grown to 2,500 stores in more than 13 countries; by 2010, it had nearly 17,000 stores in nearly 50 countries across the globe. As discussed in Chapter 1, the Starbucks line has extended into supermarkets, other products such as ice cream, and peripherals for coffee and tea drinkers. The Starbucks chain gave rise to a host of national and local copies. Some are poor copies; others have attempted to move to the Upper Right by offering a different but still high-quality product. Bookstores have installed coffee shops to heighten the book-buying and browsing experience and to make them more like libraries combined with coffee-houses—a notable example is Barnes & Nobles, which partners with Starbucks.

Positioning Map of GE Adventure Series

The GE Adventure Series is a different type of example of moving to the Upper Right. The Adventure Series is not about developing new technology: The product is the exact same technology as any other GE CT scan device. It is also not about changing the form from the original machine: No new parts needed to be molded.

Instead, it is an example of interface design and the capability to transform a product through the means by which the form and technology are delivered, to address the empathetic and emotional needs of the user (in this case, the child patient). The Positioning Map is simply the traditional CT scanner in the Lower Right and the Adventure Series in the Upper Right (see Figure 2.11).

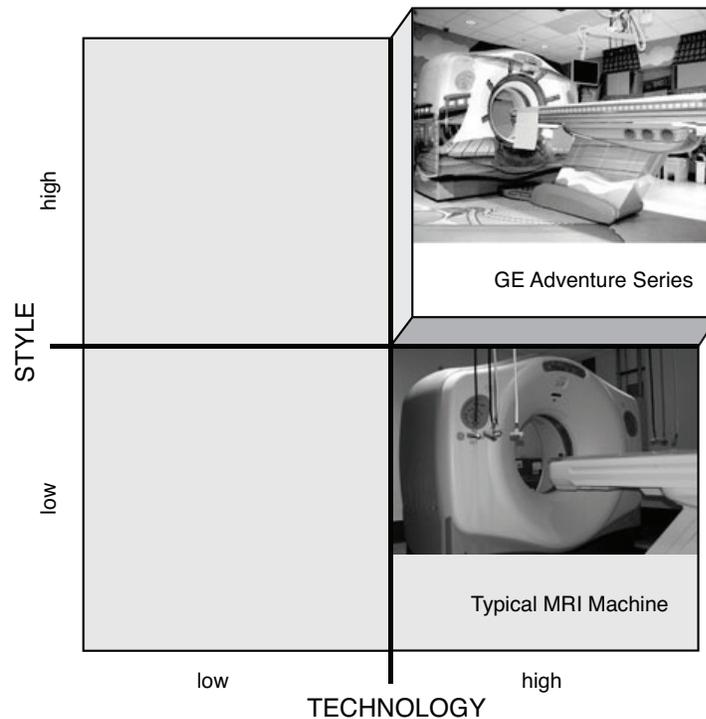


Figure 2.11 GE Adventure Series Positioning Map. (Courtesy of GE Healthcare)

Knockoffs and Rip-offs

As already indicated, when a product succeeds in the Upper Right, it often inspires a multitude of companies looking to copy its success without the investment in the value represented through lifestyle impact, features, and ergonomics. Companies take one of three directions. Established value-oriented companies cannot just copy, for fear of blurring their brand. These companies are forced to develop different Upper Right solutions that have equal perceived value. In this case, the Upper Right product spawns new Upper Right products designed for a different insight. Many companies, however, have the goal of competing by charging less and skimming the profits of the original Upper Right product, thus appealing to customers who believe they can get the same value for less cost. These companies

configure themselves to actually copy. They want to take advantage of the brand identity of the leading company. Unless a product can differentiate itself from one in the Upper Right, it will end up back in the Lower Left or off the map altogether. Companies driven toward a lower price point but able to create a genuine product end up in the Lower Left. Most times, however, companies interested in ripping off success use a cosmetic approach but sacrifice on choice of material and manufacturing quality. The product is neither technology nor style driven and lacks the sincerity of a generic product. This pushes the product off the map altogether. Consumers quickly realize that these products are a compromise and that they rarely perform as anticipated. The companies that do this are usually positioned for sales in lower-end retail stores and are often looking for short profit cycles with no investment in brand loyalty.

Many companies have been trying to rip off the look of GoodGrips products (see Figure 2.12); all of them are cheaper in price, but none works as well. However, the clear difference in quality and the consistent innovation that stems from the company continues to place its products in the Upper Right.



Figure 2.12 Selection of GoodGrips knockoffs.

In contrast, in the first edition of the book, we featured the Black & Decker Snakelight (see Chapter 11, “Where Are They Now?”). The Snakelight is a clever hands-free flashlight with a flexible core that can wrap around a person’s neck or be positioned to sit on a surface for hands-free lighting. The Snakelight had a successful ride as a high-valued Upper Right product. However, cheap knockoffs made of inferior materials and lower-quality manufacturing lessened its perceived value. Because the company did not continue to innovate and differentiate the product, it soon became commoditized.

The compromise of quality in materials and craftsmanship of rip-off products results in poor performance and short product life. These rip-off, low-cost companies are often sued successfully for design and utility patent infringements, costing the manufacturer far more in the long run than if it had tried to innovate in the first place.

The Upper Right and Intellectual Property

Given the effort to develop a differentiating, breakthrough, high-valued product, the company has an interest in protecting the investment and preventing others from copying it. When most people think about IP protection, they think about utility patents that protect the functionality and manufacture of a product. However, a selection of IP tools protects innovation in both the technology and style of a product. Our book *The Design of Things to Come*⁶ offers a tutorial of the different types of IP tools. Figure 2.13 illustrates how IP law can protect all aspects of the breakthrough innovation. High technology is protected through utility patents. But style is protected through design patents, trade dress, trademarks, and copyrights. If a company uses all of these tools, the Sheer Cliff of Value to the Upper Right can be difficult, if not impossible, for others to climb.

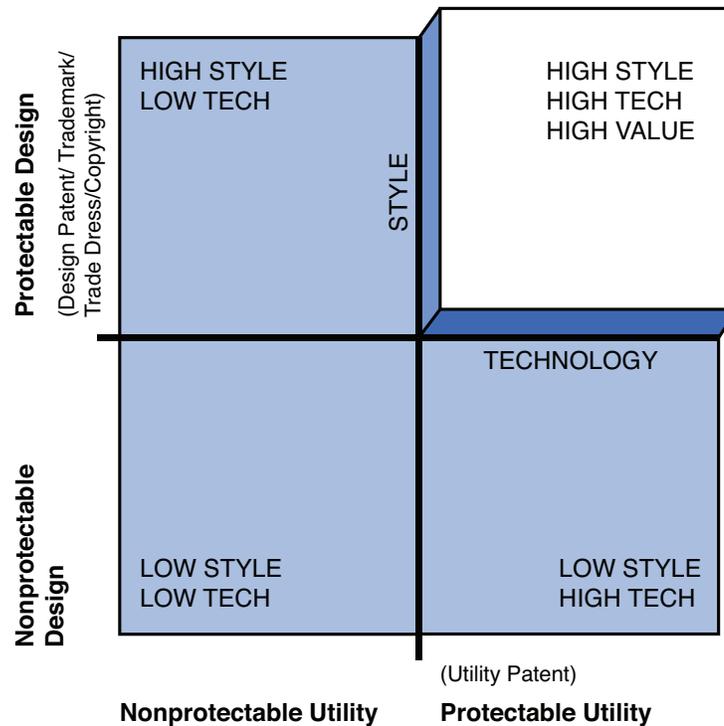


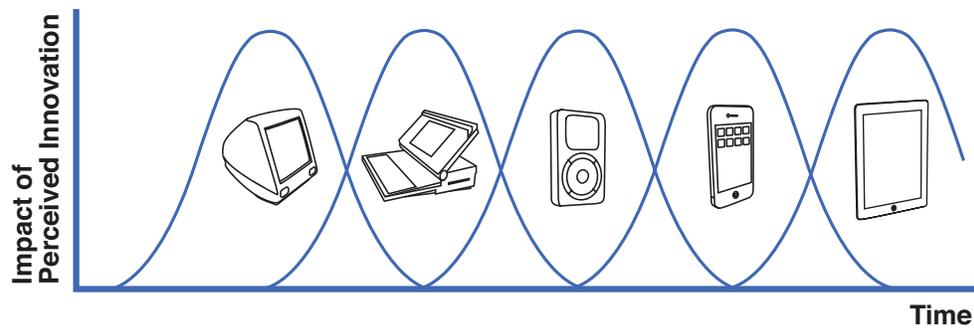
Figure 2.13 Positioning Map showing different ways to protect a product through IP tools.

Revolutionary Versus Evolutionary Product Development

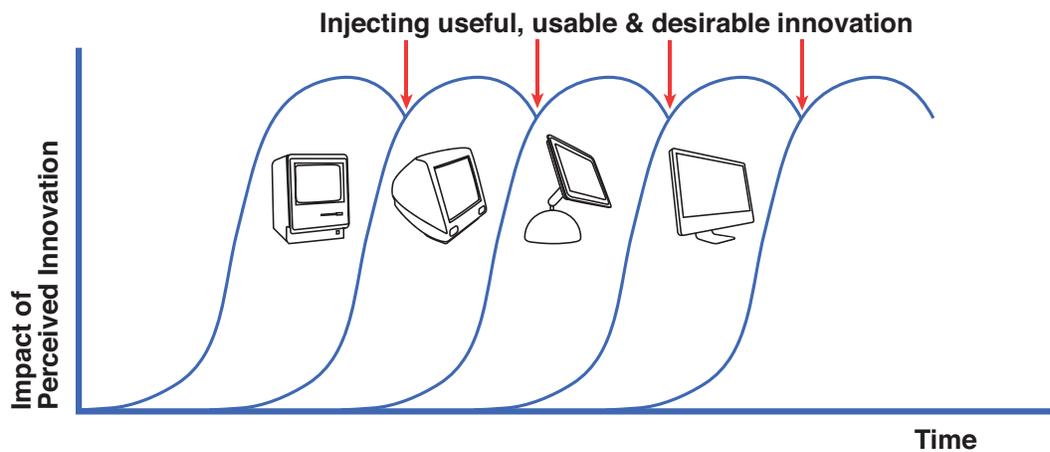
Upper Right products can be revolutionary new products or evolutionary changes to an existing product line. Revolutionary products establish a new market or solution within a market. Evolutionary products typically begin in the Upper Right and remain there as new useful, usable, or desirable innovations that address the dynamic SET trends. They require injections of new value to maintain the consumer's connection to the product. Revolutionary products enter in the Upper Right and remain there only by becoming evolutionary products that change with the SET Factors.

Figure 2.14a shows the perceived innovation of a product in a market and how a company introduces revolutionary changes to maintain the perception of cutting-edge innovation and capture new portions of the market. As an example in the figure, Apple introduced revolutionary innovations in its products, beginning with the iMac (and the original Mac before it), then the iBook, and next the iPod, iPhone,

and iPad. To keep the product in the Upper Right, new models must add innovations that meet the needs, wants, and desires of the market. Figure 2.14b shows how these injections of innovation keep the product line at its peak in the Upper Right. For this example, for the Mac, each successive product increased computation capabilities while compacting the components into smaller forms that could be integrated into varied cutting-edge form factors. Each of these innovations kept the company ahead of the competition and in the Upper Right.



(a) **REVOLUTIONARY DESIGN:** Apple innovations



(b) **EVOLUTIONARY DESIGN:** Apple innovations

Figure 2.14 Revolutionary new Upper Right products (a) and evolutionary maintenance of an Upper Right product (b).

The goal, then, is to become and remain a leader in the Upper Right by introducing revolutionary new products or evolutionary changes to existing products. To do so, the product must add significant value over the competition. Understanding value, not just trying to copy successful examples in the market, is critical to the success of the move to the Upper Right and is the focus of the next chapter.

Summary Points

- Throughout history, breakthrough products have succeeded by merging style and technology.
- Breakthrough products are found in the Upper Right of a Positioning Map, indicating high style, high technology, and high value.
- Breakthrough products in the Upper Right maximize lifestyle impact, features, and ergonomics.
- Upper Right products lead or create new markets.
- Both evolutionary and revolutionary Upper Right products demand constant innovation.

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Chapter Three

The Upper Right: The Value Quadrant

Breakthrough products are driven by a complex combination of value attributes that connect with people's lifestyles. This chapter examines the seven attributes of value and introduces a Value Opportunity Analysis (VOA) process. During the last decade, the VOA has been one of the most widely adopted tools we have developed. The method helps interdisciplinary teams develop a shared understanding of the current state of a product opportunity and to project where value improvement needs to occur as they navigate the Fuzzy Front End. This is an essential step in any new product program. Failure to thoroughly and thoughtfully complete this phase will have a negative impact down the line. The goal is to create a baseline reference for determining directions for research and subsequent concept development; the result is an early definition of the requirements for product success.

The Sheer Cliff of Value: The Third Dimension

As you look through the Positioning Map diagrams shown in Chapter 2, “Moving to the Upper Right,” note how the Upper Right is separated from the rest of the quadrants. The reason is not just to highlight the importance of this quadrant. As mentioned in the previous chapter, the Upper Right has a third dimension, as shown in Figure 2.2 (repeated here as Figure 3.1). Unfortunately, it is not as simple as just putting a technologist and stylist together to move to the Upper Right. Products in the Upper Right are there because they add value to a user; we illustrate this in the 2-D version of the map by separating out the Upper Right quadrant. Adding value is not a trivial process—it requires a strategic commitment from the company to a user-centered iNPD (integrated new product development) process.

Figure 3.1 illustrates our theory that the third dimension, value, comes into play only in the Upper Right. Chapter 2 showed that products in the other quadrants, especially the Upper Left and Lower Right, do provide some value by addressing either image or features. The Upper Right products, however, maximize image, features, and ergonomics, targeting a *significant* level of value that meets the needs, wants, and desires of consumers without sacrificing usefulness, usability, or desirability. Thus, products that fall in the other quadrants are on a different, lower level of value. The shift to the Upper Right is a dimensional change that is not gradual; it is abrupt and significant. In many ways, it represents a sheer cliff, which we call the Sheer Cliff of Value. Ascending this cliff requires a strategic approach that begins with commitment and planning and ends with a user-centered, integrated approach to product development. As discussed in Chapter 1, “What Drives New Product Development,” the product development process is

akin to rock climbing. To create products in the Upper Right, you must climb the Sheer Cliff of Value.

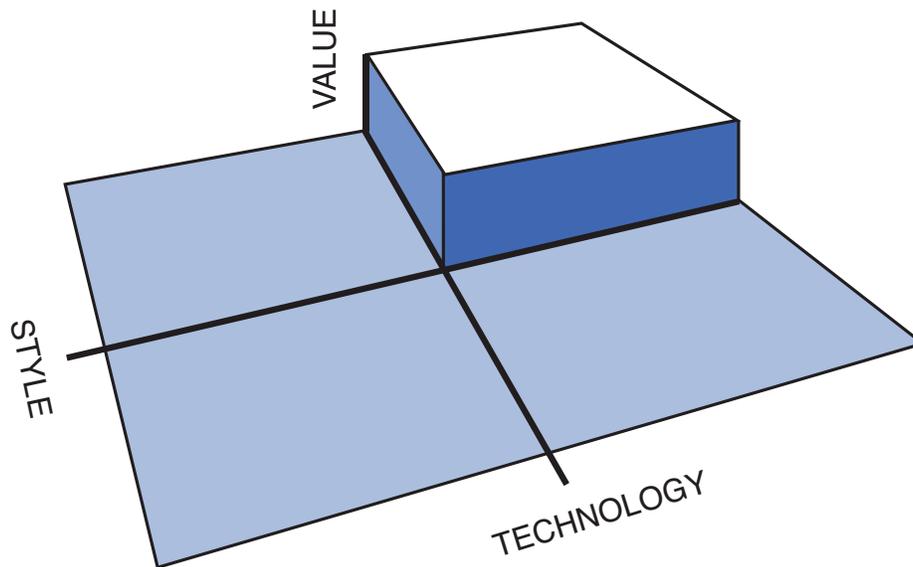


Figure 3.1 The three-dimensional Positioning Map showing the Upper Right Value quadrant.

In this chapter, we discuss customer-based value and show you how to use the concept of *Value Opportunity* to clarify a Product Opportunity Gap. Chapters 4, “The Core of a Successful Brand Strategy: Breakthrough Products and Services,” and 5, “A Comprehensive Approach to User-Centered, Integrated New Product Development,” then discuss the corporate strategy for committing to this process first by relating value to the corporate and product brand strategy and then by introducing a value-oriented product development process. The remainder of this chapter is devoted to understanding what value means in developing products for the Upper Right.

The Shift in the Concept of Value in Products and Services

■ Value in its true sense is lifestyle-driven, not cost-driven.

During the period of mass marketing, value was seen as the services or features a product provided for the price it cost. Good value was based on the lowest cost with the greatest number of features. The goal was to keep cost low, make moderate profits, and sell in mass quantities. Products in the Lower Left are still driven by how many features can be delivered for the lowest cost. They are often sold in discount stores such as Walmart and Kmart. Value in its true sense, however, is lifestyle-driven, not cost-driven. According to *Webster’s Dictionary*,¹ *value* is the relative worth, utility, or importance of one item versus another; the “degree of

excellence”; or something “intrinsically valuable or desirable.” *Relative worth* does not mean cost, but rather the quality that causes something to be perceived as excellent. From the perspective of a product, the key terms are *utility* (namely, *usefulness* and *usability*), *desirability*, and *overall perceived excellence*. A product is considered excellent when it is ranked high in all appropriate aspects of value and delivers the qualities people are looking for. For the purpose of the development of Upper Right products, we define *value* as the level of effect that people personally expect from products and services, represented through lifestyle impact, enabling features, and ergonomics—together, these result in a useful, usable, and desirable product.

So a product is valuable if it is useful, usable, and desirable. Though not directly recognized as a definition of value, these words were first applied to product development by Fitch, a design consulting firm headquartered in Columbus, Ohio, to describe aspects of a successful product. A useful product is one that satisfies a human need, is capable of being produced at reasonable cost, and has a clear market. A usable product is one that is easy to operate, easy to learn how to operate, and reliable. Finally, a desirable product is one whose technology, function, appearance, and market positioning make customers want to own it. *Products in the Upper Right are useful, usable, and desirable*—that is, they have high value in that they are perceived as excellent in a number of factors.

Although cost is still an issue in the era of market segmentation, the more powerful factor is the consumer’s need to connect product purchases with personal values. When a product does connect, customers are willing to pay a higher price. People purchase products that enrich their experiences based on what is important to them—their values. The product must support that value base. The more the product does support that base—in other words, the higher its perceived value—the more people will pay for it. In the ideal case, and cases we have observed in practice, *the cost to make a highly valued product increases less rapidly than the amount people will pay for it!* In other words (as shown in Figure 3.2), the more value in a product, the higher the price people are willing to pay, with the price increasing more rapidly than the cost. The profit is the price minus the cost; thus, the profit increases with higher value. The OXO GoodGrips peeler adds so much value that consumers will pay several times that of the generic metal peeler. However, the cost to produce it is not several times that of the generic counterpart, so the profit margin is significantly higher for the higher-valued product. This is also the case in the auto industry with higher-end vehicles built on the same platform. Although an SUV costs twice the price of a pickup truck whose platform it is built on, the cost to produce the SUV is not double that of the truck. The auto

companies make significant profit on these high-value vehicles. This is the first way Upper Right products lead to increased profit.

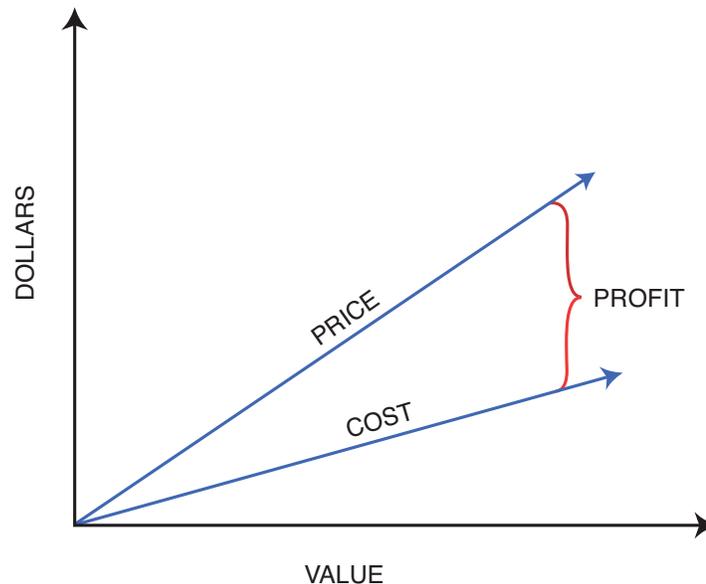


Figure 3.2 Price and Cost versus Value—Profit increases with added Value.

In some instances, due to manufacturing costs and the expenditure for emerging technologies, high-value products may have a sales price that demands a lower profit margin compared to the cheap, poor-quality, competitor's product. But although proportionally they make less profit per item, they still make a large profit based on their increased volume of sales. This is the second way Upper Right products lead to increased profit. The Lower Left competitor or off-the-map rip-off created by looking for the cheapest way to manufacture usually results in a poor-quality product that may be churned out for a fraction of the Upper Right cost but that customers do not value and will never pay a premium for.

The third way that Upper Right products lead to increased profit is by establishing brand—and, thus, customer—loyalty. Although not all Upper Right products result in higher profit per item over competitors in the other quadrants, producing an Upper Right product is sometimes a strategic decision. This decision is made to establish a long-term relationship with the customer. When an Upper Right product fulfills the expectations of customers, they are more likely to return to the brand for future purchases. As discussed in detail in Chapter 4, this happens because the product is the core of a company's brand strategy, and the value of the Upper Right products help to establish strong brand equity. Strong brand equity

means that customers are more likely to purchase your product over one from a competitor that has not established a core or appropriate brand identity. Not only will customers return to purchase the next generation of the product they enjoyed, but when they eventually seek out new products or higher-value products, they will return to the company with that Upper Right product.

This was the strategy Volkswagen used in 1998 when it redesigned its classic design and introduced the new Beetle. The features and style of the product met and generally surpassed the value expectation of the customer. Although VW did not charge an exorbitant amount for the vehicle, the goal was to move customers into higher-priced lines, such as the Passat, with future purchases. Sometimes brand can be built with an Upper Right product that not everyone can afford. Navistar introduced the LoneStar, discussed in Chapter 9, “Case Studies: The Power of the Upper Right,” as a means to rejuvenate its brand and change the perception of its trucks as innovative and cutting edge rather than mundane and basic.

The fourth way an Upper Right product leads to increased profits is actually by charging less than the competition. An effective process of integrating engineering and design can lead to products with fewer parts and a more efficient process of manufacturing and using finishes. These products end up costing less to produce than the previous solutions. Sharing that cost reduction with the consumer makes a strong statement for enabling market penetration. It also establishes a strong brand equity built on innovation and cost reduction. Although this enviable position is not easy to come by, the attention to detail that results from creating an Upper Right product can have surprising ramifications. Dell Computer developed a system for innovation in product customization and delivery that enabled it to acquire a strong share of the market yet keep its products at competitive prices. Unfortunately, it also contributed to the commoditization of the PC and, thus, its own business.

You might think that adding new technological features is a way to attract customers and increase sales price and, hopefully, profit. But this works only if customers value and desire the feature. Just having a feature attracts only a limited group of early adopters. If the broader majority of customers don't want the feature, they won't buy it. Even so, there is a limit to what an early adopter will pay just to have the technology. But there is no limit to innovation and the potential value it can deliver to a customer. If you create features that people value, need, and desire, they will pay for that feature. And that is a property of a product in the Upper Right.

Qualities and a Customer's Value System: Cost Versus Value

Consumers have come to expect a high degree of quality in the products they buy. Quality tools and programs such as TQM, QFD, 6 σ , and ISO 9000 have continued to raise the bar on the quality of manufacture and product performance. These attributes have become the expected baseline of entry into a market. What makes a product successful in the marketplace today, however, is determined by the qualities it represents and how these product qualities connect to personal values. Product qualities result from the combination of image, features, and ergonomics.

B. Joseph Pine and James Gilmore describe the emerging economy as the “experience economy,” in which companies will succeed by producing or supporting experiences.² According to Pine and Gilmore, commodities lead to goods, which, in turn, lead to services that are now leading to experiences. These experiences are a new source of value for the consumer. What is striking in their research is that each progression has led to higher pricing of the product (see Figure 3.3). Commodities provide the means to create goods that provide services that, together with goods, stage experiences. There is as much as an order of magnitude increase in price between goods and services and experiences. In other words, people will pay—and pay highly—for quality experiences. Figure 3.3 also shows how those companies that provide experiences differentiate themselves from the competition.

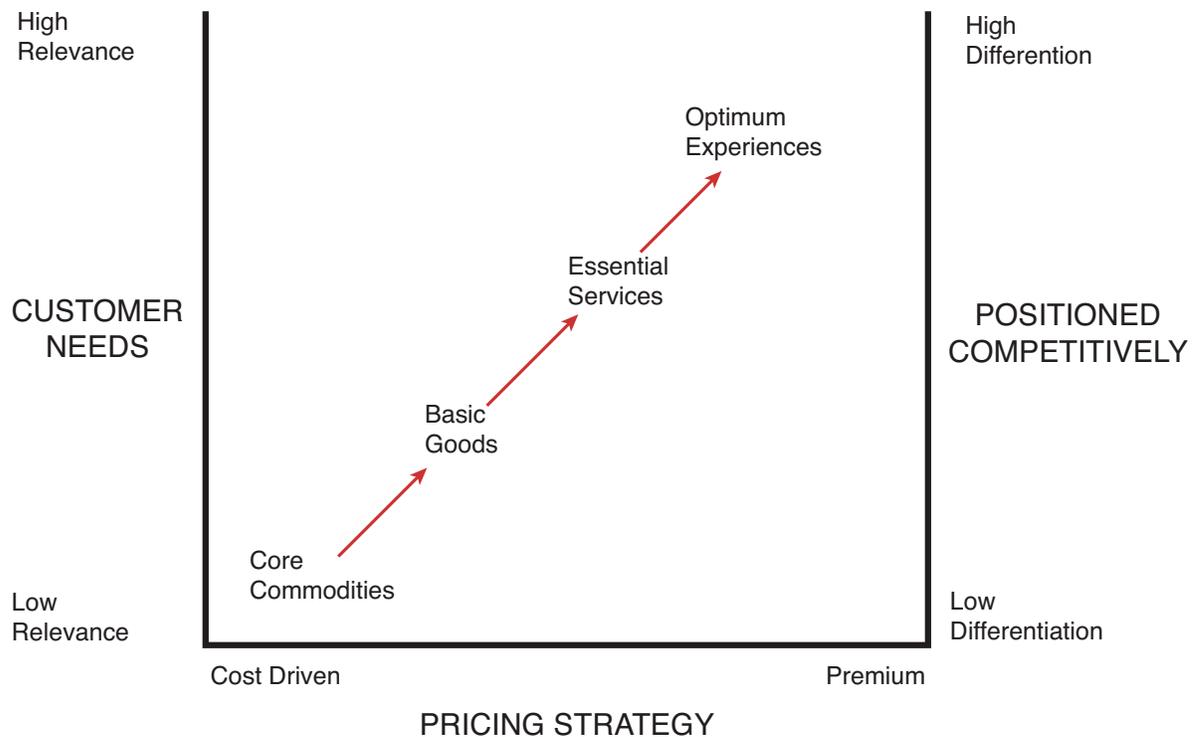


Figure 3.3 The progression of economic value from core commodities to optimum experiences. (Adapted from *The Experience Economy*, by Pine and Gilmore²)

As stated earlier, form no longer follows function. This has been replaced by *form and function fulfilling fantasy*. The shift from the industrial revolution to the Information Age is also the shift from the world of high work effort with low fantasy expectations to the world of work as a means to provide for an ever-increasing array of fantasy expectations. Customers expect a product to enhance and fulfill their lifestyle, both physically and symbolically. In short, people want to fulfill their dreams. But what one group fantasizes about as an ideal product is different than what another group imagines.

The entertainment industry has created a world culture of fantasy. Movies, television, books, vacations, and products are all attempts to live up to customer dream expectations. Vacation resorts such as Las Vegas and Disney World or cruises to natural settings bring fantasy into experience. People all over the world want to experience that level of fantasy. They want to extend that fantasy into every phase of their lives. Think about the influence of *Star Wars*, *The Matrix*, and *Star Trek* on products, fashion, and digital imaging. We now have products that look like three-dimensional cartoons (such as Graves products for Target) and cartoons that look real (such as the toys in *Toy Story*, with the Buzz Lightyear action figure toy created from the same type of digital representation used to create the cartoon character in the movie). As anticipated by *Star Trek*, we can watch videos while on the move, talk to anyone anywhere in the world, and use onboard navigation systems to figure out where we are on the planet at any moment in time and determine where to go next to arrive at our destination. As predicted in *Minority Report*, we can even use our hands to move items around a screen and immerse ourselves in a virtual world with Microsoft's Kinect, even if, for now, it is only to play a game.

But it isn't just fantasy for a personal lifestyle. People expect fantasy in the business-to-business world as well. Consider utility connectors for commercial appliances that provide the feeling of confidence and, for the commercial kitchen designer, make you feel on top of your game. Or consider the dangerous, dirty, and dull task of inspecting sewer systems; the fantasy here is to not have to be in or around the sewer. RedZone Robotics fulfills that fantasy to crews that used to have to go down to inspect deep sewers by having a robot do the task instead.

■ The Upper Right represents the products that support the new experience economy.

In the Upper Right are products that differentiate themselves from the competition by enhancing experiences. In other words, the Upper Right represents the products that support the new experience economy.

As consumers become more sophisticated in their ability to select products and their fantasy expectation increases, companies must learn to understand the new value structure of their core customers. Though aspects of this value system are

deeply rooted in religious and personal beliefs, much of the system changes rapidly as people mature. Culture and trends shift faster and faster in more and more product markets. Thus, successful companies must see the process as dynamic and must constantly update their understanding of who their customer is. Connecting product qualities to the value system of customers is the new method for creating successful products.

Arguing for value-driven products over cost-driven products does not mean that price is never an issue. Pine and Gilmore state, “[N]o one repealed the laws of supply and demand. Companies that fail to provide consistently engaging experiences, overprice their experiences relative to the value received, or overbuild their capacity to stage them will of course see demand and/or pricing pressure.”³ People have a capacity that limits what they can afford. In the down economy after the fall of Lehman Brothers, what people valued and where they spent their money shifted. Yet those products that people did value—such as the iPhone and iPad, the \$4 Starbucks grande latte, and the LoneStar truck—still demanded a premium in price and profit. The point is that people will pay for value beyond what they pay for commodities, even in a down economy. The key is to understand what that limit is and what a given market looks for in a product, and then to add the right features for the appropriate value.

We call this *psycheconometrics*. Psycheconometrics is the psychological spending profile of a niche market. It determines what people perceive is worth spending money on. The user experience is enhanced by the value people feel they are paying for.

Clearly, Starbucks provides a richer experience than the local diner, OXO GoodGrips boosts the cooking experience beyond the generic peeler, and the FIT System provides personal health feedback beyond the pedometer. People have paid a significant cost increase for the added value of these experiences. It has been argued that if two identical products are on the market, the one that costs less will succeed. We respond that, in practice, no two identical value-oriented products are on the market. Two different companies or divisions create differences in the products through brand equity, if not through differing features. Why do people shop at Tiffany’s when they can buy similar jewelry at a lesser price in the local jewelry store? The answer is that Tiffany’s provides a shopping experience and a story for the customer to tell. The Tiffany’s experience helps people feel better about themselves, and people are willing to pay for that.

However, if you are going to charge more than the competition, the customer had better perceive that the added value is worth the additional cost. If the product does

not add value, then as a higher-cost commodity, it will fail. Manufacturing commodities is still an option, but you must recognize then that you are creating Lower Left products and that price becomes the purchasing driver.

Value Opportunities

Value can be broken down into specific attributes that contribute to a product's usefulness, usability, and desirability and that connect a product's features to that value. Products enable an experience for the user, so the better the experience, the greater the value of the product to the consumer. Ideally, the product fulfills a fantasy by facilitating a more enjoyable way of doing something. We have identified a set of opportunities to add value to a product, called *Value Opportunities* (VOs). These seven VO classes—emotion, aesthetics, identity, ergonomics, impact, core technology, and quality—each contribute to the overall experience of the product and relate to the value characteristics of *useful*, *usable*, and *desirable*.

The VOs differentiate a product from the competition in the way that people's needs, wants, and desires influence the purchase and use of that product. The VO is a snapshot in time. What makes one set of VOs relevant today, due to the current analysis of SET Factors, might make the same VOs irrelevant tomorrow. Also, interpreting the VOs is based on the SET Factors for a target market; the attributes one group finds important might be uninteresting to another.

The ergonomics, core technology, and quality VOs each address the satisfaction of the product during use, both immediately and over the long term. The social and environmental impact, product identity, and aesthetics VOs each address lifestyle aspects of the consumer. The emotion VO connects most directly with the consumer's fantasy in using the product. Together these VOs define the third axis of the Upper Right, the value of the product to the consumer. In examining each of these in more detail, recognize that each affects a product differently. Although each is broken down into specific VO attributes, this breakdown can be augmented as needed; as cultural needs change, new value needs will emerge. This list, however, is fundamental and generally supports the analysis of value for most product classes, including all of the products discussed in this book. Since the first edition of this book, the VOs have been used to design and analyze hundreds of products in a variety of applications. In each case, these value attributes have directly applied, with no need for further augmentation. The key is to define these attributes in the context of the product domain, enabling a tuned and focused value proposition.

The VOs are an extension of the breakdown of value in Chapter 2 as lifestyle impact, features, and ergonomics. Lifestyle impact represents the emotion, aesthetics, identity, and social impact value opportunities; features represent the core technology, quality, and environmental impact VOs. In the last chapter, we argued that only Upper Right products are strong in all three categories. Although all VOs might not be targeted by an Upper Right product, generally at least one relevant VO attribute that falls under each category must be targeted for a product to exist in the Upper Right. Of course, the more VO attributes that are targeted and maximized, the stronger the product's place in the Upper Right will be.

Emotion

The first Value Opportunity is emotion. All the VOs support the product's capability to contribute to the user's experience, but emotion defines the essence of the experience; the emotion contribution defines that fantasy aspect of the product. If the VOs were a hierarchy, the emotion VO would be at the top, ultimately supported by the other VOs. In their book *Built to Love*,⁴ Boatwright and Cagan demonstrate the value of emotion in increased willingness to pay and overall corporate profits. The emotion VO is the perceptual experience of the consumer when using the product. Different fantasies distinguish different products. We break the attributes of emotion into these categories:

- **Sense of adventure**—The product promotes excitement and exploration.
- **Feel of independence**—The product provides a sense of freedom from constraints.
- **Sense of security**—The product provides a feeling of safety and stability.
- **Sensuality**—The product provides a luxurious experience.
- **Confidence**—The product supports the user's self-assurance and promotes motivation to use the product.
- **Power**—The product promotes authority, control, and a feeling of supremacy.

Think about the sensual feeling of sipping a cup of coffee at a Starbucks in Manhattan on a cool fall day. Consider the feeling of adventure, security, and calm in a child having an MRI in the GE Adventure Series. Think about the sense of adventure, independence, and confidence that results from positive feedback about a more active lifestyle while wearing the BodyMedia FIT arm band. Products can utilize more than one emotional attribute toward value. This is true for each VO.

Although some products succeed by focusing on key attributes, the more relevant attributes of each VO that can be targeted, the higher the likelihood that a product will add value to a target market. Each Upper Right product captures a range of VO attributes, as shown later in this chapter and in Chapters 8–11.

Aesthetics

Aesthetics, the second Value Opportunity, focuses on sensory perception. The five senses are all important attributes of this VO. Many products focus only on visual and tactile senses. However, stimulating as many senses as possible through the use of a product or environment builds a positive association of the product with its application. This provides an exciting opportunity to add value to a product if competitors' products lack this focus. Although aesthetics are expected in consumer products, their opportunity to differentiate business-to-business products is often overlooked. The range of senses involved with aesthetics supports the emotion value opportunity, especially the sensuality attribute. The aesthetic attributes are:

■ Stimulating as many senses as possible through the use of a product builds a positive association between the user and the use of the product.

- **Visual**—The visual form must relate shape, color, and texture to the context of the product and the target market.
- **Tactile**—The physical interaction of the product, not only focusing on the hand, but also including any other physical contact between the product and user, must enhance the product experience.
- **Auditory**—The product must emit only the appropriate sounds and eliminate undesired sounds.
- **Olfactory**—The product must have an agreeable smell, providing appropriate aromas and eliminating undesirable odors.
- **Gustatory**—Products that are designed to be eaten, used as a utensil, or otherwise placed in the mouth (such as a child's toy) must have an optimum flavor or no flavor at all.

Product Identity

Products in the Upper Right make a statement about individuality and personality, expressing uniqueness, timeliness of style, and appropriateness in their environment. The product identity VO captures differentiation of the product in look or performance from the competition, connects the product to (or, at times, defines) the brand identity (see Chapter 4), and gives the product context in the market-

place. The identity of the product supports the emotion VOs and the consumer's fantasy in owning and using the product. Three attributes of product identity are personality, point in time, and sense of place:

- **Personality**—The product has unique characteristics in look and performance that set it apart from the competition. The two main issues in a product personality are 1) the ability of a product to communicate its core capabilities and differentiate itself from its direct competition, and 2) the connection that a product has to the rest of the products produced by that company.
- **Point in time**—For a product to succeed, it has to capture a point in time and express it in a clear, powerful way. Point in time is a combination of features and aesthetics that define the reference to a time period and the emotions that result from that period, whether future or past, and potentially defining a new aesthetic trend. This is captured by the dynamics of the SET Factors indicating changes over time.
- **Sense of place**—Products must be designed to fit into the context of use. This is also a by-product of the SET Factors, providing the appropriate look and feel for the product when and where in use by the customer, and when offered for sale in the marketplace.

■ Products must be designed to fit into the context of use.

Consider the design of the Frozen Concoction Maker. Its unique form features, bright color accents on the pitcher against a soft gray background with shiny trim, define a fun but serious personality that implies confidence that it can handle any party. The product references a contemporary point in time, highlighting the technology advantages over competitive products. The Frozen Concoction Maker has a sense of place that connects Key West to the backyard, providing a focal point for a party, especially while playing Jimmy Buffett's *Margaritaville*.

Impact

A company has a number of ways to demonstrate that it can be a responsible manufacturer and respond to socially oriented issues. Social responsibility is connected with the customer's personal value system and, as discussed in Chapter 4, can often build brand loyalty. Charitable donations, safe work environments, and health- and family-oriented benefits all promote the corporate image. However, the company can positively affect society through the product itself. Based on consumers' preference to buy products that benefit rather than hurt the environment or social groups, opportunities exist to add value to a product through social and

environmental impact. Products can also have social impact by affecting changes in how people communicate and interact with each other.

- **Social**—A product can have a variety of effects on the lifestyle of a target group, from improving the social well-being of the group to creating a new social setting (see the accompanying sidebar).
- **Environmental**—The effect of products on the environment has become an important issue in terms of consumer value. Design for the environment, or “green design,” focuses on minimizing negative effects or producing positive effects on the environment due to manufacturing, resource use of the product during operation, and recycling (see the accompanying sidebar).

In 2001, when the first edition of this book was released, this Value Opportunity and its related social and environmental attributes were probably the least explored of all the VOs. At the time, it was hard to get companies to even think about sustainability, never mind design products to minimize environmental impact. Today sustainability is becoming a core value to consumers. Similarly, attention to social well-being was not a focal point. In the past decade, social media was invented, with Facebook, Myspace, and other Web sites changing expectations for social interactions and sparking technology features on computers and smartphones that now enable constant communication. In addition, in terms of the aging population, Baby Boomers have changed the social expectation, and products are emerging to enable social interaction as people age in place. Social expectations and their delivery will continue to evolve and influence the design of products in consumer and business-to-business markets. Thus, the impact VO continues to have a growing effect on product development.

Ergonomics

The next Value Opportunity focuses on usability. Ergonomics refers to the dynamic movement of people and their interaction with both static and dynamic man-made products and environments. The terms *ergonomics*, *human factors*, and *interaction* are all related and are discussed in Chapters 7, “Understanding the User’s Needs, Wants, and Desires,” and 8, “Service Innovation: Breakthrough Innovation on the Product-Service Ecosystem Continuum.” Ergonomics has both a short-term and long-term effect on the perception of a product. Consumers look for comfortable fit, maneuverability, and intuitively simple controls in a new product, but a product must also hold up over time in comfort, consistency, and flexibility in use. The

ability of a person to interact with a product with ease, safety, and comfort contributes greatly to its overall value. These three attributes of ergonomics are also the attributes of the VO:

- **Ease of use**—A product must be easy to use from both a physical and cognitive perspective. A product should function within the natural motion of the human body. The ergonomics of the size and shape of components that a person interacts with should be logically organized and easy to identify, reach, grasp, manipulate, and navigate.
- **Safety**—A product must be safe to use. Moving parts should be covered, sharp corners eliminated, and internal components shielded from users. Application scenarios should be considered to anticipate and mitigate unsafe uses of a product.
- **Comfort**—Along with ease of use and safety, a product should be comfortable to use and should not create undue physical or mental stress during use.

SOCIAL IMPACT VO

Both social consciousness and social interaction provide opportunity for added value in a product. Several products highlighted in this book have a strong effect on social well-being, including Design Impact's products for underdeveloped nations (including a charcoal briquette maker) and the GE Healthcare Adventure Series that reduces fear and anxiety in children undergoing a medical procedure. The Live Well Consortium at the University of Cincinnati explores product opportunities for the over-50 population, including reusable packaging for the Baby Boomer consumer. The OXO GoodGrips, originally primarily targeting elders with arthritis, was designed and marketed for almost any individual to use. That objective is known as Universal Design (sometimes referred to as transgenerational design), an extension of the Americans with Disabilities Act (ADA). The ADA is usually discussed in terms of access to buildings and the ability to maneuver in public spaces. Designers such as Pat Moore have crossed these bounds through the design of products and interfaces.^{5, 6} The goal of Universal Design is to make products useful and usable to the broadest range of users. The rule of thumb when employing a philosophy of Universal Design is that companies should never knowingly design a product that prevents a significant percentage of consumers from using it in normal operation of intended use. It is easier to design for broad use of a product if it is a priority in the early stages of a design. The reason OXO GoodGrips has been so successful is that it embodies the philosophy of Universal Design by clearly demonstrating that a product developed to respond to people who are physically challenged can work for everyone without stigmatizing anyone.

Other products might not target social conscientiousness directly, but they still affect the interactions among people. Starbucks created a nonalcoholic way for people to meet and enjoy each other's company in a public setting. On the other hand the Frozen Concoction Maker created a primarily alcoholic way for people at parties to enjoy a hot summer's evening. The FIT System enables people to blog with each other, encourage others, and offer contests about healthy lifestyles.

Even Harley-Davidson created an entire new subculture of social interaction. The Harley was once associated with a criminal fringe lifestyle, but the company re-focused its brand and extended its product line. Today white-collar workers escape the 9–9, Monday–Friday grind and transform themselves on weekends by joining Harley Clubs that ride in full Harley attire. The Harley motorcycle—the core product—and all of its accessories create an environment that fosters a sense of camaraderie and escapism. (See the case study in Chapter 4.)

ENVIRONMENTAL IMPACT VO

Design for the environment, or “green design,” presents an opportunity to improve product value with broad societal implications. Herman Miller lists materials and recycling information on the bottom of its chairs; the Mira Chair is 96% recyclable. Ninety-nine percent of the Nissan Leaf electric vehicle (see Chapter 9) is recyclable, and the Leaf is the first mass-market commercial electric vehicle. Be Green Packaging (see Chapter 10, “Case Studies: The Global Power of the Upper Right”) designs, manufactures, and distributes Cradle to Cradle certified, tree-free, compostable packaging that is safe for people to eat from and improves the sustainability of the planet. Many companies in the U.S. lag behind Europe in terms of concern for environmental impact. Consumer attitude and government regulations, however, are leaning toward more stringent requirements (government) and expectations (consumer) for environmental friendliness. This Value Opportunity provides another means of differentiating from the competition.

In Europe, legislation toward mandatory take-back of durable goods at the end of their lifecycle requires companies to consider issues of disassembly and disposability. At the same time, legislation that durable goods must be built to enable a minimum recyclable content (around 85%, with an increase of up to 95% scheduled) focuses on the design of products with reference to the environment. In the U.S., no such legislation exists. Thus, use of recycled components and materials, and recyclable components and materials, is limited but growing. In the U.S., however, autos do have a reasonably high (75%) use of recycled materials by weight, with steel and aluminum, in particular, being processed from scrap. Nonetheless, this decision in the U.S. is purely cost driven; it is cheaper for companies to use recycled steel than virgin steel. The opportunity is here for more focus on green design and the related consumer awareness of the effort.

As Europe moves toward a higher percentage of recycled components in durable goods, its companies are exploring the idea of selling a service rather than a product. For example, car companies are considering primarily leasing or even just loaning cars that are mostly refurbished. Instead of trying to market a car as new that is mostly filled with rebuilt parts, companies would provide the car as a service, just as copier companies do with their machines. Rent, repair, and Web access are all means to make money off the service of the vehicle, and the problem of take-back disappears.

German company Bosch makes automotive equipment, navigation systems, home appliances, industrial equipment, and power tools. The company is proud of its environmental approach to the design of its products. Its design strategy takes into account aspects of the environment, such as choice of material, disassembly sequences, and separation of material in products. One aspect of its business is the sale of refurbished power tools. Many customers like to trade up to the newest models introduced. Bosch will take back the older tools and either recycle them (because they are designed for disassembly) or resell them after refurbishment. It turns out that many tools have been used for only a short time. Those are the tools best suited for resale. Bosch has introduced a chip in the tool that records parameters indicating how many times a tool has been used and under what conditions. By processing that information, they can refurbish tools and sell them for additional profit instead of disposing of them.

Core Technology

Just as aesthetics and personality target the style aspects of the Positioning Map, the core technology and quality Value Opportunities target the technology aspects. Technology alone is not enough, but technology is essential. It must enable a product to function properly and perform according to expectations, and it must work consistently and reliably. People might want more than just technology, but they expect technologies to evolve at a high rate with a constant increase in functions that are better and more consistent.

- **Enabling**—Core technology must be appropriately advanced to provide sufficient features. Core technology can be emerging high technology or well-manufactured traditional technology, as long as it meets customer expectations in performance.
- **Reliable**—Consumers expect technology in products to work consistently and at a high level of performance over time.

Quality

■ Products should be perceived to be of high quality when purchased and should meet those expectations over a long period of time.

The final Value Opportunity is quality: the precision and accuracy of producing a product. For physical products, this includes manufacturing methods, material composition, and methods of attachment. For services, interaction, and software, this includes the consistency of interaction across a product and the flexibility of a product in use scenarios. Although related to technology, the focus here is on the production of the product itself and the expectation that customers have for product quality. Products should be perceived to be of high quality when purchased and should meet that expectation over a long period of time. This value is measured by the sound a door of a car makes, the seams connecting two parts of the laptop computer, or the seamless flow of a package from pickup to delivery, for example. Although not an easy task, manufacturing technologies and assembly methods have progressed to the point that this goal is both obtainable and expected. A major argument of this book is that, by spending the time up front to create a product that meets customer expectations, the downstream production detailing and delivery becomes more straightforward. By including manufacturing in discussions early in the process, potentially costly defects can be caught and dealt with early before

economic investments in molds and assembly. Likewise, the inability to deliver the expected features in a service is addressed before the service is made available. The quality VO is broken down into two attributes:

- **Craftsmanship (fit and finish)**—The product should be made with sufficient tolerances to meet performance expectations.
- **Durability (performance over time)**—The craftsmanship must hold up over the expected life of the product.

As discussed in Chapter 8, the quality VO attributes of craftsmanship and durability are equally applicable for physical product, services, interaction design, and software. However, in the nonphysical fields, the terms *consistency* for craftsmanship and *flexibility* for durability are often used and might make more sense for companies in those fields.

Value Opportunity Charts and Analysis

The Value Opportunities provide the basis to determine what characteristics a new product must have to successfully move to the Upper Right and also to analyze why successful products exist in that quadrant. The goal is to assess the VO attributes of existing or competitor products and to create target VOs for a new product. Figure 3.4 shows a Value Opportunity chart that lists each VO class and its attributes in a column. The values are measured in a qualitative range and are expressed as low, medium, and high for each attribute. If a product did not meet any level of that attribute, no line is drawn. The assumption is that if there was any intent to focus on an attribute, there would be at least a low measure of success; if not, the blank line indicates failure. If an attribute is not relevant to a product opportunity the term “N.A.” (for “not applicable”) is used.

		low	med	high
EMOTION	<ul style="list-style-type: none"> adventure independence security sensuality confidence power 			
ERGONOMICS	<ul style="list-style-type: none"> comfort safety ease of use 			
AESTHETICS	<ul style="list-style-type: none"> visual auditory tactile olfactory taste 			
IDENTITY	<ul style="list-style-type: none"> point in time sense of place personality 			
IMPACT	<ul style="list-style-type: none"> social environmental 			
CORE TECH.	<ul style="list-style-type: none"> reliable enabling 			
QUALITY	<ul style="list-style-type: none"> craftsmanship durability 			
PROFIT IMPACT BRAND IMPACT EXTENDABLE				

Figure 3.4 Value Opportunity chart.

Below the chart are listed *profit impact* (across the company), *brand impact* (on company brand), and *extendable*. Although these are not VOs, they are included in the chart because they indicate the overall success of the product. A product in the Upper Right produces profit in a number of ways. The argument is that products might cost more, but people will pay for value. Companies can increase market share and gain stockholder and investor confidence. They can generate greater sales than other products in the company or significantly add to the existing product lines. They can increase the equity of a brand and/or broaden the equity by moving into new desirable markets. Companies such as Mercedes have always enjoyed greater profit margins. Sam Farber, founder of OXO, has stated that one of the major challenges a company has to meet is to determine the potential overall profit of a product that will cost more to produce and will need to be priced higher

than the competition. Making this decision requires the combined insight of the team and management, along with appropriate feedback from customers. It has been said that only one company can be the cheapest; the rest have to compete using design. We add that they must compete using integrated design that produces value.

One question often asked is “Doesn’t cost play a major role?” Yes, it does. However, the goal is to focus on what customers value—what they need, want, and desire—and then make decisions based on cost and the willingness of the market to pay for the resulting product. Costs can be trimmed as long as they do not change the ability of the product to deliver on the VO attributes. If a product delivers value that people need, want, and desire, they will pay for it. Smart design does not have to result in high costs. But if costs are higher than customers will pay, instead of trimming value, the product should be reassessed and possibly not produced at all; a new means to deliver the VOs should be explored.

■ A strong product and corporate brand means a higher likelihood of repeat business to the company and a higher price that the product commands.

People we have interviewed from various industries note that companies often make a “safe” decision and let spreadsheets and cost reduction become the primary ways to increase profit. Although these approaches are sound, they can actually backfire and have a short-term payoff with a long-term negative effect. As price stays the same and profit is generated through reduction in parts, cost, labor, and steps in manufacturing, companies can start to lose the ability to be innovative. They lose sight of the competition and emerging trends. Companies have to learn to balance innovation risk management with conservatively tested measures of cost controls, carryover, and parts reduction. Developing a new product without significant innovation is a bigger long-term gamble than investing in an innovative product that brings new product attributes to the marketplace. Creating a stable platform and then using mass customization to create the proper style and feature interface is one method of accomplishing this. Swatch Watch, Nokia, VW, and Apple (via the apps store) have been successful with this approach. Establishing a consistent approach to product development and then applying it creatively in different products is another. OXO and Tupperware have successfully developed new products with this technique.

Having maximized their Value Opportunities, products in the Upper Right have a strong brand identity and can have an even greater impact on the corporate brand. As stated earlier and discussed in more detail in Chapter 4, although many important factors form the brand strategy of a company, the product or service must be core to the process. Upper Right products and services have a strong brand impact at the corporate level, while products in the other quadrants tend to either be nondescript (Lower Left quadrant) or have heavily biased brand impact from

aesthetics (Upper Left quadrant) or technology (Lower Right quadrant). A strong product and corporate brand means a higher likelihood of repeat business to the company and a higher price that the product commands.

Products in the Upper Right often lead to expansions into other versions of the same product or other product lines. GoodGrips now makes more than 850 products, including pizza cutters, knives, and gardening tools. Starbucks has expanded in a number of store locations and also in environments where their coffee is sold and with product types (such as ice cream) that focus on coffee. The Margaritaville Frozen Concoction Maker comes in several different models with different capabilities and other related products. Lack of extendibility will not prevent a product from moving to the Upper Right, but the VO attributes are generally so strong that such extensions are natural.

The VO chart of a successful product is useful in trying to understand what VO attributes the product team targeted and how well the product turned out. However, the chart is most useful as a comparison against competitive products and as a means to determine what attributes a new product must have to be differentiating and successful, and possibly revolutionary. In the Value Opportunity Analysis (VOA), one chart indicates a previous product or solution to a task; the other represents the product of focus. In many ways, this analysis is easier than when considering a product alone. When focusing on the target market, understanding how previous products failed enables you to discover how much better your product is—or should be.

■ When focusing on the target market, understanding how previous products failed enables you to discover how much better your product is—or should be.

We now apply a VOA to the Frozen Concoction Maker, FIT System, Starbucks, and Adventure Series MRI.

VOA of Margaritaville Frozen Concoction Maker

Comparing the VOA of a typical blender with the Margaritaville Frozen Concoction Maker reveals why this device has become an instant hit in the market. The Frozen Concoction Maker evokes a sense of secured adventure; users can experiment with different ingredients, but they are assured that the maker will deliver their frozen drink in the best thickness and ice consistency. In typical blenders, on the other hand, the results are unpredictable. Often ice is not thoroughly crushed and the frozen drink is mixed with large chunks of ice, or the ice is overly crushed and results in a watery drink. The back reservoir of the Frozen Concoction Maker prevents the melted ice from seeping into the drink and making it watery. The Frozen Concoction Maker aesthetic has given it a specific personality, which is clearly related to the Margaritaville brand and its cool culture of

enjoying the moment and having fun. After the success of the original maker, the company has expanded its line to new models. It currently offers a cordless maker that can be carried to any destination, as well as a mixed drink maker that is capable of making 48 different types of drinks at once, further empowering the user to be in control of the party. The Frozen Concoction Maker encourages social interaction and, similar to the water cooler in the office, can be the central place to congregate.

The Margaritaville Frozen Concoction Maker is about aesthetics, ergonomics, and functionality, resulting in an enjoyable experience for users. The result of the unique combination of aesthetic and ergonomic value has a strong, fun identity. It utilizes high technology in an invisible manner and enables the user to easily interact with the blender and intuitively operate it without going through the manuals, and with safety in mind. It's easy to interact with. Although tall in comparison to other kitchen appliances, the product fits comfortably in an outdoor environment. Its operational noise is also lost in the outdoor party. The blender, on the other hand, lacks personality, aesthetic, emotional reward, and social interactions. It's no wonder almost all users claim that the high price is justified by the Frozen Concoction Maker's quality and the great frozen drinks it makes.

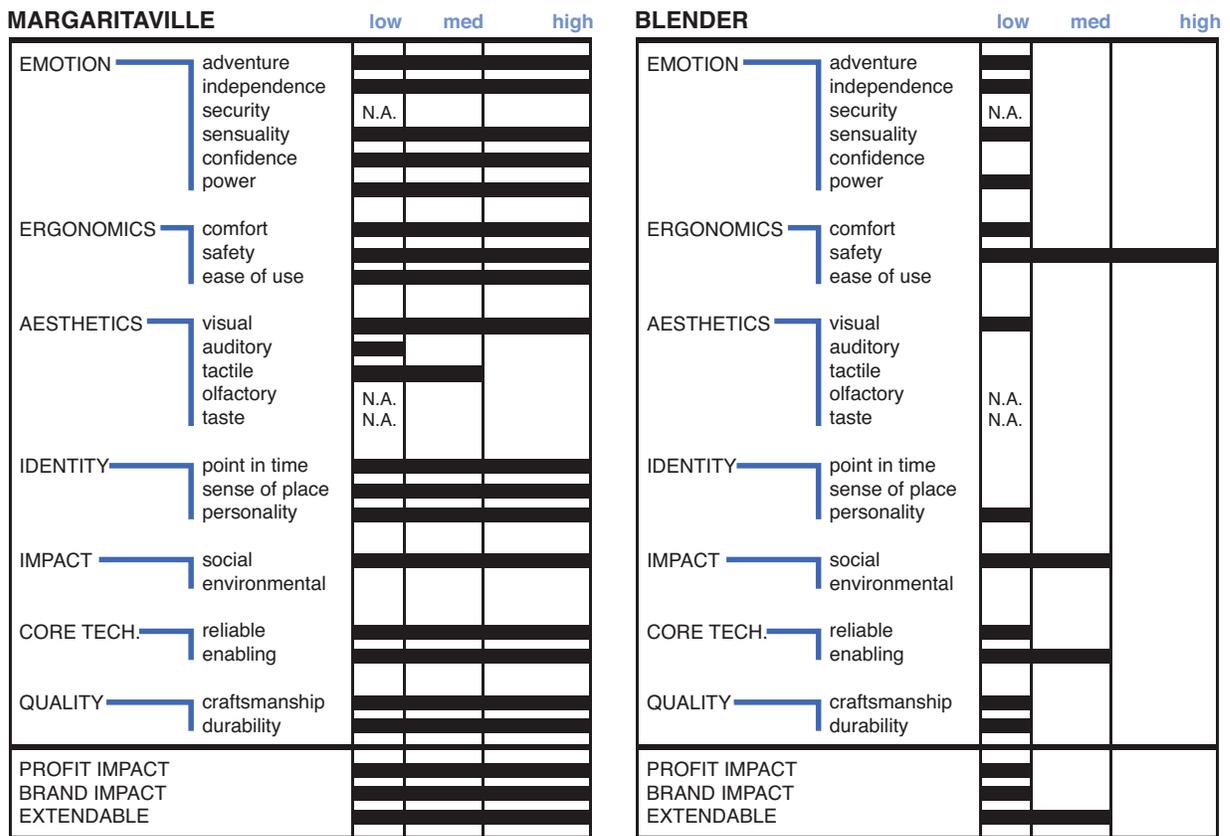


Figure 3.5 Value Opportunity Analysis of Frozen Concoction Maker versus blender.

VOA of BodyMedia FIT System

Two competitive VOAs can be compared to the BodyMedia FIT System. The first is the clinical VOA that includes both the sleep lab and the metabolic cart, which, as Figure 3.6a shows, is quite sparse. In a clinical product without regard to the Upper Right, little positive emotion is designed into the product. The environment is neither comfortable nor easy to use: The patient needs to wear leads and sleep in a lab or has a tube in the mouth to breathe into. Aesthetics are also bland. The core technology, however, is its strength, enabling and providing reliable results. The technology itself is durable, although parts are disposable. There is no brand recognition, yet the product does enable a profit based on the charges to stay in a sleep lab or use the metabolic cart.

Figure 3.6b shows the pedometer as the consumer competitor. Here the VOA shows more attention to the value proposition than the clinical lab. Some emotions result from the capability to take a level of control over one's health and be able to explore the environment while walking or running. Pedometers are extremely easy to use and comfortable. Aesthetics become more important, with a range of visual and tactile aesthetics in different models. They clearly belong in the equipment of those who are exercising but are generally indistinguishable. Although people often like to exercise with others, pedometers neither encourage nor discourage such interaction. They have basic technology that delivers useful information, but at the time that BodyMedia was developing the BodyMedia FIT System, pedometer technology was quite basic, using a mechanical lever mechanism. Most pedometers are basic in their overall quality (although some are built well). Finally, the prices and the costs are both low so that a decent profit can be made.

Contrast this with the VOA for the BodyMedia FIT System (see Figure 3.6c); note that the VOA for both the clinical and consumer products is the same at the chart level, although product requirements might differ slightly. The product pays attention to all aspects of the value proposition that customers seek. The product enables an emotional connection. People can go anywhere they want and track their performance. A sense of luxury accompanies using the FIT that enables a feeling of confidence and power in people who take control of their health. From an ergonomics perspective, the product is comfortable to use; that comfort has increased over multiple iterations of the product so that today it is very comfortable—people almost forget they are wearing it. Most important, the FIT is extremely easy to use. It also looks great, with a contemporary aesthetic and brand recognition that fits into people's daily lifestyle and that makes people proud to wear it. Unlike the previous competitors, the FIT enables communities of people that connect to discuss their health and healthy lifestyle; some present their

achievements in their blogs, and others offer competitions to see who can burn the most calories. However, the product cannot yet be designed with sustainability in mind. BodyMedia paid attention to the technology and manufacturing qualities, making a product that is effective, well made, and durable (it can even get wet briefly).

The BodyMedia FIT System has a strong differentiating brand, with strong profit impact that includes a “razor blades” model of recurring revenue based on its service. The product platform has demonstrated its extendibility, progressing from the clinical to consumer markets. APIs allow for integration into a range of systems; for example, you can watch your Panasonic TV and see your caloric burn rate on the screen.

Although two somewhat different products were used for the clinical and consumer markets, the VOAs for both are quite similar. The consumer version includes the service component, potentially amplifying some of the VO attributes. And some aspects of the product, such as its size, have only made the overall experience better.

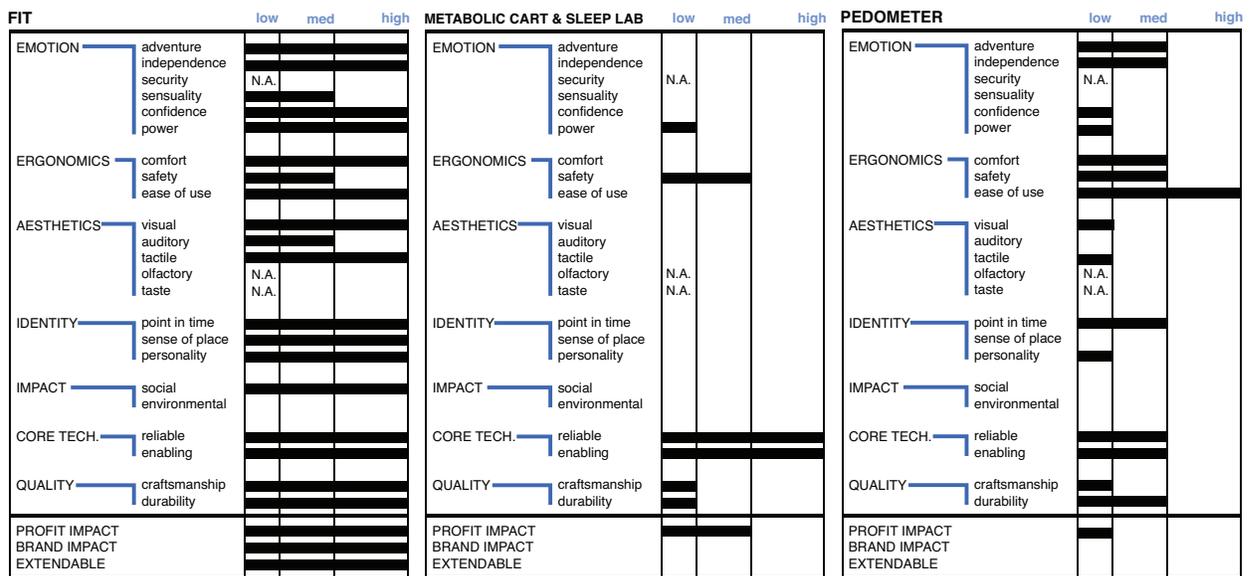


Figure 3.6 Value Opportunity Analysis of BodyMedia products versus clinical sleep lab and metabolic cart and consumer pedometer.

VOA of Starbucks

We now turn to a Value Opportunity Analysis of Starbucks (see Figure 3.7). Recall the SET Factors in Seattle and the target market of professionals with disposable

income. The previous focal points for coffee and conversation were coffee shops (our choice of comparison), diners, and doughnut shops. The typical coffee shop had reasonably tasty and reliable food and a pleasant but often dated and nondescript atmosphere. Patrons gathered to socialize and eat, but they didn't consider it a leisurely environment, a particularly inviting space, or the place to "be seen." Instead, there was a level of independence with a focus on food and often a sense of adventure to find the really distinct environment with the great specialties instead of the usual mediocre fare. Coffee shops are reasonably profitable but typically lack any brand equity or ability to expand.

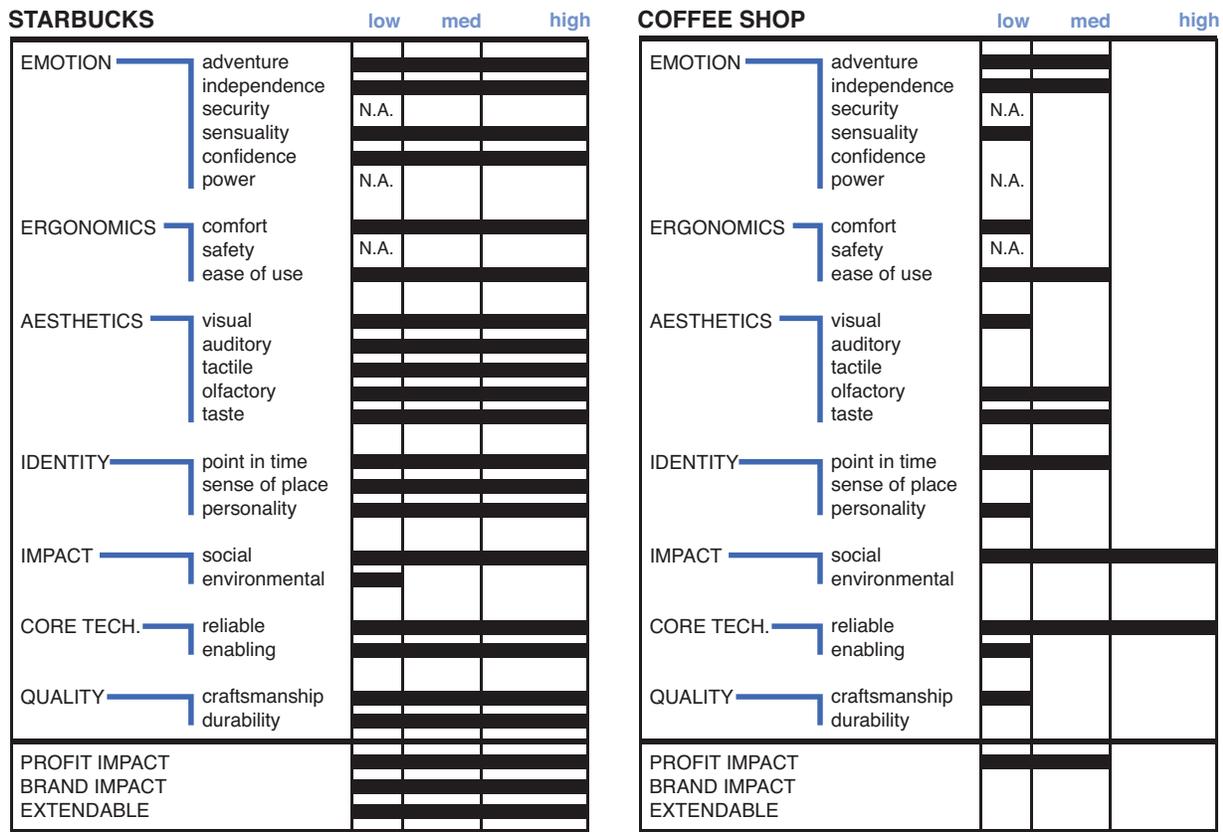


Figure 3.7 Value Opportunity Analysis of Starbucks versus a coffee shop.

Diners and coffee shops are as American as the apple pie they serve. However, as the SET trends shifted, the environment, atmosphere, and perceived quality of food and coffee diminished. Diners gave way to fast food chains that created increased speed and established a threshold of consistent value at low prices. As the cycle continued, fast food lost its perceived value and an opportunity arose for Starbucks to create a new solution that promoted coffee first and food second. Its

standard was higher, and so was the price. The environment changed to create an appropriate atmosphere for purchasing and experiencing a higher-quality coffee than could be purchased at a fast food chain or at the few remaining diners. Starbucks saw the POG. It created the new experience for people, allowing them to take a few minutes out of their day to relax and enjoy the company of others or to read a good book.

Starbucks is a stark contrast to fast food and a shift from the classic diner. Here the emotion, ergonomics, aesthetics, complete identity, core technology, and quality VOs are at a maximum. Starbucks' ability to capitalize on all Value Opportunities is an indication of its success. It even has strong impact VOs, with the creation of a social gathering place and its concern for the environment through recycled paper goods. The result is that Starbucks has high profit margin on their products (today we can pay more than \$6 for coffee and milk under such names as latte, cappuccino, double espresso, and caramel macchiato). Starbucks has clearly demonstrated how value and strong identity enabled an expansion into more than 17,000 stores in nearly 50 countries, with products available in airports, turnpike rest stops, and supermarkets.

VOA of GE Adventure Series MRI

The VOA of the GE Adventure Series against the typical MRI equipment (see Figure 3.8) demonstrates the significant impact that the new and improved device has had on the journey of a child through an imaging process. Although typical MRI machines are highly reliable in terms of their core technology and their imaging results, the interface of the products lacked the fantasy value that the GE Adventure series has. The Adventure Series contributes value across the board. It builds a strong emotional connection with the child through story telling and creates an environment that motivates the child to voluntarily participate in the process and complete it as an epic mission. The entire room becomes part of the stage by stimulating a child's different senses through sound, color, texture, and smell, resulting in an attractive, dynamic aesthetic. Its impact goes beyond its direct users, the children, and affects other stakeholders, such as parents, nurses, and physicians, and makes their experience in the imaging room less troublesome and still reliable. The value proposition is based on the interface design, but the overall impact is significant to the effectiveness of the MRI or CT scan experience.

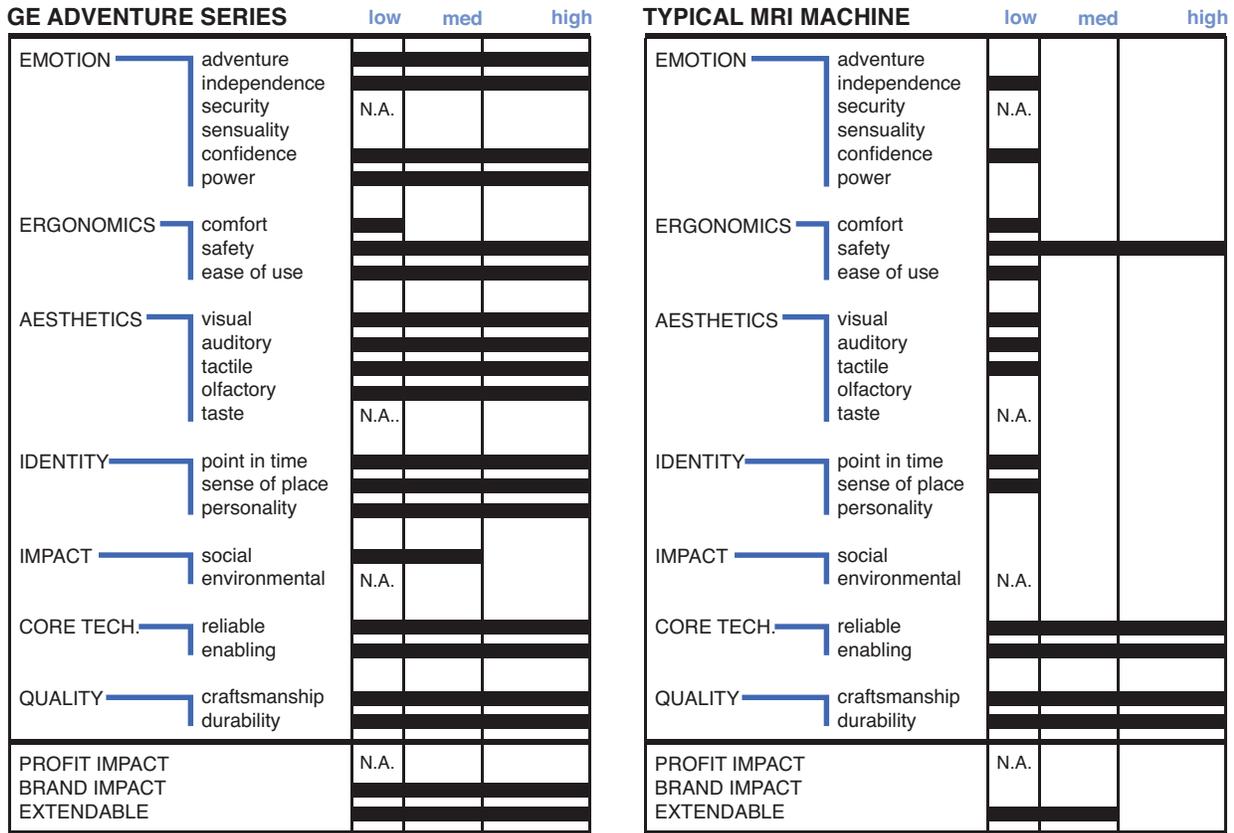


Figure 3.8 Value Opportunity Analysis of the Adventure Series versus traditional MRI.

The Time and Place for Value Opportunities

Just maximizing the Value Opportunities isn't enough to guarantee an Upper Right product. Two critical issues must be considered. The first is that mechanically finding ways to just increase the VO attributes, as you perceive them, is doomed to failure. The VOs must be maximized based on the product stakeholders' perception of value. Furthermore, the VOs must work in concert to create a complete product in the Gestalt sense, not a set of features that each work in their own independent way to achieve an aspect of an experience. To enable a team to successfully reach a complete design requires a vision—and usually a visionary. Often a core team or even an individual has the vision of what the product should be—not in a detailed

sense, but in the POG sense. In large companies, the visionary is often not part of the core team, but rather is a manager in the position to fund and protect the core team. Upper Right products don't just satisfy POGs; they satisfy the vision of how the POG affects society and the SET Factors.

The second critical issue is to recognize that VOs are a representation of the SET Factors at a given point in time. SET Factors are dynamic. If the company does not keep a sense of the pulse of change in the target market as the SET Factors and VOs change, an Upper Right product today can easily become a Lower Left product tomorrow when a competitor recognizes the new SET Factors and creates a product to meet a more current POG.

VOs and Product Goals

The VOA chart is only half the battle. The chart captures which VOs are important, how important they are to the stakeholders, and how a potential product can differentiate from the competition. But it does not yet communicate how to achieve these VOs. The VOA does not apply generically to the design of all products. Instead, it provides the basis for developing product-specific goals. Each VO attribute needs to be interpreted within the context of the SET Factors and specific POG for a given market and user type. For each VO attribute, what must the product do to deliver on the designated level of value?

Figure 3.9 shows specific goals for each VO attribute for the FIT System. In these examples, a single product goal is given for any particular VO attribute. In reality, several product goals often emerge to deliver each VO. Knowing what customers want is the result of insightful user research, as discussed in Chapter 7. Those user insights are then mapped onto the VOA and the resulting goals provide an early set of product requirements. You don't know what the product is, but you know what the product must achieve to maximize the value proposition.

FIT

<p>EMOTION</p> <p>adventure independence security sensuality confidence power</p>	<p>Allow user to be able to use product outside of the lab Freedom to use the product in private or anywhere without constraints N.A. Freedom to use the product in private or anywhere without constraints Actionable personal information to help user lose weight and stay fit Ability of user to take ownership of personal health</p>
<p>ERGONOMICS</p> <p>comfort safety ease of use</p>	<p>Be as small as possible while still being able to hold a battery. Armband has enough stretch to move with you without falling off or cutting off circulation; not bulky; enjoyable to wear Will not casue abrasion or rash on skin; will not cause injury Easy to don one-handed; turns on when on skin; Bluetooth enables data to directly upload data to computer</p>
<p>AESTHETICS</p> <p>visual auditory tactile</p>	<p>Needs to be aesthetically pleasing for user to wear continually and in the long term; clinical version must be clinical looking without seeming cold; consumer version must be friendly but serious Provide feedback to user when memory is full and battery is low User is able to wear product for extended periods of time on skin under different temperature and humidity conditions</p>
<p>IDENTITY</p> <p>olfactory taste point in time sense of place personality</p>	<p>N.A. N.A. Must use latest technology and be contemporary with regard to health Device needs to fit in with user's daily and varied lifestyle Must look unique; user should have option of wearing as badge of honor or more subdued; needs to fit under shirt as well as openly on arm</p>
<p>IMPACT</p> <p>social environmental</p>	<p>Online system should connect people interested in healthy lifestyles; enabler of conversation about health and pride over accomplishments with repect to energy exenditure</p>
<p>CORE TECH.</p> <p>reliable enabling</p>	<p>Create accuracy that can be replicated only in the lab Accommodate and integrate accelerometers, galvanic skin response, temperature, and heat flux sensors; provide user with the means to take control over health; deliver energy exenditure data in a format that the user can understand and use</p>
<p>QUALITY</p> <p>craftsmanship durability</p>	<p>Provide a device that is both well designed and well made, with clean lines, smooth edges, and water-resistant seals Create a device that can be used across as many daily activities as possible, including vigorous exercise; must be water resistant and hold up to moisture and sweat; easily cleaned; worn 24-7 for multiple years</p>
<p>PROFIT IMPACT BRAND IMPACT EXTENDABLE</p>	<p>Service model enables ongoing revenue stream First to market, clear aesthetic and visual identity, scientific validation, and IP protection will establish strong brand Initial clinical market extendable to consumer market; system model will include APIs for partnership and extensions</p>

Figure 3.9 Value Opportunity goals for BodyMedia FIT System.

■ With the VOA, you don't know what the product is, but you know what the product must achieve to maximize the value proposition.

Just claiming that a new product will maximize all the VO attributes would be easy. To be useful, the team must determine *how* the product will maximize each relevant VO. In examining the VOAs of the products in this chapter, it is clear that breakthrough products are able to “fill the white space” that remains in a VOA from the competitor or predecessor product. If a current-state VOA looks sparse, then an opportunity arises for a new product to deliver high value to the user. In some cases, it is only a particular VO attribute that differentiates the previous product from a potential new product; in that case, captivating the marketplace might be more difficult, but it will be obvious where to put the innovation effort: in that particular differentiating VO attribute.

When the set of product goals is determined for each VO attribute, as many as 50 to 100 or more requirements can result. In this case, the team must prioritize the critical goals to achieve. Goals can be categorized into those that *must* be achieved, those that *should* be achieved, and those that *could* be achieved. An initial approach might be that all VO attributes rated high must be achieved, those rated medium should be achieved, and those rated low could be achieved. However, in some situations, either industry standards or areas that are not differentiated but are still necessary (such as with safety) must still be achieved. In addition, some product goals might be derived from a high value level but, in practice, might be less critical than others.

Having clarity through the Fuzzy Front End is often difficult. The process of using the VOA to capture user insights and develop product requirements can be a powerful driver of the iNPD process. This process typically makes downstream activities more effective and efficient, and helps guide the team to create a breakthrough product.

The Upper Right for Industrial Products

What is striking today is that Upper Right products that enhance experiences or fulfill dreams are emerging in all types of industries. Crown's Wave (discussed in Chapter 11, “Where Are They Now?”) is one example of a product category (warehouse personal lifts) that previously had no recognition of the need for style and value. The Beyond Blast machining tool by Kennametal (in Chapter 9) is another. Electronic test equipment has found the value in adding style to an otherwise banal industry. Fluke's consistent yellow-and-gray styling, clear brand identity, and ergonomic design separate its product from the pack.

Even traditional commodity manufacturers are making the move to the Upper Right. VistaLab Technologies manufactures pipettes used in various laboratory

applications, including sample preparation, reagent addition, and other precision liquid-handling tasks (see the accompanying sidebar). The company has been working closely with a major design firm to design ergonomic, styled products. The company recognizes that, even in the conservative laboratory supply industry, adding value through style and ergonomics adds to the experience of using the product and separates the company from the competition. By improving the balance and feel of a common laboratory tool, technicians can feel better about their work and themselves.

Dave Smith, leader of the design of the Wave, comments, “When you design a product you don’t change who the customer is. When you get up in the morning, you use your electric razor and clean yourself by dispensing soap from the pump container. You go downstairs and get ice and water from the door in your refrigerator. You get in your car and insert your key, and away you go.” All of these products are designed to meet your value needs, wants, and desires.

Smith then says, “You get to work and all of a sudden you are supposed to change? It doesn’t work that way. You have a basic expectation of product features and form. You evaluate your environment based on cumulative experiences.”

So if you are a manufacturer of clamps or bolts, why should your customer have to sacrifice what is expected in personal purchases? Think about an ergonomic clamp or bolt, much as VistaLab has considered an ergonomic pipette. Creating such an Upper Right product could significantly differentiate you from your competition and raise the level of expectation of the customer who needs to assemble your product.

In addition to enriching the work experience on the assembly line, consumers are now demanding an aesthetic for the interior of products. The trend began with the original iMac, where translucent exteriors meant that the aesthetics of the interior of the product mattered. End users saw each and every component, so the style of their assembly became critical to the overall success of the product.

The same is true in other products previously considered impervious to the issues of style. Engine compartments in cars must now capture the theme of the vehicle, even though the customer is likely to open the hood for the first and last time in the showroom.

From supplier parts to complete Original Equipment Manufacturer (OEM) products, high-value products are the leaders today. This and the previous chapter explained the characteristics that make a product move to the Upper Right. The book now turns to a process of how to get there—strategic commitment, brand management, and a well-developed, user-centered iNPD process.

VISTALAB DESIGNS THE FIRST ERGONOMIC PIPETTE

For more than 45 years, VistaLab Technologies has made pipettes and other liquid-handling products. Its original pipette is a 40-year-old product sold to the laboratory market, which is very conservative in buying habits. Many lab technicians were trained on the VistaLab product and are still using it many years later (see Figure 3.10). The current market is competitive and cost driven. VistaLab's original product is still made from metal, whereas competitors use plastic and tend to have much lower production costs.

The VistaLab Product Development Team, led by Vice President of Product Development Jeff Calhoun, decided that, instead of catching up to the competition, they needed to leapfrog the competition and “do



something very different.” The problem with most pipettes is that they are not ergonomic because the piston is in line with the pipette tip. When the thumb pushes down, its angle is unnatural and can be hard to control. The other extreme is fully electronic equipment in which the technician controls the liquid distribution electronically instead of with finger pressure. The design team discovered that lab technicians like to control and feel the liquid moving in and out of the tip themselves by pushing the piston. VistaLab rethought the process and decided to create an ergonomic pipette with a shape that was determined by the human anatomy, not design convenience. They also chose to use electronics to assist the technician in setting the adjustable volume instead of overautomating the liquid-handling process.

Figure 3.10 Original VistaLab pipette product. (Reprinted with permission of VistaLab Technologies)

The design team hired Frog Design from New York (how else to leapfrog the competition?) and worked closely with the firm to create the Ovation ergonomic pipette, shown in Figure 3.11. The goal was a radical departure from the standard design, capturing a creaturelike and emotional form that was easy to approach. The team performed a detailed ergonomic study (a task analysis discussed in Chapter 7) of the mechanics of using a pipette. It combined primary research with VistaLab's cumulative and intimate knowledge of the customer to create this Upper Right design. The company is clearly making a statement of how style and ergonomics can merge with technology to create a differentiating, high-value product. In 2001, the product won the Gold Industrial Design Excellence Award for the industrial and scientific equipment area by the IDSA and sponsored by *BusinessWeek*.

In the decade since the product was released, evolutionary design has enabled the introduction of multichannel versions (see Figure 3.11) that follow the ergonomic form of the original but enable more efficient use with microtiter plates (with multiple small wells). A more automated electronic singlechannel version was also produced for customers who need advanced functionality such as serial dilution and repeat dispensing. The product family doubled sales revenue for VistaLab. One approach to help customers get comfortable with the unusual shape of Ovation pipettes was the introduction of a demo program. More than 50% of the people who try the product decide to buy it. After ten years, there is still no competitive product in the market, partly because of VistaLab's aggressive approach to IP, with eight issued patents and another two pending.



Figure 3.11 VistaLab's new ergonomic pipette: both single and multichannel versions. (Reprinted with permission of VistaLab Technologies)

The Upper Right of Commodity Products: Trading off Value among the Aluminum Can, the Plastic Bottle, and the Glass Bottle

Value isn't just for high-end products. Even commodities have a value proposition. A VOA highlights the benefits and challenges and a means to differentiate to manufacturers in these industries. Identifying points of differentiation creates an opportunity to develop better, higher-end products or to highlight differences in communications. For many years, glass bottles were the only containers for Coca-Cola. In the 1950s and 1960s, aluminum cans became popular, followed by plastic bottles in the 1970s. Each container carries both high and low value attributes. For the materials manufacturer, recognizing what advantages and disadvantages their material contributes to the value proposition is critical to differentiating future products, and the marketing and other communications about those products. Consider the VOAs of all three (see Figure 3.12).

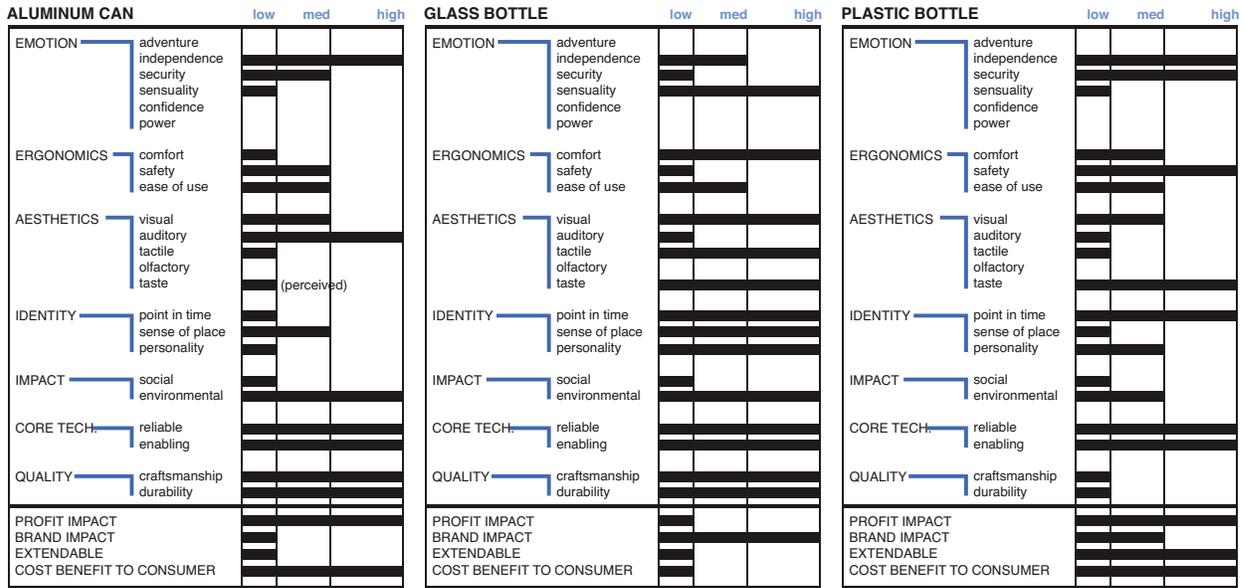


Figure 3.12 VOAs of beverage containers: the aluminum can, glass bottle, and plastic bottle.

The glass bottle is clearly the most sensual, comfortable, and both visually and tactilely appealing of the three. It has a strong identity and stimulates fond memories of earlier times. It carries no taste and is perceived to be the most enjoyable to drink from. It is also high in its sustainability factor. However, it is more difficult to use, in that it is harder to open and has the potential to break, keeping the user less secure. The glass bottle manufacturer needs to leverage its strengths and turn the negatives into positives (such as the emotion and satisfaction of drinking the beverage after that cap is off).

The aluminum can is always easy to open, and the satisfying sound of the carbonation escaping augments the experience. The aluminum can is strong in sustainability, an attribute that makes it more desirable than the plastic bottle. But there is a perception (even if false) that the aluminum leaves a taste in the beverage, and the experience itself of drinking from the can is unexciting and unappealing. The aluminum can manufacturer needs to highlight the environmental benefits of recycling cans over using plastic. Aluminum manufacturers have developed a container in the shape of the bottle with a screw top to compete with glass and plastic, but it is not clear how competitive it is.

The plastic bottle is the most secure; the bottle can be resealed when it's not being used. It is also the safest bottle, in that it won't break and doesn't have the sharp edges of a can. It can be molded to comfortably fit in the hand and can echo the form of its distant cousin, the glass bottle. But it is flimsy to hold and generally unattractive. And it leaves a negative footprint on the environment; even if it is

recycled, the cost of reusing the material is high and the reused material has limited applications. The plastic bottle manufacturer needs to emphasize the safety and ease of use while indicating that there are recycling possibilities.

Summary Points

- Value is no longer the most features for the lowest cost. For breakthrough products, value is lifestyle driven, addressing the qualities of a product that make it useful, usable, and desirable.
- Breakthrough products fulfill a fantasy by facilitating a more enjoyable way of doing something.
- Seven basic Value Opportunities differentiate a product and contribute to the overall experience of use: emotion, aesthetics, identity, ergonomics, impact, core technology, and quality.
- VOs are relevant at a point in time and within the context of a product opportunity. They provide the basis for developing product-specific goals to meet the needs at that time.
- All industrial products are candidates for the Upper Right by addressing ergonomics and lifestyle effects in conjunction with technology features.

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Chapter Four

The Core of a Successful Brand Strategy: Breakthrough Products and Services

At the core of any brand strategy is the successful experience of using a product or service. Identity, advertising, and distribution cannot correct the failure of a product to perform as expected. Thus, as this chapter discusses, all members of product development teams must understand and participate in brand development. Customers purchase breakthrough products to support their lifestyle values. They also identify with companies that represent values compatible with their own. Developing a successful product brand begins with understanding your customers' values and connecting that awareness to the broader goals of your company's values. Those values are then captured in a unified strategy. The strategy, often articulated as a mission statement, flows to programs, products, and satisfied customers. This chapter presents ideas and methods to build and support both corporate and product brands, and it highlights products that have successfully achieved this.

Brand Strategy and Product Strategy

We have established the fact that the best product opportunities materialize from emerging trends that are the result of changes in the SET Factors. These changes generate Product Opportunity Gaps (POGs) that must be broken down into Value Opportunities (VOs). VOs must be then translated into product features and style. The process of identifying VOs and converting them to product characteristics begins with a corporate and product brand strategy, the focus of this chapter.

■ If new companies establish their brand by accident rather than by design, reinventing or cleaning up the brand later becomes expensive and difficult.

One of the most powerful forces driving contemporary businesses today is the development and management of brand. Graduates in MBA programs study brand, and many consulting firms are experts in advising companies on brand. Other core disciplines in the product development process also need to be aware of the relationship between a company's overall brand strategy and how that affects the new products it develops. In addition, the products that a company markets both deliver and define the brand, regardless of whether a strategy has been defined. In small, emerging companies, it is important to understand that the first products developed establish the brand of the company. If new companies establish their brand by accident rather than by design, reinventing or cleaning up the brand later becomes expensive and difficult. BodyMedia started the right way and built naturally, but not all companies have that foresight. Interdisciplinary teams need to have a shared vision of the brand when developing products. The vision needs to balance the everyday expectations of the customers in the intended market with the longer-term strategy and mission of the company. Imagine if Apple's electrical and mechanical engineers did not buy into the commitment to design the original transparent iMac. Equally important was the need for the manufacturing engineers to

commit to the quality needed to produce transparent and translucent parts without flow lines. The industrial designers also needed to design parts with a clear understanding of the visual effects of the interior components. All of these groups needed to work in unison to deliver an aesthetic result that was flawless in execution and that built on the brand history of innovation and user-friendly personal computers that the Apple II and Macintosh had established two decades earlier.

Apple's integration of design, engineering, and brand continued in every product it has produced since. The iPod, iPhone, and iPad all have a consistent brand strategy that starts with Apple's focus on intuitive interface design, as well as a strong influence from the visual form language of Braun products developed decades ago under the direction of Dieter Rams. Apple engineers have been able to work with programmers to design hardware that requires less energy and allows for longer battery life per day. The core product you interact with is connected to a series of services that are all easily accessed on the interactive screen on each product, an interaction that is consistent across all products.

A company's products should reflect the brand decisions a company makes. The Aeron chair, which redefined ergonomic and aesthetic expectations in office seating, makes a major statement about the brand of Herman Miller. The company chose to produce a chair based on ergonomic comfort instead of one based on a traditional office hierarchy. This decision is a clear statement that Herman Miller supports—literally and figuratively—the concept of lateral management and comfort over rank. The name Aeron, like the chair itself, is equally contemporary and ethereal. A decade later, it is still a successful chair and Herman Miller has released several new designs. The Mirra Chair has also been a successful evolution in breathable seating at a lower price point and in one size.

D. A. Aaker describes brand identity as “a unique set of brand associations that the brand strategist aspires to create or maintain. These associations represent what brand stands for and imply a promise to customers from the organization members ... by generating a value proposition involving functional, emotional or self-expressive benefits.”¹ Aaker further shows how the product is core to the brand, yet the brand is more than the product alone.

Where does a company's brand value and identity reside?

- Is it in the goals and mission statements that flow from the CEO down through management to particular divisions, programs, and products?
- Is it in the products and services that a company offers and produces?

- Is it in the corporate identity, advertising, and public persona that a company adopts to communicate its message to the public through formal and informal media channels?
- Is it in the experience that a customer has when interacting with the product or service?
- Is it in the perceived success of the company by investors, stockholders, and the economic community-at-large?

The answer to all of these questions is, yes! Many companies, however, often focus on one of these over the others. They fail to see that the branding process is a cycle that must be constantly monitored and ready to react to change. A product or service is integral to maintaining the brand value of a company. When a company produces products that are consistent with the brand strategy, all aspects of the brand work in unison to effectively compete in the marketplace. However, the failure of a product to communicate the brand value of a company to a customer can negatively affect the brand image, and no other channel can successfully offset that effect. A strong advertising campaign cannot offset a bad product, nor can updating an identity program overcome a poorly conceived product. If a company learns to build a message around the relationship between its customers and its valued product (the product experience), everything else flows from that. The brand, values, and relationship to the customer should all be represented in the mission statement of a company and in the brand identity of its products.

Brands must build on a core tradition and adapt to the current SET Factors. This was a major factor for Navistar in developing the LoneStar (see Chapter 9, “Case Studies: The Power of the Upper Right”). One of the oldest companies in America, Navistar had a long tradition of producing durable products for middle America. However, the brand lost its luster as the company focused on cost reduction in the second half of the twentieth century. At the turn of the century, the company reinvigorated its brand by reading the SET Factors and delivering innovation that introduced new capabilities while also addressing the changing needs, wants, and desires of the driver. Yet at the same time, it maintained its tradition of American values. The LoneStar was the first product introduced to be the lead statement for the new brand strategy. It redefined the expectation of a sleeper cab designed to haul goods across the country with power, aerodynamics, and fuel efficiency. It also redefined the drivers’ perception of truck style and internal comfort designed for the on-the-road 24/7 lifestyle.

■ A successful product must connect with the personal values of customers.

A successful product must connect with the personal values of customers. A product experience includes both the expression of the product and the interaction with the product. Customers are looking for three basic things from a product that will improve their lives:

1. Is the product useful? Does it enhance some activity or allow them to accomplish an activity that is important to them?
2. Is the product easy to use? Does it stay consistent in use throughout the expected life of the product?
3. Is the product desirable? Does the product respond to who the customers are as people and complement how they want to project themselves to others?

P&G accomplished this type of breakthrough in the redesign of Herbal Essences. The understanding of SET Factors for Gen Y women gave P&G an opportunity to rethink the category. The design of a new package shape created a clear visual connection to both shampoo and conditioner, making it stand out at point of purchase with useful contours that comfortably fit in the hand even when wet. The use of color and creative descriptions created subcategories for particular types of hair, making it desirable. The development of new combinations of hair chemistry delivered on usefulness through performance attributes of hair in daily life. These same issues exist in complex products. A truck is useful if it allows you to deliver goods from one place to another in a timely fashion. Some trucks are easier to use than others; some have controls and settings that are easier to adjust to particular sizes and preferences (for example, some are designed to be rented for a day, whereas others require a different grade license and training). People who drive long distances also want a truck that is more like their home; many who own their own big-rigs modify the interior because, before the LoneStar, no truck had the comfort and features of their own home.

The more complex the product and the larger the company, the harder it is to deliver on these three simple objectives. Developing a useful, usable, and desirable product that creates a meaningful connection between the identity (brand) of a company and the personality and needs of a customer is hard enough. Creating that relationship and making a profit is the major challenge. Finding the position between mass production with low margin and smaller-run niche markets at higher profit margins is a challenge companies must contend with. How low can Mercedes go with the cost of its cars before it negatively affects this brand of exclusivity? How can Hyundai get into the higher-price markets and extend its brand out of economy?

The product, the customer, and the product experience must be the core throughout the whole company. For teams to succeed, they must:

- Focus on a shared, consistent understanding of who the customer is
- Respect one another and recognize how each area of the company contributes to the product experience for each and every stakeholder
- Recognize that their approach, attitude, and end product all form the basis for the product and corporate brand
- Recognize that the value base and affiliated qualities the customer seeks must drive the product development process

In *The Brand Gap: How to Bridge the Distance Between Business Strategy and Design*,² Marty Nuemeier discusses the fact that many companies do not recognize the role of the customer in defining their brand. Nuemeier says that brand is not what the company thinks it is, but rather what “they” (the customer) say it is. To build and maintain brand value, Nuemeier describes five essential activities: A company must differentiate from the competition; collaborate across the company, with its specialists, consultants, and customers; innovate in how it presents and delivers the brand to its customers; validate the brand to make sure it appropriately resonates with customers; and cultivate the brand to grow in a dynamic way. If the product, customer, and product experience remain core to a company, the brand will connect and evolve with SET Factor changes. Managing brand is the job that never ends; it is just a question of when to make evolutionary changes and when you need to be revolutionary.

Corporate Commitment to Product and Brand

The development of products and services in the Upper Right requires a commitment at all levels of the company, from the CEO, to middle management, all the way to the engineers, designers, marketing and finance personnel, and others responsible for actually creating and producing the product. As Figure 4.1 shows, four fundamental levels to this commitment feed back and continuously refine the process for the company. First is the corporate mission itself, the strategic goals that drive the company’s long- and short-term goals. From that mission statement, program planning takes place, where the goals and resources of a product development program are defined. Next, product development takes place, with the outcome being a product or service that will be sold to a target customer group. If the

product meets or exceeds customers' expectations, they will be satisfied. And if customers are satisfied in a true sense—the product is useful, usable, and desirable—the product will sell and be profitable for the company, fulfilling and reinforcing the main goals of the corporate mission.

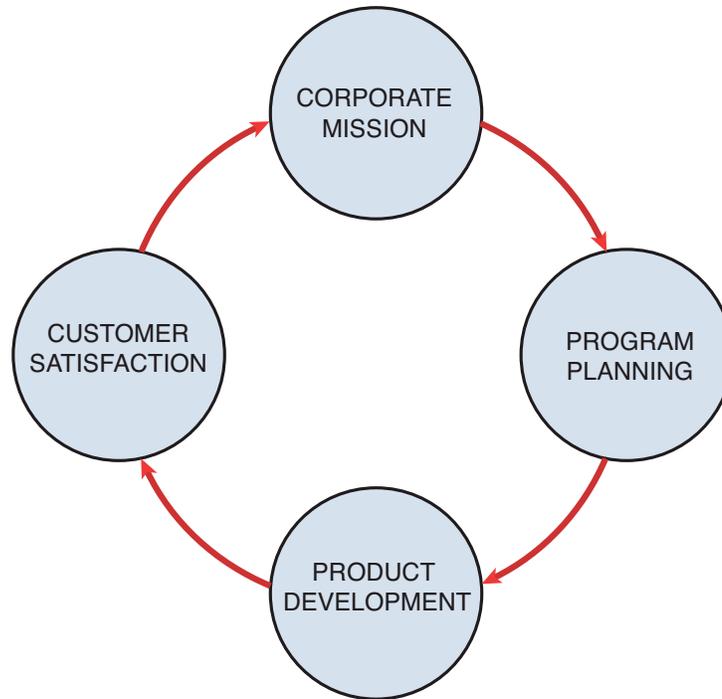


Figure 4.1 The cycle of product development, from corporate mission to customer satisfaction.

If the process succeeds and customers are satisfied, then shareholders and investors make money and they, too, are satisfied and further reinforce the corporate mission. If the process fails, then investors, often impatient and unforgiving, might require a change to the corporate mission and management. All too often, companies focus on cosmetic changes to keep shareholders happy. Ironically, companies that instead focus on the product, with the goal of creating a highly valued product, maintain the long-term satisfaction of the shareholders.

Program planning is critical to the overall process. It is this level of middle management's responsibility to translate the goals of the CEO or president into a successful product in the marketplace. When programs are over budget, are late, or fail to meet profit targets, this level of management usually is to blame (or is given the blame). Thus, a coherent process and approach to managing that course of action improves the chances of a product succeeding in the marketplace.

■ To develop a product within the mission of the company, the entire organization must have a consistent view of the brand strategy.

To develop a product within the mission of the company, the entire organization must have a consistent view of the brand strategy. Because a number of individuals and levels in a company affect the brand message, experiencing a break in the continuity of communication is easy. Product planning groups at the upper level of a company might not have a clear communication channel to the teams developing the products or the customers they are designing for. Outside consultants can be in conflict with internal working groups. Advertising companies might design the look and feel of an ad campaign without contact with the product team. A consulting firm might design a logo, Web site, or support literature without any contact with people working directly with the product. We cannot emphasize how important it is to have a shared vision of the company and the customer and to maintain an open dialogue early in the process. Keeping key decisions consistent and sequenced appropriately is also important. Deciding on a name or graphic identity could be premature until the product characteristics are clear. Committing to an arrangement and number of features might occur too early and force major engineering changes downstream. The visual aesthetics cannot be decided until it is clear that the form connects with the lifestyle image of the intended customers. All of these decisions put tremendous pressure on middle management to regulate the flow of information up and down the levels of a company and into and out of the company between inside groups and outside consultants and suppliers. It also puts pressure on a process of creating parallel decision paths that must integrate at each critical phase.

This is true for large, established companies as well as for small startups. A small company has no middle management, but the effort to project the brand and understand the implications of the initial product on the brand is critical; the initial product *is* the brand. Yet the reality of startups is often that the product is usually developed first and is often the only focus, given limited resources and the need for revenue. Taking the time to define the corporate mission and plan the product to deliver on that mission allows the company to strategically and thoughtfully define its brand up front instead of having to attempt to redefine it later. As a startup, BodyMedia had limited resources and needed to develop its first product while moving toward production. However, the company took the time to define its long-term strategy and develop a plan to get there. BodyMedia created a company logo and product aesthetic, and maintained a focus on ergonomics and comfort in its very first product. As the company followed its strategic plan—even if that plan matured and changed over time—it had a consistent approach to developing the brand, which aided the product and company awareness in the clinical and then consumer markets.

The process from corporate mission to customer satisfaction begins with a corporate strategic commitment to the process found in both the philosophy of and structure for product development. The philosophy is found in the brand identity of the company and its products. The structure is found in an integrated new product development (iNPD) process that puts the user in the center.

Corporate Values and Customer Values

A company's brand identity relates to the values it represents and how they resonate with its customers. As Chapter 3, "The Upper Right: The Value Quadrant," discussed, consumers need to connect their product purchases with their own personal values. When a product does connect, customers are willing to pay a higher price and/or are more likely to return to the company for the next purchase. Everyone has two distinct types of value systems. One acts on a broad social level; the other is personal. Although they are often connected, they need not be. In general, a company's overall actions connect with the broad social values, while the products and services it provides connect with the personal values. Chapter 3 discussed the Value Opportunities that enable a product to enhance a user experience with the product through personal values. However, a company's values can also have an impact on the perception of its products. Nike went through a tough period not because the products lost their value, but because Nike lost its perceived value as a result of its cheap labor practices. Kathy Lee Gifford's clothing line was attacked for the same reason. Tobacco companies are trying to impress customers with their altruistic commitments to offset their public image. Many antismoking factions felt that the Virginia Slims Tennis Tournament was hypocritical by supporting both women's independence and promoting a product that many consider to be the fastest-growing cause of death in women. Being a good corporate citizen helps create a broad context that supports a positive feeling in consumers. People purchase products that enrich their experience based on what is important to them—their values. Both the product and the company must support that value base.

In her book *SuperCorp: How Vanguard Companies Create Innovation, Profits, Growth, and Social Good*,³ Rosabeth Kanter states that leading companies today must have a triple bottom line for their consumers and shareholders based on the 3 P's of *people, planet, and profit*. Companies need to demonstrate that their footprint in production and post-product use have little or no impact on the environment. Companies must also show how they are supporting a humane production

process in the way they treat employees all over the world and what else they do to support charitable organizations through direct actions or by supporting and giving time to employees to make their own choices. This must be maintained as companies look to the profit shareholders expect from their investment in the company. The concept of people, planet, and profit is now part of the brand challenge for companies. Some are doing a great job and confronting it directly; others are more smoke and mirrors. Consumers have ways of finding out who is genuine and who is not—and once they do, they broadcast the result through the Web and other channels to others.

As Chapter 3 discussed, people are dynamic—and their value system is too. The most successful companies learn to anticipate trends and make changes while staying true to their core mission and identity, and they can maintain or increase customer loyalty. These companies understand how interconnected these brand attributes are. The better the brand attributes are coordinated, the better the company performs. A successful brand strategy integrates the profile of the company with its products and creates a customer experience that both is consistent with the corporate message and inspires brand loyalty. Any message that a company communicates through formal advertising or through cultural interaction and support must also be consistent with the core company–customer relationship.

Managing Product Brand

Product brand management is an art and a science. Product programs must be managed using a cross-platform approach, making sure all aspects of a product are maintained in the right balance of technology, human factors, and style. Products must be distinct in the market against direct competition while also maintaining a clear continuity with other products in the line of products it connects to. Apple products connect, while Sony products do not. OXO has maintained its brand continuity even though the company has produced more than 850 products. Any one OXO competitor only competes among a subset of its products. Finally, brand managers must be in constant dialogue with corporate strategists navigating the SET Factors to directing change at the corporate level.

Building an Identity

In some cases, a product becomes the basis for a new company. In other situations, new products are developed within an existing company. Companies can consider a variety of alternative strategies when developing a brand identity for a new product:

- How a new product can become the basis for a new company
- How a new product in an existing company can spawn a new division or line of products
- How a company can develop a new and broader identity
- How a company can use a flexible identity connecting a core across all products, but also making each product unique
- How a company can develop an aesthetic that becomes so powerful that it spills into other markets

The case studies referred to in this book represent many of those approaches. In the case of OXO and BodyMedia, a new product can become the basis for a new company. On the other hand, Navistar, Crown, and Steelcase were each established companies that spawned a new division or line of products with the development of the LoneStar, the Wave, and the Node education seating system, respectively. Starbucks brought attention to its product and service through an entire identity system across the company. In the case of Starbucks, a flexible identity allows each coffee roast to take on its own identity while keeping a constant core logo and style across products. Many auto companies produce a product to introduce a customer to the entire company, as was done with VW and the new Beetle, Mazda and the Miata sports car, and Nissan and the electric Leaf. VW's approach creates a symbol for a secondary product, such as the laser-cut key, by bringing it through the entire line of VW and Audi and creating a strong identifier for the company, much as the Coke bottle is a symbol for Coca-Cola in the soft drink industry. In the case of Steelcase, which worked with IDEO in developing the Node, as discussed in Chapter 9, the product introduced an entire new line of products in the education market, broadening the brand to this new opportunity while maintaining its identity of innovation and quality in seating systems. Other companies have effectively created such a powerful aesthetic that it spills into other markets. For example, time and time again, Apple products define the cutting-edge aesthetic for consumer-based technology products. Now every time a product is seen to resemble an Apple product, even if not made by Apple, it reinforces the brand value of the

company and generates free advertising for Apple. Some of these approaches are explored more fully next.

Company Identity Versus Product Identity

When developing new products, the relationship of the look of a product to other products produced by the company is critical to consider. In doing so, a company might choose between two options, one to maintain a strong role in the corporate identity or the other to allow the product brand to overshadow the company identity.

DeWalt products have a consistent use of graphics, color, and finish across the entire line. All DeWalt products use yellow, black, and silver. Most of the products have yellow as the primary color, silver as the second, and black for the logo and details. A few specific products reverse the emphasis for effect and use black as the primary color to promote their unique attributes. The products are instantly recognized in stores. The DeWalt brand identity extends their trade dress to an entire line of products, from compressors, to drills, to radios.

UPS, discussed further in Chapter 8, “Service Innovation: Breakthrough Innovation on the Product–Service Ecosystem Continuum,” has developed a strong brand identity around its logo and a strong trade dress around its use of the color brown. “What Can Brown Do for You?” not only captures UPS’s approach to customer satisfaction and innovation in package delivery and logistics, but also reinforces UPS’s use of the color brown. There is a consistency in everything that UPS presents to the public, with a consistent use of the logo and the color brown on trucks, planes, uniforms, and shipping envelopes, making UPS one of the most recognizable brands across the globe. In services, a consistency across every touch point, such as product graphics, packaging, employee attire, and any digital interaction screens, is required to communicate the brand to the customer. UPS is still building on their co-brand strategy for the two main components of the corporation. The focus on the word “logistics” allows them to emphasize both the package and informatics capability. They have also developed several strategies since “What Can Brown Do for You?,” such as the white board animation, to focus on their pick up, drop off, and delivery services.

When Crown developed the Wave personal lift device for warehouse pick-and-place tasks (discussed further in Chapter 11, “Where Are They Now?”), it chose to give it a unique identity to fit the context of use. The name, Wave, is the primary identity. The Crown logo, also used on all the other lift products, is downplayed (see Figure 11.6). *Wave* is actually an acronym that comes from the more technical development name, “Work Assist Vehicle;” it was chosen to give a less serious

identity to this new line of products. The graphics, manuals, video, and Web site are all built around this decision. The color of the vehicle is primarily white and gray, with the option of bright colors for details. The Wave logo is also portrayed in a more vibrant color and expressive typeface, a departure from the subdued colors of the other Crown products. Crown has also added a new sales force specifically for this product.

The brand identity of the OXO line of products is based on the interrelated ideas of a comfortable and strong grip, universally accessible products, and a sculpted handle of black Santoprene, which becomes the signature material that expresses the brand. All of the OXO products are designed using a contemporary aesthetic that combines visual sophistication with perfect tactile properties to create a secure, comfortable, and confident experience. The logo is clean and simple, easy to recognize from a distance, and easy to remember; it also reads the same way backward and forward. OXO has developed its reputation primarily by word of mouth, the most cost-effective and positive type of advertising. Yet OXO's identity is also more abstract, in that customers expect ergonomic, easy-to-use, and clever products.

The brand identity for Margaritaville is Key West subtropics and fun. The use of color accents across a primarily brushed and shiny metallic-like finish, along with both subtle and pronounced nautical symbols integrated in the Frozen Concoction Maker product, communicates that identity. Every detail continues the identity into the experience of use, including the clearly drawn treasure map on simulated brown parchment as a quick-start manual, nautical charms for margarita glasses so that guests know which drink is theirs when getting refilled, and the salt rimmer, a must for the frozen margarita. A consistency across the larger Margaritaville brand connects the product (both the Frozen Concoction Maker and consumables such as margarita mix), its communication, its environment in stores and restaurants, and its interaction (for example, on the Web); see Figure 4.2.

■ Relating the company and product brand to the core needs, wants, and desires of the customer can convert a failing company into a market-leading success.

Another approach to maintaining a separation between products but keeping a core connection to the parent company is through a flexible identity. Here a theme is maintained between products with a strong reference to the parent company, yet each product also has its own unique attributes and identity. Starbucks uses this approach to differentiate each of its roasts, yet with a clear statement that they are all part of the Starbucks family. Each roast has its own name, along with a unique icon, but under the same basic style, with the company's Starbucks logo placed consistently against the clean background.



Figure 4.2 The Margaritaville Brand Experience. (Courtesy of Altitude and Jarden)

A recent approach to constantly updating products to stay with current trends is known as *postponement*. The traditional approach to product development is to determine up front all varieties of a product that will be offered. After the molds are made and the colors decided, the product remains unchanged until the next model is produced. With the emergence of rapid manufacturing techniques and the ability to make shorter manufacturing runs affordably, a company can postpone detailing decisions until just before the product's release. Doing so enables a company to keep style details current on a continual basis. The approach also allows

for more frequent changes in products. Swatch began the trend with interchangeable watch faces, bands, and hands. Nokia used the approach to allow customers to choose from a wide variety of covers on their cellphones. Postponement allows for different product models within a core product and brand. The variety of styles available to the customer allows each user to customize the product based on personality. This feature tends to add considerable value to a product, pushing it further to the Upper Right. People will pay for value, so, in addition to allowing for variety within a brand, postponement tends to command high profit margins for these interchangeable features.

Building Brand Versus Maintaining Brand

Brand must be built and maintained. Connecting to the customer enables both to take place. UPS has long-standing brand identity; it has made the right changes to keep up with or stay ahead of the competition. FedEx, in comparison, is a newer brand that had to establish itself right away. It went from obscurity to high international recognition in a relatively quick period of time. You likely can easily recall the brown trucks of UPS and the bold purple and orange of the FedEx logo, but you use their services because you can rely on the companies to deliver what you send on time and to the intended recipient. In comparative terms, UPS is the seasoned professional and FedEx is the young upstart. Both are equally respected. One quickly built a powerful brand identity; the other has successfully managed long-term brand equity. We examine the brand strategy and growth of UPS further in Chapter 8.

This subsection examines three case studies, one in which a brand is built up, one in which an established brand is reinvigorated and redefined, and one in which an established brand is maintained. In the latter two cases, relating the company and product brand to the core needs, wants, and desires of the customer converted a failing product or company into a market-leading success.

Starting from Scratch: Cirque du Soleil

Cirque du Soleil is a well-recognized brand that connotes sophisticated style, theatrics, music, colors, and, of course, sheer talent. The current global brand is a hybrid synthesized from a variety of forms of international entertainment from classic and traditional categories to urban street-performing entrepreneurs.

Cirque du Soleil was started in 1984 by former street performers Guy Laliberté and Daniel Gauthier. Their brilliance was to recognize the white space between

circuses like Barnum and Bailey and the entertainment that adults sought. Instead of featuring elephants and tigers and clown after generic clown coming out a car, Cirque du Soleil developed a “transdisciplinary experience” that blended circus, theater, live music, song, and costume. If you examine the VOA of Cirque du Soleil against the VOA of Barnum and Bailey for the adult audience, you see the strong sensuality, adventure, power, and independence emotions; the visual and auditory aesthetics; the unique identity; and the quality craftsmanship consistent in every show and every piece of merchandise. Cirque du Soleil is also strong in social VO for its commitment to social action—for example, the group works with youth at risk and founded ONE DROP, which fights poverty by providing access to water and sanitation in developing countries. It is not unreasonable to pay three times the cost of a ticket to Barnum and Bailey to see a Cirque du Soleil performance.

Although theatrical and musical, Cirque du Soleil still connects to and pushes the boundaries of the circus. Although many of its shows are permanently placed in theaters, its traveling shows are often found in tents that are traditionally decorated in bright blue-and-yellow sweeping stripes. Each unique show is completely developed in-house, true to the group’s mission to “invoke the imagination, provide the senses and evoke the emotions of people around the world.”⁴ Cirque du Soleil also articulates a set of values:

- “To uphold the integrity of the creative process
- To recognize and respect each individual’s contribution to the body of work
- To extend the limits of the possible
- To draw inspiration from artistic and cultural diversities
- To encourage and promote the potential of youth”⁵

Every show results from a collaboration among the performers, the designers, the engineers and technical support, and the business unit.

Cirque du Soleil has built a brand from scratch, one recognized across the world and based on collaboration, social responsibility, and sophisticated entertainment.

Redefining a Brand: Herbal Essences

This example is about rebuilding a brand that had name recognition and longevity but lost its luster. For P&G, it is all about the first moment of truth. Given a competitive purchase environment, P&G wants to produce the package and product that you will choose every time. The role of packaging has expanded, and P&G has

been equally innovative in seeing packaging as a powerful way to express brand identity and deliver on the second moment of truth when you use the product. The design of a package can play a major role in helping customers through that process of use, and can complement the customers' lifestyle. P&G's goal is to build billion dollar brands and it seeks to be no. 1 or no. 2 in every category in which it competes. This is the perspective that drove the rebranding of Herbal Essences. Susan Arnold, then Vice Chair of Global Beauty and Health, took the risk to redefine the brand in record time. A. G. Lafley, then CEO, commented in his book *The Game-Changer: How You Can Drive Revenue and Profit Growth with Innovation*, "About eighteen months later the new Herbal Essences was back on the shelves and put the brand back on track to eventually become another P&G billion dollar brand."⁶

Herbal Essences is a multifaceted example in the creation of a breakthrough product. It is an excellent case study to highlight P&G's commitment to innovation. The process used in the Fuzzy Front End was part of P&G's commitment to support innovation in every part of the company. The process started in Clay Street, an off-site P&G innovation incubator, discussed in Chapter 6, "Integrating Disciplines and Managing Diverse Teams." The cross-functional team in Clay Street recognized the SET Factors for shampoo for Gen Y women and allowed the company to find an untapped Product Opportunity Gap. The commitment of management allowed it to get the product through the pipeline in half the normal development time. In spite of the pressure of time to market, the company held on to the highest standards of execution. Chemical engineering delivered on the shampoo and conditioner performance attributes to create new chemistry. With several new sub-themes, the chemists had to develop different formulas for each shampoo and conditioner set to support the results stated on the package.

Two consulting firms, LPK and Ziba, worked with the P&G in-house designers and marketing to develop the package (see Figure 4.3). LPK, a brand firm based in Cincinnati, Ohio, was primarily responsible for developing the overall brand and sub-brand scenarios for Gen Y women. Ziba, located in Portland, Oregon, was responsible for the design of the form, material choices, and function of the packaging while working with P&G packaging engineers. The sculptural packaging shape was a new look on the shelf and allowed the shampoo and conditioner to nest in the shower and be easy to identify with your eyes closed. The result created a shelf presence at point of purchase, the first moment of truth, with immediate impact on positive growth of sales and total redefinition of the product. According to Ziba, sales increased \$30M in the first year.⁷ According to LPK, for Herbal Essences, the firm found that "the right combination of verbal wit and bright, juicy color created an engaging identity and re-established its relevancy."⁸

Herbal Essences Shampoo has been in existence since the 1970s; P&G purchased it at the end of the 1990s. This case study is an interesting combination of both evolution and revolution in innovation. Clearly, the brand of Herbal Essences has changed to meet the SET Factors. The difference in this rebranding effort is the complete restructuring of the value platform. Other than the name, there is a complete break from the two previous brand concepts, and it became the beginning of a new product system for P&G. Unlike the current VW Beetle, which is a retro-future design drafting off the original, the current Herbal Essences allowed P&G to start fresh and deliver value to Gen Y women. After the new platform for the brand was created, Herbal Essences shifted into an evolution-based innovation, building and extending new products in each persona and creating new extensions, such as Set Me Up Stylers. Ten types of shampoo exist, with up to five varying products in each theme, and the brand is sold in more than 30 countries, with variations to meet the unique requirements of each new cultural context. On P&G's Herbal Essences Web site, you can find the shampoo that matches your personality and can produce the hairstyle you want.⁹ The message for women: It's not just about how your hair feels, but how it makes you feel.



Figure 4.3 Herbal Essences containers.

Maintaining an Established Identity: Harley

The Harley-Davidson motorcycle is synonymous with the American ethic of individual freedom and escape. It is not just a product; it is a lifestyle and is representative of a global subculture. The life experience of owning a Harley can be complemented by owning the apparel that goes along with it. Once Harley understood the connection, the company became a lifestyle company with a motorcycle as its symbol. A couple in France won a contest that allowed them to pick any location in the world for their marriage. They chose to be married at the Harley-Davidson Corporation in Milwaukee, Wisconsin. Not too long ago, Harley faced extinction. During the last few decades, it has risen like a phoenix and forced every other motorcycle company in the world to respond to its classic design features. These features (shown in Figure 4.4), which include the fenders; the 45° V-twin, four-stroke engine; the seat; and the handlebars; have been codified by Harley owners. Harley does not change a bolt on its design without the full support of its customers. The company stays in constant contact with its loyal customer base by holding major rallies annually where the company employees mix with its customers. This form of customer connection, a type of ethnography discussed in Chapter 7, “Understanding the User’s Needs, Wants, and Desires,” involves everyone in the company, not just marketing. Harleys previously had a strong identity but a poor record of performance. By slightly adjusting the identity from “rebel without a cause” and biker violence to freedom and escape from the 9–9 rat race, the company responded to a new trend in society. By taking ownership of their manufacturing process, Harley employees were able to reinvigorate the brand identity and produce a higher-quality motorcycle. They managed to improve performance and keep the original look and feel.

Harley does not just manufacture motorcycles. The motorcycle is the core of the company brand and has generated a range of lifestyle products that consumers use to re-experience the feeling of owning and riding a Harley. Harley stores were redesigned to sell clothing and gear. They have been so successful that the company makes more profit from its lifestyle products than it does by selling motorcycles. Honda, BMW, and all the other competitors have been forced to create their own version of the Harley Hog. A design created more than 50 years ago is out-selling all the ergonomic, aerodynamic forms developed in the last two decades. When a biker rides a Harley alone or in a group, he partakes in a fantasy experience. The combination of the sound, the wind, the look and feel of the Harley, and the attire projects an unmistakable message about the values of the rider. Brando, James Dean, and Peter Fonda are always out there with them.



Figure 4.4 1994 Harley-Davidson FLHR motorcycle. (Reprinted with permission of Jim Dillinger; photo of Dillinger with his 1994 Harley-Davidson FLHR by Larry Rippel.)

Harley found many younger buyers were attracted to the Japanese speed bikes from companies such as Yamaha and Honda. They responded by creating the V-Rod, a radiator-cooled speed bike introduced in 2001. However, to maintain the unique Harley identity, the company spent significant extra development time to give the V-Rod the consistent Harley look, with a V-twin engine, teardrop fuel tank, cupped seat, circular headlight, and triangular frame.

Brand and the Value Opportunities

■ Value Opportunities must be integrated with a company's existing and future brand strategy.

Remember that a brand is communicated to the customer through a value proposition. This communication must ultimately be articulated through the semantics of the product—that is, the attributes and personality of the product as seen by the user. The way a company chooses to develop and implement the Value Opportunities ultimately defines the semantics of the product and its associated brand characteristics, resulting in that value proposition. All products can be measured using the VO attributes we presented in Chapter 3. It is important to note, however, that all of these opportunities are in constant flux as the SET forces change. As one company interprets the SET Factors and considers the VOs during product development, another company might have a different interpretation and develop a very different product. Identifying the Value Opportunities attributes and then trying to respond to them individually is not enough; instead, the company must examine the VOs as a set in the context of the SET Factors. Each POG that evolves shifts the relationship and possible interpretation of the VO attributes. The VOs must be integrated with a company's existing brand strategy, and the company must recognize how their interpretation changes the future strategy. Interpreting the VOs is part art and part science. It requires developing insightful concepts and testing and refining those concepts against the issues established in the research phase with core customers. Integrated teams create integrated concepts and can more easily interpret and modify concepts in a coordinated way that synthesizes the style, features, ergonomics, technology, manufacturing, and cost. As the product defines the brand, so the VOs define the product. Thus, Value Opportunities are closely tied to the brand identity of the product.

Remember when computer terminals were covered in bent sheet metal? Most were gray, with a few black ones interspersed throughout the industry. Apple changed the whole look of computers with its large, one-part, aesthetically refined plastic covers. The brand strategy got Apple back in the game and was the first step in a decade of continuous brand evolution under the Apple *i* strategy. When the Apple iMac debuted, the company was the consumer-loved underdog; now it is the big dog with sales of iPad and iPhone making it one of the most innovative and economically successful companies in the world. The first iMac pushed the concept of plastic to a new level by introducing the use of clear and translucent colors. This was driven by advances in molding and affordability of emerging methods, competition, and social interest to make computers fit into everyday life in the home and office. The VOs for the original iMac included the following:

- Strong emotional attributes of independence, confidence, and power
- Visual, auditory, and tactile aesthetics
- Comfort and ease of use in the ergonomics VO
- A very strong point in time, sense of place, and personality identity
- Social impact in its ability to more readily connect people to the Internet
- Strong core technology and quality VOs

All of these VOs are akin to people's perception of the iMac, and together they define the brand. Interestingly, most, if not all, are consistent across all of Apple's products more than a decade later.

The brand of a product (as opposed to a company) needs to be developed based on the character of the product and how it communicates value to the intended market. This involves the look and style of the product as represented by the aesthetics and identity VOs, the physical interaction with the product (the ergonomics VO), the psychological interaction with the product (the emotion and impact VOs), and the performance features through the core technology and quality VOs. The product must communicate brand value throughout the short- and long-term life and use of the product. The initial impression and interaction with the product drive the short-term interest to purchase; the long-term comfort, performance, interaction, and satisfaction are the forces that build brand loyalty. A product's style, the correct set and location of features, the initial comfort, and confidence in technology are the attributes that customers look for initially. Durability, flexibility, reliability, and service are the features that promote long-term satisfaction and are an expected baseline quality attribute of all products. The Value Opportunities affect both the short- and long-term satisfaction and are critical to brand equity.

The VOA can be applied to the company itself, thereby helping to define the brand. If the brand is considered a product, it must meet the needs, wants, and desires of the company and its customers. What emotional attributes does the customer desire from the company? What is the aesthetic of the company? What are the interactions with the company? What social and environmental impact is expected and desired from the company? What is the differentiation and the company's personality and context? What are the attributes of its core technology and performance? Finally, what is the quality expectation of its products and services? These questions and the attributes of the VOs provide a basis to define a high user-valued brand identity. As such, we have successfully used the VOA even in this type of application.

An effective product development process ties the corporate mission and brand to the product and customer. All of these activities must resonate with the company's goals and broader public identity. All of the stakeholders in the company need to be on the same page relative to the product and its relationship to the competition and the rest of the company's expressed values. But the process is not easy. The team must understand the essence of the user, the desired user experience, and how that understanding translates to product criteria. The company must understand how teams of disciplines that think differently and initially have very different—and often conflicting—goals can work together to create a successful product that meets those criteria. Finally, management and the workforce must understand how all of this integrates into a new product development process with goals, deadlines, and clear objectives. And that is what we turn to in the next chapter.

Summary Points

- Breakthrough brand strategies are tightly coupled with products and services.
- Corporate brand success is linked between corporate mission, program planning, product development, and customer satisfaction.
- Consumers support companies that have personal values compatible with their own.
- Brand within a product is communicated through the Value Opportunities.
- The Value Opportunities applied to the company can help define the company's brand.

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Part Two

The Process

Chapter 5 A Comprehensive Approach to User-Centered, Integrated New Product Development

Chapter 6 Integrating Disciplines and Managing Diverse Teams

Chapter 7 Understanding the User's Needs, Wants, and Desires

Chapter Five

A Comprehensive Approach to User-Centered, Integrated New Product Development

Companies need to structure and navigate the Fuzzy Front End of the new product development process. This chapter introduces a four-phase integrated process that begins with opportunity identification and ends with the realization of a well-developed product concept. At the end of this process, a product is ready for “go/no-go” program approval and intellectual property protection. By effectively structuring the early stages of the process and embracing more qualitative approaches, downstream activities become more efficient and less error prone. This leads to a greater chance of success in the marketplace.

Clarifying the Fuzzy Front End of New Product Development

■ The most successful products surpass the original target market and appeal to a broad range of customers.

In the first four chapters, we established an argument that constant changes in local, national, and global Social, Economic, and Technology (SET) Factors produce Product Opportunity Gaps (POGs), and that POGs can be expressed in terms of Value Opportunities (VOs). VOs must then be translated into a product solution that integrates the appropriate style and features that anticipate emerging needs, wants, and desires of customers. Products are successful when they are deemed acceptable by customers because they are useful, usable, and desirable. The most successful products surpass the original target market and appeal to a broad range of customers, often transcending age, economics, and national boundaries.

In this chapter and the next two chapters, we discuss an integrated process to move to the Upper Right. We give you an approach so that you can put these ideas to work for your company. In this chapter, we provide a method for structuring the early phase of new product development, what has become known in industry as the Fuzzy Front End. In Chapter 6, “Integrating Disciplines and Managing Diverse Teams,” we discuss how to manage this approach. In Chapter 7, “Understanding the User’s Needs, Wants, and Desires,” we provide an in-depth discussion and description of qualitative methods used to gain a deep understanding of the target user and translate that understanding into product criteria. The most powerful recent area of product research is in the field of new product ethnography. This form of applied anthropology blends traditional ethnographic methods with new technology and interdisciplinary research teams to turn a descriptive process into

a predictive field that helps to determine Value Opportunities. New product ethnographers must go beyond observation; they need to deliver “actionable insights,” or insights into behavior and lifestyle activities and preferences that lead to product attributes. Through these descriptions, their work becomes valuable to other members of the product development team. The results of new product ethnography complement, and often occur prior to, traditional marketing analysis. Further methods for understanding the task and uncovering customer needs, wants, and desires are also discussed.

We are keeping the focus on physical product development, but this same approach applies to the development of interface opportunities and services. The difference is not in the structure or tools, but in the different types of disciplines involved in using them. In interface design, industrial designers are replaced by interaction designers, sometimes referred to as graphical user interface (GUI) designers, and engineering designers are replaced with human computer interface (HCI) designers and programmers; the marketing function can vary, but the business leads are still generally part of marketing and sales.

In service design, teams have more variation; a variety of designers could be involved, including architects and interior, product, graphic, and GUI designers. The engineering technical group can also be more diverse and can include HCI, programming, electrical, and mechanical experts. The business dimension can also vary, although it includes marketing and sales. Recent texts on service design consistently utilize the methods we present in this book. We further discuss the development of services and their role in the product–service ecosystem in Chapter 8, “Service Innovation: Breakthrough Innovation on the Product–Service Ecosystem Continuum.”

A New Way of Thinking

The integrated new product development (iNPD) process is not just a set of methods that can be plugged into an existing company structure. It is a way of thinking that combines three key elements:

1. A truly horizontal and interdisciplinary structure
2. A commitment to maintain a focus on what customers and other stakeholders value
3. A system that begins with an emphasis on qualitative methods of discovery and development and evolves toward quantitative methods of refinement and manufacture and/or distribution

■ Team members must trust each other, have mutual respect for the value of all the fields involved, and learn to appreciate the value in having a variety of methods to bring to the table.

The team that is assembled for this process must be representative of the three core competencies needed to deliver products: marketing research, engineering, and design. The team should include additional areas of expertise that reflect the nature of the product. The core team should be relatively small and should stay together throughout the process, with expertise added and subtracted as needed. Each discipline involved in the program often sees its own area of expertise as the most important and thinks that the methods of that discipline are superior to methods used by other areas. The primary bias that must be addressed is discipline-specific importance. Team members must trust each other, have mutual respect for the value of all the fields involved, and learn to appreciate the value in having a variety of methods to bring to the table. Team members must be good listeners and advocates for their own point of view and must not feel threatened by criticism. The most important attribute they must have is the ability to place their expertise at the service of the customer.

Team members always have their own opinions on the products they develop. Making sure that the end customer is always considered is an important way to prevent personal bias from influencing a program. Many personal insights are valid but must be confirmed by a good understanding of the customer. The success of the team depends on knowing how to integrate insight and shed bias. A product that is driven by an overemphasis on either aesthetic expression or technological process will not succeed. Translating customer requirements into the right core technology, considering type and placement of features, and selecting from an appropriate set of sensory aesthetic choices can occur only with a good understanding of and continued dialogue with the people who will use the product.

■ A product that is driven by an overemphasis on either aesthetic expression or technological process will not succeed.

The hardest aspect of this approach is the use of qualitative methods. Early in the process, as the team is attempting to find direction and then gather knowledge, it is important to avoid getting bogged down with large statistical surveys and to not start identifying and detailing solutions. The use of qualitative methods allows for broad investigation with little investment; these approaches are easier to summarize, evaluate, and communicate within the team, to stakeholders, and to management. Team members who come from technical fields might find this difficult and often fail to trust the process.

We use the term *integrated* here. Although we generally talk about interdisciplinary teams, the important issue is that the team includes the right players and is integrated together. Our inclusion of engineering, industrial or communication design, and marketing covers the bases of what issues must be addressed. But different players can fulfill these.

Note that iNPD is not just for new, clean-sheet innovation, but works for evolutionary revisions as well. The process guides new product innovation but is equally important to appropriately inject new useful, useable, and desirable value into an existing product to maintain its place in the Upper Right.

iNPD Is Only Part of the Process

It is essential to recognize that the four phases outlined in this chapter represent the front end of the overall product development process shown in Figure 5.1. If used correctly, this process will significantly reduce downstream development problems in parts integration, manufacturing quality, and missed opportunities in the style and features of the product. The process starts after strategic planning and ends with program approval to develop and manufacture the product. After program approval (and after the focus of this book) are the more detailed refinement stages of the process, where designs are refined, production prototypes are built and tested, and the product is then brought to launch. Every company uses a subtle variation of this process. The length of the total product development process varies significantly. In the auto industry, it can take several years. In the development of digital hand-held products, that process could be as short as six months.

It is becoming harder to find time for the issues raised in the Fuzzy Front End. The use of quantitative methods and fear of manufacturing or software errors make it easier for companies to commit time and resources to the back end of the process. The challenge all competitive companies face is finding the time to effectively manage the front end and giving programs the proper start. This is because companies usually do not have a clear methodology or champion for this process.

This approach is compatible with existing processes that companies might already have in place. Many companies have some type of stage gate process, a process formally introduced by Cooper.¹ The four phases presented here integrate into what are typically indicted as pre-gate 0, gate 1, and gate 2. The methods in this book help you navigate these early stages and give you a process to move into and through these early gates.

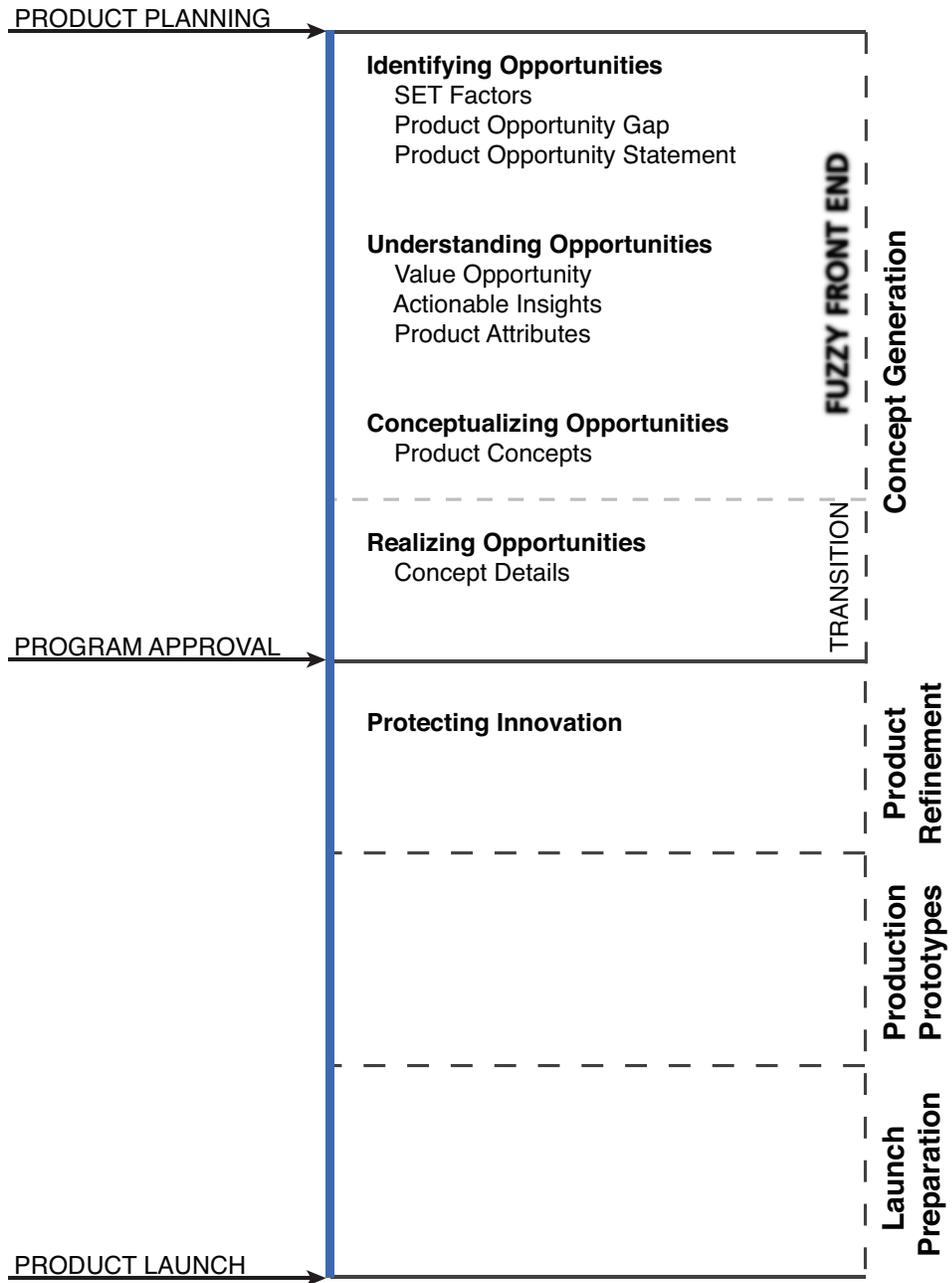


Figure 5.1 Complete product development processes highlighting the span between product planning and program approval.

User-Centered iNPD Process

The user-centered iNPD process is presented in four phases: Identifying the Opportunity, Understanding the Opportunity, Conceptualizing the Opportunity, and Realizing the Opportunity. Many consider only the first two phases, identifying and understanding the opportunity, as the Fuzzy Front End. They do this because they quickly target a project solution and spend conceptualization time refining the basic idea. They are often uncomfortable working with ill-defined ideas, and this many times appears as pre-gate 0 in a stage gate and thus is not targeted as part of the product development process. As in Figure 5.1, in our iNPD method, all four phases are part of, or are affected by, the Fuzzy Front End. The first three phases constitute the primary parts of the Fuzzy Front End, where the problem definition begins as uncertain and vague, although the process results in a formal, early product definition and complete concept. The fourth phase is a transition phase into the more concrete and analytical stages of product development. The Fuzzy Front End still extends into the fourth phase because its iterative, uncertain characteristics require customer feedback and insights gained from the first phases to bring the product toward resolution.

The focus of the process, at least initially, surrounds the management of options. The process is much like a series of funnels (as in Figure 5.2), where opportunities are expanded through a gathering process and then filtered down to one or a few ideas based on the team's analysis and interpretation. These remaining ideas are then expanded again in more focused depth, with one investigation (gathering, analyzing, and interpreting of information) leading to the next area of focus. The process is critical, in that the many pieces of information generated provide inspiration and understanding as the emerging idea develops. Some companies save these discarded pieces of information for use or idea generation in future projects. Figures 5.1 and 5.2 show where many of the tools introduced in this book fit into the process. As you read further into this chapter, reference these figures to help bring the process together.

The first phase focuses on the identification and selection of product opportunities. The main tool used in this phase is the SET Factors presented in Chapter 1, “What Drives New Product Development.” For those seeking new product opportunities, this phase is critical. For those who have already identified a product opportunity or for those involved in the modification of an existing product, this phase can still lend insights into directions to take to refine and specifically define the opportunity.

The second phase focuses on the understanding of the product opportunity. A POG was identified in the first phase, but how does that opportunity translate into criteria for a product? The focus of this effort is the user. The main tools to understand what the user needs, wants, and desires center on a set of qualitative research techniques that present an in-depth understanding of the typical user rather than a statistical overview of a mass population. These qualitative techniques are the focus of Chapter 7 but are introduced in this chapter along with complementary approaches that together define the context and characteristics of the developing product.

The third phase shifts into the more traditional product development process by introducing techniques for product conceptualization. The outcome is a single concept to be realized in the fourth phase. Our approach to this phase builds on standard approaches found in the literature on product development. The following differentiate us from these standard approaches:

1. **The connection to the user**—At each step of the process, we guarantee that the evolving concept meets the early product specifications, and we constantly obtain feedback directly from the core user and expert group. Engineers, in particular, often ignore the first two phases and disregard the significance of a user-based definition of the product prior to conceptualization. The result is often a process that compromises success by focusing too early on the detailed development of a product and misses its target in the marketplace. Therefore, although we take into account the importance of approaches such as 6σ and DFM (Design for Manufacturing), and further find these methods critical to the long-term quality-of-manufacture or implementation success of the product, we argue that these approaches are effective only if (and are actually meaningless unless) the product concept itself is effective in meeting the needs of the user. People will not buy a well-made product that they don’t want!

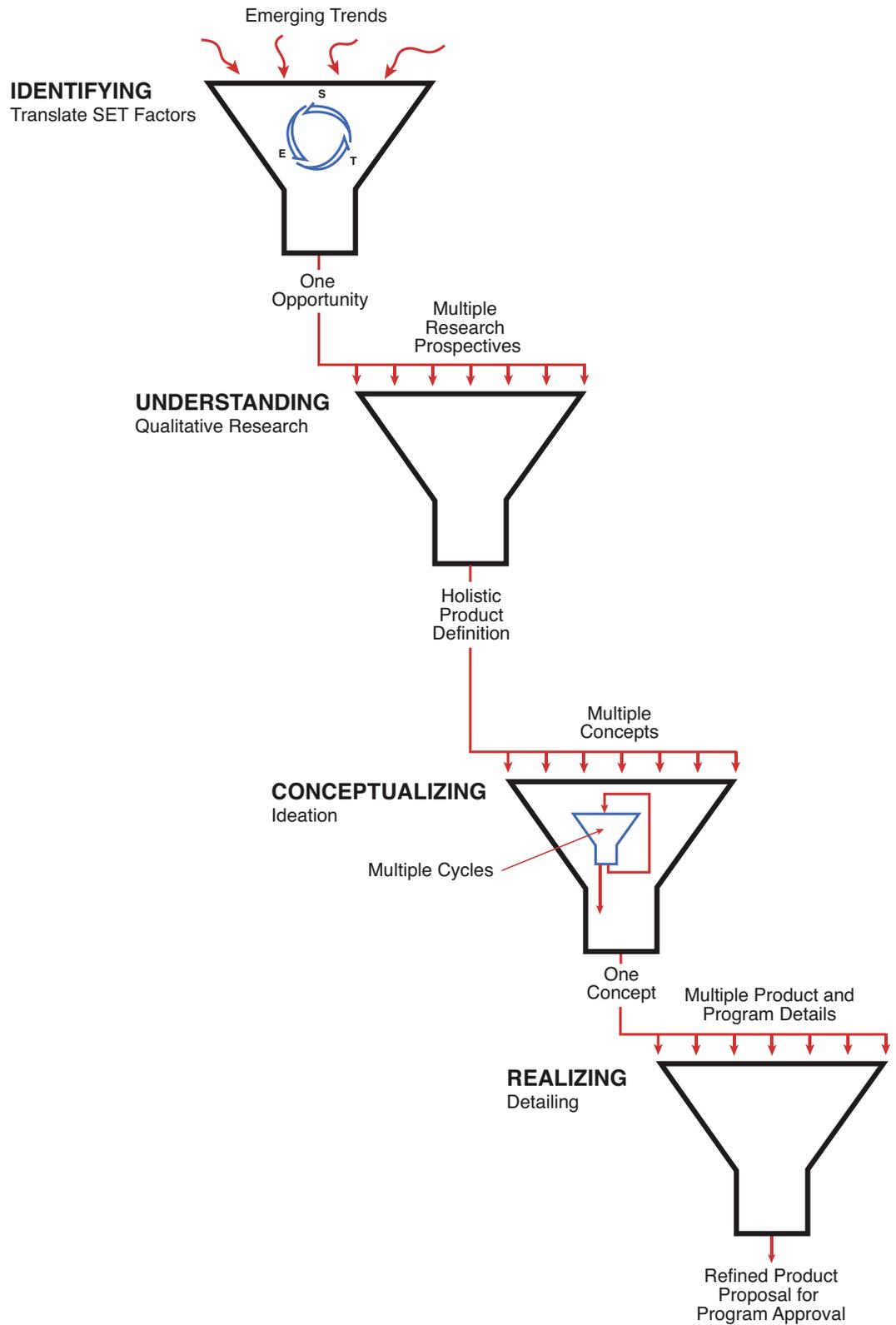


Figure 5.2 Structuring the Fuzzy Front End as a series of funnels: The four phases are Identifying, Understanding, Conceptualizing, and Realizing the Opportunity.

■ People will not buy a well-made product that they don't want.

2. **The product definition**—We begin conceptualization from a powerful position of having defined what we are trying to develop based on substantial user research. Doing so makes the process more efficient, again with fewer design changes and conflicts emerging downstream and with a higher likelihood of market success of the product. We have found that taking time from the downstream phases of the development process and allocating it to the early phases (especially Phase II) makes the process more efficient and effective, with higher-quality products in concept, and gives the team an easier time meeting quality manufacture or implementation specifications later.
3. **The integrated framework**—We introduce tools and methods for overcoming discipline bias and conflict. Team support and intrateam respect improve the environment for interdisciplinary product development. Negotiation tools that meet everyone's needs and expectations work within that environment to make the process more efficient and satisfying to the team members. Chapter 6 explores issues in team performance and interests-based negotiation strategies critical to success within interdisciplinary teams.

The fourth phase is the realization of the product, a proof-of-concept phase. It details the single concept that results from the third phase, to result in a working functional model or, for a service, scenario-based storyboards; a form model; a justification of the integration of the function and form models; a manufacturing plan; and an initial marketing plan, including initial financial figures and a possible roll-out strategy. The goal of this phase is to prove feasibility of the product, have buy-in of the customer, understand the potential sales and profit of the product, and articulate function and form innovations that differentiate the product from the competition. The result is enough information to judge whether the product is likely to succeed in the marketplace and whether the company should commit resources to move the product to market. This commitment can be significant in terms of both financial expenses and personnel resources. Also, with the timeframe to bring the product to market, the company is committing its future reputation for creating successful products. The effective use of this process, however, increases the likelihood that a product will succeed both at this critical juncture and in the marketplace. By articulating the innovations at this time and supporting that argument through prototyping, the second result of this phase is to begin the patenting process for utility and design patents and copyright protection, among others.

Further phases that occur after concept sign-off, including 6 σ approaches, manufacturing detailing, integrated prototyping, product layout, part reduction, service implementation, sales and marketing, and lifecycle concerns, are not discussed in this book. Instead, references to the literature are provided. Of course, many of

these issues cannot be ignored up front. As argued in Chapter 7, any secondary stakeholders with a significant effect on the development process should be included up front in the development team, either by inclusion of the stakeholder or by detailed specification of their concerns. These secondary stakeholders have an effect on and react to the product design, but they are often not the primary driver in its development. Secondary stakeholders often include manufacturing, environmental, and lifecycle engineers; distributors and point-of-purchase sales units; and user support personnel. Taking these concerns into account up front significantly increases the efficiency of the downstream process. Fewer design changes occur downstream, where any major change is a significant cost and involves a time drain on the process. However, the details of many of these processes still occur after the design concept is completed, where there is an abundance of literature to connect to our process.

PHASE I: IDENTIFYING THE OPPORTUNITY

Goals

Product:

- Develop a significant number of potential POGs
- Choose the most appropriate POG

Team:

- Develop team communication morale
- Move from being conscious of the team's incompetence toward unconscious competence

Results

- A product opportunity stated as an attempt to enable or improve an experience
- An initial scenario
- Identification of potential customers
- Identification of potential advisors and stakeholders

Methods

A variety of qualitative methods for identifying and selecting an appropriate opportunity:

- Scanning SET Factors to identify POGs
- Brainstorming
- Creating, qualitatively evaluating, and reducing lists
- Weighted matrices
- Beginning to open different research paths:
 - Primary research—users and stakeholders
 - Secondary research—literature
- Conducting team-building exercises

The biggest challenge in starting a new product development program is preventing preconceived ideas from driving the process. The team must learn to look at a new product as a new field of knowledge to investigate. Some of these stumbling blocks can prevent this from happening:

- Fixation on a detailed solution to a problem that is not yet well defined
- A heavy-handed management approach that details the program description and preliminary direction, and directs the team without allowing the team members to own the project
- A team member who has a bias against or is ignorant of different disciplines and tries to design the product from a particular discipline perspective, feeling that that team member's field is the most important and must direct the process
- Management sending a clear message to team members that, although they are on an interdisciplinary team, their future is in the silo report structure of their own discipline.

■ Teams with unresolved problems often break down, and the needs of the customer become lost in the discussion.

If any of these issues develop and are not addressed early, they will have a negative effect on the program. When the most stressful periods occur, teams with unresolved problems often break down and the customer gets left out of the discussion. Personal issues take over, and most decisions are made through power plays that usually require going out of the team to call on upper management to resolve issues. The interest of the customer is abandoned, and, at best, a routine or safe solution is chosen.

If the team members are to become comfortable with each other and their relationship with management, they must be comfortable moving from general and vague ideas to more focused decisions using a shared decision process that involves using their expertise in concert with the knowledge acquired during the process and their understanding of the user. Team members should welcome feedback early, look for problems, and not become defensive or overly protective of their ideas. The team must become an environment that supports each member, allows for "mistakes," and supports out-of-the-box thinking.

The first two phases of the iNPD process should be full of learning and surprises as teams develop possible paths and insights that they would never have imagined before the project. If teams are just cruising on what they know and lack a sense of discovery and excitement, they are not being positively aggressive and open in exploring and exchanging ideas. Teams should get to know each other and trust each other in the first phase. They should engage in team-building experiences and should have such an event outside the workplace. Team members from different

disciplines who open up to each other, and to the new set of information that the other disciplines bring, should be able to make a significant improvement on the current state of any product. A highly functional team will soon develop a shared expertise that is greater than any management insight. The team members will become the experts of the new product context as it evolves. The developing team needs to be understood and respected as the evolving experts.

The first step to developing a product is to identify the opportunity for that product. The competition or upper management might provide the step for you. However, you might be part of the team whose job it is to come up with the next breakthrough product for the company. Or maybe you work for a small company looking for a new product—or even its first product. In these cases, you must come up with an insight that will make it worth your while to spend the next several months or years—and to spend significant company resources—developing a new product concept.

In the first chapter, we introduced the SET Factors, those of Social trends (S), Economic forces (E), and Technological advances (T). We highlighted several examples of how scanning the evolving state of these factors helps identify product opportunities. Scanning these factors is done through secondary sources such as current popular press and newspapers, specialized magazines, and technical journals. Discussions with primary sources can also be revealing, along with individual insights. The initial primary research for this phase, however, is quite qualitative, based on informal conversations and observations. Identify “pains,” or aspects of an experience that are detrimental or lacking in some way. The result of understanding the evolving state of the SET Factors is the identification of Product Opportunity Gaps, or POGs. These POGs specify all major paths that the team might take in developing a product.

The goal is to first generate as many opportunities as possible in a short amount of time, to filter the ideas to a few of more serious interest and then to investigate each at a cursory level to enable the generation of an initial scenario. The generation of ideas merges initial SET scans with structured ideation. Techniques of brainstorming and ideation are used to generate ideas.^{2,3,4} We typically tell teams to generate upward of 100 opportunities. Of course, for targeted product areas, this number might be difficult to achieve. However, the more POGs the team identifies, the better the source for opportunity selection and the better the likelihood that it has scanned broadly enough to select the right one to focus on. As stated by Terwiesch and Ulrich in their book *Innovation Tournaments*,⁵ “If you produce more opportunities, you’ll see more exceptional ones.” Statistically, the higher the number of ideas you can produce, the higher the likelihood that you have some really great ones to consider.

The list of 100 or more POGs must be filtered to a reasonable number. The initial filter is a combination of common sense; an understanding of the potential resources that might be available to pursue an opportunity; the potential for a useful, usable, and desirable product; and buy-in and potential contribution from the team itself. Obviously, a housewares company would not (yet) find much of a market in designing kitchen goods for use in outer space, a toy company would not have the expertise or financial backing to develop an automobile, and a team of mechanical engineers and industrial designers would not be the most appropriate group to design a new computer chip. If months are allocated for the complete product development cycle, a limit in potential complexity makes sense. That said, it can be insightful to consider ideas outside the comfort zone and expectation of the company and team. The idea here is not to envision or conceptualize potential solutions, but rather to establish the boundaries and scope of the problem. Concept ideation is not required to pass judgment on the feasibility of thinking further about many opportunities; if there is doubt but enthusiasm toward an idea, it is worth keeping alive at this point.

■ Make an informed decision about which opportunity has the most potential for your company.

The purpose of the initial filtering is to reduce the number of ideas to about a dozen. At this point, the team should then take these dozen ideas to the next round, with an individual (or pair of individuals) spending one or two days exploring each opportunity in more detail. Try to find an expert or a potential target user. Ask about the problems that person or those they advise have doing a task and how effective the current solutions are. Characterize who the target market might be and roughly how big it is. Read the literature that targets the issues surrounding the opportunity. In general, spend this time gaining as much expertise as you can in each area so that, as a team, you can make an informed decision about which opportunity has the most potential for your company.

The goal of this process is not to gain personal buy-in in any one area. Instead, your job is to remain unbiased and to share your findings with the team as a whole. Personal commitment to any one project at this point can make your contributions ineffective. Instead, you must view your effort as an extension of the team. Even if the opportunities you explore are not selected, your effort was not in vain. Instead, your energy and diligence might save the team from wasting a significant amount of resources. One effective method is to make sure that the team members who propose a given idea not be the ones who investigate it.

When this period of due diligence is completed, the team reassembles and each person or subgroup presents its findings about each project. The team can now make a more informed decision on which opportunity seems to have the most potential. Again, the team must judge each opportunity based on time and financial resources;

the potential for a useful, usable, and desirable product; the potential market size; potential contribution from each member of the team; potential creativity in solving the problem; the risk and potential for success for the company in pursuing this idea; and maybe even excitement from each team member. Other criteria might evolve out of specific needs of the team or infrastructure of the company.

We recommend using a weighted matrix (see Figure 5.3) to help further filter these dozen ideas. The weighted matrix is a simple method, with each column representing an opportunity and each row representing criteria used to judge the opportunity. Each opportunity is rated from 1 (low) to 3 (high) in each category. Each row can be further weighted from 1 to 3 according to the relative importance of that category versus another. Scales and range of weights can vary, but it is important to remember that these are very qualitative decisions used only as a filter to remove the clearly less preferred opportunities. More importantly, they give the team an organized method to discuss the contributions of each opportunity. After each opportunity is rated, its value is multiplied by the weight for a given row. Columns are then summed to give an overall numeric value for comparison. The opportunities with the higher total values are the ones the team is more interested in. The ones of lower value are of less interest and should be removed from further consideration (or saved for future products).

The weighted matrix should never be used to conclusively choose a single opportunity based only on its numerical outcome; the process is subjective at this point and qualitative. Yet we have found weighted matrices quite useful in filtering out inferior concepts and stimulating discussion within the team. Even Ben Franklin is said to have used a simple weighted matrix that looked at the pros and cons of a problem.⁶

The process can take two steps: first, filtering the dozen ideas to two or three, and then, possibly after further investigation, reducing the selection to a single best opportunity. It is also possible that the team will reduce the list of opportunities to two or three and that management will then examine the details of each and decide which one the team will pursue. This last approach is recommended only if the team is excited about each of the remaining ideas. If the team now hesitates about any idea, it should be removed from consideration. At the end, regardless of who makes the final decision, the team must buy into the opportunity. Not doing so will cause downstream problems. Everyone will spend a significant amount of time pursuing the evolving product. The most successful product results from a team that enjoys the process and project of focus but, most importantly, sees its potential benefits based on the stakeholder research already completed.

CRITERIA	WEIGHTS	OPPORTUNITIES							
		opportunity #1	opportunity #2	opportunity #3	opportunity #4	opportunity #5	opportunity #6	opportunity #7	opportunity #8
<i>time and financial resources</i>	3	2	1	3	3	3	1	2	1
<i>potential for a useful, useable, and desirable product</i>	2	2	1	2	2	1	1	3	1
<i>potential market size</i>	1	1	3	1	3	1	2	2	1
<i>potential creativity</i>	2	2	2	2	3	3	1	3	2
<i>potential contribution from team members</i>	3	3	3	1	3	2	3	3	3
TOTALS		24	21	21	31	24	18	29	19

Figure 5.3 A sample weighted matrix.

At the end of the process, the team develops a single scenario, using the method presented in Chapter 7, that captures the essence of who the user is, what need the product fills, why it is needed, how it will make a difference to the user, and where and when it will be used. Again, there is no concept ideation and no specific ideas of what the product will be, what it will look like, or how it will function. All that exists is the notion that if a product existed to fill the void in the user's life, it would be a viable product for the market.

For teams given the POG by management, the initial qualitative exploration of the opportunity remains important. Furthermore, the team should still go through the exercise of evaluating the POG based on the criteria laid out earlier. The team must still buy into and get excited by the opportunity and evolving project. It is important to do this from the beginning, to enable a focused effort in the next phase. Early in the process is the appropriate time to make sure that all team members buy into the project. Shifting personnel early in the process is much easier than later in midstream. We recognize that it is not always the choice of an employee to

participate in a product development project. However, understanding the process and committing to the project is still critical for it to succeed.

■ The product opportunity must be stated in general terms and must be based on the product experience instead of product criteria.

At the end of Phase I, two results emerge: a description of a product opportunity and a scenario. The product opportunity must be stated in the most general terms and must be based on the product experience instead of product criteria. It describes the product opportunity in terms of the gap without describing specifically how the product will fill the gap. The challenge is to find the right balance between an opportunity that is stated in terms that are too specific and one stated in a way that is too general. The goal is to let the statement and scenario set up Phase II. For instance, saying that you will improve the way elderly people use an oven is a general statement that leaves too much variation. Saying that you will design a tool that electromechanically lifts food out of an oven is too specific. A balanced statement looks like this: *The product opportunity is to improve the way elderly women lift things out of the oven.*

The scenario that follows would sound like this:

Mary is 75 years old and lives alone. She loves to bake and often entertains her family for holidays. She has developed arthritis and is no longer comfortable reaching into the oven to lift things out. Losing the ability to bake things has been very depressing for her to contemplate. Mary is hesitant to have her family over and no longer feels confident entertaining in her home.

Here are the components of the scenario:

The product is for older women who have lost the strength and flexibility to lift. They become the core market. Review of the literature should focus on this group. The expert advisors for this program are health care workers who work with the elderly and doctors who work with seniors and are experts in rheumatology. It is also important to know about ovens, specifically the type of ovens that older women might own. It also requires looking at ADA guidelines. Other stakeholders are people who install ovens and sell appliances, organizations that promote products for seniors, and doctors and health care workers that might prescribe this for patients. The primary customer base is the women themselves; it is important to find women who fit in this category. Some might have already developed naïve but novel ways of addressing the opportunity. Although the discussion is applicable to men as well, the majority of the elderly population is female. Any particular issues for women might make the product better meet the majority needs, wants, and desires of this population.

By combining the statement and the scenario, the team now has direction in where to look to gain a better understanding of how a product might improve this situation. However, there is no clear sense of what the product might look like, how it

should be powered, and what material it would be made out of. The opportunity statement and the scenario will be revisited to make sure they are being adhered to and that they serve as the core of the team's understanding of the program. Both the opportunity statement and the scenario continue to evolve after each phase.

PHASE II: UNDERSTANDING THE OPPORTUNITY

Goals

Product:

- Through primary and secondary research, create an understanding of the Value Opportunities
- Translate VOs into general product criteria

Team:

- Maintaining healthy team dynamics
- Developing conscious competence
- Becoming a high-performing team

Results

- A set of guidelines that help to take actionable insights and turn them into product concepts
- An in-depth understanding of the user:
 - Clarification of intended market
 - Clear list of value expectations from core market, expert users, and advisors
- Further developed and detailed scenario
- List of product characteristics and constraints

Methods

Methods for obtaining and analyzing information from core market and expert users and advisors

Primary research:

- New product ethnography
 - Interviews
 - Observation
 - Visual stories
- Scenario development
- Storytelling
- Task analysis
- Stakeholder analysis

Secondary research:

- Human factors and ergonomic analysis
- Lifestyle reference
- Research databases

Approaches to integrate team into highly functional entity

In Phase II, a high-performance team breaks into subgroups to research the paths suggested by the product opportunity and scenario. The goal is to cast as wide a net as possible and then focus on the paths that provide the best insights. Here the team interviews and observes expert users and, in combination with secondary research in the literature and primary research in interviewing stakeholders and expert advisors, starts to generate directions for the team. Teams need to model the experience for the user and identify the Value Opportunities. The goal is to develop a model of behavior that reflects an understanding of the lifestyle and relevant activities of the core user, and the human factors and ergonomics that underlie the human action during the experience. If the experience is a woman lifting things out of the oven, then the process of baking in the oven needs to be understood.

■ Understanding how a product will be purchased is also important.

As awareness begins to grow, the team produces models of the experience and starts to develop an understanding of the Value Opportunities for the product. The factors of importance that will make the product useful, usable, and desirable start to emerge. The scope and perceived need must be quickly established to prove that this product opportunity could truly benefit the user and that a sizable market exists. Understanding how a product like this will be purchased is also important. For example, determining the patterns of oven use and how people bake determines how to make the product useful. Understanding the aesthetic needs of women and others who might purchase this product helps to frame the issues of desirability.

A very large part of the process of understanding the opportunity is to understand the user and other key stakeholders who influence the purchase, adoption, and use of the product; this is the focus of Chapter 7. Techniques such as task analysis that break down the user's interaction with a product or activity, ethnographic research that observes and models the behavior of a target market, lifestyle reference that summarizes the cultural and social interests of the user, human factors research that articulates the ergonomic interaction of the user with a product, and further scenario development that tells a story of how a customer might use a product each help to define the specifications of the product. Identifying key experts to provide a more holistic view of the user as part of a group can be an effective means of broadening the scope of people interviewed. They also can provide a conduit to identify appropriate users to target in the qualitative research. Physicians and therapists can provide expertise, and groups of patients (with their permission) can provide feedback in health and medical product design. Instructors in adult education courses can provide expertise in certain hobbies and supply a pool of potential users through their classes. Specialty store owners can provide knowledge of habits and activities in areas such as cooking, clothes buying, and furniture trends, for

example. People in manufacturing industries can provide insights into different aspects of production flow.

Three other aspects of the opportunity are considered at this point. The first comes from scanning and understanding technology. Competitive products and patents begin to describe the state of the art. Understanding technologies available or emerging but used in other types of products broadens the team's understanding of what a product might be and what is feasible to consider in developing a product.

At this point, rough prototyping also begins. How can you prototype a product if you have no concepts to build? The prototyping at this point is at the block level, helping to understand bounds on the size of the product. Initial studies explore how a person might handle a product of a given size or proportion, or navigate windows in an interface through a storyboard. Figure 5.4 shows some block-level prototypes of a hand-held augmentative communications device designed by Daedalus (shown in Chapter 11, "Where Are They Now?"). These Phase II models are weighted with lead to allow end users to start "using" the product, at least at a conceptual level. They also help the team bound the size and weight of admissible technologies and understand the possible limits in sizes and features.



Figure 5.4 Block-level prototypes that are precursors to a hand-held augmentative communications device. (Reprinted with permission of Daedalus)

Finally, a more refined scenario is developed that captures the essence of the product opportunity in a short story that focuses on a potential user. As discussed in Chapter 7, the scenario helps ground the process and keep it focused. The process

of epic storytelling can highlight key aspects of the challenges and desires for the potential customer that become core to the scenario. Along with the development of the scenario comes initial market research into the size of the market, the buying habits of the target user, and the financial capacity of the target market. What type of products does the customer purchase? How many potential customers might be in this market? What income levels do the target users make? Where do they spend their money now?

Teams have several ways to begin to understand the characteristics of the market. Qualitative research methods are the most meaningful way to find insights into a POG. However, broad-based market databases can be useful as well. Traditional demographics tend to be irrelevant at this point in the process. Instead, marketing databases that augment our understanding of the culture and lifestyle issues are more useful—for example, consider Stanford Research Institute’s Values and Lifestyles (VALs) database and PRIZM by Claritas Corp. These databases break the consumer market into segments based on values, beliefs, point in life, and financial capability, not traditional breakdowns of age, income, and education. This broad statistical understanding of detailed purchasing trends can nicely supplement ethnographic research to provide a rich picture of the targeted market. Such databases, however, should be used with caution and only to supplement in-depth qualitative research of target users, not replace it.

■ The result of all this research is a growing understanding of the user experience and the emotion surrounding the experience.

The result of all this research is a growing understanding of the user experience, the emotion surrounding the experience, the product attributes that enable the emotion, and realization of those attributes through physical or software design and definition of market resources. This realization can be described through the Value Opportunities. The VOs of a POG, supported with an analysis of the particular POG against the current competitive environment, suggest a deeper insight into the target user, the product opportunity, and the differentiation needed to move the product to the Upper Right. The VOA is also the mechanism that establishes product requirements based on a high level of resolution of the product, namely what the product must accomplish to succeed.

The result of this phase is a behavioral model of the target user, a detailed understanding of that user’s needs, wants, desires, dislikes, and resource capacity. The scope of technology available is understood. Bounds on the overall dimensions of the product or scope of interaction for a service are also known. The VOs for the product that will be used to develop product concepts and to judge the effectiveness of any concepts generated are understood. This rich level of understanding of

the product opportunity up front enables a more targeted and efficient approach to the next phases of product development.

It is important that participants from all disciplines (and, for small product development teams, all members) participate in this process. Historically, marketing alone has defined the product characteristics and specifications. Although marketing's participation is important, it alone is not sufficient. The methods we present go beyond and complement traditional marketing. They result in a deep and broad understanding of the context for a future product that the team will develop, a context that all key team players must understand. Transferring that context to the design team is difficult. We have often observed in the traditional approach that the design team interprets the description from marketing, with each person interpreting it in his or her own way, and the tie to the user is lost. An analogy is the children's game of "telephone operator," in which one person whispers a phrase to his neighbor, who whispers it to her neighbor. By the time it gets to the end of the line, the phrase has completely changed. The same happens here. When engineers and designers interpret a description that a marketing person wrote as an interpretation of user data, the connection to the user is lost. Larger teams might find it impractical for all team members to spend time researching in depth the lifestyle and essence of the customer (for example, in the auto industry, where teams reach more than 200 in number). Even with these teams, however, it is not unreasonable for all members to participate in short interviews, customer discussions, or observations. All team members should be trained on the importance of this technique and proper execution of the methods.

At the end of Phase II, all team members should have a shared understanding of the requirements of the product. They are starting to become the experts. They have developed models and diagrams of the product experience. By the end of this phase, the team has a vague sense of what the product will be like. Put in terms of human embryonic development, the cells will have differentiated and the parts of the body are there, but there is no sense of what the baby will look like. The high-performance teams start to lose their discipline-specific roles, and a lot of crossover behavior results. Marketing research, visualization of ideas, and technical feasibility are often shared activities that are invited and seen as nonthreatening by the group.

The scenario established early in Phase I would be developed further to be more specific, and the product opportunity statement would be clearer. The scenario would sound more like this:

Mary has arthritis in the lower spine and shoulders that limits her range of motion. She also has lost strength in her back and arm muscles. A device is needed that fits in the context of a standard oven that will compensate for her limited motion and reduced strength and allow her to easily put in and remove a variety of pans and baking dishes. The device will have to lift items that range in weight from 1 to 15 pounds.

The product opportunity statement might now sound like this:

The team will develop a product that will integrate with a standard oven and will be easy to install and clean. It must have a simple mechanism and must cost no more than \$50 to buy and install. Any installation should be easy enough for a family member to do. Although the primary market will be senior women with arthritis between the ages of 70 and 85, the primary purchasers may be family members.

At this point, the scenario and product opportunity statement are complemented by a series of models, diagrams, facts, and statements gleaned from research documents, to frame the issues that will serve as the guidelines for assessing the concepts developed in Phase III. For example, the size of standard ovens will be known and the team will also know that a typical oven hasn't changed in size in more than 50 years. The Value Opportunities are also framed out and must be interpreted into product characteristics. The security, safety, and independence emotion VOs and the ergonomics VOs are critical to the acceptance and use of the product. The social impact VO separates this potential product from most other kitchen appliances. The opportunity for a unique visual and tactile aesthetic, and related identity, can create a new market. Finally, the quality and core technology VOs will need to be clearly articulated to target an elderly user and her family. A task analysis and ethnographic research, all covered in Chapter 7, will provide a detailed model of how an elderly woman uses the oven and compare this to a younger, more agile and strong woman. The analyses will also provide insights into how a product that fulfills the opportunity would improve the task for the elderly user.

■ The goal is to test as many concepts as the team can.

Phase III starts to resemble a product concept phase in a typical program, but there are two main differences. First, the concepts are the result of healthy team interaction and stakeholder insights. Second, the concepts are tested against criteria established in Phase II through individual feedback and focus groups composed of users, expert advisors, and other key stakeholders. The goal in this phase is to develop a series of evolving prototypes representing the concepts. The team continuously tests as many concepts as it can, starting with simple representations and moving to more detailed versions through the phase. This process should be iterative and go through as many cycles as possible. The emphasis is on getting feedback, turning the feedback into a new generation of prototypes, and then testing again. Some companies use rapid prototyping, some use virtual prototyping, and others use blue foam models. The

PHASE III: CONCEPTUALIZING THE OPPORTUNITY

Goals

Product:

- Turn Value Opportunities into product concepts that are perceived as useful, usable, and desirable
- Generate many concepts and, through iteration, reduce to one

Team:

- Use interests-based negotiation strategies
- Overcome perceptual gaps
- Keep conflict focused on product needs

Results

- A product concept that is:
 - Represented as a rough visual aesthetic
 - Technically feasible
 - Perceived as useful, usable, and desirable
- Visual prototype
- Functional prototype
- Clear market definition

Methods

Cycles of modeling/representing prototypes tested for validity with core market, expert users, and advisors:

- Ideation
- Selection methods (such as Pugh charts)
- Focus groups
 - Drawing
 - Visual prototyping
 - Engineering prototyping

emphasis is on speed of turnaround. If rapid prototyping is expensive and time consuming, use simple methods. For digital interaction, use storyboards. The feedback is more important than the method. This is particularly true in the early rounds.

The feedback to the team through these cycles is invaluable. Many companies ignore this part of product development research and often hurry the process or hide the results instead of respecting and supporting the feedback it provides. The difference between Phase II and Phase III is that the second phase develops an understanding of the opportunity, whereas the third phase develops an understanding of the product itself. During this stage, the team becomes truly expert. By the end of this phase, team members will have a solid understanding of stakeholders and knowledge of the aesthetics, features, materials, and technology that will induce a customer to buy the product.

This phase requires a return to ideation methods to generate as many concrete concepts as can directly or indirectly meet the criteria set up in Phase II. When the team combines concepts and reduces the number to a reasonable level (say, eight to ten) based on how likely they will meet the expectations set up by the specifications from the VOA, each concept can be explored in more detail. Each concept is visualized by sketches and rough form models that begin to capture the essence of the product. High-level functionality is specified, including mechanisms or other capabilities that might enable the product to behave as desired.

At this point, the team returns to the user group for more quantitative feedback. Here more traditional focus groups and surveys help the design team understand what aspects of the concepts potential users like or dislike. This is also an opportunity for the users to help the team design the product by asking for suggestions on how to improve the product. When presenting each concept, all sketches, form models, and functional specifications should be presented at the same level of specificity. Having one design better fleshed out than another shifts the preference scale toward the more detailed concept, by default. Prototypes do not have to work, and many details can be either ignored or represented graphically. However, the prototypes should be neat and should clearly represent the features that the team is focusing on at this stage of the development process.

The key to quick prototyping and feedback is to enable several iterations in the development process. The team should use the feedback from the first round to again conceptualize ways to evolve and refine the product. At each iteration, user feedback reinforces what aspects of the product are working well and what needs to be changed. The surveys and focus groups augment the specifications laid out in the second phase, which are used to judge the success of the concept.

In parallel, this phase includes the process of reverse-engineering competitive products or technologies of interest. Reverse engineering is a useful way of making sure the team stays on top of the evolving field. Most larger companies already reverse-engineer their competition. For example, automobile companies constantly take apart their competitors' products to understand what new features they are introducing, what new technologies they are using, what manufacturing processes and materials they select, and what aspects of the product fail. The process of reverse engineering first requires breaking apart a product to understand how it works and how it is made, and then using that analysis to understand how the current product can be improved. Details on reverse engineering and function analysis of physical products can be found in Pahl and Beitz⁷ and Otto and Wood.⁸

Knowledge of technology derived from the reverse engineering process is then fed into the concept development process, helping to shape and add detail to the evolving product. Mechanisms, information flow, and logistics begin to take form. Technologies begin to be specified. As the iterative process continues, the technical features become more refined. In this phase, manufacturing and other production considerations become relevant. How will the product be made? What materials will be selected? What are the cost implications? Does the state of manufacturing need to be pushed (as was done with OXO)? At the same time, the designers are developing the look and feel of the product, refining the details as the process evolves. Marketing is beginning to think about pricing, distribution, and rollout strategies.

The process must remain integrated. If engineering works alone on the functional design while industrial design works alone on the form and marketing makes assumptions on features or aesthetics, the three likely will never integrate. We have observed many teams in trouble because each discipline does its own thing. Only after the three parties have sat down together and talked through a solution does a successful concept emerge. As product tensions mount, so do tensions within teams. The tools and methods from Chapter 6 are critical to managing conflict in the team. Tension in the development process is natural and important. One aspect of a design solution causes problems for other parts. For example, mechanisms might need to be conceptualized, but as one type of mechanism is selected, its proportions and space requirements might affect the initial form studies. Negotiating product-based conflict is an effective way to determine successful product solutions. However, the conflict should be based on meeting the interests of the user rather than personal, power-based struggles, and the negotiation must be managed in terms of time and emotion.

Weighted matrices used in Phase I are again of use here; now the columns represent each concept and the rows represent criteria derived from the specifications of Phase II. The weighted matrix becomes even more useful in this phase, providing a means for each discipline to articulate its views of the product in a form that team members can discuss. Thus, the weighed matrix becomes a support tool for interdisciplinary communication. Note that, as the product concepts become more refined and the criteria become more specific, the weighted matrix takes the form of a Pugh chart, developed by Stuart Pugh,⁹ as a means of comparing competing concepts based on technical considerations. Now one concept or standard solution is chosen as the datum to which all other concepts are compared and scored as better (+1), worse (-1), or the same (0). As with the use of weighted matrices for opportunity identification, no concept should be selected based entirely on the numeric outcome of the matrix. Instead, the matrix should be used to filter out the

inferior concepts and to enable the team to discuss the pros and cons of each preferred concept.

Focus groups help define the market. Alternative approaches for the market are considered, formulating an argument of why the new product is superior to the current state. A better understanding of the lifestyle and expectations of the market—for example, through segmentation tools—and the costs of competitive products all lead toward an initial marketing strategy and price target.

The opportunity to improve Mary's ability to bake might lead to concepts that attach to a counter or lift from a floor. Other options might include permanent attachments in the oven or, better yet, attachments that fit into a standard oven using the guides for current racks. The latter concept, being the most inviting from a usability and cost analysis, would lead to further ideation on how to get a rack from inside the oven out and up to a counter height while still supporting the weight of a casserole dish. This might include assist devices from outside the oven and innovative mechanisms from within. At the end of this phase, a good understanding of one or two primary mechanisms will be known, a basic aesthetic for the user group will be identified, and a cost target will be known.

Traditional methods for conceptual design, product refinement, and market planning can be found in books such as Otto and Wood,⁸ Ullman,¹⁰ Ulrich and Eppinger,¹¹ Urban and Hauser,¹² Wheelwright and Clark,¹³ and Dieter and Schmidt.¹⁴ Readers not familiar with these processes should read these texts. However, the tie to the user and the requirement that user-based specifications, developed in Phase II, must be met, along with an iterative, refining process of continual feedback from the user and stakeholder groups, differentiates our approach from traditional, more discipline-specific methods and ties together the methods.

A single concept emerges, as the product of the team, at the end of Phase III. The concept meets the look, feel, and technical expectations of the target market. What remains are the details: the material and color, the sizing and packaging of parts, the curves and flow of the shape, the product name and logo, the manufacturing specifications, the detailed marketing rollout strategy, and the final cost of and expected profit from the product. For digital designs, this focuses on the software implementation of the concept described in the storyboards. For services, every detail of the system is determined and each touch point and technology component is identified and integrated, to enable its implementation.

PHASE IV: REALIZING THE OPPORTUNITY

Goals

Product:

- Program approval for full ramp-up to manufacture and market rollout
- A complete product concept that is deemed as useful, usable, and desirable
- A product concept that is patentable or otherwise protectable

Team:

- Continued interests-based negotiation
- Constant communication through product integration

Results

- Refinement of appropriate aesthetic values, features, material, and manufacturing core technology
 - Form model
 - Interaction model
 - Function model
 - Manufacturing plan
- Clear marketing plan for product
 - Financials
 - Marketing rollout strategy
 - Possible logo and name
- Intellectual property protection
 - Utility and design patents, trade secrets, copyrights, and trade dress (brand identity)

Methods

- Stakeholder reaction to refinement of concepts from Phase III
- Detailed visualization and representation in 2D, 3D models digitally, and physical models in three dimensions
 - Detailed design of aesthetic components

Detailed design of technical features and interface

- Rapid prototyping
- Market testing with focus groups and interviews
- Research and selection of core technology
- Research and selection of materials and manufacturing processes
- Costing of product

In this final phase, the product concept is refined to the point that it becomes a real product. The form is refined, again through user feedback, to capture the semantics and style laid out in Phase II. The mechanics of the product are specified and sized, meeting the functional requirements of the product. The market is examined in more detail, with a strategy to move the product to market and, eventually,

become profitable. The results of this phase are a detailed form model; a detailed, working, functional prototype; a manufacturing plan; for digital and service products, a mockup that details each step in the flow of use of and interaction with the product; and a marketing plan with financial information specified. The approaches used to develop these prototypes are standard (see the references given in the previous section). However, again, the user-focused specifications from the second-phase VOA are a constant check on the success of the process. Often the process breaks into more discipline-oriented activities: Designers detail the aesthetics and make the form models, engineers analyze and detail the performance and create the functional prototypes, and marketing devises the marketing plan. Marketing also must determine what value the product has to the customer, to determine an initial price point. Although not preferred, the skills of team members might require such a breakdown to keep the process efficient. The team still functions, however, as an integrated, high-performing unit that stays intact and in constant communication. It is critical for the team to have matured to the point that it works as an integral unit so that as team members each pursue their discipline tasks, they do so only through consideration of how their decision impacts those of all the other team members and how the Phase II specifications and scenarios affect the process.

At the end of this phase is a major milestone, commonly referred to as a “go/no-go” decision point. If the form and function models differ, then, at a minimum, the team must present a design on paper (or, more likely, on computer) showing how these models will integrate. Management might want to see an integrated prototype before final commitment for the program. Often, however, individual models drawn on paper or CAD will suffice. The quality of the prototypes is critical to the decision-making process. Form models do not have to work, but they must show each feature in sufficient detail to capture the overall theme and feel of the product. Function models do not have to look like the final product, but they must be neat and clearly illustrate how the product behaves.

The oven aid will have a detailed mechanism designed with all parts specified. A function model will prove that the device is effective in sliding out of the oven and up to counter height while carrying a casserole. It will then be able to be brought into the oven with the same load. The mechanism will also need to illustrate how a weak elderly woman can lift the weight without dropping it. The form of the product will be specified enough to capture the semantics of ease-of-use, security, and safety, with a contemporary look and feel clearly articulated and represented. The approach to distribution and sales for the targeted elderly women will be specified as a cost of \$49.95, purchased where appliances are sold, and advertised in *Modern Maturity* and in doctors' offices.

Figure 5.5 shows the final concept.

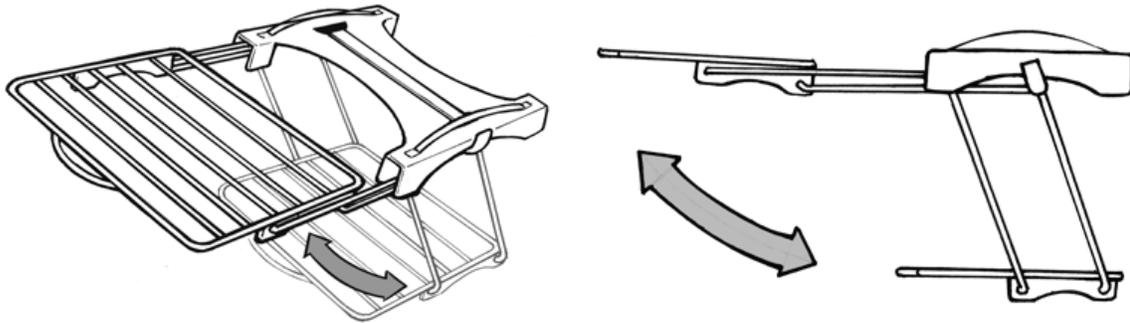


Figure 5.5 Oven aid concept to allow elderly and arthritic users to more readily remove and place objects in the oven.¹⁵

At this point, the company can decide whether the project should move into the development-to-market phase. Major costs are committed for tooling for physical products or for a production team, if digital. Plans for manufacture and quality assurance are developed and implemented. Marketing costs are committed for distribution and advertisement.

At this point as well, the company can apply for patents. Both design and utility patents should be considered. Patent protection is an important step toward protecting not only the functional innovations, but also the product form and identity. Trade secrets are another route best used for manufacturing processes and chemical compositions. Mechanical and electronic products are readily reverse-engineered and should have a distinct look and function that can be protected through patents. Digital innovations can be copyrighted, kept as a trade secret, and, in some instances, patented. Service innovation might be patented as process business method patents. In *Marketing Aesthetics: The Strategic Management of Brands, Identity, and Image*,¹⁶ Schmitt and Simonson nicely summarize the benefits of patent protection as a way to support the product and company brand. Brand is hard to build; technology is hard to develop. Intellectual property protection is the only way to protect this investment of the company.

■ Brand is hard to build; technology is hard to develop. Intellectual property protection is the only way to protect this investment.

At the end of this phase, a company must decide whether to commit significant human and economic resources to realize the product opportunity. In some companies, iNPD might take weeks; in others, it might take a year. No magic formula exists. However, companies must realize that investing 20%–25% percent of the overall product development program in the four phases outlined here will save significant time and money later. Many companies have a final phase in which a limited run of actual products is produced and evaluated. Mistakes late in the

process are extremely difficult to fix and require significant time and cost to resolve. Many products limp into the market with last-minute repairs that become apparent soon after purchase. Other times, competitors release features that must be accounted for because the team neglected to understand what features the customer really wanted. When a company fails to adequately fill a Product Opportunity Gap, it is extremely difficult to recover with subsequent products. This can have a significant impact on the brand of the company. The iNPD process is a wise investment to make sure the gap is successfully filled the first time.

This is the point of product commitment, where all of the sweat and energy of the team and the company's investments in money and time pay off. This is also the point of departure of our book. As the process moves forward from here, the tie to the user cannot be lost. Furthermore, in the next phase of design refinement, the battles between cost and feasibility often lead to compromises and frustration. The critical task is to protect any innovation from the earlier phases. To minimize compromise and maximize integrated solutions, it is critical to maintain appropriate respect and negotiation practices from these earlier phases, as discussed in Chapter 6. The ability to identify and prioritize primary user and stakeholder concerns, determined in Phases I and II (and further developed in Chapter 7), helps to maintain the integrity of the initial product concepts.

Resource Allocation

Before looking at tools to understand the user, team collaboration, and management of the process, this chapter discusses the planning of the process through resource allocation. Allocating resources is a challenging and often daunting question for a company. This section addresses the support of the user-centered iNPD process through time, money, and people. Which types of people should be put on the team? Should the company hire a consulting firm or invest in its own personnel? How long should this process and each phase take? How much money will the company spend on the process? How do these methods apply to small versus large companies? This is all part of the early planning effort for the process. The quick answer, repeated throughout the book, is that the more time you can give the early part of the process, the more cost effective and efficient will be the downstream processes.

Resources come in many forms. The most obvious is money—and, of course, everything the company does ties in to finances. Time is money. People are money. It makes the most sense, however, to explore each of these topics (time, money, and

people) separately, to make tangible decisions on how much of each should be allocated and when they must be allocated. In examining each topic, note that the bottom line is that this is not a science; we have seen repeatedly that companies that try to use results from a fixed formula in a strict way end up with projects that are over budget and late, with teams that are overworked. We also note that the distribution of resources varies by industry and product type. The design of a vegetable peeler takes a significantly different (lesser) resource allocation than the design of a vehicle. Several people and several thousand dollars are sufficient for a product such as the GoodGrips peeler, and several hundred people and several hundred million dollars are involved in just the early design conceptualization process for a car. Similarly, the design of an international package logistics tracking and delivery system takes a different resource allocation than the development of a new online store. The experience of the company also influences these allocations. As individuals build expertise and the company builds a base of user understanding, the earlier phases might go faster, at least for redesign efforts.

■ The more time, money, and people you can steal from downstream and move to the front end, the better the process will become for you.

It takes experience in the process and an understanding of what is possible in an industry to sufficiently make allocation decisions. That said, our experience has given us rules of thumb in each of these categories, rules that seem to nicely scale with increased resource allocation. The bottom line is that the more time, money, and people you can steal from downstream and move to the front end, the better the process will become for you. Often companies try to compress the front end to have the resources to fight deficiencies downstream. Teams that stay true to a stage gate but without a focus on the Fuzzy Front End still find that “job one” (production delivery) slips away, that the product is delayed often by missing features that customers want or having inconsistencies when the product is finally tested. Our position is that allocating more resources to the front end leads to a better-executed product with fewer downstream catastrophes. If you are new to the process, it may seem like a gamble, but our experience and the experience of companies that use the methods discussed in this book have shown that the gamble is worth taking. It takes as many resources to develop a mediocre product as a great one! A properly executed and supported user-centered iNPD process leads to a successful product in the marketplace.

Allocating the Time Resource: Scheduling

A car can take 36 months to develop; a software product can take months or even weeks. The timeframe of different products depends on the complexity of the product: the level of technology, the number of parts that must be integrated and the level of coupling between the parts (for physical parts, both geometrically and

functionally; for services, the information and physical product flow and interaction), the number of people who contribute to the design, and the amount of diversity in the product development team. Our experience is that the more time allocated early in the process, the better the end product will be. Our initial rule of thumb is to be generous with the early phases but build up the percentage allocation as the process progresses. One recommendation for allocating the time for the four phases is to spend roughly 20% of the time for Phase I, a bit more for Phase II, close to 30% for Phase III, and the same for Phase IV. Note that because a sufficient effort was put into defining the product, the downstream phases become more efficient and streamlined. The reasons are that the process reduces uncertainty and the resulting design changes that come from cutting short or even ignoring the Fuzzy Front End of the process are reduced. By allocating sufficient time and using the methods of this book, the front end becomes directed rather than uncertain.

Allocating the Cost Resource: Financing

The deeper into the product development process you get, the more money it will cost you. The increase is not linear, but rather increases exponentially as more commitment is made and the process gets closer to manufacturing. Getting started, however, does not take a lot of money. In fact, if the product is relatively simple, it can be developed for a few thousand dollars (prior to commitment to development of the manufacturing processes). Inexpensive form models married with functional prototypes that work can often capture the excitement of a product. Some commercialized products that we have been involved with were initially prototyped for less than \$1,000 (not including personnel and overhead).

As products gain complexity, even the prototyping costs increase significantly. For evolutionary products—ones that are built off of a previous platform or that keep components from a previous product—the prototype can (and should) reuse those parts. For revolutionary products with newly designed components, as parts integrate into a unit that begins to look like the final product, reused or off-the-shelf parts become less desirable. Instead, individual prototype parts must be detailed and made, usually by a manual process. Even in our fourth phase, in which product concepts are realized but not detailed to the point of manufacturing, integrated prototypes can become quite costly. One rule of thumb to determine what finances will be required to develop a product is to examine how detailed of a prototype is required. If separate function and form models (accompanied by arguments of how to integrate the two models into a common platform) are acceptable, the process can be done with very little financial commitment to hardware. If a working

integrated product is required, the financial commitment increases significantly. More products are being represented digitally in CAD. With this approach, the cost is limited to the time it takes to create accurate models. Much of the LoneStar truck, discussed in Chapter 9, “Case Studies: The Power of the Upper Right,” was designed through CAD, with physical prototyping used only at the end of the process. However, a physical mockup is still required: It is the only way to gain a true sense of the feel of the space and to sense the emotion of interacting with the product.

Allocating the Human Resource: Team Selection

Companies don't make products; people do. But the company picks the people to join the team to make a product. Teams should be composed of appropriate disciplines. Stakeholders within the team should have the capability to work through the four phases and develop the detailed product concept. The core team must be picked up front. The process is dynamic, however, and the team must be as well. New players must be brought on board as early as possible as the product definition unfolds. However, the company does not need to employ all the team players. Large companies such as Ford, GM, Chrysler, Motorola, Hewlett-Packard, Apple, Whirlpool, and Nike hire enough core players to have expertise in all areas of their product development. Even there, suppliers, who are not employed by the company, are often an integral part of the team. Smaller companies often find it difficult to afford to hire all participants. They rely on consultants to help develop their product. For example, in the design of the GoodGrips, OXO partnered with Smart Design, an external consulting company, throughout the whole process. But even large companies partner with external players, from full-service product development firms to open source collaboration; P&G is one company that employs both of these methods. The development of the Node chair (with Steelcase partnering with IDEO) and the Frozen Concoction Maker (with Jarden Consumer Solutions partnering with Altitude) are two other examples in this book. Consultants differ from suppliers: Suppliers actually produce parts for the product, whereas consultants assist the company in designing the product but are not responsible for producing any parts.

The question of who to hire full time and whether to look in-house for product design versus looking toward suppliers or consultants falls back on defining the core of your business and your financial capacity. If you are a small operation that focuses on technology, hiring an industrial designer for your staff might be difficult. Instead, you might look at many of the several hundred product development firms across the country and around the world to assist in the process. As you look

more seriously toward user-centered products, it behooves you to hire at least one designer. The designer can speak not only the language of the design consultant, but also the language of the user. Furthermore, the designer can bring a different perspective and focus on the application and further development of your technology. If user-centered design is your focus, a connection to the user should be considered a core corporate competency. Again, P&G does both. It has a strong in-house industrial design staff but also actively works with external product development firms such as IDEO. For further information on industrial design services, contact IDSA, at www.idsa.org.

Summary Points

- The four-phase approach to the Fuzzy Front End enables clarity and control.
- The iNPD process increases the likelihood of program approval and intellectual property protection.
- Resource allocation is critical to success in the Fuzzy Front End.

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Chapter Six

Integrating Disciplines and Managing Diverse Teams

At the core of the product development process are engineers, designers, and market researchers, with each group viewing the product from a distinct perspective. In this chapter, we present research that demonstrates the inherent gap in perception between these different players. Integrated new product development (iNPD) teams must overcome these gaps and seek to become high-performance teams. To do so, the interests of the user must drive effective negotiation strategies between team members. This chapter introduces tools and provides guidelines that will enable you to integrate disciplines and manage diverse teams. The goal of the process, from both the team and management perspectives, is to foster teams that maintain a consistently high overall performance. The process of developing a product should be as rewarding for the team as for the person who uses the actual product.

User-Centered iNPD Facilitates Customer Value

Moving to the Upper Right requires an integrated approach from different disciplines, including design, engineering, and market research. Although each discipline brings knowledge to the process, the team must integrate to create a product that is useful, usable, and desirable to the user. In contrast, the more traditional approach keeps each discipline independent and isolated (as in Figure 6.1). In the traditional model, marketing focuses on product concepts based on marketing criteria: Who wants to buy the product, what will they pay for it, how will it be distributed, and what will it cost to get it to market? Design focuses on product concepts based on the visual appearance or human factors: What should the product look like, how should it be used, and what are the best materials or sequences for the right interaction and look? And engineering focuses on product concepts based on technological innovations: How should the product work, what technology is best, and how should it be manufactured or produced? Marketing traditionally has defined the product, and engineering and design have iterated between themselves based on their respective (and usually differing) interpretations of the marketing criteria.

In looking at the commonalities among the three disciplines, design and marketing tend to focus on desirability of a product—the brand and lifestyle images, ease of use, and costs to take into account the aesthetics. Marketing and engineering both focus on usefulness of a product—the functional features, the platform upon which the product is built, safety and reliability issues, and production costs. And design and engineering both focus on usability of a product—the ergonomics, the interface with the product, the integration of the different features and associated

costs, the selection of material, and manufacturing. Each overlap is secondarily also concerned with the other two value attributes, but the primary driver of the interaction is as indicated. The point is that the usefulness, usability, and desirability of the product stem directly from the interaction among the disciplines. Thus, the overlaps in disciplines define the value of the product to the customer, the value that leads to success in the market and profit for the company (as in Figure 6.2).

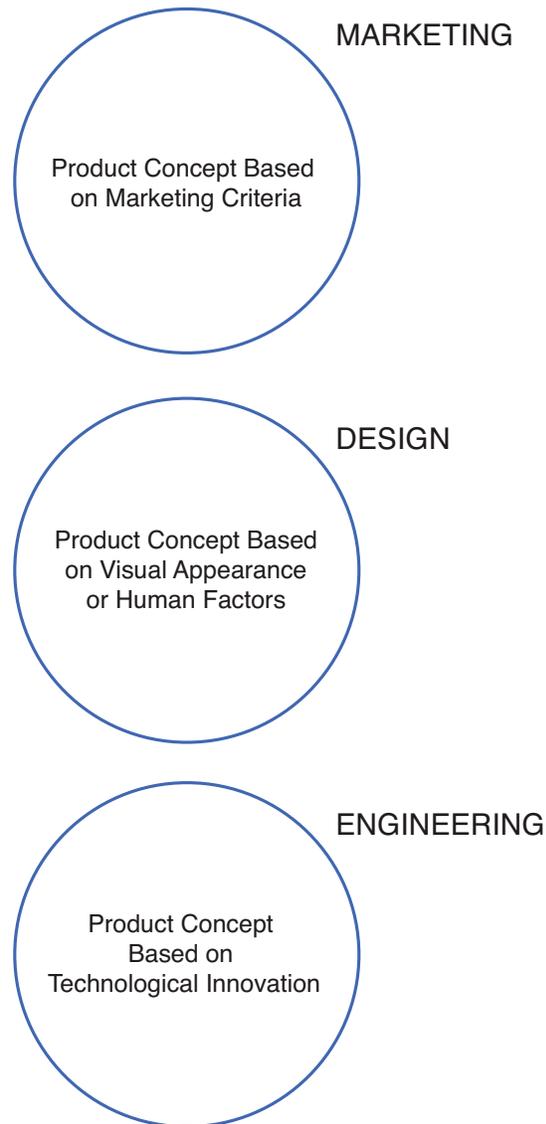


Figure 6.1 Traditional model of product development—-independent disciplines.

■ Although the need for integration seems obvious, it is not an easy thing to do.

Although the need for integration seems obvious, it is not an easy thing to do. People often find that the path of least resistance is the one that is most comfortable, that of falling back on working within their own discipline. When engineers work with engineers, or designers with designers, they speak the same language,

think the same way, and use the same tools. If different disciplines have different ways of thinking about and approaching a problem, the overlap of disciplines shown in Figure 6.2 could be difficult. When engineers and designers work together, for example, they often find themselves frustrated, feeling as if the other party could care less about their concerns. These feelings can turn into conflict, which significantly affects the design process.

■ Teams will perform at their best when individuals are inspired, feel empowered, and gain the respect and trust of the people they are working for.

Managing a group of people from various educational and professional backgrounds is exciting and challenging. Universities and corporations do not teach or even recognize the difference between managing within an area and managing across areas. All of our experience in managing teams and conducting primary and secondary research about teams has given us insights into ways to help optimize interdisciplinary team performance. Teams will perform at their best when individuals are inspired, feel empowered, and gain the respect and trust of the people they are working for. In the current climate of new product development, finding and keeping the talent to build successful teams is a challenge. If people are not treated well, they will leave the company. Product managers must have a range of abilities to effectively manage integrated design teams.

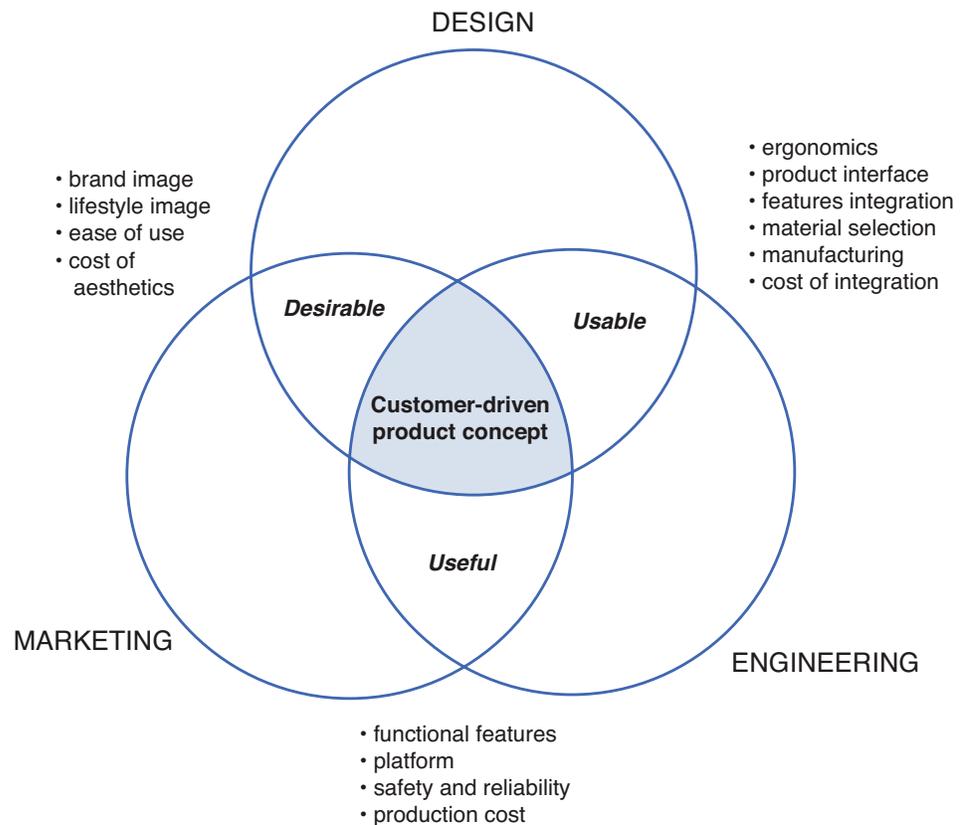


Figure 6.2 Overlap of disciplines leads to value: user-centered iNPD.

For teams to be empowered, they must:

- Recognize where differences lie and why those differences exist
- Be given tools to work through difficulties in an efficient and productive manner
- Be placed in an environment that supports integrated new product development (iNPD)

This chapter focuses on the integration and management of interdisciplinary teams, first exploring the differences between diverse disciplines in the product development process and then introducing tools and management techniques to help teams overcome those differences and be empowered. The goal is to move from the traditional structure shown in Figure 6.1 to the iNPD structure shown in Figure 6.2. We begin by introducing the concept of *perceptual gaps* between different disciplines to provide a foundation on which to understand how differently each discipline perceives a product. The discussion is highlighted through our research on product perception among design team members. Next, we characterize high-functioning teams and strategies for conflict negotiation within those teams. All parts of a complex product cannot be designed by all members of the team, so we introduce a new classification system to help teams and managers determine what parts must be designed in an integrated fashion and what parts can be championed by a single discipline. We then provide guidance on how to manage interdisciplinary product development teams, based on our experience with teams in a variety of settings.

Understanding Perceptual Gaps

To understand the root challenges in team integration, we first examine how different these disciplines really are. We worked closely with a major automobile company to explore this issue. One part of the research focused on a qualitative study of studio designers, engineers, and marketing people to elicit their perspectives on the product development process. The study had multiple parts. Here we review one part of the results; we refer to other aspects of the study later in this chapter. For further details of the study, see Cagan, Vogel, and Weingart.¹

In this part of the study, we chose to focus on a set of colanders, very simple products that are independent of the auto industry. Each of the three colanders shown

in Figure 6.3 has its own characteristics. The colander in Figure 6.3(a) is a stainless steel colander; the one in Figure 6.3(b) is a two-piece plastic molded colander from Tupperware that won the 1995 Gold IDSA Excellence Award in Consumer Products (sponsored by IDSA and *BusinessWeek*); and the one in Figure 6.3(c) is a cheap, one-shot injected, molded colander. To each participant, we asked, “If you owned a company, which colander would you prefer to sell and why?” Participating in this study were three studio designers, three marketers, five engineers, and two suppliers (who happened to be trained as engineers).

The results, shown in Figure 6.4, were significant. All of the designers selected the stainless steel colander. All but one of the engineers, including the suppliers, selected the cheap one-shot plastic colander. And no one chose the award-winning Tupperware colander. The marketers had a mixed view of the products; their contribution to other parts of the study that focused on their industry was more definitive.

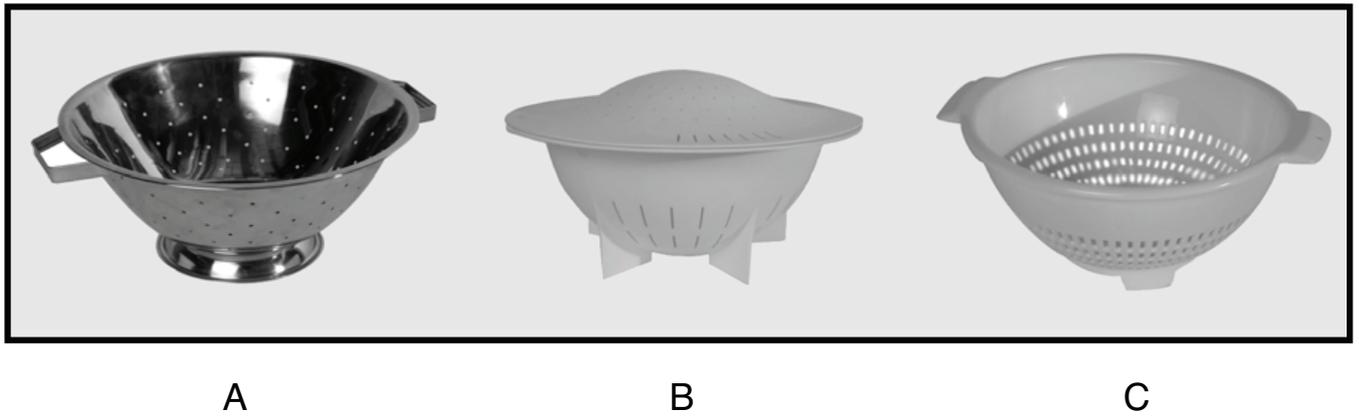


Figure 6.3 Three colanders used in study.

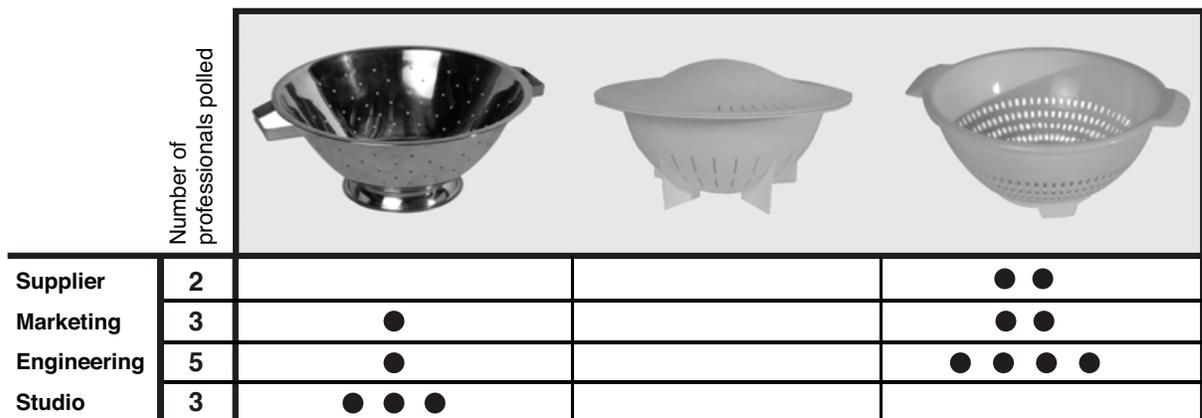


Figure 6.4 Overall results of colander study.

It is interesting to note that the one engineer that preferred the stainless steel colander was known for his sensitivity to styling issues and was even identified by the other participants, despite the results being kept anonymous. In following that engineer's performance in the company, we found he was one of the best at negotiating solutions among suppliers, engineers, and designers. In one instance, he led the effort in developing an innovative solution to a "routine" problem that positively affected many other parts in that subsystem. He was seen as someone able to bridge the impasse in perspectives. His identification clearly indicated that team members are aware that differences in perception typically exist, and that those who overcome them stand out.

When we asked the participants why they had made their preference choice, the designers felt that the metal colander was indicative of qualities such as simplicity, durability, and good value, and was in keeping with current styling trends while saying "Chrome is in!" Chrome had come back in vogue in the auto industry. In contrast, they felt that the one-shot plastic colander was "cheap and ugly looking," was "not elegant," and had "an unresolved shape." The designers, up on current trends, rejected the Tupperware colander as "overstyled," recognizing that tastes and trends change (what was trendy and award-winning five years previous was no longer the current style).

The engineers had a different view of the products. They found the stainless steel colander an "old-fashioned" aesthetic and "complicated and intricate" due to the multistep manufacturing process, thus directly affecting manufacturing costs and quality control. The plastic one, on the other hand, was affordable ("cheap") and easy to manufacture. For them, the two-piece Tupperware colander was "confusing," with the purpose of the top unclear.

■ Perceptual gaps are the differences in perspectives that team members have that stem from discipline-specific thinking.

Behind the different preferences between designers and engineers is a more fundamental difference in approach. For the designers, shape and aesthetics drive the decision process; for the engineers, cost and complexity drive the process. These differences in perception are what we call *perceptual gaps* (see Figure 6.5). Perceptual gaps are the differences in perspectives that team members have that stem from discipline-specific thinking and prevent teams from developing an integrated, interests-based conflict-resolution process. These gaps make negotiation and collaboration strategies difficult.

Perceptual gaps come from several sources. One stems from differences in education. Engineers are trained to know what is "right." They use physics and math to model, understand, and eventually control their environment. They recognize what can be done and what can't be done, based on their understanding of how the world

works. They think in terms of function; form is often secondary. They focus on performance, quality, and manufacturing. Designers, on the other hand, are primarily visual thinkers, trained to explore and think about what should be, not what is. They are limited only by their imagination and are influenced by the human side of the world around them. They have a good understanding of manufacturing but are comfortable pushing the limits if doing so allows them to better express their forms. They think of quality as aesthetics and emotional impact.

Another source of perceptual gaps is the inherent personality of an engineer versus a designer. Engineers tend to be black and white—things are right or wrong. They are comfortable with math and use statistics to reach consensus and conclusions. Designers are more comfortable with uncertainty. They view the world around them as evolving and indecisive. Engineers like to get to specifics early, whereas designers like to leave options open late.

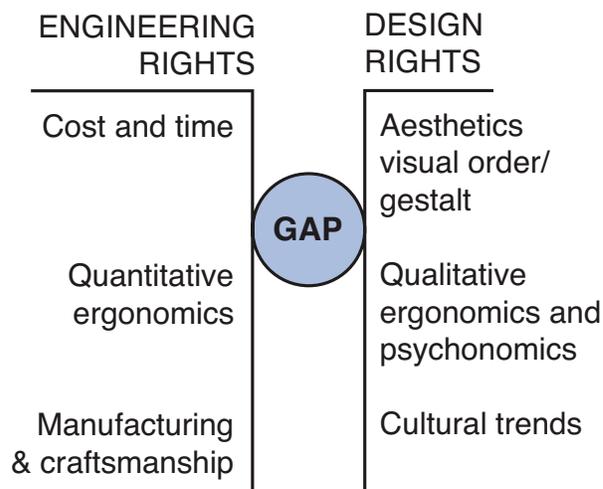


Figure 6.5 Perceptual gaps model.

We present three particularly relevant examples of perceptual gaps that we witnessed in industrial settings. The first was an interaction between a designer and an engineer discussing a 15 mil gap that occurred between the body of a car and the bumper. Two alternative designs were presented. The designer felt that they had worked hard to achieve a preferred design, if only the engineer would get rid of that gap. The engineer, however, was frustrated because the designer didn't understand the complexities involved in removing the gap. It wasn't easy. First, there was the need for structural reinforcement, which would add weight to the vehicle and introduce added complexities to manufacturing. In addition, the manufacturing machines in the intended plant were not capable of producing a part that would meet the designer's needs. The engineer's view was "This cannot be done," but the designer had heard all that before from engineering.

The second example involved an engineering manager who had to work with a design manager who never seemed to meet cost targets. The engineering manager said that the process was similar to bringing a child to a candy store and telling that child to pick out the biggest, best, most impressive basket of candy he could. The child would get very excited and really work hard to pick out the best candy he could. Then when he came up to the register, his parent would say, “Wow, that’s great, but you have \$200 worth of candy and we have only \$20, so you will have to put most of it back.” The engineering manager saw himself as the parent and the design manager as the child. No one wants to tell a child that he can’t have what he wants, but the fact is, the money is limited. The parent will work with that child to make sure the child gets the things he really wants. But the parent sees the child kicking and screaming and getting upset, which does no good because the child still will not be able to get all that he wants. He understands that it’s hard to put that candy back. But if the child had let the parent walk around through the store calculating the sum from the beginning, this hurtful scene at the cash register would never have happened. But the child (designer) does not want him to do that.

The designer’s view is quite different. The third example came from a design manager discussing his interactions with engineers. To him, the form of a product was like a bowl of gourmet soup. All the ingredients are there for a reason—it tastes good! Although you can take the pepper out or reduce the amount of salt, doing so sacrifices the taste. But you can’t really say why. If you keep going, you end up with a bowl of water. Designers are like chefs; they understand how everything fits together into a great-tasting soup (or product). The engineers keep trying to cut costs by taking out a little of this and a little of that until the soup (product) tastes (looks) bland.

■ Differences in perception are an important and positive part of the design process.

Differences in perception are an important and positive part of the design process. These differences help provide the trade-offs that make products innovative and yet affordable, and produced on time. However, these gaps might also disrupt the process if the players do not respect each other (as with the second and third examples). Each player must appreciate the alternative perspectives (lacking in the first example). All too often, disciplines feel superior, leading to roadblocks in the design process and preventing group consensus. At times, this leads to personal conflict with lasting effect. Often different players work together repeatedly, but if early encounters are negative, developing trust and respect in future projects will be hard.

Team Functionality

Individuals from diverse disciplines face perceptual gaps when they come together to work as a team. In addition, teams must navigate their own diverse personalities. We turn now to the literature and our own experiences with team functionality, especially in the design process. We examine the aspects of collaboration, negotiation, and performance.

Team Collaboration

Conflict within a team does arise, and it must be managed. Weingart and Jehn² argue that collaboration is the key to managing that conflict. The first step is to identify whether the intrateam conflict is based on the task at hand (task disagreements) or personality-related issues such as political views, social activities, hobbies, and opinions about clothing or hairstyles (these types of conflict are called nontask conflict). Our view is that task conflict can often be beneficial to the design process. The goal of iNPD is not to remove conflict, but to make it productive and focused on the task at hand. Nontask conflict tends to be detrimental to the team as a whole, interfering with the project, taking valuable time away from the effort, and at times exacerbating personality differences that prevent team members from communicating at all. The goal is to minimize nontask conflict and manage it outside the project environment. When teams are formed, we recommend that they take time outside their work environment to get to know each other through a social activity. For example, one of the most highly functional teams we have observed went spelunking. It is also important to realize that team members don't need to like each other. Instead, they need to respect each other professionally and focus on the task to get the job done. We observed one team whose members clearly didn't want to be in the same room together. By focusing on the project and using our user-centered iNPD method, they were able to produce a fantastic design. Of course, the preferred state is for team members to work out their nontask disagreements and enjoy the process.

When the focus is on disagreements about the task at hand, collaboration can take place. Through collaboration, disagreements can be altered into joint gain. The idea behind collaboration is not to compromise; compromise means that each party in the process “gave in” and left the process disappointed. Instead, collaboration implies more mutually beneficial results based on more effective communication. Weingart and Jehn describe three techniques to support collaboration.

The first is to create a group atmosphere that supports team focus, the capability to solve the problem, trust among each other, and open communication channels with which to discuss conflict. In many ways, we see trust as the most critical. Trust is hard to build and easily broken down. Trust must evolve slowly through positive interactions and responses. Trust might be slow to build, but we have seen high levels of trust lead to very efficient and productive design processes.

■ Once a conflict takes on a personal or competitive tone, it is very hard to disperse.

The second technique to support collaboration revolves around group member behavior. The goal is to look for and act on opportunities for joint gain, situations in which both parties can win. It is critical that team members exchange truthful information. Factual information keeps team members aware of each other's needs and helps substantiate each person's position. Similarly, exchanging information about one's priorities can facilitate trade-offs across different issues. If some issues are more important to one party than another, making concessions on the less important issues might enable each party to gain on other, more important ones. In addition, this increases insight into the other party's viewpoints, which can make future collaborations more efficient. Once a conflict takes on a personal or competitive tone, it is very hard to disperse. Instead, people tend to "one up" each other, and the conflict gets worse and more personal. The key to success is to recognize that this is happening and try to respond with a new tact, a direct response that brings the conflict into the open, or a more integrative and collaborative response that might shift the process back on track.

The third technique to support collaboration focuses on the mindset of the team members. Many people approach resolving conflict as a win-lose situation and think that one party has to win while the other comes out on the short end. Of course, this does not have to be the situation. Instead, an attitude of cooperation and collaboration and an openness to creative thinking can often lead to win-win situations. We have observed both types of attitudes, and the win-win view usually leads to innovative, superior solutions. Finally, collaboration requires interdependence on other team members. Negative emotional outbursts and attitudes such as frustration and anger tend to interfere with collaboration. These emotions need to be kept in check and resolved as nontask conflict outside the scope of the project.

Negotiation in the Design Process

Now that strategies and techniques are in place to set up collaborative efforts, the team needs to focus on approaches for negotiating solutions to conflicts that emerge in the design process. We turn to a discussion on the use of interests, rights,

and power, as discussed in Ury, Brett, and Goldberg,³ and our investigation into their use and effectiveness in the design process done in collaboration with Professor Laurie Weingart at Carnegie Mellon's Tepper School of Business.⁴ As people choose to use interests, rights, or power, they significantly affect the tone, atmosphere, and effectiveness of the negotiation in design.

Interests-based negotiation addresses all of the concerns, desires, and needs of each player in conflict. People's preferences and priorities can be learned and trade-offs can be found to overcome barriers so that everyone wins. This implies that people exchange information, that all relevant stakeholders are included, and, in particular, that interests of the user are considered. The result can be innovative solutions to difficult problems. This is the ideal approach to conflict negotiation in the design process.

A rights-based approach uses standards, precedence, and views of what is right and wrong to resolve a conflict. Here there is either a winner or a loser, or compromises must be made, indicating that a better solution probably was available. Often prior solutions, industry averages, and traditional profit or cost targets and analyses are the basis for such negotiation. Although rights have their place in the design process (as discussed later in this chapter), solutions based on precedence alone are often routine or mundane and can be ineffective.

Finally, a power-based approach is one in which a person is forced to do something he wouldn't otherwise do. The result is that people feel bad about each other, and the losing party often enters future engagements looking for revenge. Power-based techniques include strong-arming, threatening, invoking the boss' power, and hoarding information.

Figure 6.6 shows three concentric circles, with interests in the center, rights in the middle ring, and power on the outside.³ As shown in the figure, interests-based negotiation might be the central goal, but such negotiation is realized only by understanding that one or more parties could retract to rights or even power if the process doesn't have complete buy-in from all parties.

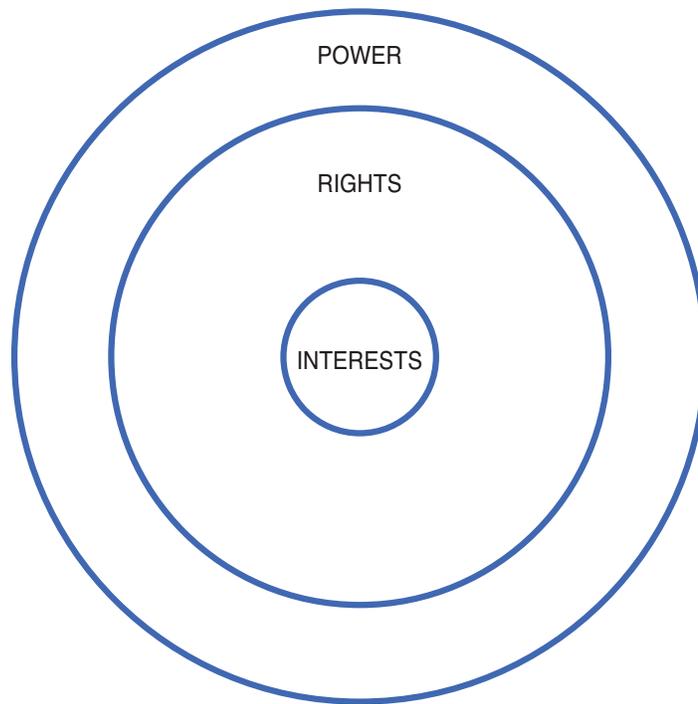


Figure 6.6 Interests, rights, and power. (Based on Ury, Brett, and Goldberg³)

This is particularly relevant with full-service suppliers who participate in the design of a system or part. Although all players should express their interests and be aware of the interests of others, fundamentally, the company that hired the supplier could very well fall back on the position of threatening to look for another supplier. Also, this is relevant within a team when one person is more highly ranked than the others. Although the middle or upper manager could easily unilaterally make a decision, doing so would undermine the cohesiveness and attitude of the team. Participants might think, “Why should I bust my butt to save money or improve the quality or aesthetics of a part if the manager is just going to throw away my effort?”

Figure 6.7 maps the concentric interests, rights, and power circles of Figure 6.6 onto the perceptual gaps model of Figure 6.5. The common situation is that there is no basis for interests, often thanks to perceptual gaps. Instead, team members rely on rights to argue for their perspective. In the end, upper management decrees a decision from above. Clearly, for an effective iNPD process, team members must overcome these gaps and use an interests-based approach to negotiation. To maintain an interests-based stance is to recognize the long-term gain from a cohesive, collaborative team. By driving the process based on the user’s interests (the needs, wants, and desires of the customer), the process remains focused, and all team members can bridge their perceptual gaps by focusing on a common argument of why decisions are chosen (as shown in Figure 6.8).

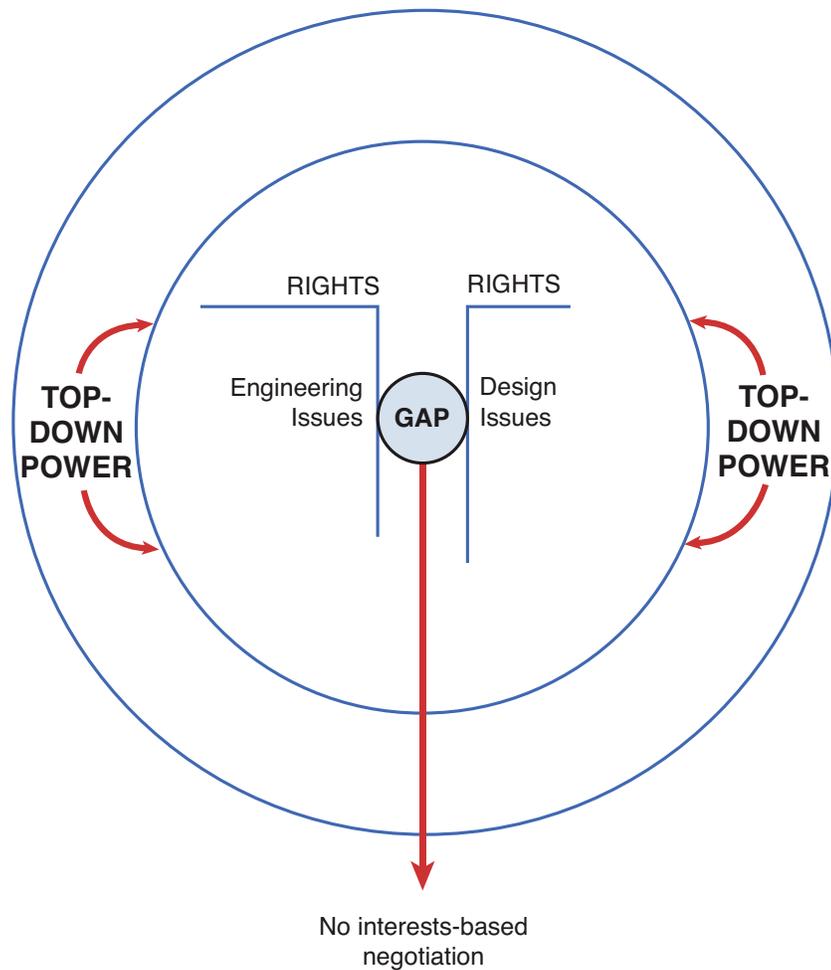


Figure 6.7 Typical perceptual gaps and the dysfunctional use of interests, rights, and power.

When teams use the collaborative techniques discussed in the previous section in conjunction with interest-based negotiation, we have seen the design process become more effective, less emotional, and more successful overall. We turn now to an understanding of what is considered a high-performing product development team.

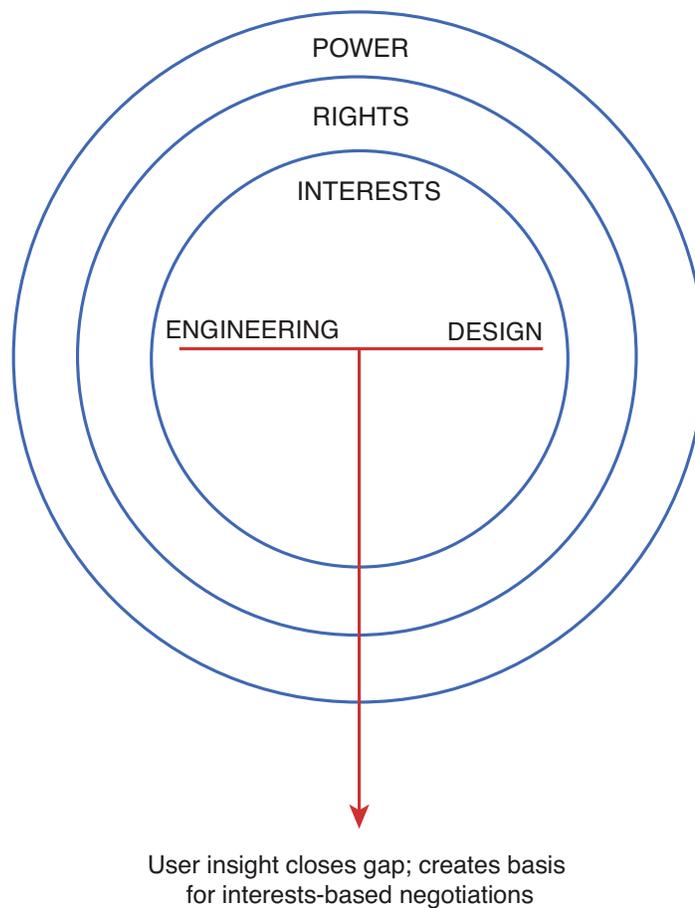


Figure 6.8 iNPD perceptual gaps negotiation model—the user’s interests help bridge the gaps.

Team Performance

The goal, according to Katzenbach and Smith in *The Wisdom of Teams*,⁵ is to develop and manage high-performance teams. High-performance teams have these characteristics:

- Are self-motivated, accept criticism, quickly establish an atmosphere of mutual respect, and integrate different perspectives
- Function horizontally instead of in a hierarchy, and shift leadership roles as appropriate
- Actively seek advice and input from managers, expert advisers, and potential customers
- Want to identify and correct flaws rather than become overly defensive

- Have a clear rationale for their decisions
- Tend to have a sense of humor as a group and use it to shed stress
- Quickly become experts in the subjects needed to develop insights into the product opportunity
- Accept the fact that they are mutually responsible for the work of the team
- Develop the Gestalt dynamic, in which the team is greater than the sum of the individual capabilities of its members

The ideas expressed by Covey⁶ and Kao⁷ are consistent with these points. Covey points to looking for win–win decisions and stresses learning to master the art of hearing and being heard. Perhaps the most important aspect of Covey’s principle is the shift from being independent to understanding the value of interdependence. Most of us are taught that independence is the goal to shoot for, but Covey considers this only the beginning. Realizing that your success is inextricably linked to the input of other team members makes you able to get the most out of a team experience. Kao compares successful teams to a performance of improvisational jazz. When musicians are “jamming,” all the players know where they are going without requiring a clear vision of the end, and they respond and play off one another, building as they go. No one is reading sheet music, and they are not playing from memory. Applying this approach to product development requires trust and listening and is based on the belief that the best results will unfold naturally as work progresses. True innovation is not developed from preconceived notions. Innovation is developed as a result of the maturing of the wisdom of the team to see the direction and move with it.

■ True innovation is not developed from preconceived notions.

An ideal high-performing team evolves quickly and, therefore, makes the most of each phase of the program. If teams take time to mature, they do so at the expense of the process. If a team is not functioning effectively early, it might fail to identify a true opportunity. Team members’ research of the opportunity might not be as deep, preventing them from identifying true insight that leads to Value Opportunities. As Covey points out, if team members have achieved the level of self-confident independence, they are more able to adapt to the challenges required to work in an interdependent team atmosphere. Teams that have members who lack the first level of Covey’s personal development often need to learn to trust and share ideas.

The challenge for managers is to get teams to a high performance level as quickly as possible. A manager must expend the most energy early in the process, to get

the team up to speed, and must stay with the team until it shifts into high-performance mode. When that state is achieved, the manager can spend less time questioning the team's insights and decisions. The role of managing then shifts to supplying the team with resources, clearing obstacles for the team, and serving as a check on the process.

In the book *Flow*, Mihaly Csikszentmihalyi⁸ contends that individuals (and we believe teams as well) work best when challenge and ability are both set at the proper level to achieve maximum performance and satisfaction—namely, a “state of Flow.” When teams achieve this state, their dynamics are positive, team focus is heightened, and they are able to shut out distractions. High-performance teams achieve a state of Flow more naturally. Managers have to work harder to help lesser-functioning teams reach the state. Several advantages emerge while helping teams achieve a state of Flow:

1. The positive atmosphere increases the potential of creating breakthrough products.
2. Team members enjoy the process and gain satisfaction from seeing the end product.
3. Positive team performance extends to future experiences within the company.

P&G has developed an interesting model for supporting the team. Clay Street is the name of a street in the old part of downtown Cincinnati known as Over the Rhine. Clay Street is also the name given to the innovation workshop developed during Claudia Kotchka's tenure as vice president of design under A. G. Lafley. Clay Street began when Kotchka brought in David Kuehler, who had developed an innovation workshop based on the entertainment industry at Mattel. This is a variation on what companies historically called a “skunkworks.” However, the structure of this version of the offsite is very different. The approach uses a theater structure, with the team leaders working in the role of director and assistant directors. A cross-section of a business unit is chosen to come to Clay Street for eight weeks. The team members must completely disconnect from their regular role in P&G. The process allows everyone to reinvent themselves in a new role as performers in the play. The eight weeks end with a performance and story, not as a formal PowerPoint presentation, as is so prevalent in business. Through a variety of exercises and experiences, teams learn to see the opportunity they are charged to work on in new ways. They learn that innovation can come from anyone. They also have

inspirational speakers come in for sessions, and they take field trips for ethnographic research and inspiration. It was in Clay Street that a team defined the brand for Herbal Essences, discussed in Chapter 4, “The Core of a Successful Brand Strategy: Breakthrough Products and Services.”

We have observed a variety of teams in our work. We have learned that teams can evolve quickly in a managerial atmosphere where the communication is clear, consistent, and constant, with a structure that helps support the team’s development. A team can lose direction, and if left undiagnosed for any length of time, reversing the trend can be difficult. As we have fine-tuned our approach, we have been able to get teams up and running quickly in the first phase. Figure 6.9 illustrates five team profiles over the product development cycle. Team 1 is the ideal team, able to quickly move to a high-performing team and produce a truly successful product concept. Team 2 is somewhat typical, in that it gradually becomes functional and then high-performing, with possible ups and down as its members gain trust in each other and the process. Teams 3 and 4 are examples of how teams should not function. Team 3 is barely a functional team, achieving success at design reviews only at the end of each phase. Team 4 is every manager’s nightmare. The team does not follow the iNPD process and, due to personality conflicts within the team and inappropriate discipline participation, never functions well and produces, at best, a mediocre product. Management must restructure the team to allow the members to achieve at least a functional level of performance. Finally, Team 5 is an interesting dichotomy. The team members do not like each other and have strong personality conflicts—the dotted line shows the team performance based on personality only. But unlike Team 4, they follow the iNPD process and are able to produce a high-quality product as a functional team and, at the end, even achieve high-performance status, as illustrated by the solid line. This last team shows that, even if the team members don’t like each other, if they respect each other’s abilities and follow the process outlined in this book, they can still produce a high-quality and highly valued product.

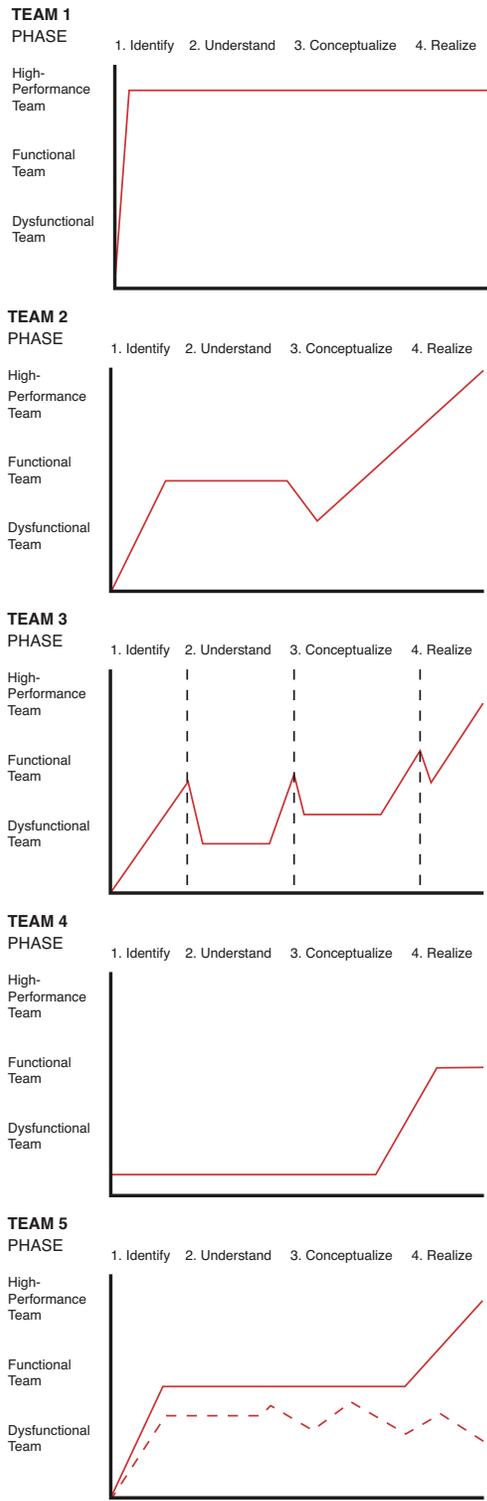


Figure 6.9 Five team performance profiles across the product development cycle. Team 1: High-performance team from beginning to end; Team 2: Early dysfunction evolving into high performance; Team 3: Team peaked for Phase reviews, decreases in function in between reviews, and fails to maximize process; Team 4: Dysfunctional throughout, and management needs to restructure it to achieve a functional team level; Team 5: Team performance is functional and team dynamics are up and down, but the team respects the process and works through to a high-performance result.

Part Differentiation Matrix

Not all parts of a product should be designed the same. That might seem obvious, but it isn't to most companies. Companies tend to think about a system and its components in the same way. We have found in our collaborations with industry that two characteristics most affect how parts should be designed.

The first is the lifestyle impact, those parts that capture the essence of the fantasy of the product to the customer and make the product desirable, especially at point of sale. Any parts that a customer sees or touches have primary lifestyle impact. These parts have the biggest effect on the product brand. Any parts that affect the performance of the product but are not visible and tend to merely satisfy a level of expectation of the user have secondary lifestyle impact. These secondary lifestyle impact parts do affect satisfaction, especially over the long term, but they aren't critical to the semantics of the product and its statement about who the user is.

The other characteristic is the complexity of the part or system. By *complexity*, we mean the inherent coupling of features within the part and its interdependence with or impact on other parts of the product. In other words, how connected is a part to other parts, by both physical connectivity and functional connectivity?

These two characteristics can be mapped against each other in a two-dimensional matrix, shown in Figure 6.10, which we call the Part Differentiation Matrix (PDM). In the PDM, the top cells represent primary lifestyle impact components; the bottom cells represent components of secondary lifestyle impact. Complexity is represented through the horizontal axis, with high complexity to the right and low complexity to the left.

For more complex products of multiple systems and subsystems, a company clearly would not have the resources for complete, integrated teams to design every part, down to the nuts and bolts. Such an approach, although theoretically ideal, is not feasible in practice. The PDM lends insights into just how integrated a team should be to design a given part and what negotiation strategies are most effective for an efficient design process.

The lower left cell of the PDM represents commodity or incidental parts, namely parts that are not highly interdependent or complex and that have little influence on brand or point of purchase sale. These are parts that the customer doesn't see and doesn't generally care about. Numerous suppliers manufacture these parts, and as long as they meet some minimum quality standard, it doesn't matter who makes them. Integrated discipline design is not necessary except for the specification of the part. Cost is the only factor that would influence the selection of one manufac-

turer over another. The minimum quality standard cannot, however, be taken for granted, for customers will blame failure of these parts on the manufacturer of the product, not the component.

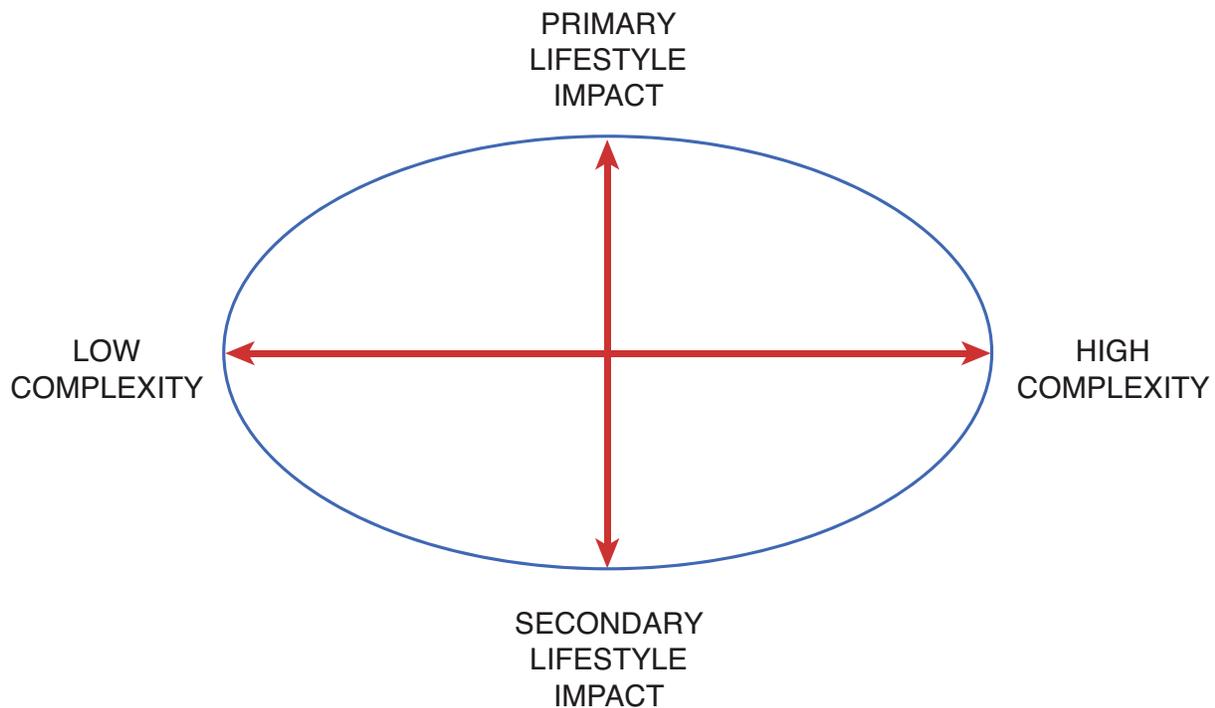


Figure 6.10 Part Differentiation Matrix.

On the other hand, in the lower right cell, that of high complexity but secondary lifestyle impact, are parts that won't directly influence the purchase of the product but will influence the reputation of the product and the likelihood that a customer will return to buy another of your products. This is the platform and core technology of a product. These are the parts that most influence long-term customer satisfaction, based on the quality of the product's engineering. The influence of these parts on sales is subtle. The customer has a basic level of expectation about performance of these parts at point of purchase, but as long as that expectation is met, the parts will not influence sales. Often company reputation is the most critical part of satisfying customer concerns for these parts. Here engineering takes the lead in part development. The design group, however, must still buy in on the design. The details of the platform and system integration have important implications on how parts with primary lifestyle impact can be designed. For example, attachment points, overall size, and potential weight limitations are all determined or at least influenced by the design of these lower-cell parts. So although it would appear that the engineers alone should design these parts, it

becomes clear that some level of team integration is needed. Within services, these are the technology components that support the service and make it function, but the user doesn't see them.

The upper left cell, those parts of low complexity but primary lifestyle impact, has a similar interaction between disciplines. These parts are primarily driven by visual aesthetics and have minimal function. Instead, they are critical in their support of the brand identity of the product. These components help sell the product and are the most visible aspects of the product at the point of purchase. They are part of the soup referred to earlier: You aren't sure why they belong, but if the design works, then every one of them has a purpose. Here design takes the lead, yet engineering must deliver the part at a sufficient cost and quality. As with the lower right cell, development of the parts in the upper left cell also requires some level of team integration.

The upper right cell, that of primary lifestyle impact and high complexity, represents parts that merge features and resulting technology with style and resulting brand image. These parts are critical to the look and feel of the product, its performance, and the effect the product has on the customer that leads to a sale. These parts (usually subsystems) require strong input from all players in the development process. In particular, design and engineering must work together in an integrated fashion to create part systems that meet identity, technology, and feature requirements. User buy-in to the product depends on the success of this process, and, of course, a user focus is required for the process to succeed.

The PDM was developed through our research in the auto industry in collaboration with Professor Weingart.¹ As shown in the sidebar, the matrix is quite effective in focusing integrated effort and resource allocation in the vehicle development process. What we learned from the auto industry clearly transfers to any product that holds a reasonable level of complexity, requires user interaction, depends on styling and identity, and utilizes sophisticated technology. What is interesting is that the PDM can also lend insight in simple, straightforward ways to all manufactured products. Furthermore, the PDM supports the infrastructure of service industries. We now examine its application to the FIT System, the Margaritaville Frozen Concoction Maker, and the support products for Starbucks.

First, consider the PDM for the Margaritaville Frozen Concoction Maker (see Figure 6.11). The upper right cell holds the key integration that delivers the user experience. This includes the interface and controls, as well as the overall form of the housing. The lower right cell includes the technology to shave and blend the ice, the development primarily the task of the engineers. The branding elements

that connect the product to the Margaritaville brand were the primary responsibility of the industrial designers, as indicated in the upper left cell. This also included color and form details of the product, and elements such as the design of the pitcher to look different than an ordinary blender container. Very little exists in the lower left cell, which includes the commodity component parts and secondary components such as the more basic electronics; the team paid attention to every detail of this product in terms of its style, technology, and integration.

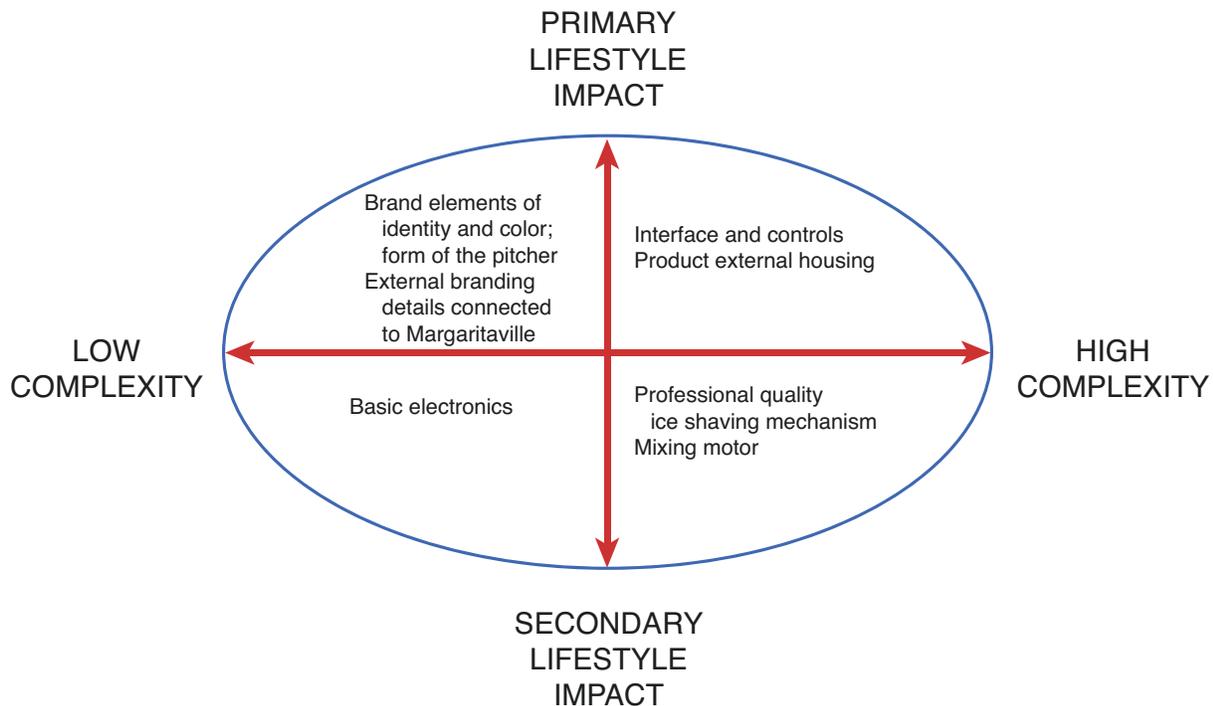


Figure 6.11 Part Differentiation Matrix for Margaritaville Frozen Concoction Maker.

The BodyMedia FIT System, an advanced, high-tech product that integrates into people’s lifestyle while trading off complexity, makes the PDM relevant for the product’s compliance and success (as shown in Figure 6.12). Here the upper right cell contains the housing and strap, but also the Web interface—these are the interfaces between the technology and the user. The technology itself is the majority of the parts of the FIT and is represented in the lower right cell, which includes the sensors and information communications technology. The lower left cell includes the individual electronic components and batteries. The upper left cell houses the logo and external panel for the product. This is very much a product designed through integration. Although the designers captured many features in the shape and style of the housing, they had to work closely with engineering to guarantee that the technology would integrate into the form.

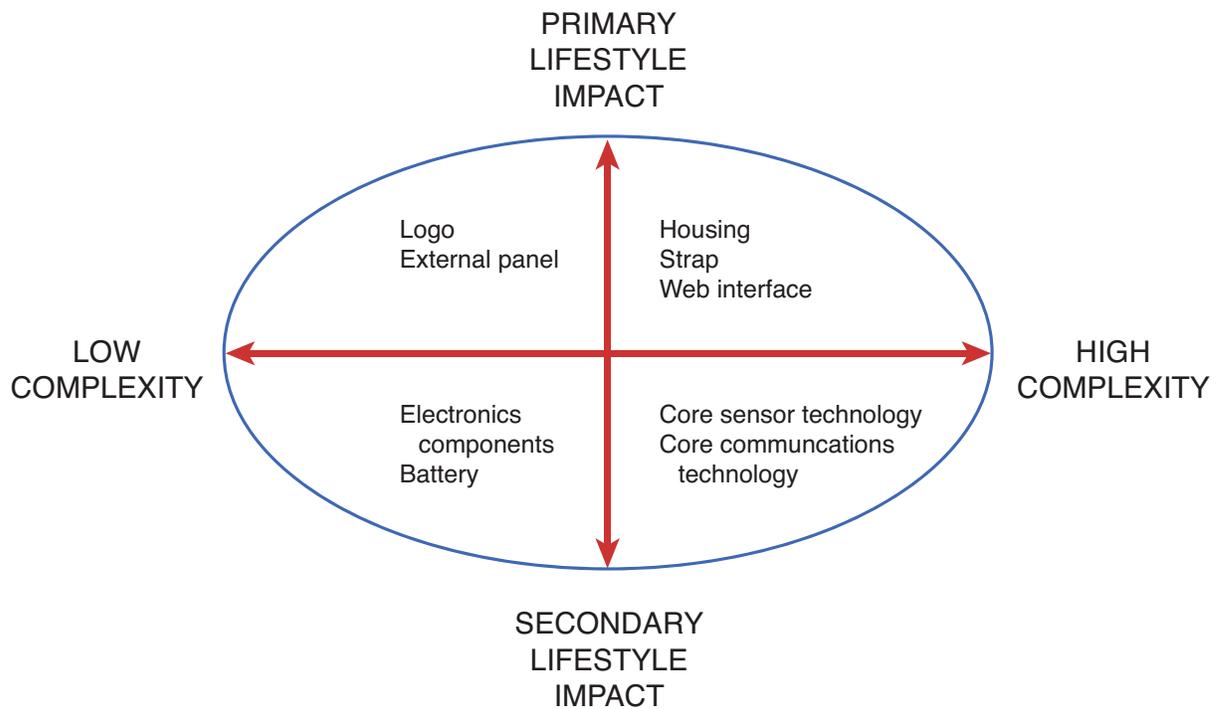


Figure 6.12 Part Differentiation Matrix for BodyMedia FIT System.

Starbucks, a service product, also can benefit from the PDM (as shown in Figure 6.13). Here the PDM decomposes all aspects of the support structure for the service environment and product line for Starbucks, from the perspective of style and complexity/technology. The core players are not necessarily traditional product designers or engineers. The personnel at Starbucks fulfilled the roles of engineering, design, marketing, planning, and finance. In many ways, this case study shows that discipline background is not critical. Instead, what is needed is the ability to fulfill the multiple roles required to create a product or service in the Upper Right of the Positioning Map. The upper right cell of the PDM (as opposed to the Positioning Map) is the core product—the beans, roast process, and interior design of the retail stores. These cores are the focus of the designers, the engineers, and the marketing and planning group. The lower right cell is the core machinery—the coffee brewing and roasting machines that are standard for the industry. The lower left cell houses the extras, such as milk, sugar, and napkins. In the upper left cell are the peripheral products, including ice cream, books, and travel mugs. The peripheral products are designed by the designers and farmed out for production. The roasting and brewing machinery is specified by Starbucks and supplied by vendors. As Starbucks has grown and diversified, it has continued to maintain its core standards—that is, Starbucks coffee consistently uses top-quality beans, roasted with precision, with coffee served in a warm, inviting environment. The

recognition of this core product in the upper right cell of the PDM keeps the company focused on its strength even through its rapid growth.

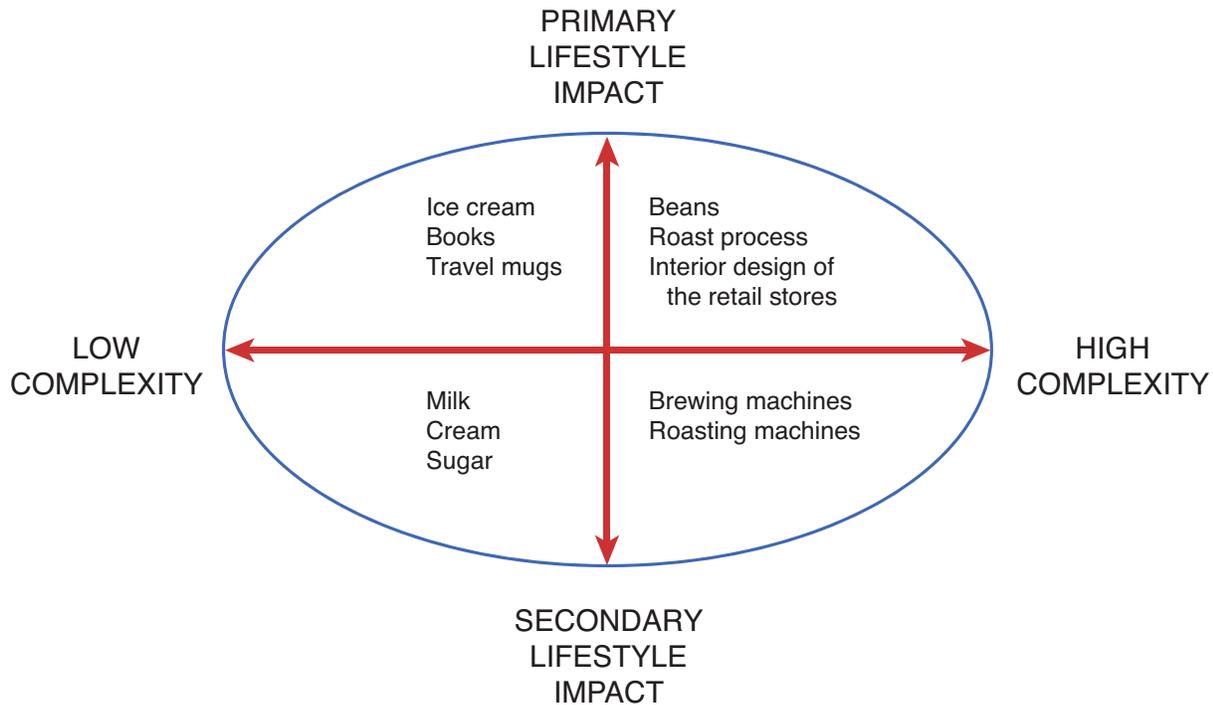


Figure 6.13 Part Differentiation Matrix for Starbucks.

■ In the ideal world, all parts of the design would be developed in an integrated fashion, but time and financial resources limit the feasibility of such an idyllic process.

The PDM helps the product development team understand how to allocate resources between focused, discipline-driven design and integrated part development. Again, in the ideal world, all parts of the design would be developed in an integrated fashion, but time and financial resources limit the feasibility of such an idyllic process. The PDM, however, does not imply that engineers alone should design parts in the lower right cell while designers focus on the upper left. Not only do engineers have to produce the parts the designers create, and the designers have to build on the platforms subject to constraints imposed by engineers, but the basic axiom of iNPD is that all members of the process are part of an integrated team. As such, each team member brings perspectives and expertise to the process that must be welcomed and appreciated. Thus, all team members should be encouraged to comment on the design of all parts and verify their integration into the overall functionality and theme of the product. Part design cannot take place in a vacuum.

■ The goal is to add the right features for the appropriate cost.

As a last comment on the PDM, note that the lower cells tend to be more science driven, with more predictable costs. The upper cells, however, are more emotionally driven and have less predictable costs. Many companies try to set cost targets

up front on all parts of the product. Although this is a reasonable goal, it must be realized that, until the lifestyle issues of the product are understood and integrated into the design, predictions for costs of upper-cell parts are just estimates; flexibility is required. Cost- and lifestyle-driven processes must work in balance; there is a limit to how much a consumer will or can pay for a product. The goal is to add the right features for the appropriate cost; the PDM tells us which features directly affect sales and can support added costs. Using the typical cost-driven approach for the design of all parts often causes team conflict—and rightly so, as discussed in the next section.

PDM IN THE AUTO INDUSTRY

The PDM evolved out of our research with the auto industry. The PDM is an excellent way to analyze the vehicle, a highly complex product with intimate user interactions. Figure 6.14 shows a breakdown of some major components of the vehicle into the four cells of the PDM.

The lower left cell holds the low-complexity, secondary lifestyle-impact components, such as the tires, fuses, and seatbelts. These items are all commodities, with multiple commodity suppliers producing them for many auto companies. Cost is a driver, but the onus is on the auto company to specify and verify an acceptable level of quality. These parts might not be critical to the design and manufacture of the vehicle or the lifestyle impact on the customer, but their failure can have negative effects on the customer. For example, in 2000, the Bridgestone tires on the Ford Explorer began losing their treads and causing fatal accidents. Both parties blamed the other, and eventually Ford stopped using Bridgestone as a supplier (at least, at the time). Nonetheless, the effects of this commodity part on the performance and customer impression of the vehicle was significant.

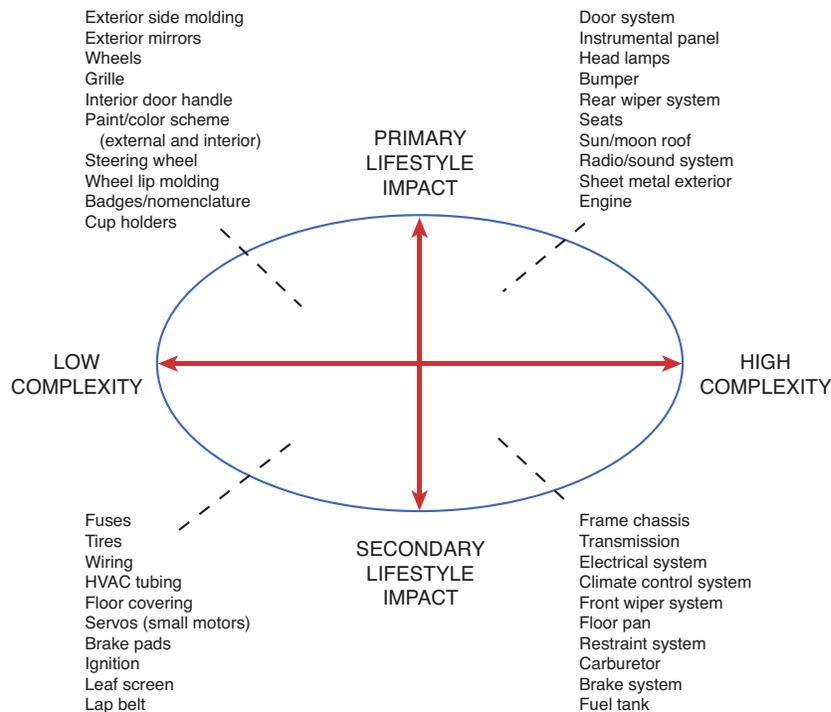


Figure 6.14 PDM for a vehicle.

The lower right cell shows the high-complexity but secondary lifestyle-impact components. These parts don't interact with the customer directly but are critical to the long-term quality and customer satisfaction of the vehicle. These are the parts that will determine whether a customer will—or, more likely, will not—return to the company for a future purchase. Included in this cell are the floor pan, inner panels, the transmission, and the electrical system. Customers have a basic expectation that these parts will perform, but no emotion or passion accompanies their effects on the vehicle. The engineering part of the team takes the lead in designing these parts, but the studio must have buy-in because the parts affect the size and style of the vehicle.

The upper cells are the most relevant for this book. The upper left cell represents the low-complexity but primary lifestyle-impact parts. These include the exterior side body molding, the grille, the embellishments, and the wheels. The only real technical challenge is that of manufacturing the part. These parts are tightly connected to brand. They have a strong influence on and are strongly influenced by style, and they help to sell the car in the showroom. The interesting aspect of this cell, as discussed in this chapter, is the different perceptions of the design complexity within this cell between engineering and studio. This is often a source of conflict.

The upper right cell is the critical cell for a user-centered iNPD process. Parts in this cell are highly complex and have primary lifestyle impact, both short and long term. The importance of style and technology brings an added complexity into the process. Yet these are the parts that define the vehicle, as style, technology, and the user meet in this cell. Parts in this cell, typically systems, include the door system and instrument panel. Interestingly, a part on one type of vehicle might be in the lower right cell, whereas on another vehicle, it is found in the upper right cell. For example, an engine in a minivan is a lower right cell part, whereas, in a sports car or pickup truck, the engine becomes an upper right cell, partly because the performance of the engine is more integral to the statement of what the vehicle is and who the owner is. Engines are designed to respond to perceived needs by marketing the performance features expected by the target market. In other vehicle categories, there is a need to balance engine performance with visual style. A number of years ago, the Cadillac Northstar engine won design awards. The goal is to make the engine reflect the brand, particularly for that part visible when the hood is open. These are parts where all of the methods introduced in this book strongly apply.

Team Conflict and the PDM

By examining the PDM in the context of perceptual gaps, it should seem obvious that unproductive conflict is inevitable without a proper iNPD method. Conflict in the upper left (primary lifestyle impact and low complexity) and lower right (secondary lifestyle impact and high complexity) cells occurs because one group needs to take the lead, but the other still must influence the part design. In the upper right cell (primary lifestyle impact and high complexity), conflict emerges because each party fights for its own perspective within a challenging design framework. Recall earlier in this chapter that we engaged in a study on perceptual gaps among product development practitioners in the auto industry. In a different part of that study, we focused on perceptual gaps in the primary lifestyle impact (upper) cells of the PDM. We found stark contrast in the types of gaps and conflicts that emerged from these two cells.

The auto industry, like other industries, is challenged by constant time-to-market pressures; the conceptualization, detailing, and integration of a large number of parts; limited space; limited budget; and a variety of government regulations. As studio designers complete part designs, engineers must determine their cost to manufacture and begin the design of molds, usually in conjunction with a supplier. The more parts that can be completed early, the less pressure there is toward the end to get every part finalized and integrated. To the engineers, the parts in the upper left cell of the PDM are relatively simple parts that should be completed early in the design process. To the studio designers, these parts should certainly be envisioned early in the process, but there is no way that a part can be specified until much later in the process because it must fit within and help express the brand identity of the vehicle. Engineers do not want to consider the cost of brand identity, but, as discussed earlier, designers do not tend to consider the complexities in manufacturing of even such simple parts. Thus, the upper left cell parts (exterior side molding, in our study) can cause conflict because of a difference in perspective of when a part can be designed and how complicated the part should be.

Parts in the upper right cell introduce different challenges and conflicts into the process. By examining a primary lifestyle impact and highly complex system (that of the design of the door system), it became clear that all participants understood the difficulty and complexity of the design task. Challenges included goal conflicts (between disciplines and trade-offs among design requirements), styling, human factors, component packaging (whenever a component is moved, it affects the placement of many other components around it, much like the placement of pieces in a jigsaw puzzle—except that here there is no clear “correct” answer), and craftsmanship, or fit and finish. When participants (engineers and studio designers, in particular) were asked about the primary challenge in designing the system, however, each discipline said that its own was the biggest challenge. In other words, each discipline fell back on its own world as the driver of the process. Thus, upper right cell parts of the PDM are challenged by the sheer complexity of the process and the need for each individual to get his or her own job done.

It is interesting to see how our discussion of interests, rights, and power applies to the PDM.² As shown in Figure 6.15, the upper right cell requires the use of interests—and only interests in solution negotiation. It is critical that the interests of each discipline be taken into account. Further, because this team will likely work together for a reasonably long period of time, any other approach will cause distrust and long-term problems for the team’s dynamics. The cross-diagonal cells of the upper left and lower right also should be mostly based on interests, but here rights also come into play. Because one discipline takes the lead in these cells, their previous approaches or standards for designing the part become more prevalent. In the lower left cell, interests are not needed. Instead, rights and power can be used to get the best price and delivery time for the commodity parts.

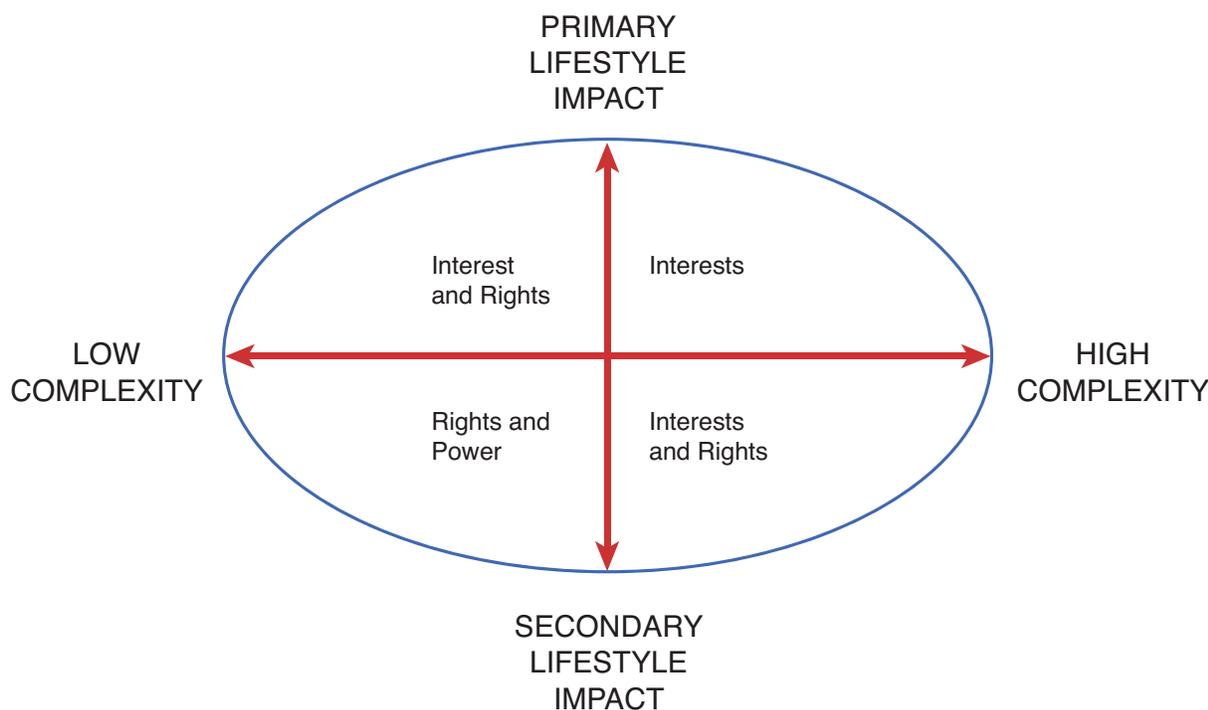


Figure 6.15 Part Differentiation Matrix and the application of interests, rights, and power.

PDM and the Role of Core Disciplines

It follows, then, that there must be balance between team integration and discipline-specific activity. The goal of iNPD is not to neutralize individual discipline expertise, but for each individual to bring to the table the strength of his or her knowledge. Engineers are the only group trained to perform analytical simulation such as finite element or computational fluid dynamics analysis. Engineers tend to be the people trained in the details of manufacturing. Designers tend to be the

players trained in human factors (at least through a qualitative sense), aesthetics, and 3D physical modeling. Marketing and finance tend to be trained in cost structure and market characterization.

■ The goal of integrated development is not for individual discipline expertise to become vanilla, but rather for each individual to bring to the table the strength of his or her knowledge.

Engineers and designers can bring a unique perspective to market research, designers and marketing researchers to feature definition, and engineering and marketing researchers to user preferences. However, each discipline still is responsible for details in their area. Thus, it is important in companies where teams colocate and integrate that individuals maintain their training in their fundamental area. Furthermore, each individual is best suited to understand advances in his or her area in other programs in the company. Thus, you are advised to encourage individuals in a discipline to interact in some formal or informal setting with people of the same discipline from other areas of the company. This could take place, for example, through seminars where people present discipline-specific details of their team's product.

Issues in Team Management: Team Empowerment

Integrated design teams are difficult to manage. Many managers feel that they are supposed to be the expert and have all of the answers. Some even think that they are supposed to make all of the design decisions. Typically, this just does not work. Companies need interdisciplinary teams because no one individual has all the answers. Companies make the effort to hire the best people into those teams because they believe in their employees' talent. The best approach to managing an integrated team is to give the team direction and stay back, taking on the role of advisor rather than micromanager. In many ways, the manager is like a coach, guiding and training the team; however, the team must win the game. Like the coach, the manager is typically not in the trenches, observing and understanding firsthand the needs, wants, and desires of the user. The team members are, and they must produce the product that succeeds in the marketplace.

The manager faces two main challenges:

1. How to foster creative problem solving within limitations of time and economics
2. How to manage the team's particular needs at any given point in the process, keeping in mind the broader issues and goals of the entire program

This section describes approaches and insights to meet those challenges and manage interdisciplinary design teams. We have gained these insights through management of and discussions with a variety of teams in a broad base of settings. Although this team empowerment approach might be difficult at first, most participants tend to step up to the plate and excel in the product development process.

Understand the Corporate Mission

Recall in Chapter 4 the four levels of corporate commitment to product and brand: corporate mission, program planning, product development, and customer satisfaction. It is the program manager's job to translate the corporate mission into a successful product in the marketplace. A program can get lost in detail and small problems, and start to move away from both the customer focus and the strategic plan. It is the manager's responsibility to make sure that the team understands and stays true to the corporate mission, and to understand the impact of brand strategy on the process. As the team develops new insights into customer trends, the program manager is the conduit to feed that information back to upper management.

Serve As a Catalyst and a Filter

The manager needs to maintain a balanced view as neither a “company man” with a top-down approach nor an overprotective manager with a bottom-up focus. Supporting top-down management can be an effective way to gain advancement in a company. Making sure you are always doing what your superiors say and then telling those under you what the rules are is a safe way to manage. However, this approach often stifles a team and limits innovative solutions. Becoming overly defensive and protective of a team is another style that is used. This “champion of the little people” approach makes you a hero with your team. However, it also creates negative relationships with upper management and isolates the team. This second approach is far less effective for achieving advancement than the first method. Maintaining a balanced point of view is important. Teams are often right and insightful. The program should create possibilities and new ideas that management mediates and, at times, allows to alter preprogram strategies. Knowing when to push upper management for more time resources or a shift in focus is more art than science. However, successful managers trust their teams and must be able to separate the normal tendency of a team to want to do things a different way from its true insights and breakthroughs.

Significant product breakthroughs usually have a cost attached to them. The original cost targets might be challenged when a breakthrough idea emerges. The program director must make a decision to argue for increased cost or to tell the team to make it work in the program cost structure. This is a matter of understanding the dynamic tension between constraints and variables. Every program has areas where change and experimentation are required (variables) and other areas where rules must be adhered to (constraints). For instance, if a product must debut at a trade show in 12 months, that constraint cannot be ignored. Missing an external deadline could throw off a program by an entire year. Finalizing the aesthetic features prior to understanding the lifestyle desires of the customer, however, is a variable that must never be prematurely frozen. Doing so will lead to failure of the product at the show or in the marketplace. Making sure that constraints are respected and variables are sufficiently investigated is a talent that a good manager must cultivate. The program manager needs to work with upper management to set the product development schedule, such as determining appropriate deadlines for completing the four phases. Doing so ensures that the team has time to explore the variables and meet the constraints.

In balancing the interaction between upper management and the team, the manager must shield the team from distractions, providing an environment that promotes focused work on the project at hand. Distractions with constant peripheral meetings break the concentration of the team members. Furthermore, the team manager must prevent upper management from interfering with the iNPD process, especially when upper management does not understand the issues. Dave Smith, a consultant for Crown Equipment Corporation, set up a skunkworks away from the corporate setting to promote integration in the team during the development of the Wave. One way to shield the team from distractions is to prevent those distractions from the start. Problems in terms of time pressure, budget cuts and restrictions, and personnel cuts, as well as other unanticipated problems that arise outside the focus on the product, should be the responsibility of the manager. Let the team members focus on the project at hand.

Be Unbiased

Most managers have a core discipline that they consider theirs. When managing an integrated team, having a discipline bias can be threatening to team performance. Very often a discipline-specific focus can lead to a perception that the manager's domain is considered superior to other fields. iNPD managers must learn to see the program through the eyes of different disciplines. They must learn to respect the

commitment and value that an integrated team has. One way to resolve this is to create management teams from key disciplines. This might not seem cost effective, in that extra personnel are required, but it can be a very successful model in the long run.

Although team members will collaborate with each other across disciplines, they must bring their own discipline knowledge to the process. Integration means joining together different knowledge, ideas, and approaches. Managers must be sensitive to the wisdom of disciplines through team members, allowing each perspective a voice appropriate for the discussion or problem of focus. The Part Differentiation Matrix, mentioned earlier, can help a manager frame the approaches to different aspects of the product.

Empower and Support the Team

It is appropriate to make the analogy that managing an iNPD team is similar to other creative fields in sports and entertainment, such as a coach, orchestra conductor, and movie director and producer. Two main approaches to management exist: dictatorial and benevolent. In sports, managers' and coaches' approaches to their respective sports are out there for everyone to see. Coaches who win consistently have found a way to blend their knowledge of the game with their ability to mold talented individuals into an integrated team. Any good team must have diverse types to fit different roles. A variety of coaching styles range from dictatorial and totally controlling to benevolent and supportive. Here are some versions that we think fit leading iNPD teams.

John Wooden is perhaps the quintessential coach of all times and his *Pyramid of Success*⁹ describes how to be a winner as a person, not just a player. Phil Jackson as a modern model of coaching could take diverse and sometimes difficult personalities and get them to blend together. He used a style that educated players to work as a team and around the triangle offensive model. He had great talent in Michael Jordan, Shaquille O'Neal, and Kobe Bryant, but he also always complemented that with spot players who had key abilities and limited roles, particularly three-point shooters. Mike Krzyzewski, known as Coach K, recently passed his mentor, Bobby Knight, as the winningest coach in college basketball. Knight had an intimidating style of coaching that was seen as excessive; it eventually led to his dismissal from Indiana University. Coach K has blended Knight's approach with a softer style at Duke. All good coaches seem to find an opportunity gap in the way to mold players and win. They then build a coaching staff to implement it and draft players that

■ The dictatorial approach of fear, power, and intimidation cannot work long-term in a creative environment.

fit the scheme. They also understand the competition and leverage their weaknesses. Coach K knows that, in the last two minutes of a half, teams tend to let up, so Duke players work harder in that time period. John Calipari built a team of primarily freshmen at Kentucky and won the NCAA Basketball Championship. He read the SET Factors of college basketball, where today talented players often leave after one year. He took a disadvantage and made it an advantage by drafting players whom he knew he would have for only a year, but he gambled that he could get them to mature by the end of the season. Each player could have been a star on his own, but he got them to share the ball and believe in the idea that winning beats stats and that teamwork would set the stage for their future. The best coaches inspire and have a horizontal management style, but can also take over the team when needed. The dictatorial approach—which uses fear, power, and intimidation for strict control and direction, and which quickly deals with violations of control—cannot work long term in a creative environment. Study the best coaches' approach to motivation and game plan, and it will help you learn how to get the creative people in your business to win your version of the Super Bowl or NCAA playoffs.

An orchestra conductor also manages an integrated team of musicians. Getting the string, woodwind, brass, and percussion sections to play in harmony is as challenging as working with any team or group. Each part of an orchestra is similar to a different discipline. Directing a movie, TV show, or play is also similar to managing an integrated design team. Directors must work with actors, cameramen, set and costume designers, special effects designers, and film editors. This diverse group of people must be brought together to produce a seamless piece of entertainment, often dealing with very large egos. All of the cost constraints and timelines that product programs face, film producers and orchestra conductors also face. The director and conductor are right in the middle of all of it.

The more understanding a manager has of the user-centered iNPD process, and the more experience with its application, the better will be the manager's ability to efficiently guide the process. Each time through the process, the manager should perform a self-assessment that leads to feedback used to modify future approaches, actions, and the process itself. We have perfected our own approaches to management of design teams through experience, evaluation of our performance and the team's performance, and continued iteration.

Let the Team Become the Experts

By the end of the second phase of understanding the opportunity, a team should know more than any manager about that particular program. A manager must learn to question the assumptions and ask for proof or clarification without telling the team what to do. The manager must learn to argue for the customer as well as the company and the team. It is important to help a team recognize why a seemingly “good” solution that does not fulfill the requirements set forth from the VOA might not be the most appropriate for the program.

■ Criticism without purpose or direction is not productive.

Sometimes the manager has insight from years of experience that can assist the team. More often, the manager finds that the team is lacking expertise in a certain support area. In that case, it is the manager’s job to establish help through a support network. Such a network can be built up throughout a company or, for smaller companies, outside the company structure.

Recognize the Personality and Needs of the Team

Teams have very different personalities. They work together in a variety of ways. The best high-performance teams require very little maintenance. Some teams are that way from the start. All teams should reach this level by the end of the second phase. We have seen many types of team dynamics, as discussed earlier. The manager must recognize and manage the overall team personality. The team must function as a whole. It tends to develop its own group personality, but the team is still built of individuals. Individuals have their own needs that range from being recognized for their effort to needing help in overcoming personality differences with others. The manager must also recognize individual needs and nuances and work with the individuals and the team to create a positive iNPD environment. It is important that criticism be constructive and productive.

Use of an Interests-Based Management Approach

The members of a product development team are a vital resource to the future of a company. They are a set of creative individuals with the knowledge needed to develop the future capability of a company. They are as important to a company’s success as a set of actors is to a movie, musicians are to an orchestra, and athletes are to a team. With the shortage of talent at this level and the need for new products and services, employees know that their services are a precious commodity. Fostering their sense of self-worth and commitment to a project and a company is

an important part of managing. People inherently want to do well and be part of a process that they feel integral to. A hidden part of the role of a manager is helping to foster a positive relationship between the employee and the company. Given that long-term loyalty by employers and employees is not the guarantee that it was in the middle of the twentieth century, the manager is the short-term representative of the company for optimizing loyalty and commitment for the duration that someone works for a particular firm. One of the most rewarding experiences for a manager is to transform a group that is perceived as mediocre into a high-performance team.

This current business atmosphere requires a management style rooted primarily in interests and, at times, rights, and requires a thoughtful use of power only as a last resort. Managers must help teams reach decisions using the customer's interests and sometimes different disciplines' rights. Only when teams are hopelessly deadlocked should management power come into play. Managers need to empower the team with the ability to make decisions, and every use of power is a potential threat to the team's morale. As teams become experts, a manager must trust the insight of the team because the team members together will normally surpass the knowledge of the manager. Managers need to let that happen. Managing today has more to do with responsibility than power. Building trust and clear communication with a team is more important than forcing them to take directions that the team does not develop on its own. The approach of balancing interests, rights, and power can work in a Burger King as well as the auto industry. You might be able to use an approach that relies more on power in the fast food industry, where pay, morale, and dedication are low and turnover is high, but when you are managing a team with the range of fields involved in the product development process, the power approach will have detrimental effects. People might work hard for a manager who uses power, but they will never work creatively. The use of power might help teams make deadlines and hit cost targets, but it will not help teams achieve a breakthrough that has insight and produces true product value to the customer. Only through the use of an appropriate balance of an interests, rights, and power approach can managers hope to move the products produced by their teams to the Upper Right.

We are not saying that power plays no role in the process. Dr. Peter Johnson, former chairman and CEO of TissueInformatics, has said that doctors are educated to be Athenian and Spartan. They are usually Athenian when working with others. They use a diplomatic approach to problem solving: When a surgeon is operating, he needs to have a good team atmosphere. Sometimes, however, emergencies arise and decisions must be made quickly. Doctors in this type of life-saving situation must become Spartans and make quick, decisive decisions. Similarly, at times

management must step in and recharge, redirect, and reprimand a team. Knowing when to shift from Athenian to Spartan is part of the art of managing. The Spartan approach should be done in a nonthreatening way, and the relationship of trust between managers and teams should allow for direct and clear exchanges that re-energize the teams.

Visionaries and Champions

Although day-to-day managing is critical, it is important to recognize the role that vision plays in developing successful products. Coupled with vision is the role of being a champion for a product program. Sometimes it seems that companies feel that they can just plug in the numbers and use methods in a distant and detached way, and the process will take care of itself. At other times, companies fail to recognize the role that key people have played in keeping a dream alive and maintaining an atmosphere that fosters excellence. The methods and ideas we describe in this book are important for any new product program. However, the greater the vision is at the top, the easier the process will flow. The greater the ability for top management to infuse the rest of the company with that vision, the better all projects will run. In contrast, failure to champion the insights of a team will push the best process dangerously off course.

Often product programs hit go/no-go decision gates or places where major assumptions are challenged. In the course of doing research for this book, we have come to understand how important it is to have a visionary who acts as a champion when these major events occur. A visionary has a broad sense of the mission and goals of the program and trusts the people charged to carry it out. The team is infused with a sense of commitment and enthusiasm. When the team clicks, the visionary knows it. At key design points, the visionary manager can support the team and allow it to overcome a challenge by keeping core ideas intact. Conversely, a visionary can also critique a team successfully and offer suggestions because the team trusts that person's motives.

■ As the product development process is user centered, team management is people centered.

Summary: The Empowered Team

Managing interdisciplinary teams is hard but rewarding. It takes patience, adaptability, and flexibility. Managers must understand people as well as disciplines. They must be willing to learn new ideas and trust in the team's ability to get the job done. As the product development process is user centered, team management is people centered. Learning to be a team manager takes time. The teachings and methods of this book, coupled with experience gained from trial and error, are the best tools for taking on this exciting challenge. The reward is a team of individuals who come together and produce a successful product or service that no one discipline could have ever produced alone.

iNPD Team Integration Effectiveness

This chapter began with a goal of converting members of independent disciplines (see Figure 6.1) into an integrated team, as shown in Figure 6.2. Four major elements were presented to assist in this integration:

- The need to overcome perceptual gaps between team members of different disciplines
- Ways to optimize team functionality, including negotiation strategies that focus on users' interests
- The allocation of parts of a product in the Part Differentiation Matrix, based on lifestyle impact and complexity, to understand where true integration is necessary and when different disciplines will take the lead in the development process
- Management strategies that empower the team to function independently, as appropriate, through the development process and that respect individual disciplines

As Figure 6.16 shows, each of these elements works collectively to enable an effective iNPD process. Effectively addressing these components results in a high-performing team that enjoys the process and is poised to develop a breakthrough product.

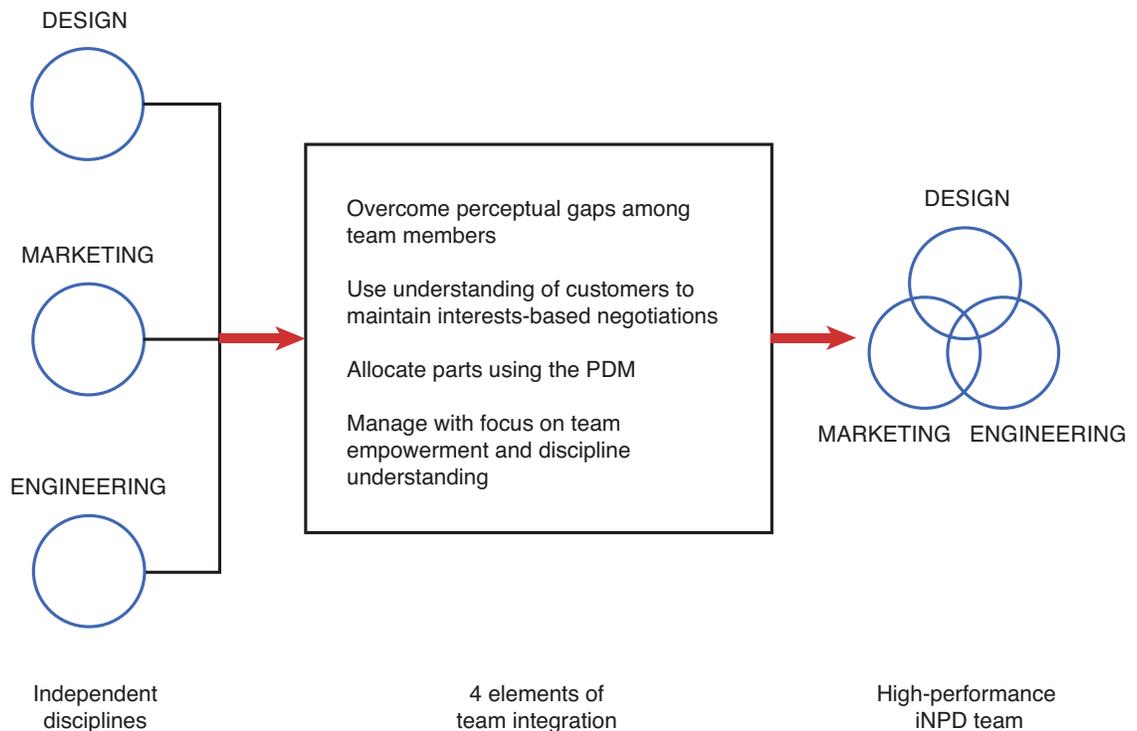


Figure 6.16 Four elements to effective iNPD team integration.

Although this might seem ideal, our experience is that this model works. Teams that integrate quickly and fundamentally consistently excel in the product development process, producing great products that meet or exceed cost and time constraints as well as performance and quality specifications. For the process to work, however, the team needs to understand the interests of the user as a basis for critical decisions. The next chapter focuses on techniques to develop a common shared understanding of a target user.

Summary Points

- Perceptual gaps between team members from diverse functions exist and must be overcome.
- An effective use of interests-based negotiation is critical to the long-term success of a team; power is a last resort that management should use only sparingly.
- The user’s interests should drive critical decision making.

- The Part Differentiation Matrix helps teams understand where parts integration is critical and when engineering or design should take the lead.
- iNPD team members must respect all other disciplines that participate in the team and appreciate each contribution to the overall process.
- iNPD teams should be managed through empowerment and support, recognizing that all disciplines have an equal voice in the overall process.
- High-performing teams enjoy the process, improve their potential of success, and carry their positive experience to other programs.

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Chapter Seven

Understanding the User's Needs, Wants, and Desires

To create a breakthrough product, your company must know who your customer is and how to place that knowledge in the perspective of the market your product competes in. This chapter provides techniques to help you balance qualitative methods for understanding needs, wants, and desires with more quantitative approaches for assessing issues of usability. Traditional methods of ergonomics research are complemented by a range of other techniques, which include new product ethnography, scenario development, storytelling, task analysis, and lifestyle reference. The results of this research provide insights that characterize potential customers in the target market and serve as a basis for testing the validity of product concepts.

Overview: Usability and Desirability

According to the Human Factors Ergonomics Society (HFES), the discipline of human factors focuses on “the scientific ... understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and other methods to design in order to optimize human well-being and overall system performance.”¹ What is often thought of as a focused approach in biomechanics and anthropometrics is actually a much broader understanding of who and what a person is. As you learn in this section, many other members of the product development team, beyond human factors specialists, are interested in the characteristics of human beings and their relationship to systems and devices.

The HFES evolved from the systems analysis conducted by the military during World War II. The three main types of research were anthropometrics, interpretation and management of complex information, and systems analysis in the deployment of troops and equipment. The systems analysis varied in scale and complexity, ranging from the large-scale systems planning used in preparing the invasion of Normandy, to the process of understanding how to best place and equip personnel from an aptitude and size point of view. The D-Day invasion was one of the most complex events of the twentieth century. It required a scale of logistical organization of men and material that was unknown before the beginning of the war. On a smaller scale, the range of equipment and military assignments meant understanding how to organize, train, and assign military personnel to make the most of their aptitude and body type. Soldiers had to be trained

quickly and effectively to use and maintain the vast array of war technology developed during World War II. There were size limitations for pilots, submariners, and tank drivers. The development of complex new equipment required finding the best personnel with the right training for navigators, cryptographers, code breakers, radar and sonar operators, and bomber pilots and crew.

After the war, as post-war companies and the products they produced grew in size, scope, and complexity, many of the systems analysts found opportunities in the commercial sector. This post-war focus gave rise to the formation of HFES in 1957, but the early origins of human factors can be traced back to the development of mass production and the need to improve efficiency in production. As the nature of work shifted away from craft production and agrarian labor, new concepts for working in factories evolved. The Ford assembly line and Taylor's theories of efficiency² started to have an effect on the planning process for the nature of work and education, and even in home economics, where women were instructed to organize and plan their homes around modern principles of domestic management. At the end of the twentieth century, a much broader concept of human factors was emerging—and evolving through to today. This new version is in response to the recognized need for a deeper insight into customers' patterns of behavior. It involves qualitative research methods and explores emotional as well as cognitive issues in human factors. The HFES has a variety of technical groups, including aging, cognitive engineering and decision making, environmental design, individual differences, industrial ergonomics, medical systems and rehab, macroergonomics, safety, and visual performance. Currently, however, most research in the discipline of human factors focuses on usability, not on desire.

■ A successful brand creates a Gestalt image in the market, formed from a variety of factors, which include the look and features of the product, the name, the advertising, the price, and the perceived value to the customer.

A number of new trends are changing the way companies attempt to know their customers and their needs, wants, and desires. Many companies are using ethnography as a research tool in the early stages of product development. Ethnographic techniques are qualitative processes that apply methods from cultural anthropology to the field of product research. These techniques are proving to be valuable in early phases of marketing and in helping product teams develop the actionable insights they need to translate into the style and features that people are looking for. A second reason this is changing is the result of the new focus on brand management. As discussed in Chapter 4, “The Core of a Successful Brand Strategy: Breakthrough Products and Services,” many companies realize that giving a product a strong brand identity is a clear competitive advantage. The book *Marketing Aesthetics*, by Schmitt and Simonson,³ describes the value of a visual identity system and how all aspects of a product must communicate clearly and consistently with customers. A successful brand creates a Gestalt image in the market, formed

from a variety of factors, which include the look and features of the product, the name, the advertising, the price, and the perceived value to the customer. By taking a broader view of what it means to factor the characterization of humans, this new category of human factors explores how a company's core values can connect with the lifestyle goals of its customers. Harley-Davidson has created one of the most powerful brand identities in the world, merging the logo, core product (motorcycle), and complementary lifestyle products (clothing and gear) with the way customers want to live their lives. Even the noise a Harley makes is part of the brand.

Another reason the study of human factors is changing is a result of the emergence of interaction design. Interaction design, discussed further in Chapter 8, "Service Innovation: Breakthrough Innovation on the Product–Service Ecosystem Continuum," is a vibrant area in human factors research and is based on human–computer interaction (HCI). This group recognizes the need to create more humane interactive products that cross hardware and software boundaries. It is also clear that quantitative research alone is not enough to solve these problems. Ethnographic research has become a part of HCI research so that researchers can better understand how people use and need computing in work and play (and how computers are integrating work and play).

The human factors discipline consists primarily of professionals and faculty from the fields of systems engineering, physiology, and cognitive psychology, but both the origins and current manifestations of the field are far broader. For nearly a century, advertising, marketing, industrial design, communication design, architecture, and the entertainment industry have all used a variation of human factors to help to define the parameters and evaluate the success of their products. Although these other fields might have lacked the formal research and forum for disseminating their methods through academic journals, recently their methods for abstracting behavioral models and customers' likes and dislikes have found important relevance in industry and research. The emerging view of human factors is the need to develop qualitative, empathic methods to compliment the quantitative, logical methods that evolved in the twentieth century. The terms empathic and affective design and interaction have emerged to capture the need to convey emotion responses through product interaction by those in the field.

Because of new research and diagnostic apparatus in kinesiology and biomechanics, it is now possible to follow the mechanics of swing in sports, record the pressure of each finger on a keyboard, and track the eye movements of someone in a purchasing environment looking at competitive products. It is even possible to know what parts of the brain are involved in making a decision or observation through recent advances in the field of neuroscience and the use of fMRI machines.

The book *Buyology*, by Martin Lindstrom,⁴ summarizes emerging ways that marketers are uncovering consumer preference through such brain scans. New research is also beginning to uncover how product designs can account for preference from fMRI scans; for example, people clearly account for emotional decisions, not just rational decisions, when making choices of different product options, even when functional performance is a critical component.⁵

■ Too often, companies try to customize before knowing the true needs of their customers.

The SET Factors have changed and the pace of industry has accelerated, yet markets have become “demassified.” Product development has moved from a period of mass manufacture and consumption to a period that can be defined not only as mass customization, but also as *mass customer-zation*. Mass customer-zation is the act of attempting to understand the needs, wants, and desires of ever-smaller and rapidly changing markets. Mass customer-zation is also the ability to customize your order as you make the purchase or the support to customize your product or service after purchase. Mass customization is the product that results from that understanding. Too often companies try to customize before knowing the true needs of their customers. Every category of products now demands the use of a variety of research methods to gain insight into the way people live and work and what their desires are. The Pontiac Aztec is a now-classic example of a product that attempted to capture the X generation with a car customized to their every need. Yet it failed to hit the market the way the Nissan Xterra did several years before because, although it incorporated style and technology, it did not properly respond to the Value Opportunity attributes of pinpointing time and sense of place. Even in fields as seemingly conservative as manufacturers of lift equipment, the ability to add a sense of pleasure and pride in the design can be a major factor in determining success. The Crown Wave meets all the safety and anthropometric requirements for lift equipment. However, the style and name also make it viewed as enjoyable to use and create a positive incentive for people to come to work. The enjoyment factor is another type of broader view of human factors. We describe a number of methods in this chapter for helping you to understand your customer. The method of task analysis is a more commonly accepted method used by human factors experts, but scenario development is not. Scenarios are as essential as any other facet of early product development. The scenario gives a product development team a common and concrete vision of who the customer is. It translates the generic term *customer* into a person (or persons) with a name and personality attributes, and places that person in the context of where the product will be used.

In characterizing the inherent difference in philosophy and approach between the two main categories of consumer research, the quantitative systems analysts tend to be searching for errors in existing approaches and the potential for injury in the use of products and environments. The process focuses on physiology and

cognitive processes. The use of these methods can identify areas that must be addressed to decrease fatigue, stress, and injury, or reduce the number of steps needed to perform an operation. The qualitative methods tend to identify emotional and expressive aspects of customers' expectations and focus on the potential of what a product could be. Both types of analysis are needed. The best products produce an effect that customers usually do not anticipate. They instantly fill a need no one knew existed. No one predicted that car buyers would be interested in buying a two-seat retro convertible with rear wheel drive. Not even Mazda realized how big the market was when it introduced the Miata. No one anticipated the success of a peeler with an attractive, ergonomic handle made out of black rubber with fins under a new brand named OXO. Those factors were not measured directly, but instead were anticipated by "reading" the SET Factors. Then, using form development and ergonomic research working in tandem through conceptualization cycles and refinement, the final design was developed and launched.

The challenge is in mediating these two seemingly opposite approaches to understanding human behavior. A successful product must reduce the likelihood of injury and misuse, and it must simultaneously make people feel that the product enhances their experience. Cars are an example of how human factors research has been used in the design of the interior; at the same time, the exterior look and feel of the vehicle is generally emotion based. The interior design is the result of human factors analysis that maximizes the interior space of the vehicle, thus making it comfortable, safe, and flexible. In the better designs, the interior is also visually designed to complement the exterior look and feel without compromising usability. The exterior look and feel provides a highly emotional response that customers see as either highly desirable or not. This type of response is a qualitative response that is just as important for purchase and satisfaction as the interior safety. This issue is particularly important, with the focus on smaller, more efficient cars. The interior sense of space has been significantly altered by how the seats, dashboard, windows, and minimum rear storage work in harmony to give the optimal sense of space, both real and imagined. As price of features decreases, more features are further integrated into the low-end cars as well. The Honda Fit is a number-one seller in its category of small car, and the interior could almost be described as roomy.

The design of the deployment of an airbag is critical to the safety of a driver in an accident. Failing to design this with proper ergonomics analysis can result in the death of a driver. The steering wheel itself is something the driver uses every day. The look and feel of the steering wheel is a combination of visual appeal, a cognitive understanding of controls, and an understanding of how the hand interacts with a circular form with a round cross-section. Drivers look at the steering wheel and

use it every time they drive the car; its design is critical to the driving experience. The airbag deploys only in an emergency, and hopefully the driver will never need it. Both of these design features are critical to the success of the product. The look and feel of the steering wheel is important from the point of purchase through the lifetime of the vehicle; it is a long-term product detail. The airbag is not. But if the airbag fails in an accident, everyone who owns a version of the car will feel unsafe, and this could affect others shopping for a new car. The airbag requires research and testing rigor and manufacturing standards that are greater in some respects than the design of the steering wheel. The steering wheel is in the primary lifestyle impact upper right cell of the PDM discussed in Chapter 6, “Integrating Disciplines and Managing Diverse Teams,” whereas the airbag is in the secondary lifestyle impact lower right cell. However, both are important to the overall success of the product.

All the products we have reviewed have a balance between the type of human factors that is the result of research and testing, as well as the kind of research that creates insights that lead to the proper balance and expression of product form and features. Companies involved in new product development must try to merge the thinking between these two seemingly disparate approaches to understanding human behavior. For example, in the GE Adventure Series, the child-friendly interface must work in harmony with the core technology and not compromise the image or access to the technical interface that operates the imaging system.

An Integrated Approach to a User-Driven Process

It is critical that each discipline be involved in user research. Fundamental to the success of a product is a positive user experience. When all is said and done, a consumer will use the body monitoring device, drive the electric vehicle, or enjoy a margarita. The product enables users to do something they either couldn't otherwise do or couldn't do as well or as easily. The product also enables a fantasy of what could be. The interaction of the product with the user and the quality of the resulting activity summarize the overall product experience. If the experience meets or exceeds expectations, people will buy your product, recommend your product, and use your product. If it is poor, the customer will feel let down, frustrated, and negative. They will also tell their friends in person or online not to buy the product. The goal is to understand how to create a product that enables a user to have a positive experience initially and throughout the life span of the product.

■ The interaction of the product with the user and the quality of the resulting activity create the overall product experience.

As shown in Figure 7.1 (inner loop), surrounding the user experience is the user's expectation of interacting with the product. This expectation has three features: First is the look and feel—does the product affect the user's lifestyle and image appropriately or improve the aesthetic or psychological experience? Next is performance—does the product function as anticipated, and does the overall interaction with the technology enhance the overall experience? Third is what we defined in Chapter 3, “The Upper Right: The Value Quadrant,” as psychometrics, the psychological spending profile of a niche market—Does the product offer the value people perceive is worth paying for? The goal is to understand these expectations and translate them into product features.

The expectation of what the experience will be is realized by the attributes of the product (see Figure 7.1, middle loop). Users perceive the look and feel of a product through the sensory factors—the visual, tactile, auditory, olfactory, and gustatory aesthetics. The performance of a product is a direct result of the features incorporated into the product. The psychometric element is accomplished by focusing on a target market.

These attributes become the product and are manifested through style (creating sensory factors), technology (enabling features), and the price and brand strategy (describing cost preferences of the product and a brand appropriate for the target market), as shown in Figure 7.1 (outside loop). As the figure shows, these manifestations map directly to design, engineering, and marketing (and finance). Each discipline, then, directly affects the user's experience with the product, and each is required to contribute to the development of the product.

Understanding the expectations of the user experience gives each discipline a direction to pursue in developing the product. The goal in developing a breakthrough product, then, is to understand the user's expectations. We now turn to tools and methods for understanding the user.

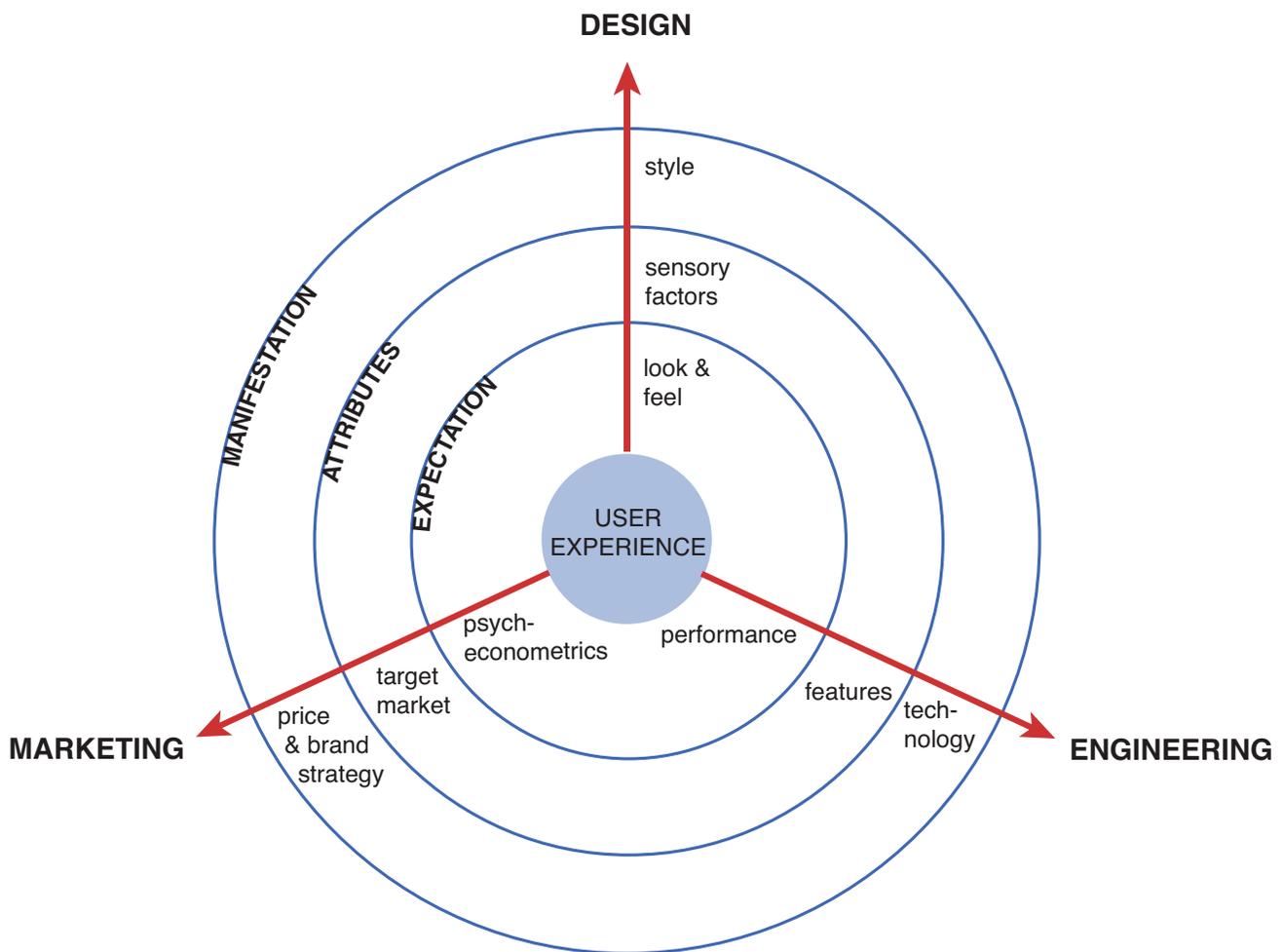


Figure 7.1 User-centered design—the user’s expectation sets up attributes that are manifested through the disciplines.

Scenario Development (Part I)

Recall that the SET Factors are a scan of the Social trends (S), Economic forces (E), and Technological advances (T) in society. The goal is to recognize the need for a product to influence the lifestyle of a group in society—in other words, a product opportunity. After identifying that opportunity, the first step in qualitative research is to create a scenario, or story, about a typical user in the targeted activity and determine how the lack of a product makes that activity harder or less fulfilling.

The initial scenario is short (maybe a paragraph or two in length) and covers the basic elements of the opportunity. These elements include the who, what, why,

how, where and when of a situation. In other words, who is the target customer, what is that customer's need, why does the customer have that need, how is the task currently accomplished, where does the experience take place, and when does this happen? This initial scenario often captures the pain points—the problem areas and frustrations—that potential customers feel in the current state of product offerings, opening the potential to make their experience better.

For example, consider this scenario:

Ron is an independent contractor. He typically works alone or with a crew of one or two. When Ron arrives at the worksite in the morning, he drops off his larger equipment as close to the work area as possible. Setting up a work area typically means carrying sawhorses and boards, as well as large ladders and tools. Most of the equipment is heavy, and many trips to a destination far from the truck can be time and energy intensive.

If Ron can work near his pickup truck, he often uses the tailgate as a cutting or work surface—even a place for eating lunch. Ron's truck has side-mounted toolboxes that he installed and both a ladder rack and towing hitch that he had installed professionally. This means that Ron has no free space within his truck bed and that he often has to put his tools on the ground during unloading; this is damaging to both the tools and Ron's back.

This scenario identifies:

Who: Ron, a contractor

What: Need for flexible workspace associated with his truck

Why: No room in typically loaded truck; makeshift solutions are not satisfactory; current approach is bad on the back and tiring

How: Equipment carried and put together on the spot, or tailgate used as makeshift table

Where: Carried outside the truck bed and usable anywhere on the work site

When: Throughout the workday

We still don't know a lot about Ron's needs and the details of his activities. We also don't know a lot about the solution to his dilemma. But we do know that we have a wonderful opportunity to create a product to meet Ron's needs. We also know, from our SET Factors and informal discussions with contractors, that Ron is not alone: Many contractors have these same problems every day.^{T1}

We use this project surrounding Ron and his needs, wants, and desires throughout this chapter to illustrate several methods of user-based research and show how this scenario eventually led to a superb and innovative after-market product for pickup

trucks. This product, patented by Ford Motor Company, resulted from a 16-week part-time effort by a team of novice engineers, designers, and a marketing person who followed the user-centered iNPD process laid out in this book.

As discussed in Chapters 1, “What Drives New Product Development,” and 3, “The Upper Right: The Value Quadrant,” the SET Factors and Value Opportunities change over time. If the product meets a wider range of needs, wants, and desires, it will stay in the Upper Right for a longer time. The scenario can help create a more robust Upper Right product, one that is not sensitive to slight variations in the SET Factors and resulting VOs. When the core scenario is stated, it should be considered under different environments. For Ron, how would the scenario change if the consumer base became more “green” (that is, environmentally aware)? How would increased fuel costs affect Ron’s business? Or how will Ron’s need for workspace change as his truck becomes networked and becomes his sole office? Such context variation helps the team think in a broader context about the product opportunity.

A scenario is a powerful tool to keep the development process focused. Although the scenario might get more refined, revisiting the scenario and making sure that the evolving product meets the who-what-why-how-where-when of the scenario is critical at each step along the way. If at any time the product deviates from this description, the design team must decide whether the purpose of the product has changed (with evidence from further qualitative research) or else rethink the solution to get back on track with the scenario.

After completing an initial scenario, the next task for the team is to seek to understand in detail the activities, needs, and preferences of someone similar to the person or people in the scenario.

New Product Ethnography

■ Ethnography can help to determine the qualities that products should possess.

During the second half of the twentieth century, companies involved in new product development looked to the social sciences for information about ergonomics and attitudes of consumers. Most recently, techniques used in the field of anthropology have been employed to aid in the preliminary stages of new product development through the use of ethnographic methods. Traditional ethnography is the art and science of describing a group or culture. It is a form of cultural anthropology that uses fieldwork to observe the group and derive patterns of behavior, belief, and activity. Fetterman⁶ provides a clear overview of traditional ethnography. The

new form of ethnography used in product development is a blend of these traditional methods with new emerging technology for observing, recording, and analyzing social situations.⁷ However, new product ethnography is more than just applied anthropology. The most important element of this new form is that it is not merely descriptive, but also predictive. This new branch of ethnography has emerged as a powerful area for predicting consumer preferences for product features, form, material and color, and patterns of use and purchase. In other words, ethnography can help determine the qualities that products should possess. Wilcox⁸ sums up the motivation for including ethnography in the design process: “We should be concerned about the study of culture for one central reason: It is the primary determinant of what people want to buy and how they like it.”

Ethnography techniques have emerged as a research tool for both marketing and human factors. In marketing research, ethnography can help in identifying and understanding emerging trends. In human factors research, these same techniques can be used to better understand people’s patterns of use and preferences when developing the criteria for products. The use of ethnographic methods is critical in the early phases of product development because they provide deeper insights than broad statistical surveys. Existing databases compiled by market research can complement and help direct this type of research. However, broad surveys and focus groups are more useful downstream when there is a basic understanding of the user. You need to know what questions to ask to make a focus group or survey useful; ethnography helps you find out what questions are relevant.

New product ethnography provides four benefits to the product development process. The first is an in-depth understanding of a small representative sample of the intended market. Again, the goal in the early stages of the process is not to obtain statistically significant, general information about product features. Instead, it is to understand in depth the needs, wants, and desires of a market segment. Ethnography provides insight into all of these and is a keystone to understanding the everyday behavior of the customer.

The second benefit of ethnography is a focus on the consumer’s lifestyle, experiences, and patterns of use. These insights allow the team to identify the features of a product that will make it sell. But beyond features, these insights help define the essence of the product—the look, feel, function, and purpose of the product. Ethnographic insights are the difference in defining the gap between the functional generic blender and the Margaritaville Frozen Concoction Maker, the pedometer and the FIT, and the coffee shop and Starbucks. These insights can help car companies understand why some people prefer a basic pickup truck while others prefer an SUV, and still others a plug-in hybrid car.

The turnaround time between identifying the need for a product and seeing the product on the market is anywhere from six months to three or more years. Huge financial commitments must be made, from cost of design and engineering to manufacturing equipment, consumer testing, labor, marketing, and sales. Given the significant amount of money and resources at stake, it is critical that the product designed today be successful one to three years down the road. How can a company commit its resources to a guess regarding what a consumer will want to purchase in the future? Ethnography is a key to making the right decisions by removing the guesswork. So the third benefit of ethnography is predicting major shifts in consumer needs. By seeking out the essence of how people think about the world around them, what is coming into their focal point, and what is leaving, the product development team can gain insights into what needs, wants, and desires people will shift to in the near future.

Instead of just focusing on the product itself, the team must understand the levels of detail surrounding the product. How will people use the product and in what situations? What other products will people use in conjunction with this one? What activities, besides the one of focus, does the customer like to participate in? What difficulties does the customer have in the current experience? These difficulties go beyond the details of a task analysis. They exist in the storage, access, and maintenance of the product; in the environments where current products fail; and in the type of environments where people live, work, and play. Understanding the essence of the lifestyle and patterns of use of the end user is like peeling away an artichoke: The heart is at the bottom, but each leaf has meat to enjoy and contributes to the overall experience of eating an artichoke (or designing a product).

The fourth benefit for new product ethnography is the ability to monitor dynamic markets. What people like today they will probably not like tomorrow; what people liked yesterday they will like again soon. Why is rock climbing in vogue after so many years? Why do Gen Xers like to skydive and bungee-jump? Why did the PT Cruiser and Beetle become so popular when their styles had been “out” for so long, only to lose popularity to more contemporary-looking cars again? When will online streaming overtake DVDs (which overtook VHS) as the forum of choice for movies? Why did the style and ease of use of the iMac succeed when consumers had previously been obsessed with faster processing speed and more features? Ethnography can help the team see changes in the marketplace before they occur by observing the frustrations and enthusiasm of customers to aspects of technology, style, and activity.

The techniques of ethnography useful in product design include these:

- **Observation**—Taking a birds-eye view of a situation allows the ethnographer to obtain a (somewhat) unobtrusive understanding of the context and particular activities surrounding a product opportunity. Observation methods include the ethnographer physically being at an event or, alternatively, using video and sound recording for later analysis. (One product ethnography firm paid people to keep a camera in the living room for a week.) The videos are then analyzed, section by section, looking for interesting insights into behaviors. The result of the observation is often interpreted by the ethnographer in conjunction with data from interviews and visual stories using state-of-the-art video-editing and organizing software.
- **Interviews**—Within the context of use in which people encounter the product or general opportunity under consideration, interviews provide insights into the way individuals think about, understand, and relate to their behavior in relation to that part of their lifestyle. Stories about situations and objects are desired to understand the context within which a product would function. Here the interviews go much deeper than just the details of the product, into the general lifestyle or work function of the user and overall target experience. The emergence of Web-based research tools and capabilities has opened up this medium as an interview option, particularly when distance is an issue between interviewer and interviewee.
- **Visual stories**—Visual stories are data produced by the target users (the research subjects) themselves. They are narratives that provide insight into typical activities surrounding a particular lifestyle. Visual stories are created by participants via reusable or cellphone cameras and diaries/journals in which people record what they think is important in a defined setting. This setting might be the activity of focus, the highlights of a day, or even photos of their favorite fashion or colors.

The goal of each approach is to contribute to an overall understanding of the issues surrounding a potential product opportunity and lifestyle issue. The result is insight that leads directly to an understanding of the Value Opportunities for the product. From the resulting patterns of behavior, a model emerges that indicates the flow of activities, behaviors, attitudes, or emotions surrounding the product opportunity. For the interested reader, Martin and Hanington present an extensive set of ethnographic and other qualitative research methods in their book *Universal Methods of Design*.⁹

Consider the opportunity of organizing and storing medicines in the household for families. A team using ethnography to understand this opportunity visited several families in their homes and applied the ethnographic methods of observation and in-depth interviews. After analyzing the data, they derived a model of behaviors of medicine use, shown in Figure 7.2. In the model, the following loop is followed:

- **Needing medicine**—Someone gets sick and tries to find a remedy to feel better. This could involve getting a prescription from a doctor and learning about the medicine from the doctor.

Remembering to get the medicine is required to move to the next step.

- **Getting the medicine**—The sick person or a family member obtains medicine from a pharmacy, herbalist, or somewhere else. This can involve further education from the dispenser.

- **Managing the medicine**—The medicine is integrated into people’s lives when they create or adopt routines.

Remembering to take the medicine is required to move to the next step.

- **Taking the medicine**—The person consumes the medicine, possibly with other requirements, such as food.

Recording that the medicine was taken is sometimes done or desired. The process returns to “Needing medicine.”

No product is defined or suggested, but at every arrow or box in the model, clear opportunities for products exist.^{T2}

As a different example, the team that focused on Ron and other contractors discovered many relevant lifestyle issues through observation and in-depth interviews. In terms of their pickup trucks, all contractors had some sort of accessories on their trucks. Few had a cap, many had ladder racks, few had behind-cab toolboxes, and most had side-mounted toolboxes. These observations showed that this market is willing to spend money to buy accessories for their truck if they are useful and help them work. The wide range of accessories and set-ups on the trucks indicated that the team was going to have to design a product that did not interfere with the present configuration of the contractors’ trucks.

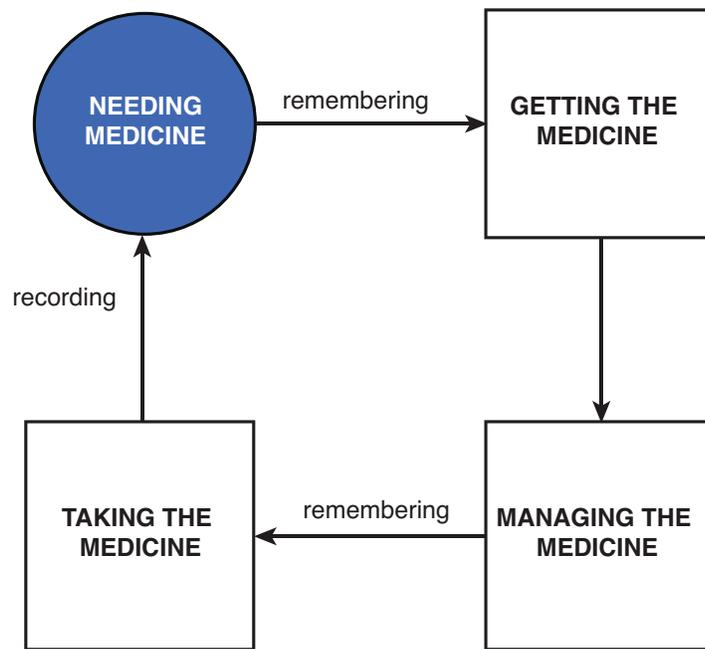


Figure 7.2 Behavioral model of medicine taking and storage in the home, derived from ethnographic research.

All of the people interviewed had a makeshift workspace that they themselves had made at the site. This usually consisted of two sawhorses and a board to make a table. About a third of the people interviewed said that they used worktables that they bought in addition to the one they made. These tables were usually foldable tables that came with a tool and were used with only that one tool (for example, a circular saw and the factory-made, collapsible table that it attached to). Half of the people interviewed used the tailgate as a workspace. The activities at the tailgate include setting up a brake and bending material, cutting material, using it as a workbench, using it as a sawhorse for the worktable, and sitting and eating lunch.

The information gathered from the interviews led to a list of additional concerns that had to be addressed when developing the product:

■ A deep qualitative understanding of the customer can lead to an innovative new product concept.

- How much space does it take up?
- Where does it live on/in the truck?
- Can it have its own power source?
- Can it be removable?

Using Ethnography to Understand Parrotheads

When Jarden licensed the Margaritaville brand, they did not have a particular product in mind. Altitude helped Jarden find the POG. Altitude's team conducted two levels of product ethnography. The first goal of product ethnography is to look for insights that will inspire focused direction and identify a clear Product Opportunity Gap. The second level is conducted once the focus is there; teams need to understand what Value Opportunities will lead to product characteristics. In the first level of ethnography, the Altitude team, in collaboration with the Jarden innovation team, was looking for the right product opportunity. The team members observed Parrothead parties. They also asked Parrotheads to record visual and textual stories of their process of throwing a party. Figure 7.3 shows the text version of one family's party from preparation to cleanup.

One thing stuck out: People liked to drink margaritas and other mixed drinks, but the current-state observations showed significant room for improvement. During outdoor parties, the challenge was going inside to make the drinks in the kitchen, away from the party; most blenders were small and could not make a lot of drinks at one time.

Another factor was the challenge of getting the right ice consistency for the drinks; they were never like the ones at the bar or restaurant. This observation led to three product insights: There was a POG for an outdoor mixed drink maker, the product had to be bigger to make more drinks, and it had to make the right ice consistency. Those became the core drivers for the product development phase. The team then moved to the second phase and started to conduct research on the successful professional mixed drink makers used in restaurants and bars. Team members found that the best product cost \$5,000 and was successful because it shredded the ice rather than chopped it. The challenge for the engineers was to create a mechanism that could produce the same silky ice consistency but be manufactured and hit the right price point for a consumer market. From a price strategy, the goal was to make the product profitable above \$100. The product also had to be easy to use, safe, and easy to clean.

To protect the product from the competition, the company needed to have a distinctive design that would generate a design patent, along with any utility patents for the ice production process. The design had to reflect the Margaritaville lifestyle and also allow for a unique look that could be protected by a design patent and eventual trade dress protection, to prevent cheap look-alike competitors. Altitude conducted additional research to find the right trend elements that Buffett fans would identify with and that would fit into the atmosphere of an outdoor event, reminiscent of the subtropics. Ethnographic research revealed different themes,

with the theme of “Affordable Luxury” emerging as the core brand language for the product. The team determined that the product should look like a home counter top product but fit outdoors. The overall form has rounded, soft shapes and large radii with a brushed and shiny aluminum-like finish and colored plastic trim. The details and graphic elements created the trademark identity and consistent details that made the product look contemporary and high end, yet echo the fantasy lifestyle of the Florida Keys for Buffett fans. Small details such as nautical rings to individualize drinking glasses and similar symbols subtly placed on the product helped connect it to the subtropics.

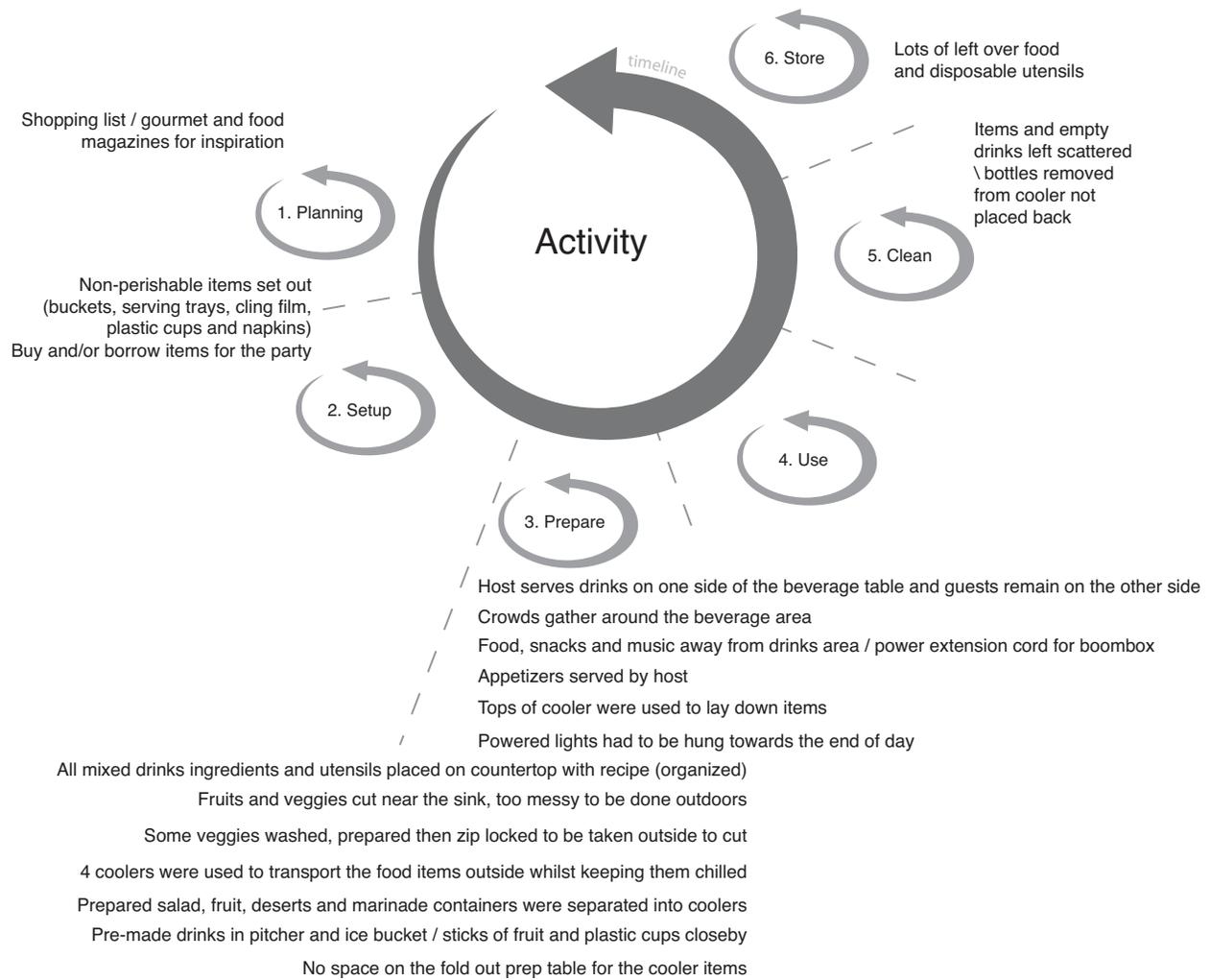


Figure 7.3 Activity-based ethnography model used by Altitude in user research for the Frozen Concoction Maker. This is a partial example of one family’s approach to organizing a party. (Courtesy of Altitude and Jarden)

The ethnographic research combined with secondary analysis of current product capabilities and the physical requirements to appropriately shave the ice led to well-defined functional considerations. The performance variables were as listed:

- Volume of beverage batches
- Variations in ice quality, shape, density, and size
- Variations in supply water temperature, flavor, and mineral content
- Speed/control/simplicity of drink creation (at all stages)
- Melting ice in hopper, diluting mixed beverages
- Entertaining without distraction or lower performance
- Cleanability, maintenance, and replacement
- Storage (commercial machine is left out, but this one travels, gets stored, and so on).

The component variables were these:

- Shaving motor size, shape, cost, and longevity
- Mixing motor size, shape, cost, and longevity
- Shaving blade sharpness, size, shape, longevity, cost, and replacement
- Power supply
- Software/processor/firmware
- Materials/finish of everything, including carafe

By delivering on the primary research goals and the performance requirements, they were able to create a product that listed at three times the target. The extra profit per item resulted from understanding the value proposition and delivering integrated style and technology that excited the customer. The product debuted exclusively in Frontgate catalog for one year and was extremely successful, leading other retailers to want to sell the product. Altitude did some minor redesign to the Frozen Concoction Maker for other stores and to attract a broader customer base.

The front-end qualitative research led to the identification and refinement that allowed Jarden to have a new market category for the company in outdoor products and at higher-end retailers. This success not only can lead to more Margaritaville lifestyle products, including five versions of just the Frozen Concoction Maker, but also other themes as well. This is a clear case in which getting it right early and focusing on an Upper Right product with integrated technology with features, and style with brand identity at the right pricing strategy fulfilled fantasy expectations and successfully delivered a desirable experience to a broad market base.

Lifestyle Reference and Trend Analysis

Why do so many products for some target markets have the same look and feel, even though they are designed and manufactured by different companies? Clearly, companies try to copy successful and current styles. Some companies are leaders; most are followers. In order to lead, companies need to commit to competing in the Upper Right. The climb starts with understanding your consumer and anticipating their next product expectation and ends with a product or service that is unique and reflects the trends and values that your team has identified. A part of that is to introduce new styles that anticipate and meet the expectations of the market.

New styles and trends start in industries where style changes each year or even each season, as in the fashion industry. At the same time, music, film, and sports are indications of the current emotional and stylistic trends. The cartoons of Disney have clearly influenced the cartoonlike products Michael Graves has designed for Target. Early in the iPod's growth, Apple developed a special edition with U2, with a black base and red scroll wheel, to coincide with the release of the group's album *How to Dismantle an Atomic Bomb*; the band members' signatures were even engraved on the back. Michael Jordan inspired an entire industry with Nike and the Air Jordan line of shoes and that strategy has evolved into the Nike Jordan Team with 28 men and women representing basketball, baseball, football, and track and field. New products in one industry or product line are influenced by products from other lines. Herman Miller introduced the SAYL chair, an elegant design inspired by the suspension system of a bridge, creating the chair's breathable elastomer back, the overall shape looking like a mainsail. Finally, although a company wants to be the leader, it must also respond to success from direct competitors or advances in related markets. When responding to competitors, leading companies find alternative opportunities consistent with their brand strategy and avoid copying the trend directly.

A method that integrates these factors is *lifestyle reference*—namely, reference to other products, styles, and activities from the target market segment. The goal of lifestyle reference is understanding what people buy, the context of how people use products, what people value, and what people define as their expectation of quality. The idea is to identify and surround yourself with a snapshot of the customer's life, to immerse yourself in the world of the user. In their concept studios, General Motors blasts the music of the target customer and creates areas filled with products that the target generation uses. Ford has huge picture boards with a variety of images, including product photos. The idea is that the music, colors, styles, and looks give the designers a feel for who the customer is and what he or she wants in a product.

The ability to capture a lifestyle reference is really quite simple. We recommend beginning by purchasing magazines that target your market segment. For example, magazines for an older, upper-class economic group might include magazines about cooking, architecture and interior design, golf, and travel; Echo Boomer magazines might include those about mountain biking, snowboarding, music, and technology. From the magazines, create a collage, known as a *mood board*, of the key lifestyle images and typical products. The mood board can be organized by subject or color, or can be randomly put together to give an interpreted snapshot of the user. Figure 7.4 shows two example boards that represent the lifestyle issues surrounding the quick rejuvenation for a mother of young kids or a young professional. Both of these were target markets for a product that sought to bring the spa to one's everyday shower.

From the magazines, identify products from feature stories or advertisements. Purchase these products, or borrow and use them. Photos indicate a first look, but touching and using a product gives you a sense for the current use of materials, accents, and touch and feel of the products.



Figure 7.4 Lifestyle reference collage of mothers of young children (a) and young professionals (b) seeking fast rejuvenation in their shower.^{T3}

Identify music and films popular with the target group. The sense and emotional tenor from the music or the tone of imagery from a movie translates into product style.

Of course, some products can be transgenerational. Transgenerational products usually start with success in one market segment and expand to other market segments. OXO started with a universal/inclusive design focus but soon became a successful transgenerational success. The Frozen Concoction Maker started with a focus on Baby Boomer Parrotheads and quickly expanded into young markets as

well. The Herman Miller Aeron and Mirra chairs were initially purchased by young entrepreneurs in dotcom firms and design companies, and then became mainstream for every type of business and user. Transgenerational products succeed because they hit a universal cord with consumers that starts in one market segment and explodes into others.

■ If the team tries to reach too broad of a market with a given product, at least initially, the product might not gain enough buy-in from any one group to succeed.

Be careful, however. Because product opportunities stem from the SET Factors, they are also targeted to a specific group of users. If the team tries to reach too broad of a market with a given product, at least initially, the product might not gain enough buy-in from any one group to succeed.

Trend analysis is a complement to lifestyle reference analysis and image boards. LPK in Cincinnati has a unique version of trend research that is a combination of fashion, technology, gastronomy, and emerging consumer values. This process, developed by Valerie Kramer, allows the branding company to track emerging lifestyle trends that are consumer-driven as opposed to traditional trends based on political, economic, and military data. This approach complements scenario development and ethnographic research and helps to provide actionable insights for the brands LPK manages. Following a new restaurant in Russia, experimental food in a cart in Portland, or a new fashion developing in South Africa can allow the company to anticipate potential mainstream value shifts.

Ergonomics: Interaction, Task Analysis, and Anthropometrics

Another critical area of user research surrounds ergonomics. This includes the interaction with a product, task analysis that breaks a product's use into succinct steps, and anthropometrics that give the ranges of body dimensions and their reach.

Interaction

Ergonomics refers to the dynamic movement of people and their interaction with both static and dynamic manmade products and environments. A product has two primary and interrelated levels of interaction. Human beings experience the world through cognitive perception and physical contact. The two modes work in a dynamic cycle that produces the world we experience. Both levels of interaction must be accounted for when designing how customers navigate the use of the product. When consumers look at a product, it must be consistent with cognitive models that they have already developed. If the product is perceived as cognitively

dissonant (inconsistent with former patterns), it will be difficult to use and often rejected. This is particularly relevant for breakthrough technologies. Technology-based products that seek to supplant current approaches to an experience find challenges based on new interfaces. Should a breakthrough technology include a breakthrough interface? Car companies have found that consumers accept electric vehicles better if they look like their internal combustion counterpart (see Chapter 9, “Case Studies: The Power of the Upper Right”). When the Web was blossoming, many users experienced cognitive dissonance, particularly older consumers who found screens unfamiliar and saw only one layer of the information. In contrast, a book or magazine has a front cover and a table of contents, and both can be quickly scanned. The entire product is visible, and parts are instantly accessible by physically thumbing through it. The logical order used is linear. When introducing e-books, tech companies tried to mirror many features of the paper predecessor, to maintain the feel of flipping pages and reduce that cognitive dissonance.

A product interface must account for a variety of users who vary in language, age, ability, gender, education, and cultural norms. In the medical field, a product might be used by a 60-year-old doctor, a 25-year-old nurse, and a 30-year-old medical technician who is a recent immigrant and who can barely speak English (or other local tongue). The chance for error with a product that has multiple users is high. Developing one interface that all these potential users will find easy to navigate is a challenge, and in the medical profession, an error can easily be fatal. That same product might be sold in several countries around the world. Does a multinational product have to be redesigned for each country, or should the product team try to use or develop terms and symbols that are internationally understood? Just think of the liability riding on that decision.

When people interact physically with a product, the issues of physical comfort and ease of operation also are a factor. A product can be uncomfortable by causing pain on contact or through awkward positioning or extension of the body (or any part of the body). A sports car is usually uncomfortable for tall or overweight people because the interior comfort and space is often compromised for aerodynamics. Food is often packaged in sealed containers for freshness and safety that are difficult to open. Reaching an ATM machine from a car window is often an uncomfortable activity. Office chairs are now designed to provide a stable five-star base, support the lumbar section of the spine, and adjust to different types of tasks. They have a curved front edge that helps to promote blood flow to the legs and prevents the numbing effect (falling asleep, or feeling pins and needles) that can occur when seated for too long.

Understanding the physical interaction of the product in use is important. One of the common problems with products that are tech driven is that they are often brought to market before ergonomic issues are identified. If engineers and programmers determine the cognitive and physical interface, they often design it for themselves and not for the general public. They then underdesign and create a product that is too complex for the average person to use. Industrial designers can also put form ahead of usability, creating products that look beautiful but are difficult to use. The former issue is described in Geoffrey Moore's book *Crossing the Chasm*.¹⁰ Products designed using an engineering, technology-driven approach will be attractive to lead users and early adopters, who look for the latest versions of products. But this approach will not transfer to the larger consumer segments because the followers of lead users demand a simpler and friendlier interaction with a product. Moore clearly describes the problem for high-tech products, but he does not give the whole solution. The method in this book, using ethnographic, customer-centered research and integrating design, engineering, and marketing, gives a product a much higher chance of success in the larger market. This scenario is clearly illustrated in early technology such as MP3 players. The early MP3 high-tech products failed to penetrate the market until Apple established an appropriate interface and identity with the introduction of the iPod and iTunes. If ergonomic and interaction problems are not predicted and solutions integrated into the product early, they are not easy to account for later and will invariably have an effect on the style of the product. Just adding physical product features or warning labels will compromise the look and the consumer's trust.

■ Products must be easy to understand cognitively and comfortable to use physically.

Discomfort can be immediate or can develop over time. Industrial and office labor has highlighted the problem of repetitive stress injury. By reducing the number of activities in a work task to improve efficiency, companies often create situations in which workers fall victim to an array of injuries that occur when they repeat the same action nonstop for days, months, or years. Carpal tunnel syndrome is the best-known example of repetitive stress injury and can appear in those who use computers or perform factory work. Scanners in supermarkets were causing a high incidence of carpal tunnel syndrome until the scanners were redesigned to be handheld. These newer, ergonomically correct scanners allow cashiers to hold the product and the scanner. This reduces the number of repeat attempts and prevents the need to continually use the same motion of dragging items over the static glass window. A masseuse now commonly comes into computer-intensive environments to release the tensions in the neck, shoulder, and arms of people who work at keyboards most of the day. Similarly, the Wave is a product designed as a response to back injury in the workplace due to lifting and climbing. Products must be easy to understand cognitively and comfortable to use physically.

Task Analysis

The goal of task analysis is to break down the current approach to solving the problem in a step-by-step manner. The result is a flow chart of each step that constitutes an activity. This can be as broad as the major steps in the day of a construction worker, an analysis of each motion that a person goes through to pick up or put down an item, or motions that the body goes through to climb or descend stairs.

If the goal is to improve the situation for a person who has physical challenges, how does that person's process differ from the process of those without physical challenges? Here the task analysis is performed for both types of people, and the differences are compared. Of course, you might question whether the process is ideal for even the "normal" person. For example, consider the design of the OXO GoodGrips peeler. The original focus was to provide a vegetable peeler for a person with arthritis. How, then, does an arthritic person use a generic metal peeler? How does a person without arthritis use the peeler? What actions are the same and what are different? What actions cause pain for the arthritic person, and what adjustments does he or she go through to compensate for the pain? Furthermore, consider the nonarthritic person. How effective is the action of peeling with a generic peeler? Are any aspects of the process uncomfortable? This type of analysis eventually led to the GoodGrips peeler. The large grip, the improved tactile feel, and the quality of the blade all addressed the needs of the arthritic individual and, it turned out, the nonarthritic user as well. A task analysis of the GoodGrips peeler shows a significant difference in the way a person with arthritis uses the GoodGrips versus its metal predecessor.

Because of the level of detailed analysis required for a task analysis, most often the activity is first videotaped. Then the video is used to break down the task. Usually several people are videotaped, and their processes are analyzed together. The task sequence is written down step by step. If different people perform parts of the task differently, branches in the sequence occur to show the different options. If the sequences converge again, the points of convergence are shown. The approach is general and must be adapted to your own needs and context. The challenges in this process are to look carefully at each step and develop the ability to separate important steps from more trivial elements in the task. Someone who is not trained to look carefully at situations can often miss essential issues. Having a number of people with different perspectives reviewing the tape is ideal. Different disciplines are sensitive to different issues. Task analysis can also be completed through observation; it is just more difficult to focus on and replay details through the analysis.

When the task breakdown is complete, the resulting flow chart or step sequences are analyzed to indicate what is good or ineffective about the process. Also, how does one process differ from another in number of steps, number of alternatives, and number of places of difficulty? The goal in developing any product is to either reduce the number of steps in the task or make the steps more effective and easier to accomplish. A task analysis comparison of the prior state and the new state affected by your product can verify the effectiveness of the product. The comparison can also be an effective means of proving the value of the product to the company, investors, or the user. The goal is to use task analysis to help create an understanding of the current user experience in a given situation and to help identify where a product can best improve that experience.

Long-haul trucks provide a home on the road for the driver. Yet typical trucks have none of the comforts of home. Even preparing a basic meal such as a sandwich is generally cumbersome, at best. One aspect of the research is to understand how a driver currently makes a simple meal in a truck. Figure 7.5(a) shows a task analysis of preparing a meal with a George Foreman Grill. Multiple steps are required to prepare and clean up the meal. There is no designated place to work, so the driver must sit on his bunk. There is no ventilation, so windows must be opened and a room fan used. Lack of storage means that items must be purchased when needed. Cleanup is even more difficult, with no trash receptacles or means to clean the grill. Figure 7.5(b) shows a task analysis of the same person using a kitchenette specifically designed for the truck. Here the number of steps is reduced, and the process of cooking and cleaning is more compact and efficient, focused on the same location. Everything the driver needs to prepare and clean up from a simple meal is provided. The original task analysis identified aspects of the process that needed to be improved, and the new one verified the effectiveness of the product.^{T4}

Another use of task analysis is to help organize and model process information. Consider the opportunity to clean all the nooks and crannies in the kitchen, such as the grooves inside Tupperware lids, holes in cheese graters, and blades of egg beaters. An analysis of more than 30 such objects led one team to a form representation of the majority of such nooks and crannies (shown in Figure 7.6). Such a summary of the types of slots and holes that need to be cleaned keeps the process generalized to all applications rather than fixated on a specific example.^{T5}

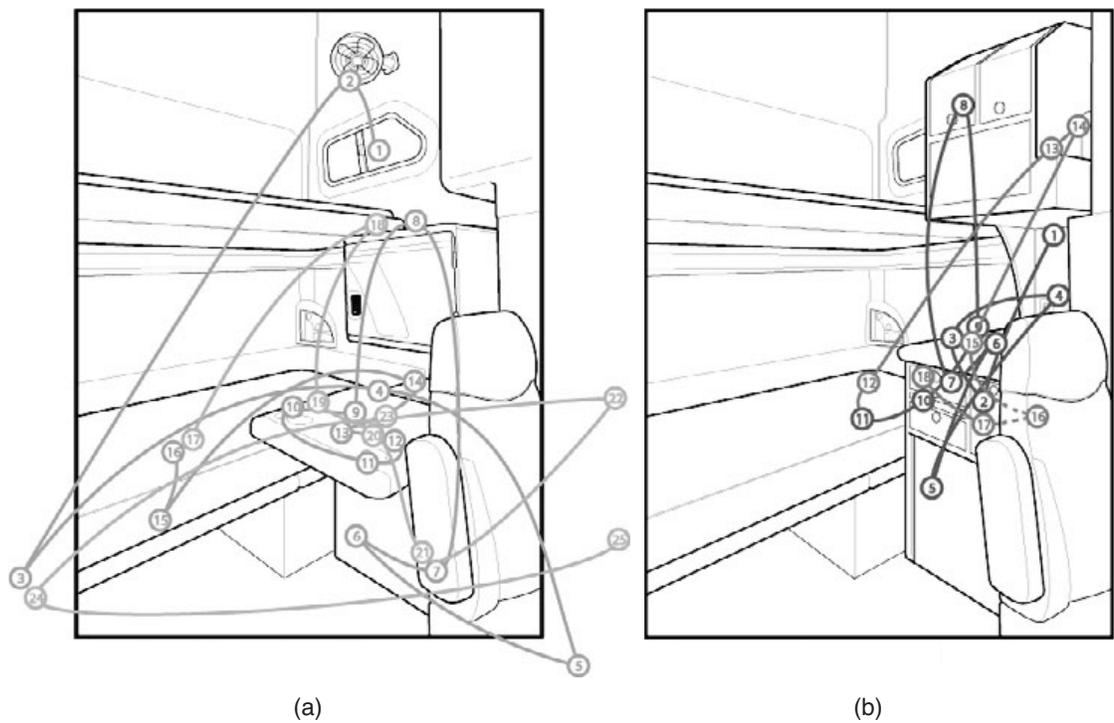


Figure 7.5 Task analysis of preparing a simple meal in a long-haul truck in the current situation without (a) and in the desired situation with (b) a specifically designed kitchenette.

Finally, a task analysis of Ron the contractor in the earlier scenario showed a significant number of activities centralized in the beginning and end of the workday. Contractors typically work in small teams or solo. Additionally, two or more trips to and from the supply store and the site are often needed before work can begin. Organizing, loading, and unloading small to medium objects in, out, and around the truck bed emerged as a primary task for this user group. Another key task is the need to remove the workspace and set it up closer to the work being done when it is not possible to locate the truck close enough. Tasks in this situation include cutting, planing, and elevating supplies.

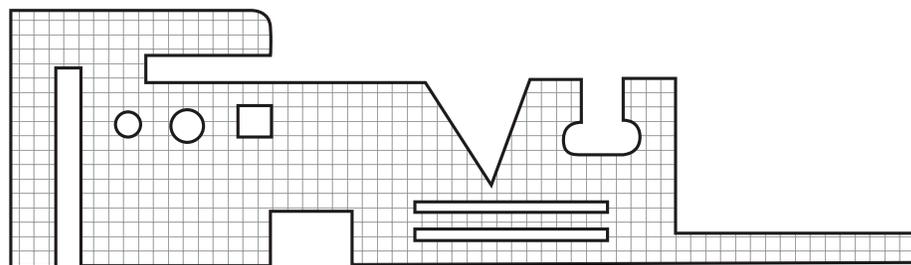


Figure 7.6 A representation of nooks and crannies found in the kitchen.

Anthropometrics

During World War II, issues of man–machine relationships became critical. Given the size of armies and the mass production developed to equip them, designing equipment to be usable by the largest range of soldiers and understanding the limitations of use became critical. The process was an early version of what would evolve into mass marketing during the 1950s. Before that time, boots, uniforms, and bunks were designed for the average soldier, or what became known as the 50th percentile. Other military equipment had size limitations, and taller soldiers were usually banned from certain assignments. For instance, pilot cockpits, tank driver compartments, and submarines were designed for function only and, thus, limited the height and weight of the soldiers who could work comfortably in those spaces. After World War II, this changed with an analysis of and focus on a broader range of users. Over the second half of the twentieth century, anthropometric information was applied to the military and then to the manufacture of industrial and farm equipment and office work environments.

A seminal book in this area is *The Measure of Man and Woman: Human Factors in Design*, by Henry Dreyfuss.¹¹ The book is in its fourth version of a publication developed by the design firm Henry Dreyfuss and Associates, originally published in 1959 and titled *Measure of Man and Woman*. Dreyfuss was a pioneer in the use of ergonomics for seating and work environments. The original version relied heavily on data that the military gathered, but the newest version represents decades of research gleaned from the work of the firm in a variety of product programs, including farm equipment, transportation, office environments, seating, phones, and cameras. This expanded version includes information that responded to ADA requirements. It is perhaps the best introductory book and collection of data on the market. The current version has excellent anthropometrics charts (for example, see Figure 7.7) that range from infants to seniors. It covers the ergonomics of living and working environments for fully abled people and those with disabilities.

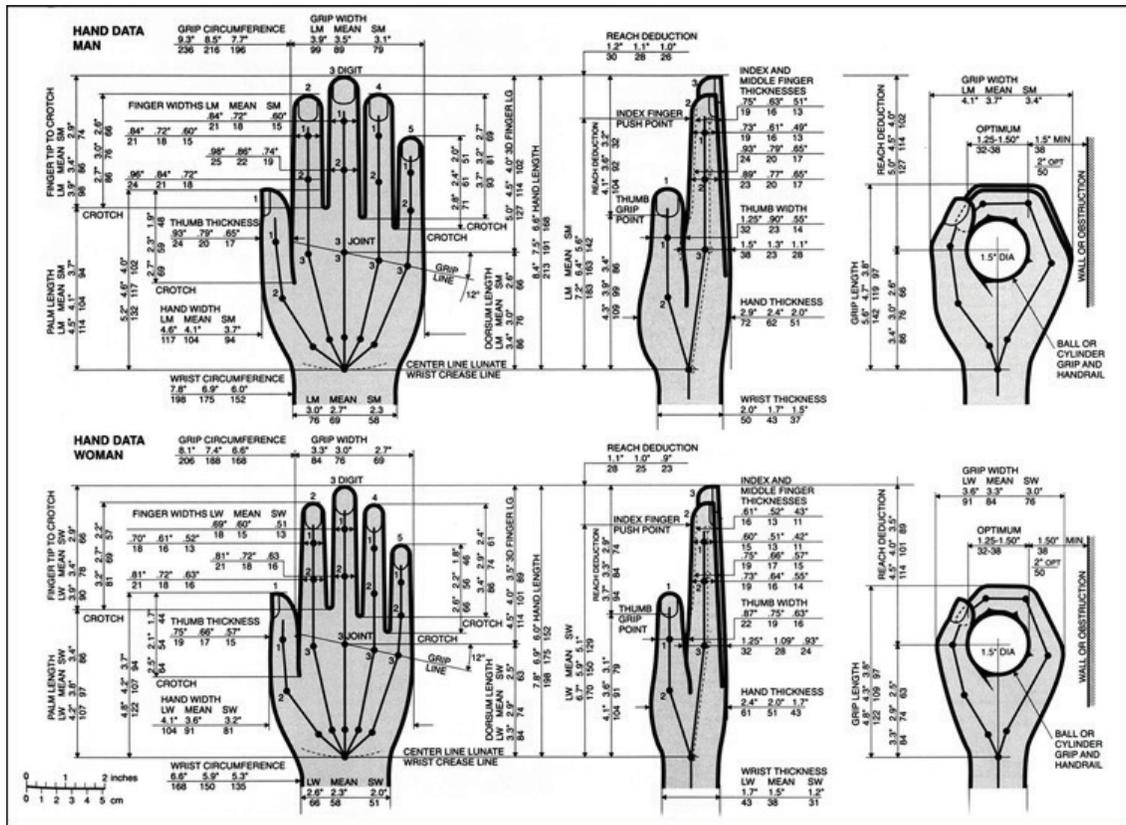


Figure 7.7 Example Dreyfuss anthropometric chart. (Reprinted with permission of Henry Dreyfuss Associates)

The team focusing on space for contractors to work on used the Dreyfuss charts to determine what anthropometric constraints the design would need to take into consideration. The data covers 99% of the population, ranging from the 1st percentile female to the 99th percentile male:

- Table height will range from 32 inches to 36 inches.
- As the height decreases, it becomes easier to lift heavy objects. This translates to a height of 6–8 inches below the user’s elbow.
- Table depth can range from 18 inches to 36 inches, allowing the user to reach across the work surface and access shelves above the workspace.
- Table length is dictated by the ability of the user to handle and potentially carry the work surface—no more than 6 feet, allowing for use on different-length trucks.

The use of anthropometric analysis in product development is complemented by a detailed understanding of biomechanics. Including nuances down to the level of muscle activation lends insights that lead to the successful design of products. The ergonomic pipette designed by VistaLab Technologies and Frog Design, discussed in Chapter 3, resulted from a detailed ergonomic analysis of physical motion of the body in conjunction with a task analysis of the steps required to use a pipette. Figure 7.8 shows a snapshot of that analysis. As Figure 7.9 shows, in developing the Aeron chair by Herman Miller, designer Bill Stumpf performed a detailed study on the variation in shapes and sizes of body types, a biometric task required to truly understand the bounds and range of interactions with the product.

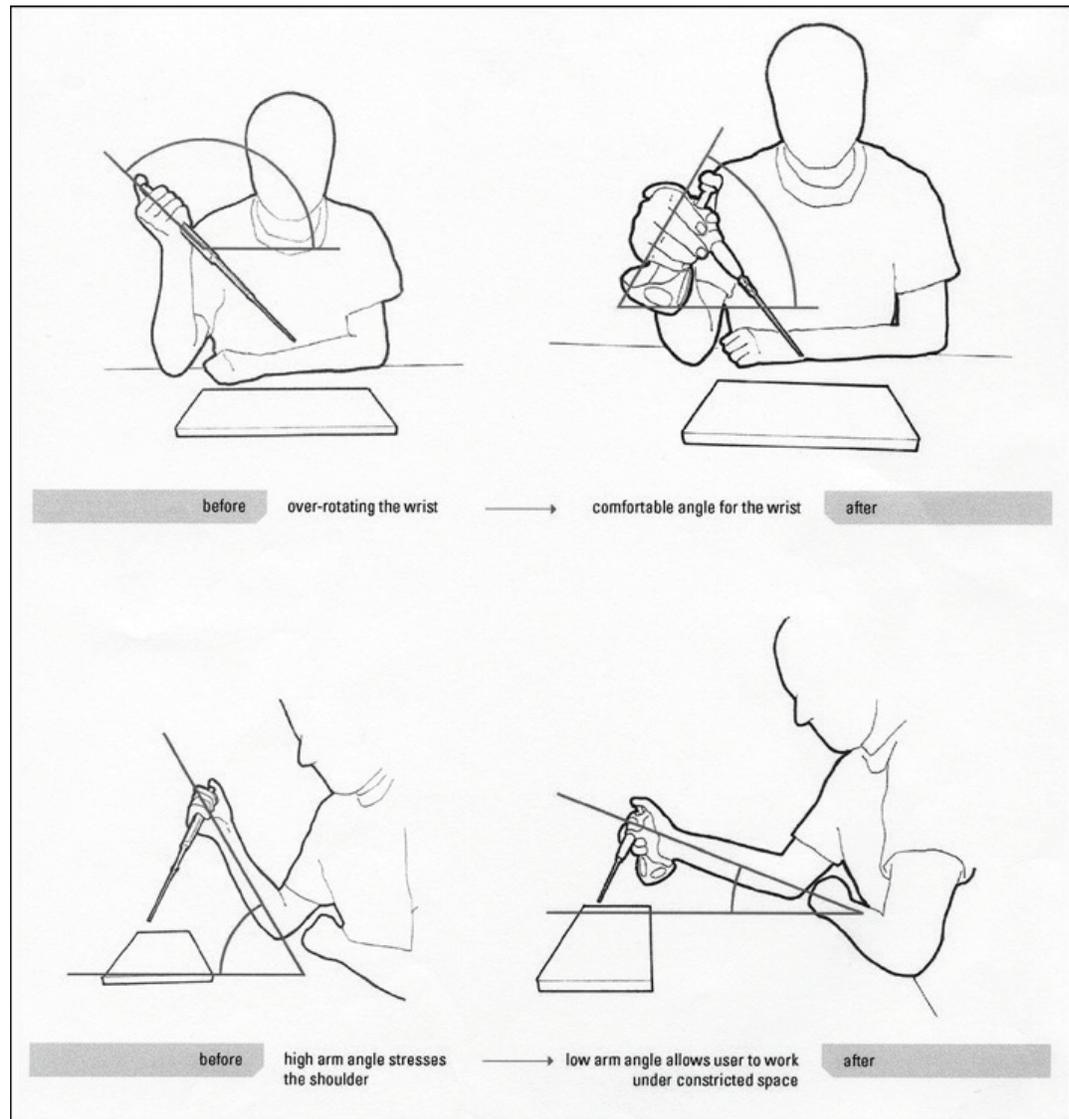


Figure 7.8 Task and biomechanics analysis of the use of the original and new pipette for VistaLab. (Reprinted with permission of Frog Design and VistaLab Technologies)

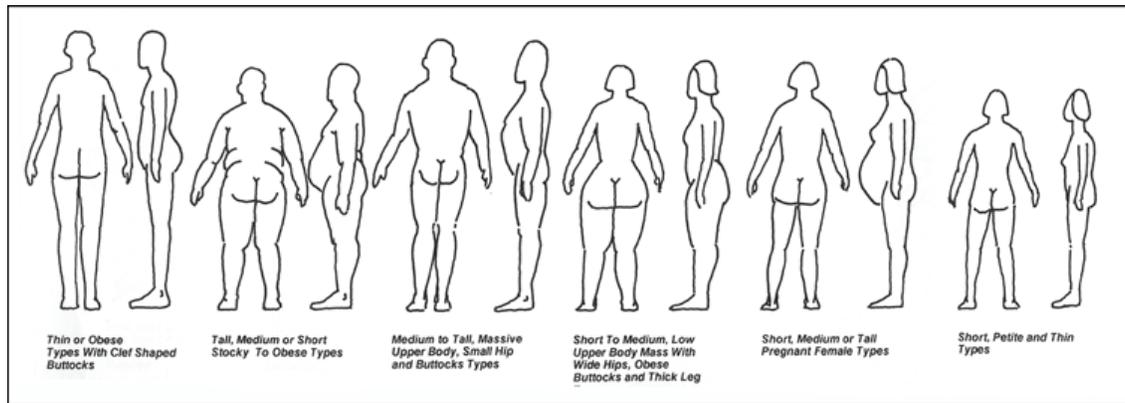


Figure 7.9 Illustration of the variation in body types of people who might sit in the Aeron Chair. (Reprinted with permission of Stumpf Weber Associates)

THE AT&T DREYFUSS PHONE

An excellent example of the evolution of human factors understanding is the evolution of the telephone. The first attempt by AT&T to blend style and technology was in the phone shown in Figure 7.10, designed using the firm of Henry Dreyfuss as consultants. Dreyfuss conducted its own human factors research and form development and worked with the engineering systems group in AT&T. The phone housed the latest communication technology in a product that was the result of thorough research in the encoding and decoding of sound. The receiver and mouthpiece were set in a hand-held product that was the result of the best average distance an ear and mouthpiece needed to be separated around the face. The Dreyfuss firm conducted research and determined the best overall fit that would accommodate the broadest range of customers—the type of analysis used during World War II and known as designing for the 50th percentile. This meant designing for the largest part of a population within a normal bell curve distribution (shown in Figure 7.11). The handle was designed with a cross-section that made it easy to hold. The development of a dial in the design reflected a change in the technological factor of making phone calls: automated switching systems that allowed callers to phone directly. People no longer needed to contact an operator to make phone calls; they could just dial a set of numbers to reach another person. The dial was placed at an angle to make it more comfortable to see and dial, and was set on a base that was heavy enough to provide stability to dial with one hand. The base needed to surround the core technology required to send and receive calls, which was too large and heavy to be put in the handset.

The shift from a heavy two-piece product designed for a mass market to a one-product-fits-all approach has led to the evolution of a vast array of communication products. Nokia was a leader in consumer phones a decade ago and began using concepts in mass customization. Its use of postponement allowed it to match the latest style trends with the latest technology. Nokia must now compete with other companies such as Samsung, Motorola, and Apple who have successfully read the emerging SET Factors resulting in innovative form, interaction, and applications. Apple took mass customization and postponement to a new level through the creation of a core physical platform, customized through software via individualized screen images and a unique set of apps for each user. The evolution from the original Dreyfuss phone for AT&T to the contemporary designs of Nokia and Apple reflects the changes in the field of user research in new product development.



Figure 7.10 Model 302 phone for AT&T, by Henry Dreyfuss, 1937. (Reprinted with permission of Henry Dreyfuss Associates)

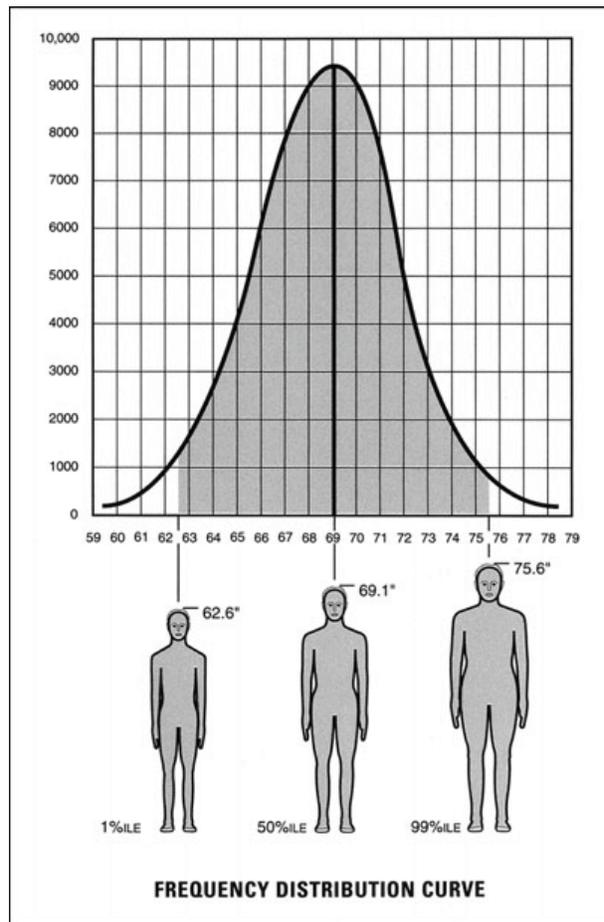


Figure 7.11 Bell-shaped distribution showing the 50th percentile, used by Dreyfuss. (Reprinted with permission of Henry Dreyfuss Associates)

Scenarios and Stories

The scenario is complemented with epic storytelling to capture the essence of the needs, wants, and desires of the key stakeholders. The scenario evolves from the ones that initially describe the POG. It emphasizes the facts and expectations surrounding the eventual product. Shane Meeker's approach to epic storytelling that captures the journey of achieving a fantasy goal through a product, based on Christopher Vogler's 12-step process, presents a different approach to scenario development. Epic storytelling merges the product's potential capabilities with the vision of what the ultimate experience could be for the user, fulfilling the mantra of form and function-fulfilling fantasy.

Scenario Development (Part II)

Earlier we explained the use of scenarios in the product development process. The initial scenario helps the team understand the user profile enough to find target users for ethnographic study and task analysis, and to follow up on lifestyle reference and human factors analyses. The scenario is a reference point for the entire product development process. The result of the qualitative research, then, can and should augment the original scenario, fleshing out details and context for the use of the product. Be more specific about pain points, requirements, specifications, and interactions with the product. The revised scenario is based on primary qualitative research, as well as secondary research that provides context, details, and requirements for a successful product. The scenario for Ron was revised after observation, interviews, task analysis, and lifestyle reference, and now includes more detail and a better articulation of the issues involved, as presented in the sidebar.

FINAL SCENARIO FOR PHASE II

Ron is an independent contractor. He accepts jobs ranging from siding and roof repair to interior/exterior renovation and restoration. He has a wife and three kids, and a nice house in a suburb. His wife is a homemaker and helps him manage his business by taking phone calls and assisting him with the books.

Ron typically works alone or with a crew of one or two. His jobs often require large quantities of building supplies, such as siding or roof shingles, not to mention a variety of tools. Although he can hold most of his smaller tools in the side toolboxes, his larger tools, such as the brake, miter saw, compressor, and saw horses, fill the bed of his F-150 so that not even a small amount of building supplies will fit. This means that he has to make two or more trips to and from the site before work begins every morning.

When Ron arrives at the worksite in the morning, he drops off his larger equipment as close to the work area as possible. This sometimes means that he has to put tools on the ground in a pile next to the truck and pick them up off the ground later. Next, he drives to the supply warehouse and loads the building materials for the day. Then he returns to the site and sets up a work area next to the building. Setting up a work area typically means carrying sawhorses and boards to work on, as well as large ladders and tools. Most of the equipment is heavy. Many trips to a destination far from the truck can be time and energy intensive.

If Ron can work near his truck, he often uses the tailgate as a cutting surface, for assembly, tool cleaning and maintenance, as a surface on which to read drawings, and even as a place to eat lunch. He has noticed, however, that because his toolboxes block the sides of the truck, he has no access to the bed if he uses the tailgate for these things. He also has noticed that his back gets sore when he works over the tailgate too long because it is lower than his workbench. Ron also worries about accidentally cutting into the tailgate and damaging his saw blades. So even though working on the tailgate is convenient, he tries not to make it a habit.

Ron's truck has side-mounted toolboxes that he installed. He also has a ladder rack and towing hitch that he had professionally installed. Ron stores his smaller tools in the side-mounted toolboxes. He has noticed that, as he is digging for a specific tool, he has no convenient place to put other tools to get them out of the way, except on top of the boxes. The top of the box is over his head, however, and doing that has caused him to hurt his shoulder in the past. So he sometimes sets the heavier tools on the ground, but this can make them dirty and cause his bad back to act up as he tries to pick them up. These inconveniences, like other things, are just part of having a truck—at least, in his mind.

After a hard day of putting up siding, he puts the tools in the back of the truck. The first thing he does is put the ladders on because he has to stand in the bed of the truck to move them up onto the rack and secure them. Then he loads the tools and excess materials. Sometimes a tool or piece of equipment arrives at the truck out of order, and he has to place it on the ground before loading it into the truck. This means that it might get mud or dirt in it, and Ron also has to bend down to pick it up before loading it.

We now have a deeper understanding of Ron's home life, the extent of his business, the types of supplies he carries, the truck he owns, how he uses the tailgate and the difficulties in doing so, and ergonomic issues in loading and unloading his truck. The scenario still has no focus on a particular product or its features, but it clearly indicates the difficulties and the opportunities for products to improve Ron's daily activities.

Storytelling

Mastering Myth and Epic Storytelling to Drive Innovation: Shane Meeker's New Approach to Product Stories

■ Epic storytelling merges the product's potential capabilities with the vision of what the ultimate experience could be for the user, fulfilling the mantra of form and function fulfilling fantasy.

Shane Meeker was just named chief historian at P&G, although a more appropriate title is Epic Storyteller and Keeper of the P&G brand. It took Meeker several years to get to his current position, and he is an atypical archivist and historian. This case study is about hybridization of a career how one plus one made three for him.

Meeker studied industrial design and began his career as a designer at P&G. Although he loved design, his passion was always the film industry, and he even contemplated becoming a screenwriter and story developer for the movie industry. He was particularly interested in epic adventures and started to conduct research on the structure of epic narrative. Being a fan of George Lucas and *Star Wars* led him to Joseph Campbell's work, epic stories, and the mythology of all cultures. Campbell had been the inspiration and advisor to George Lucas for the *Star Wars* movies. Meeker wanted to know more about how Lucas had integrated several mythological stories into a new epic adventure that captured the imagination of movie fans around the world. This also led him to the work of Christopher Vogler and his work on the fundamental structure that is the foundation for epic adventures. Vogler developed a 12-step, three-act narrative structure that anyone can use as a point of departure. Now Meeker had two complementary sets of innovative knowledge and method to merge: epic storytelling and industrial design.

Shane Meeker himself is a great storyteller and a dynamic presenter. He started using his visual design ability and public speaking skills to present his ideas within P&G and at various design conferences. In the book *Outliers: The Story of Success*,¹² Gladwell describes how innovators often put in 10,000 hours to develop a unique strength and insight. Meeker had 10,000 hours as a designer and 10,000 hours in his work on myth and epic stories. Instead of becoming a movie writer, he started a new innovation capability within P&G: brand narrative. This hybrid idea came when he realized that consumers of products are all on their own epic adventure in search of treasure. It could be whiter whites for clothes, skin free of wrinkles, diapers that did not leak, or just a feeling of accomplishment. To consumers, their products are the enablers to help them overcome the obstacles of dirt, aging, care for infants, or simply how to get things done. Meeker often cites as an example that Mr. Clean is not a hero, but is the Yoda or Gandalf of cleaning in the home.

He helps the hero or heroine keep floors, glass, and counters clean. The consumer must always be the hero; brands are mentors who inspire and provide magic items to enable consumers to achieve the desired goals in life. When P&G made the commitment to elevate consumer experience through design, Meeker's idea was the perfect empathic complement to the R&D expertise and chemical logic that makes products such as Mr. Clean work. After several years of inspiring project teams to understand the epic aspect of products, P&G appointed Meeker as company historian and leader of the Heritage Center. He replaced Ed Rider, a legend at P&G who helped establish the archives and who contributed to many of the books and articles written about P&G. In his new role, Meeker is now a steward of the P&G brand, integrating the idea of storytelling into how the archives informs and inspires employees, partners, and consumers about the mythic adventures of P&G.

When Meeker conducts his storytelling workshops, he instills in his audience the enthusiasm of college freshmen, and inspires them with his favorite movies. He has the unique ability to quote scenes from any epic movie and connect them seamlessly to theories of Joseph Campbell, Christopher Vogler, and Robert McKee. Whether at P&G or at conferences or universities, Meeker holds his audience spellbound through a combination of expertise, passion, and audience participation.

With his unique skills, Shane Meeker helps his students understand that they are on their own epic adventure. No matter where they are in the world and no matter what the context is, everyone is on a quest. The chalice they seek might seem simple to others, but it is a major part of the fulfillment we all seek. Through examples in this book, we describe how products such as Herbal Essences successfully connect with Gen Y women through understanding how a bad hair day can destroy self-esteem, or how the GE Adventure Series for children transformed the dreaded CAT scan into an epic adventure, with technicians as enablers in that adventure. Using mythic narrative as a tool is a complement to ethnographic insights and scenarios. It helps not only to create an empathic understanding, but also to elevate the everyday event to a new level of importance and inspire teams. In his book *The Centaur*, John Updike used Greek Mythology as a vehicle to elevate the story of a father and a young boy in a small city in Pennsylvania. Tolkien and J. K. Rowling created epic adventures as well, one through tremendous research and the other in a coffee shop. Meeker's work is an example of using a classic tool in writing and entertainment, then redefining it for corporate life and as a methodology to drive product innovation for consumers.

The Hero's Journey: Applying Vogler's 12 Steps to Creating Epic Product Stories

Christopher Vogler developed 12 steps to creating epic stories, based on the writings of Joseph Campbell:

1. Ordinary World
2. Call to Adventure
3. Reluctant
4. Meet the Mentor
5. Cross the Threshold
6. Test, Allies, and Enemies
7. Approach the Inmost Cave
8. The Ordeal
9. The Reward
10. The Road Back
11. Resurrection
12. Return with the Elixir

These are often placed in a three-act structure. The first act sets up the adventure and crosses the threshold from the ordinary world to the extraordinary world. The second act brings the hero/heroine to obtain the reward. The last returns the hero/heroine to the ordinary world with the reward. Inspired by Shane Meeker, when using Vogler's steps in creating epic stories for products, it is an easy process to put the consumer in the role of hero/heroine and then run them through an elevated version of an everyday event. You can select from these steps to create a narrative; Meeker chooses about half of them. This version blends *Oz* with *The Wiz* and the design of a new pair of shoes.

Let's focus on Dorothy, the poor farm girl who always wanted to buy new shoes and travel. She is invited by her two wealthy aunts to take a trip to Europe, but the flight out of New York is canceled and she is stranded in the city. She takes a yellow cab to Manhattan with her two aunts, who have two opposite personalities, one supportive and kind, and the other negative and hypercritical. She is finally in the city of endless shoes as she walks down Fifth Avenue. After an argument with her difficult Aunt, she wanders off on her own and gets lost. Dorothy remembers that three of her high school friends are studying at Columbia. They meet her and take her around the city on a variety of adventures. She finally gets the shoes at a bargain mall in Lower Manhattan. As a bonus with the sale, she is given a special new app that awards free trips. While at first thinking it a joke, she tries the app and ends up winning a trip for four to Paris! The good aunt who admires her newfound confidence supports a semester abroad in Paris. Dorothy walks around the City of Lights with her friends in her perfect new travel shoes. The moral of the story is: For some, home is no place to be; these shoes will take you wherever you want to go in style.

You pick the shoe company and how the features of the shoe enable Dorothy to have the perfect journey. Consider how Dorothy finds it worth fighting for the shoes and overcoming obstacles to obtain them, and consider how help from unexpected sources makes the difference between the shy farm girl and the confident

young tourist in Paris. This scenario is not just about the shoes; it is all about the journey. Figure 7.12 shows Vogler’s structure for creating this story. The approach gives you a means to create exploratory scenarios to drive product development and the delivery of a brand message.

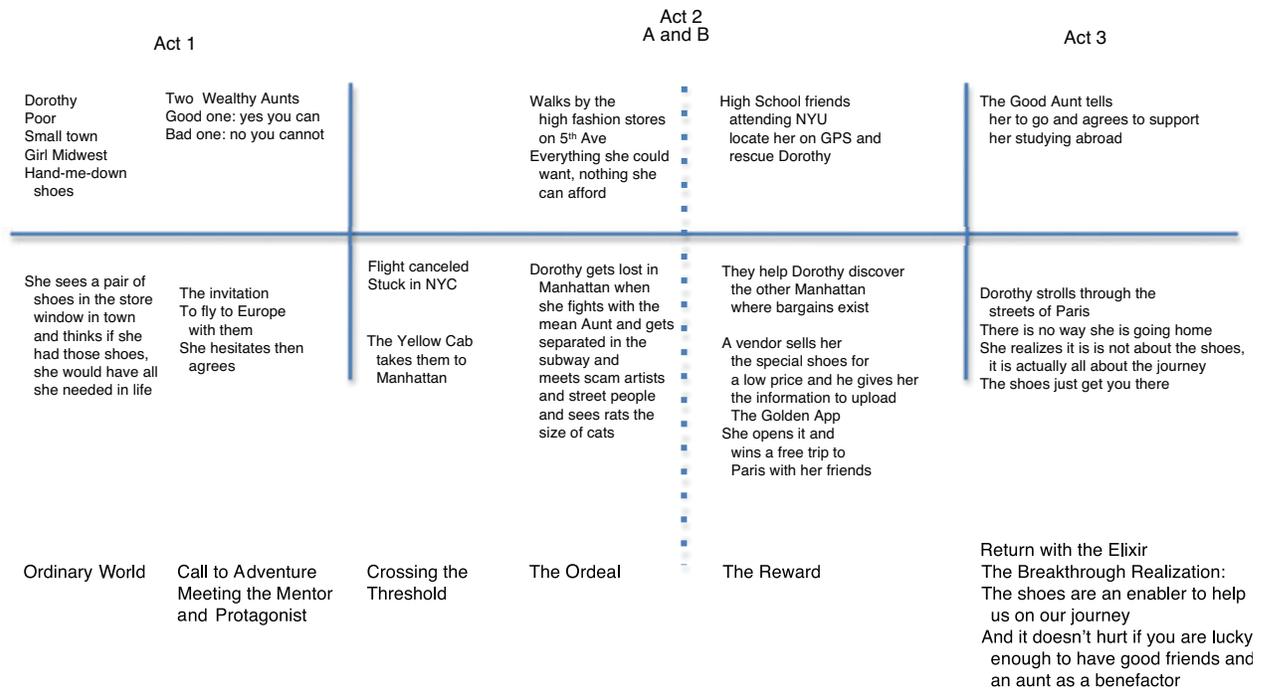


Figure 7.12 Vogler’s steps, applied to Dorothy and her search for new shoes.

Broadening the Focus

In addition to the end user, other stakeholders that interact with or are impacted by the product need to be researched. These stakeholders are external to the company, but many stakeholders internal to the company also impact and are impacted by the product’s design.

Other Stakeholders

Our focus has been the user. Fundamentally the end customer is the one who will use the product and, generally, pay for the product. Of course, multitudes of people interact with the product during the development process. Within a company, warehouse and distribution, sales, and facilities management all interact with the product. At times, these seemingly secondary functions can have a major effect on the development process. For example, if a new car cannot fit on specially designed

vehicle transport trailers, the company might need to spend money and time to redesign trailers. Similarly, shipping many products is a significant added cost. Truck sizes are standard, so a slight increase in a box size might significantly reduce the number of products that can ship in a given truck. As another example, the lifecycle costs of the product, often not a focus in the design process, might have huge financial effects on the company. As discussed in the sidebar of Chapter 3, European companies have some responsibility for the disposal costs of products. Taking into account the disassembly and disposal costs of a product during its development can reduce the overall cost effects.

Outside the company are distributors and point-of-sale issues such as the packaging size, the look of the packaging, and the means of displaying the product, which all become relevant in its sale. Many times, especially in the medical industry, support individuals (nurses, family members, and so on) need to operate the product in addition to—or even instead of—the targeted user. In terms of purchasing, in many situations, the end user does not make the decision to purchase the product. A major aspect of this issue is the approach to sales of the product.

Installation and service of a product are critical. Otis Elevator needs to be concerned with not only the use of its products (by people entering a building), but also the interface with the building's construction methods and the people who install it, service it, and inspect it.

In general, all stakeholders should be identified and prioritized, and their needs, wants, and desires should be understood early. If secondary stakeholders are significant, their input should be directly included in the process. This could mean including a representative from that area on the team. More generally, the team should at least understand the requirements and desires from these other downstream stakeholders through primary research. In *The Design of Things to Come*,¹³ we present a method of identifying stakeholders motivated by a “Powers to Ten” analysis that looks at a product from the perspective of all the people who are influenced by the product and those that use it. Each level of impact results in a different scale of perspective—for example, from the user, to the infrastructure that supports the product, to those who support the infrastructure. Often certain stakeholders are critical to the success of a product, but the design team does not consider them initially important. Consider the operator of a machine that incorporates the product, or a union that must accept a change of process that might be more efficient and result in fewer operators; they don't make purchasing decisions, but they do affect its successful adoption.

Taking into account the needs, wants, and desires of key stakeholders increases the likelihood that the product will deliver maximum value and reduces redesign

efforts that hinder the development process timetable, cause added frustration to the team, and often reduce the overall effectiveness and quality of the product.

Identifying Users in Nonconsumer Products: Designing Parts within Products

The focus of this book takes into account the end user of products and services. The ideas and methods introduced in the book, however, also apply to products within products. Supplier parts and core technologies, the parts found in the lower cells of the Part Differentiation Matrix, often function within a product but are never touched, seen, or otherwise directly managed by the user. Many times these parts are designed and produced by suppliers independent of the end user of the product in which they will be used. A generic part such as a bolt or other fastener, an air conditioning unit in a vehicle, a turbine in a jet engine, and a chip in a computer are all technology- or manufacturing-oriented parts that are never touched by the user of the heating system in a home, the air conditioner in the car, the airplane that is flown, or the smartphone that organizes and engages with a person's busy day.

However, users are very much an integral part of the design of these parts. The user here is not the end consumer, but the person who will assemble the parts into products. These parts are technology oriented, and the word *style* might not be as relevant here. Instead, the words *interface* or *interaction* design might be more appropriate, in that the parts must be designed to be interacted with. The notion of value here might focus on the quality, core technology, and ergonomics VOs, although creating a part's corporate identity or aesthetic attribute might differentiate one supplier's part from that of other suppliers in the field (as with Intel).

■ No matter how simple or small, every part that has human contact has a user.

Within this context, all of the methods in this book are relevant to the design of these types of products. The Positioning Map and Value Opportunity Analysis can help differentiate one product from the rest. Ethnography serves an important role in helping the design team understand context in which its components are used within the larger product and how the parts are handled and manipulated. Recognizing that usability is an important attribute in the development of the product and that part context and ergonomics must be at least included with manufacturing in the parts development team is a critical step toward creating successful components. No matter how simple or small, every part that has human contact has a user and must be designed with the needs, wants, and desires of that user in mind to create successful, differentiating products.

Product Definition

Ethnography and lifestyle reference together define the characteristics of the product that the team will design. Task analysis and human factors give details on the mechanics of product use. Understanding the needs of the key secondary stakeholders broadens the context of the product requirements.

This analysis provides an understanding of what the target customer needs, wants, and desires in a product and, furthermore, what the customer expects and values. The research offers a basis for defining the Value Opportunities (VOs) of the product and performing a Value Opportunity Analysis (VOA) of the product relative to the competition.

The VOA, in conjunction with the qualitative user research, provides actionable insights into the POG that lead to a differentiating definition of the product:

- **What will it do?** What is the basic function of the product, and what qualities in performance will the product have?
- **Who will buy it?** Who is the target market?
- **What will be its rough dimensions?** Rough sizes and even rough 3D block models give the product some physical context in relation to competing or alternative products for the target group.
- **What styling features will it have?** What types of lines, corners, material qualities, and embellishments will it have?
- **Who are the major competitors?** Specify competing products or alternative products that the market spends money on. The alternative to the iPod was the CD and associated equipment to play it. An alternative product to BodyMedia's FIT System was a pedometer at the low end; at the higher end, the same demographics would spend money for the iPod.
- **What functional features should it have?** In addition to style, what performance qualities and capabilities does the target market expect?
- **What are the psychological descriptors or semantics of the product?** Product semantics is an interesting phenomenon. A product should be designed in such a way that users describe it in a predicted way, using words of choice by the design team. These descriptors come from the styling of the product within the context of other products used by the market. For example, a sports car should be called "fast" and "exciting," a minivan "safe" and "practical," the Frozen Concoction Maker "fun" and "laid back," and the iPad "cutting edge" yet "inviting."

- **What is its context?** Where will the product be used, and where will it be stored? What other products must it be compatible with? How often will it be used? What emotions does the user seek?

Whether in the university or through corporate training, we teach teams how to understand the user. Generally, the teams solve a real problem, going through the methods of this chapter to gain a rich understanding of key stakeholders' needs, wants, and desires. However, even in just a one-day exercise, teams can learn the basics of the process. We provide a product opportunity statement, the history of similar products, a taped ethnographic interview of several potential users, a human factors/ergonomics analysis, and a series of appropriate magazines. From this information, teams are able to create a scenario capturing the product's use, establish a lifestyle reference of the target customer, build a Value Opportunity profile and compare it to the competition through a VOA, describe the characteristics and features of the product (including rough dimensions, attributes, and visualization of use), and develop product solution concepts that meet each criteria specified by the team.

Summarizing the product to be developed to assist Ron the contractor, the opportunity is a workspace that would be mounted to the side of the pickup truck for use by contractors and others in the building trades. Having the workspace on the outside of the bed would leave more space inside the truck bed itself for loading building materials. The table could be used on the side of the truck or could be taken off and used closer to the job site. Some of the tasks that could be performed on the table while it is attached to the truck are cutting, assembling, material and tool prep work, and paperwork. The table could also serve as a type of loading platform. Tools and materials could be placed on the table before being loaded into the bed of the truck. In this way, the table could serve as a stage for organizing items before putting them in the truck bed.

Semantics of durability, ease of use, and versatility are the three main factors that would drive the design of the product. The target market is makers who are involved in the building trades as a part of a small (one- to four-man) residential contracting company. This market should expand to all makers in contracting businesses after the product is established in the market.

The sidebar shows how this team used its product definition from user research to develop an exciting new product. Other case studies in Chapters 9, "Case Studies: The Power of the Upper Right," and 10, "Case Studies: The Global Power of the Upper Right," further illustrate how having a fundamental understanding of who the user is and what the user desires drives successful product innovation.

SIDEWINDER: SIDE WORKTABLE^{T1}

An annual course offered at Carnegie Mellon on integrated new product development integrates engineers, designers (industrial and communications), and MBA students to create a complete product concept based on an open-ended industrial problem. In the 16-week course, the students follow the iNPD method laid out in Chapter 5, “A Comprehensive Approach to User-Centered, Integrated New Product Development.” Teams are mixed, typically with six students on a team.

Sponsorship by Ford Motor Company one term focused on the design of after-market products for the back of a pickup truck (a Ford F-150), the course taught by the authors. One student team focused on the contractor Ron and his needs, described earlier in this chapter.

The students observed several construction workers and conducted detailed interviews with 20 other such workers. In addition, they explored a lifestyle reference analysis, performed an ergonomics analysis, and had access to the VALs database on values and lifestyles. From all of this research, they built up an understanding of Ron and folks like him. By thinking “out of the box” (literally), they realized that an unused part of the truck—and, really, the best one for their needs—was the side outside the truck rails.

In comparison to the sawhorses-and-boards alternative, the VOs showed great opportunity to add value and create an Upper Right design. The potential existed to address the emotion VOs (through independence, security, and confidence), aesthetics (through visual and tactile), identity (personality and sense of place), ergonomics (safety, ease of use, and comfort), core technology (enabling and reliable), and quality (craftsmanship and durability).

After broad concept generation, the team focused on 15 distinct concepts and weighed them (in a Pugh chart) qualitatively against 18 criteria (time, versatility, durability, ease of use, cost, manufacturability, stability, security, safety, mountability, closed profile, implementation of range of motion, prototype, appearance, market size, market versatility, installability, and compatibility with other products). Of those, five were weighted more significantly (versatility, durability, ease of use, cost, and compatibility with other products). This resulted in a reduction to five concepts that the team took back to the user group for more feedback. The team then reduced its designs, first to three and then, after further revision, to one. Along the way, the team refined the features of the product, based on direct and implied feedback from the contractors.

Further refinement led to the SideWinder, shown in Figure 7.13, which targeted the heavy use/heavy utility segment of the F-150. The main innovations were a table that resided on the side of the truck and could be removed and brought to the worksite, where it had legs that folded down; while on the truck, it folded up and locked during transportation. Because many small contractors use their truck for personal business on the weekends, the table and brackets must be removable. The team decided to attach the table to the underframe of the vehicle, in much the same way as a tow hitch works; the idea of a tow hitch on the side of a vehicle is, in and of itself, innovative and leads to many follow-on products. However, this led to difficult structural issues due to the cantilevered design. Through further refinement, the team made the table supported by two brackets, each able to withstand a 400-lb. downward force from the table. The table has an adjustable height and angle and replaceable cutting surfaces. Combined steel, aluminum, and polyethylene construction enabled a design able to withstand the wear and tear in its use, yet light enough for the contractor to carry. Ford patented the final design concept (U.S. patent 6,467,417).



Figure 7.13 SideWinder removable side table.

Visualizing Ideas and Concepts Early and Often

Visualization is key throughout the four phases of the iNPD process. The type of visualization is different in each phase. During the first three phases, visualization should be a shared activity since ideas can come from any team member. Visualizing early and often is essential to develop a shared understanding among team members. In the fourth phase, teams communicate but act more along disciplinary lines.

In Phase I, teams must start to develop a representation of secondary research, POG identification, and decision-making processes. Converting research into shared diagrams allows the team to build shared understanding of the opportunity. In Phase II, lifestyle trend research, reference boards, and task analyses are modeled as presented in this chapter. Key words and phrases start to build the basis for scenarios. Scenarios must have visual and verbal components; an image of the customer gives the target market a face and provides the early description of the lifestyle aspects of the opportunity. Visualization helps the team to share and build but also to communicate to outside stakeholders. Visual images can be used to interact with consumers to help elicit insights that verbal interaction alone will not identify.

In Phase II, drawings might be cartoonlike. For example, Figures 7.14 and 7.15 show cartoons discussing the evolution of the SET Factors for the redesign of the Mazda Miata. These cartoons helped the team members understand how their work was targeting a unified set of design goals. Chapter 11, “Where Are They Now?” shows the eventual design of the Miata.



Figure 7.14 Cartoons stating four prime customer attributes of the original Miata. (Reprinted with permission of Mazda)

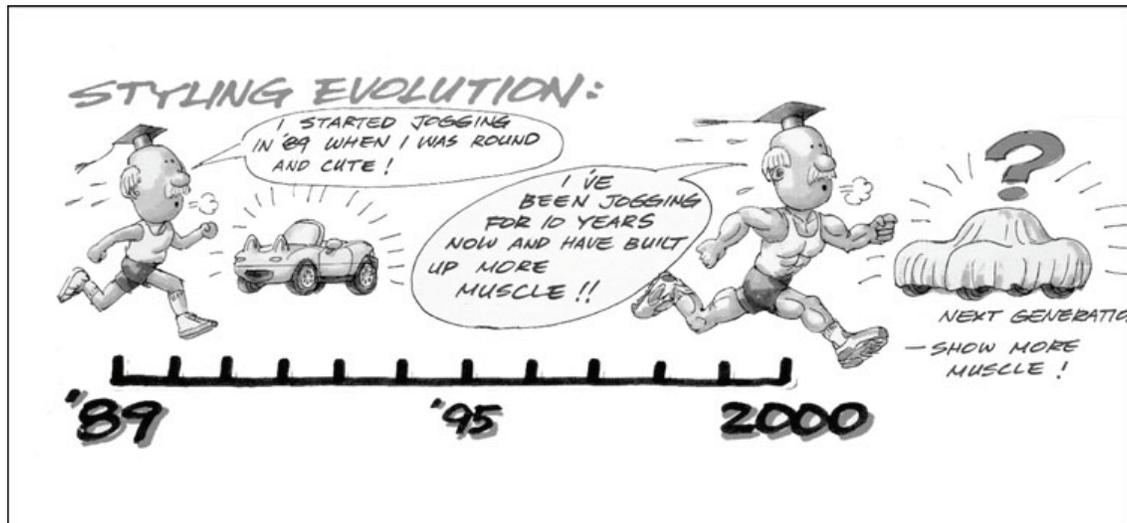


Figure 7.15 Cartoon illustrating the understanding of the change in SET Factors for the Miata. (Reprinted with permission of Mazda)

Even in this early phase, simple 3D models can set the stage for concept generation. For example, block models made out of lead-weighted blocks of foam can be used to test the size and interface of a product—for example, consider a technology-driven hand-held augmentative communications device (see Figure 5.4).

At the end of Phase II, teams should resist the temptation to develop visual representations of solutions. They must, instead, have the framework that provides an overview of understanding the opportunity, to help evaluate concepts that will be developed in Phase III. The VOA chart gives teams a clear reminder of the current and desired state. Scenarios provide more details about the opportunity. Representing the benchmarking of materials and technology options provides the early steps in developing core technology. Ethnography research must be converted into actionable insights and product requirements. The better both the visual and verbal record of user research the better the team is prepared to generate concepts in Phase III.

There is a temptation to jump to finished rapid prototyping and computer-generated 3D imagery. During the last decade, every school and company has developed their own balance between quick sketching and modeling methods of objects and service steps, and finished computer-generated images and rapid prototyping. The simple rule to keep in mind in Phase III is the less time you put in a model the less vested the team is to it; the goal is to create rapid and iterative models, not to develop a single model in great detail. Desktop modeling works well in this phase where designers use a variety of inexpensive materials that are easy to cut with hand tools to produce quick and inexpensive representations of products. The advantage is that the team has a physical concept that can be touched and “used.”

A transition occurs in Phase III from information-gathering and visualizing information and insights to forming and modeling solutions. Representations of concepts are developed and tested against stakeholders. Designers can develop a variety of alternative drawings that can be used in focus groups to promote discussion and direct teams to the next level of refinement. Early drawings of products start the dialogue among design, engineering, and manufacturing. This establishes the tension between the external configuration and the internal components. The models and sketches help teams gain additional insights as well as provide information about what is or is not working in the minds of these key stakeholders. Some ethnographic researchers use a technique in which they let people build or draw their own prototypes. As they do, researchers work with potential customers and ask questions about their decisions and choices. A company that is developing a new layout for a car dashboard could invite truck drivers to a concept development session, give them pieces that represent components, and ask them to lay out

the instruments on the dash themselves. The drivers could give interesting potential solutions as well as identify and give insight to the problems they are having with existing concept versions.

In each step in visualizing ideas in Phase III, the quality of images and models continues to improve as details become clearer and the level of input is focused on particular aspects of the product or service. When ideas have been developed in simple ways, they can be transferred into computer images with CAD software that design and engineering can easily share. In order for teams to enter the final phase of the process, a clear set of options must be identified for refinement.

Visualization in Phase IV shifts from qualitative to quantitative, as core technology, form, interaction, and market information must start to lead to a compelling argument for getting a refined solution into the pipeline which will lead to getting the product to market. Models become refined through detailed 3D CAD tools. Many design firms have employees who fill the gap between engineering and design. These computer technicians can help convert sketches to 3D CAD models and translate CAD images into engineering files for technical development and manufacture. That said, computer technology today has made it easy for all members of the team to rapidly model their ideas in CAD.

Functional prototypes, refined form models, and 3D computer imagery are all pushed to the highest level of detail and refinement. Core technology is more clearly developed and represented with both functional models and CAD models, with added details about cost and manufacturing factors. Rapid prototyping through a variety of computer-aided methods make fast 3D models of products. Stereolithography, NC milling, laser sintering, and fuse and wax deposition are some of the primary processes usually used. With current technology, the team can quickly go from rough prototypes to short-run functional prototypes. This capability shortens the product development cycle time.

Even with CAD capabilities today, a physical representation of the space, constraints, and of the physical product at different points is critical to capture the sense of the product. Figure 7.16 shows the evolution of a wearable computer based on research at Carnegie Mellon University. The sequence from urethane blocks to stereolithography prototypes or breadboard prototypes shows the advantage of creating rough prototypes early. These early prototypes became a basis for the eventual creation of BodyMedia and the FIT System case study featured in this book.

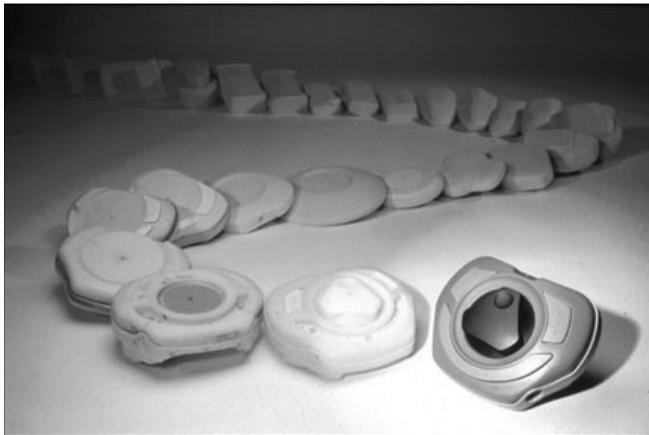
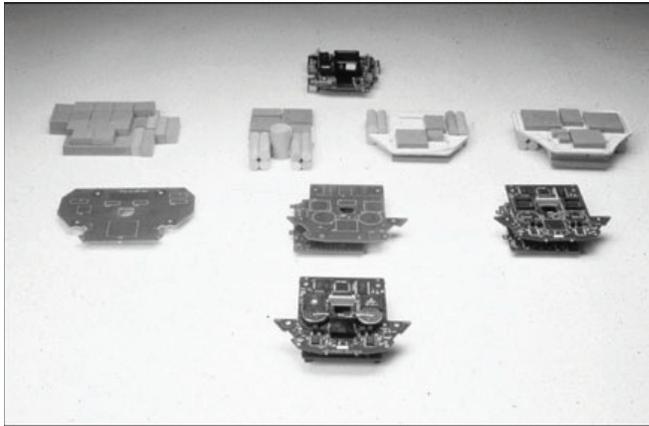


Figure 7.16 Evolution of a wearable computer through various iterations of prototypes: a) form prototypes; b) breadboard prototypes; and c) final VuMan 3 developed at Carnegie Mellon University. (Reprinted with permission of Dan Siewiorek, Ivo Stivoric, and Chris Kasabach)

The main point is that producing a series of prototypes is important; however, the way you do it should be based on time, budget, and availability of processes. You can do some effective modeling early without a major time expenditure or costly investment.

Each aspect of the final representation of the opportunity requires different visual representation. Even market analysis of cost and profit projections and potential role-out strategies can be modeled visually. Final presentation of Phase IV should allow the team to present a logical flow of information from Phase I to the final idea. The visual verbal record of the process provides the substantiation and compelling argument for claims made in Phase IV.

■ Visualizing early and often is essential to develop a shared understanding among team members.

Whenever possible, it is always more effective to have information visible and sketches and/or models present when discussing issues. The more cycles of concept testing and refinement you have, the better. In our research for an automotive company, we were able to attend a meeting of representatives of internal team members and suppliers. Their goal was to attempt to resolve design problems with the door of a vehicle. The meeting was an excellent example of the value of visualization. The meeting started with several subgroups discussing door subsystems. Each group had a limited representation of the door, based on their team members' own focus. There were clay models of the interior trim, full-size technical plots of the door component layout, wiring diagrams, and actual internal sheet metal of the structural carryover. As the day progressed, the groups started to merge when they realized how interconnected the door was. Soon groups started to bring together the different types of representation of the door. They needed to see the clay models to determine where the interior details would connect with the location of internal systems. Even though they had all seen computer images and had been working on CAD systems to develop internal components, this was the first time these groups were in the same room at the same time with multiple full-scale representations of the product. This meeting enabled the internal groups and external suppliers to work out problems that had been unresolved for months. Visualization of information and concepts is one way to overcome perceptual gaps within a team. Everyone was finally on the same page.

Summary Points

- The user's experience is the driver in the development of breakthrough products.
- Qualitative research on user desire, including new product ethnography, is necessary to gain an in-depth understanding of the user.

- Methods that analyze usability and desirability that work together to develop that understanding are new product ethnography, ergonomics (interaction, task analysis, and anthropometrics), scenario and storytelling development, and lifestyle reference.
- Human factors as a field is growing beyond physical interaction analysis, to begin to include issues of desirability.
- A successful product balances usability and safety with desirability and fantasy.
- Visualizing concepts early and often helps the product evolve consistently through the team, management, and potential customers.

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Part Three

Further Evidence

- Chapter 8** Service Innovation: Breakthrough Innovation on the Product–Service Ecosystem Continuum
- Chapter 9** Case Studies: The Power of the Upper Right
- Chapter 10** Case Studies: The Global Power of the Upper Right
- Chapter 11** Where Are They Now?

Chapter Eight

Service Innovation: Breakthrough Innovation on the Product–Service Ecosystem Continuum

Services are intangible. You buy them and use them, but you don't take them home. Yet the service sector accounts for more than 65% of the U.S. gross domestic product (GDP). Navigating the Fuzzy Front End of service design is no different than doing so for physical products. However, the new opportunity for the twenty-first century is to recognize that an ecosystem of physical products and intangible services working in concert and supporting each other is where breakthrough innovation lies. Designing services within the context of that ecosystem is the topic of this chapter.

The Era of Interconnected Ecosystems: Product, Interface, and Service

During the last two centuries the U.S., Europe, and Japan evolved from agrarian, craft-based economies into manufacturing economies. Service and information companies evolved as well, but the primary emphasis was on creating new companies based on technology innovation as their core capability. The telephone was the focus for the consumer, even though the communication system was the key to delivering phone calls. The Ford assembly line produced affordable cars, and the new system of manufacture was second to the success and sales of the Model T. No one thought about the road infrastructure system, or the energy system needed to support the growth of vehicles, or the fact that when the U.S. focused on roads, it de-emphasized railroads. Edison discovered the filament to make electric lights affordable, but he also developed an electric distribution system for direct current to bring power to home and business. Carnegie is recognized for steel production, but he also developed the idea of vertical integration, from raw material to the trains and tracks needed to ship raw material and deliver finished steel. These men were celebrated for their ability to bring greater access to products for a growing middle class and to generate profits. Ford Motor Company, Edison General Electric, and U.S. Steel could have just as easily been considered the founding of the U.S. service systems industry.

The financial services sector has always been part of the growth of the manufacturing economy and is represented by people such as J. P. Morgan, who brought a new scale to the banking investment capability in the United States. The information economy evolved to manage the rise of the large modern corporation.

Information systems did not start to catch up with manufacturing scale until after World War II, when IBM was the first to see the potential in computers to handle vast amounts of data required to manage modern global corporations. Even then modern mainframe facades hid the kluge of wires driving IBM computers. Hardware was the focus and the anticipated means for innovation. IBM told Bill Gates he could keep the software he was developing because IBM was not in the software business. When Gates left IBM after that fateful meeting, he started Microsoft, and information software as a major industry was born—and would eventually trump hardware products in much of the computer industry. Historically, the service economy was the supportive entity of new product development and took second stage to the celebration of the product as a standalone demonstration of the consumer society. The service economy, information economy, and product development economy were viewed as separate. When people thought about banks, health insurance, schools, or the post office, there were possibly new product offerings that extended the service directly, but none of these were seen as sources for physical product innovation or innovation at the system level that integrated new types of physical, software, and service capabilities.

Most products developed before the end of the twentieth century were one dimensional; they did one thing well and were not directly connected to any service or information service system. The rise of the Web, the desktop, the smartphone, micro sensors, and GPS has changed the rules of the game. Steve Jobs and Apple connected the products of IBM, the software of Microsoft, and the research of Xerox to the new capabilities of the Web to eventually produce the integration into a system that is now the new standard.

In the first edition of the book, we discussed the relationship between products and services and showed that the early stage development of both is the same. During the last decade, this relationship has grown and become interconnected in powerful new ways. Product systems and service systems can no longer be discussed as separate. The opportunity for innovation is in creating new businesses where products, services, and interface are seen as interconnected parts of the value and profit in any new idea. Every product is connected to a service system, and every system relies on products to deliver value to consumers. Every product and service has an interface or touch points. The interface touch points can be tangible product controls, digital, human, or any combination of the three. The interface defines the way people interact with the services and physical products. Figure 8.1 shows this model.

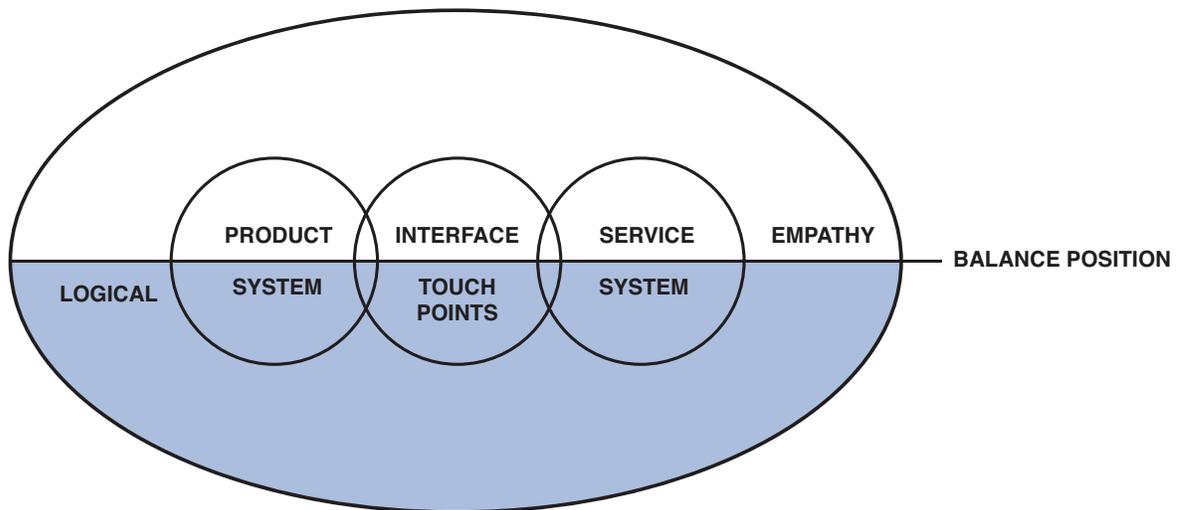


Figure 8.1 The relationship of products, services, and interfaces.

This model emerged as every major new product evolved either to have embedded intelligence connecting to external services or to have a digital service system that supports it. Smartphones are clear examples; today the smartphone is one product in an interconnected web of products and services that connect phone to computer to social media. Cars are now another example: OnStar, GPS, and other services connect the car to a network of information and services. Services, too, have multiple touch points that either rely on overt physical product touch points or are reinforced by products. UPS has trucks and scanning products that delivery people use, but it also has planes, trucks, and integrated tracking products that work behind the scenes of deliveries or stores.

So three levels of systems are important to consider. Physical product development systems are one type of system in this book. Physical product systems relate to the process required to conceive of and deliver a tangible product to the market and maintain the product as a competitive offering. Navistar's LoneStar is a case study of a physical product development system. Service systems relate to the process of conceiving of and delivering a service offering and maintaining it as a competitive offering. Starbucks is an example of a service system.

The third system is the higher-level interconnection of the intangible service and physical product systems. This interconnection enables a new level of value, the means to deliver the needs, wants, and desires of the customer in a deeper and more complete manner, and with different models of revenue streams. In this model, iTunes and iCloud provide connectivity of Apple products through people's daily lives, along with ongoing revenue streams. Also in this model, Amazon designs

and sells the Kindle, a physical product, as a means to enable e-book purchases through the Web.

There is generally an emphasis on the tangible or intangible in a company. On one hand, the physical product is the focus and the service is the support that helps differentiate and generate profit for the company. Ford makes cars, but cars are now “driven” by internal systems connecting one part of the car to the other and to the driver/owner. Cars now connect externally to a host of services supporting the driving experience. The value of the vehicle as a product to get from one place to another is complemented by the new interactive services that a driver can access while traveling. On the other hand, the service is the focus of the system and provides less tangible value to customers as its core value. Google is now developing a car that will use its services and interface to create a driverless vehicle. So is Ford a service company and Google a product development company? The answer is yes to both situations. Some companies seek to balance the tangible and intangible. Apple is a great example. They make profit on the hardware, but also from the linked services including iTunes, iCloud, and the iPhone plans. UPS generates profits through their intangible services, but they must invest in a significant number of physical products to provide that service.

Delivering packages, insurance, health care services, smartphone apps, cable TV, and government agencies are examples of services. They require a variety of touch points working in harmony to deliver their value to customers. Cable TV is an invisible supplier to the monitor in your home, but it still requires a cable box. If you have any problems, an installer/repairman shows up at your door. He has tangible cable that is required to connect to your television. He arrives in a truck and has a variety of tools to install your cable in your home or repair your cable box or connection from your home to the street. An army of people and offices supply that service to you, yet you never see them when you are watching your favorite HBO series or sports event.

■ New innovative offerings require the integration of tangible and intangible systems to deliver brand equity to maintain customer loyalty.

The challenge in developing new innovative offerings is to understand the tangible and intangible systems that drive your product or service and how to effectively integrate all aspects to deliver brand equity to maintain customer loyalty.

Empathy Versus Logic

Two aspects must be balanced to deliver a brand experience through the product, service, and interface system. The logical aspect accounts for the quantitative and analytical aspects of the system. This includes cost and price analysis, technology, durability and safety, benchmarking of competition, and cost cutting. The empathetic

aspect accounts for the qualitative and human side of the system. This includes emotion, aspiration, fantasy, personality, style, and connection between people. In practice, all good companies balance the logical and empathetic aspects of their system. The value proposition of an Upper Right company or product naturally balances these attributes, as captured in the VOA. Generally, the emotion, aesthetic, impact, and identity terms are empathetic. The quality and core technology are logical. Ergonomics has both logical and empathetic characteristics, the logical being the anthropometric and analytical approach to assessing reach and physical interaction, and the empathetic being the feel and sense of the space. Price and profit are also logical and are byproducts of a successful value proposition.

■ In practice, all good companies balance the logical and empathetic aspects of their system.

However, some companies choose to emphasize logical or empathy aspects in their branding and messaging. Internally, Apple is a balance between empathetic and logical. However, to consumers, the brand perception is that the empathetic understanding is stronger than the logical: Apple is part of your lifestyle and life. It is an Upper Right company. The company that emphasizes the logical without regard to the empathetic generally is the Lower Right or Lower Left brand, emphasizing cost or technical performance. HP is a company that is respected for the logic of its business machines. The consumer perception of the brand for HP is in the Lower Right. Dell is known for its price and speed of delivery and is perceived to be in the Lower Left. The company that emphasizes empathy without regard to logic is the Upper Left brand, emphasizing style and fashion alone.

The goal, then, is to recognize that your product or service is part of a larger system, and that larger system is often the bigger business opportunity. Addressing the bigger opportunity requires a plan that is more than the development of one product, one feature, or one touch point. Instead, the bigger system requires a larger strategy. Amazon.com began as an online retailer of books. The larger plan was to be a point of sale for anything consumer on the Internet and to broaden beyond virtual to physical products such as the Kindle. Even when profits were down, CEO Bezos maintained his vision and his system-level plan. The result is one of the more successful companies of the twenty-first century.

The second aspect of the system is to recognize the value of empathy and its balance with logic. That is one of the main points of this book and is equally valid for tangible products, intangible services, and the larger system of both. As you see throughout this chapter, the methods of identifying opportunities, understanding those opportunities, and conceptualizing those opportunities apply equally to all of these models: physical product, service, and system.

Traditional Service Design

Services are the intangible means to provide value, often through activities or accommodation. The U.S. Census Bureau considers the service sector to consist primarily of truck transportation, messengers, warehousing, and storage; information services, financial securities and brokerage, and rental and leasing services; professional, scientific, and technical services; administrative and support services; waste management and remediation; health care and social assistance; and arts, entertainment, and recreation services. Customers don't own the service, and the service tends to be consumed at the point of sale. Yet services are estimated to account for between 65% and 75% of the U.S. GDP.¹

Consider what some might think of as the ultimate service: the Ritz-Carlton. At the Ritz, you don't take anything home with you; you don't own any product you buy. Yet you pay a hefty price for the luxury that comes from staying there. Horst Schulze, founding president and COO, recognized that you don't even go to the Ritz to just sleep or eat. "In the case of the bar," when referring to the bartenders, "customers are entering your room, but they are not coming for you. They are not coming to drink—they have drinks in their rooms and at home. They are not coming to eat. They are coming to feel well. ... Your ultimate responsibility is that each guest feels well when they leave because of how you enhanced their life in the moment that you had to serve them."² You go to the Ritz because of the exceptional service it provides, because every person there makes you feel great. The design of that service requires understanding the value proposition—how you feel, the senses that you experience through your interaction with all aspects of the service, the ease of interaction, its consistency and attention to details, the social interactions you might have there, and the unique look and feel that the Ritz consistently provides in each and every stay. In sum, the Ritz succeeds because it understands the value attributes captured in the VOA. The Ritz is clearly positioned in the Upper Right, providing an interactive experience unlike any other and luxurious style that pampers every guest, differentiating itself from other hotels through its highly valued service.

THE VOA AND SERVICES

The VOA applies to tangible products, services, and the product–service system (see Figure 8.2). All of the VO categories apply to services, although some of the terms can be changed to more directly connect with the terminology of service design. Ergonomics might directly apply to some services, but interaction is a more general term that applies across all services; interaction includes every touch point between the service and the customer. Because not all services use technology, but all services do deliver performance, the term performance can be used instead of core technology. Within quality, craftsmanship becomes consistency, or how consistent the service experience is each time it is used and across all aspects of the service. Unlike a physical product that might be used over and over again, the service is intangible, so each time it can be used under potentially varying circumstances; thus, under quality, the term durability is replaced with flexibility, or the ability to account for variations in the sequence of use of the service. Although these terms are more appropriate for service design, all the attributes of the VOA remain applicable; as mentioned in Chapter 3, “The Upper Right: The Value Quadrant,” the terms of the VOA need to be defined as appropriate for the domain of application. Thus, the original VOA terms are often used within the domains of service design; however, the modified VOA is available for those in traditional service design. These terms are also applicable to interaction design, as will be discussed later in this chapter.

SERVICE		low	med	high
EMOTION	<ul style="list-style-type: none"> adventure independence security sensuality confidence power 			
INTERACTION	<ul style="list-style-type: none"> comfort safety ease of use 			
AESTHETICS	<ul style="list-style-type: none"> visual auditory tactile olfactory taste 			
IDENTITY	<ul style="list-style-type: none"> point in time sense of place personality 			
IMPACT	<ul style="list-style-type: none"> social environmental 			
PERFORMANCE	<ul style="list-style-type: none"> reliable enabling 			
QUALITY	<ul style="list-style-type: none"> consistency flexibility 			
PROFIT IMPACT				
BRAND IMPACT				
EXTENDABLE				

Figure 8.2 VOA chart for service and interaction design.

Although all of the tools and methods presented in this book to navigate the Fuzzy Front End apply equally to physical products, services, and systems, the traditional service might differ from the physical product at the level of implementation. The physical product must be built with materials, and production typically accounts for mass or at least multi-unit production. The service is not physically built, but is instead planned, detailed, and modeled. It results in a step-by-step process to perform the service. As with a physical product, the service must be prototyped and tested, both through anticipated uses and with actual customers.

Although at first glance the service industry might appear very much focused on people and not technology, in all facets of service, technology plays an active and often critical role. From UPS, which spends more than \$1 billion per year on technology; to interaction design that focuses on technology interfaces; to Disney movies using CGI, technology abounds. Even with law firms, rooted in the ability for a lawyer to effectively convince a jury of innocence or guilt for the accused, technology comes into play: Depositions are searched and projected during a trial with the hope of catching a witness off-guard so that the person might perjure him or herself. Thus, with more than half the GDP based in service industries, opportunities for innovation abound not only in the services themselves, but also in the technology that supports them.

In the rest of this chapter, we explore a range of services and product–service systems to better understand how to navigate the Fuzzy Front End in this context. We begin with a traditional service, the banking industry, by looking at the design of Umpqua Bank. You will see that, even in the realm of traditional services, the opportunity to address the larger product–service system presents an opportunity for breakthrough innovation. Next, we explore another traditional service, package delivery and logistics, through UPS, again recognizing the extensive use of physical products to enable the delivery of the service. We also look at the entertainment industry by discussing one aspect of the ultimate entertainment service: Disney. Interaction design, more general than just for services, but particularly critical for the success of services, is explored next. Together, these discussions and case studies show the opportunity to approach service design with the same rigor and organization as the design of any other product, and focus on the product–service ecosystem as the broader opportunity for growth and innovation.

Umpqua: Designing a Bank Like a Product

Banks have been one of the anchors of the financial services industry for centuries. During the last 50 years, banks in the U.S. have had to continue to evolve. Bank facades used to look like government buildings, with clear references to Greek or Renaissance architecture for their exteriors and interiors, communicating stability and substance. The bank was a serious, hushed, formal space where tellers stood behind counters and armed uniformed guards stood at the door. Then during the past several decades, banks had a generic personality, with a combination of ATMs on the outside and tellers at the counter, and managers in various types of consistently bland offices on the inside. You could be buying insurance or getting your taxes done if it were not for tellers exchanging your money. Banks went from authoritative to unimaginative, encouraging customers to use the ATM machines in the front and the drive-thrus in the back.

However, banks today—particularly regional banks—want to be seen as people friendly and accessible. Ray Davis, the president of Umpqua Bank in Portland, Oregon, recognized that he was actually in the retail business and so needed to sell his products in a way to make customers want to shop there. To rethink his bank strategy, he turned to an atypical source to redesign the employee and customer experience. Ziba Design, an international product design firm based in Portland, was asked to help rethink the brand experience to create a bank that could be viewed as a neighborhood partner and friend rather than a stand-off, undistinguished business.

A bit about Portland gives context to this collaboration. Both Umpqua and Ziba are part of the cutting-edge culture of Portland. Portland is also the home to Nike, a unique DIY culture, and a center for experimental cuisine. Portland food carts and restaurants are admired for their originality and experimentation, and trend researchers all over the world follow the culinary culture. The city is known for its cultural diversity and a commitment to outdoor activities and healthy living. The mayor rides a bicycle to work. Both Ziba and Umpqua are active participants and supporters of the Portland culture. It seems like an obvious choice, then, that Umpqua would seek out Ziba to design its new neighborhood banks, even though Ziba had not designed a retail or professional environment before. Ziba translated the idea of a trendy interactive neighborhood into a cultural experience that transformed how the employees worked and how customers saw and used their bank. This case study demonstrates that the traditional definitions of product, interface, and service are no longer valid in the product–service ecosystem.

The result is a bank that has received acclaim from both the banking industry and the design community (including a Gold IDEA Award from *BusinessWeek* and the IDSA), not to mention the customers. This case study demonstrates that successful design stems from the high-quality relationship between client and consultant. Ziba used the same approach in taking on this design challenge that it does when approaching any client opportunity. Using an ethnographic approach, it looked at both sides of the equation: how customers would like to see the bank operate and how employees currently worked and interacted with customers. The team created an experience that removed the barrier between customer and employee. To accomplish this, it changed the space of the interior and added support elements that enabled employees to more directly interact with customers and for customers to find the bank a place they wanted to visit.

Ziba created the look and feel of the bank to make it competitive with a high-end retail store, contemporary restaurant, or a coffeehouse (see Figure 8.3). It offered space for community events and even had featured local musicians through CDs and online services. The design elements in the space were contemporary and competitive with the trend-setting stores in the Portland area. The bank became an experience to savor, not a drive-thru. Umpqua offers free Wi-Fi and a lounge area, and even its own blend of coffee, for customers to stay for awhile or comfortably wait for services. Employees were repositioned in the space with new types of office furniture and equipment, to make it clear they were there to interact with customers. All the touch points for the bank, from the outside communication on the Web and in print, to the direct experience at the bank, were consistent, creating one unified brand.

Envisioning the bank service as a retail product resulted in a new way to look at its traditional service. The result was success. When Umpqua opened its first “store” under this model, it generated record deposits: \$1 million in the first week and \$50 million over the first nine months. The bank then converted each of its branches to this new format.



Figure 8.3 Umpqua Bank. (With permission of Ziba Design)

UPS Moves Beyond the Package Delivery Industry

Since Jim Casey founded UPS in 1907 with just \$100 in financing, the company has grown to be more than a \$50 billion corporation today. What is often thought of as a package delivery company has transformed into a global service provider of information and logistics, financing, and delivery of goods. After going public, the company was named the 1999 Company of the Year by *Forbes Magazine*, which stated, “UPS used to be a trucking company with technology. Now it’s a technology company with trucks.”³

UPS has developed the most recognized brand in the package delivery business and is overall one of the most recognized brands today. Its shield, color brown, and drivers are core to the brand and, along with the vehicles and employee loyalty, have made UPS one of the most successful companies of the second half of the twentieth century and the beginning of the twenty-first century. UPS has targeted and achieved attributes of reliability, trust, quality, and attention to detail.

Customers send their packages around the world with confidence, knowing that they will arrive on time and intact.

UPS has a consistent identity system that graces a plethora of products, including packages, drop-off boxes, storefronts, interiors and counters, uniforms, trucks, containers, aircraft, and Web sites. The UPS shield was recently updated for a 3D global world. However, the shield itself goes back to the 1930s and, along with the color brown, communicates value to loyal customers.

UPS saw a POG in the evolving global economy. Companies spread across the globe required the ability to exchange goods quickly. UPS's development of a global infrastructure allowed it to develop its own new business in global commerce. Today the company is in constant evolution as it anticipates the effects and needs of the global economy.

UPS has become an “enabler of global commerce.” Its goal is to play a role in the supply chain over the life cycle of a product, from the sourcing of raw materials through manufacturing of the product, to delivery of the product, and, finally, to after-market repair, replacement, and disposal of the product. To accomplish this vision, the company has broadened its focus to the movement and control of goods, information (that accompanies those goods), and funds that enable the transaction of the goods. UPS recognized that, in addition to an infrastructure to support the transport of goods, its infrastructure supported the transport of information. UPS spends more than \$1 billion each year in the development and maintenance of information technology to support its services. Its package-tracking system rivals that of any competitor. UPS knows where a package is at any time and, through an electronic signature, when the package was delivered. UPS knows the buyer and seller, and possesses information about their shipping methods and product inventory. Knowledge is power—and in this case, this knowledge gives UPS the power to provide additional services to the customer. For example, financial transactions between buyer and seller are triggered after a package is delivered. The electronic delivery signature coupled with a growing financial arm to the company allows UPS to commence financial transactions between the buyer's and seller's banks.

UPS recognized that customers became stressed over the care of their packages and that they feared they might be late or, worse, lost. Given that the company had the ability to know exactly where a package was at any point in time, UPS saw the opportunity to offer the same information as a service to its customers: A customer can track a package as it travels around the country or the world. In reality a customer needs to know only that the package will arrive at the destination on time. However, this added service augments the VO attributes of security, confidence, and power of the customer, a no-cost service capability with deeply felt emotional returns.

UPS, then, has grown to be not only a package delivery service company, but an information company. By contributing to the production of a product and tracking that product over its life cycle, the company has successfully identified numerous POGs. For example, UPS might not own the ocean liner that transports the goods across the ocean, but it can control the information about the inventory on the ocean liner. UPS might also use its capital arm to fund the inventory and support the transactions with the inventory. It can also control the information that moves the goods across customs and then transport the goods from there. As another example, as the Internet created e-commerce, not only did UPS sense this POG early and establish itself as a core service to transport goods purchased over the Internet, but it also provides services to support the infrastructure to enable commerce over the Web.

To establish and maintain its reputation as an information company, UPS's challenge has been to move the brand at the speed of the company while maintaining brand loyalty. The company wants customers to associate the brand with the attributes of speed, express delivery, innovation, technology, and global reach, in addition to the established attributes of reliability, trust, quality, and attention to detail. In this competitive industry, the company must constantly anticipate new challenges from the competition. For instance, UPS has been delivering overnight packages since 1954, but with the integration of overnight transportation into the speed of business in the 1990s, overnight delivery became a critical service and the new cost of doing business. As other companies got into the market, UPS took advantage of its infrastructure and evolving technical expertise to remain the leader in overnight delivery today, delivering more packages overnight than any competitor. The challenge is for the company to counteract advertising and branding messages from other companies, such as FedEx, and to maintain the consumer's perception of possessing the speed and technology to be the best overnight delivery company.

Product companies and service companies overlap. This is certainly the case with UPS. The product that UPS produces is an increase in the speed at which companies can do business. UPS manufactures and processes deliveries; the manufacturing starts with accepting information in envelopes or packages (raw material) from one point and distributing it to another point. The process in between is a delivery factory/central processing unit that collects and redistributes information. It encodes from the pickup customer and decodes to the delivery customer with each package as if it were a byte of information. UPS measures its success by its percentage of on-time deliveries the way companies measure the manufacturing quality of their products. The UPS on-time delivery rate is the 6σ of the service

industry. Behind the package that someone receives is an array of people and products that are required to deliver that package.

The PDM serves not only to understand where UPS must focus its effort, but also to see where the focus on information comes from. Figure 8.4 shows the PDM for UPS. In the lower left cell are the packaging materials used by customers, speeded out by UPS but readily manufactured to order by many vendors. The lower right cell holds UPS's 100,000 ground vehicles, each built to UPS specification, and the more than 200 planes and array of buildings that process the packages. The upper left cell includes the brand and logo design. The upper right cell, as always, shows critical components to UPS's business. Located there are the technology to process the packages en route; the tracking system; the information technology to process tracking, delivery, and financial information; and the information itself. The information must be included there because it is the resource that allows UPS to deliver its services. Thus, it becomes clear that information is core to UPS's growth, which explains why UPS has become an information company.

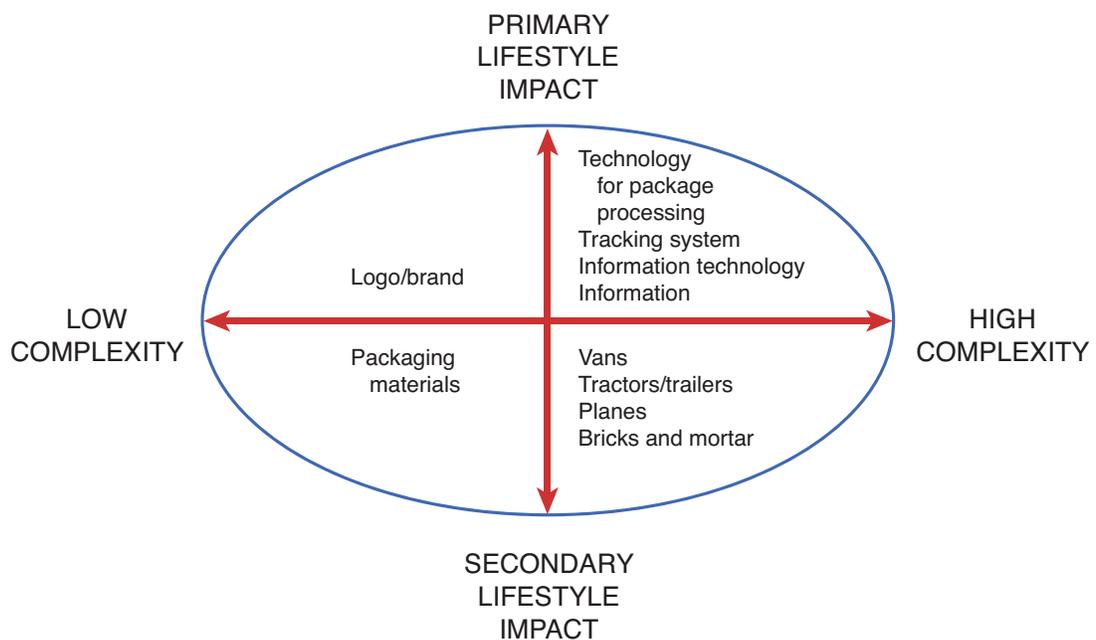


Figure 8.4 PDM for UPS.

UPS has extensive and ongoing user research. It takes three complementary paths: First is what it calls a Customer Satisfaction Index, an ongoing, in-depth analysis based on an extensive questionnaire sent to several thousand customers on a quarterly basis. Second is its Dialog Program, a constant (24/7) program in which customers are phoned and asked about one or two issues for feedback on their delivery. Finally, UPS uses small focus groups that target specific markets and

geographic locations. It would be interesting to see how the ethnographic methods of Chapter 7, “Understanding the User’s Needs, Wants, and Desires,” might further benefit this successful company.

UPS is a company in the Upper Right. It clearly adds value and merges technological innovation with brand equity. The service VOA chart (see Figure 8.5) shows the service product high in the security, comfort, and power emotional VOs; the product interaction VOs; the visual aesthetic VO; the product identity VOs; and, of course, enabling and reliable performance, and consistency and flexibility VOs. The company also addresses environmental impact, as discussed shortly. The company addresses social impact to some extent by supporting communications across the globe, but UPS has an opportunity to develop this VO further. The only other non-high VO is adventure, which is still strong, in that people are not on an adventure, but their packages are, and they can follow the adventure online.

UPS		low	med	high
EMOTION	adventure	█	█	
	independence	█	█	█
	security	█	█	█
	sensuality	█	█	█
	confidence	█	█	█
	power	█	█	█
INTERACTION	comfort	█	█	█
	safety	█	█	█
	ease of use	█	█	█
AESTHETICS	visual	█	█	█
	auditory	█	█	█
	tactile	█	█	█
	olfactory	N.A.		
	taste	N.A.		
IDENTITY	point in time	█	█	█
	sense of place	█	█	█
	personality	█	█	█
IMPACT	social	█	█	
	environmental	█	█	
PERFORMANCE	reliable	█	█	█
	enabling	█	█	█
QUALITY	consistency	█	█	█
	flexibility	█	█	█
PROFIT IMPACT		█	█	█
BRAND IMPACT		█	█	█
EXTENDABLE		█	█	█

Figure 8.5 VOA of UPS.

With overnight delivery, domestic package delivery, and global delivery, UPS transports 5.5% of the U.S. GDP and 2% of the global GDP every day. Because of the vast resources needed to accomplish this, UPS recognizes its impact on the environment. The company instituted an approach for carbon-neutral shipping through carbon offsets, actively compensating for the obviously required carbon emissions to provide shipping today. It also instituted an eco-responsible packaging program to encourage the use of sustainable packaging materials.

Combining physical, technological, and human assets with a unified means of communication has allowed UPS to grow from a package-delivery company to a logistics company. As the company targets new areas and finds emerging competitors with different services, the package and information delivery service promises to be an exciting arena for growth in the twenty-first century.

The Disney Renaissance: The Ultimate Entertainment Service

Entertainment is another form of service. The industry is human intensive, with the movie, TV show, or amusement ride only the means to help deliver the otherwise intangible attributes of fun, escape, and fantasy. Clearly, the ultimate entertainment service is Disney. From the parks, to the shows, to the movies, the delivery is outstanding, with every touch point considered and designed to deliver the optimum experience.

However, Disney was not always the poster child and exemplar of the entertainment industry. After pioneering theatrical animation in 1937 with the release of *Snow White and the Seven Dwarfs*, Disney animation was the undisputed leader throughout the Golden (1930–1940s) and Silver (1950s–1960s) Ages of animated film. However, Disney animated films began to decline in quality and success during the 1970s. A confluence of factors led to the 1980s being considered the darkest period in Disney's history.

Although Disney continued to pioneer the use of new technologies, specifically CGI, the films were considered forgettable and the appeal was unidentifiable. In 1985, for example, *The Black Cauldron* was almost given a PG-13 rating, whereas, just one year later, *The Great Mouse Detective* was deemed too juvenile and had no adult appeal. Disney was operating without a cohesive vision for its movies. The result was minimal critical praise for its movies, with general disappointment in the

box office between 1979 and 1988. And for the first time, Disney faced direct competition. Don Bluth, Disney's lead animator, left in 1979 to start his own successful production company, Don Bluth Productions, which produced such hits as *An American Tale* and *The Land Before Time*.

However, by the late 1980s, changing SET Factors created a new POG for what would become known as the Disney Renaissance. This period, between 1989 and 1999, was one in which Walt Disney Animated Studios released a string of commercially successful and critically acclaimed animated films, including *The Little Mermaid*, *Beauty and the Beast*, *Aladdin*, and *The Lion King*. Disney's success through the Renaissance was the byproduct of an interdisciplinary collaboration between the team of Roy Disney leading animation, Jeffrey Katzenberg from business, and Michael Eisner at the helm, allowing and supporting Katzenberg's quest. Linking a clear business strategy for higher profits with investment in traditional animation, leveraging new technological capabilities through computer-aided animation, and recognizing the potential of Broadway-like songs and lyrics created the SET Factor combination that responded to the need for a more sophisticated yet emotional product.

The stage was set for a resurgence of Disney with a population boom in its core audience. The rise of the Echo Boom, or the children of Baby Boomers, began in 1981. These Echo Boomers became young children by the late 1980s and early 1990s, providing a large target audience for animated films. Additionally, in 1987, the United States economy was hit by a recession that would last through the early 1990s. With a bad economy, American families often chose to go to the movies instead of taking weekend trips. As a result, from 1987 to 1989, the total domestic box office gross was increasing over the previous year across all films, including both live-action and animated films. *Who Framed Roger Rabbit?*, a non-Disney film, was released in 1988 to both critical acclaim and box office success. The film, which grossed \$156 million in the U.S. release (compared to the \$35 million typical for Disney films in the pre-Renaissance period), paid homage to the Golden Age of animation that reignited the public interest. At the same time, Broadway had released two massive hits, *Les Misérables*, in 1987, and *The Phantom of the Opera*, in 1988, showing the public's excitement over the experience of musical productions. Bringing the musical to the animated screen with quality production and meaningful stories became the basis for the Disney Renaissance. Ironically, the successful screen later spawned new Broadway productions as well.

During the beginning of the Disney Renaissance, there was a technological change in the way animated films were created. After poor releases in the early 1980s, Disney invested in new production methods, working with Pixar Studios to develop the Computer Animated Production System (CAPS). CAPS was the first digital ink-and-paint system, and it revolutionized the way animated films were created. Also during this time, Disney began to outsource the noncreative areas of the animation process. By streamlining the production, Disney was able to release a movie every 18 months instead of every two or three years.

When comparing the Value Opportunity Analysis of Disney pre-Renaissance and Disney Renaissance, stark differences become apparent (see Figure 8.6). In the dark days of Disney, there was a lack of any real emotional connection to the films. Even the production aesthetics, consistency, and overall quality were limited. Until Ariel was introduced in *The Little Mermaid*, the first film of the Disney Renaissance in 1989, there had not been a Disney Princess, strong in ability to connect with audiences, since 1959. The lack of sensuality in the pre-Renaissance story and through the movie experience was indicative of the overall low value delivered to the viewing customer. The resulting lack of extendibility, the inability to merchandize or tie the films to the parks, further dampened the Disney brand and its revenues. In sum, the customer was cautious, without confidence or optimism about the Disney product.

Through the Renaissance, the value proposition changed. The strong adventure and sensuality (recall Sebastian the Crab crooning “you gotta kiss de girl” while Eric and Ariel were on the lagoon in the rowboat in *The Little Mermaid*) engendered an emotional connection to the characters. The films of the Disney Renaissance were musicals instead of the ill-fated action films, with songs written by Broadway veterans and scores that earned accolades and Academy Awards. Along with beautiful animation, the visual and auditory aesthetics were maximized. With the advent of CAPS, the visuals of the films were considered groundbreaking, and breathtaking. The technology was leading edge, and the quality was impeccable.

During the Renaissance, the films were showered with acclaim, garnering 24 Academy Award nominations and winning 11 Academy Awards. The average domestic box office gross of each film during the time was \$142 million, with *The Lion King* grossing \$312 million domestically in the U.S.

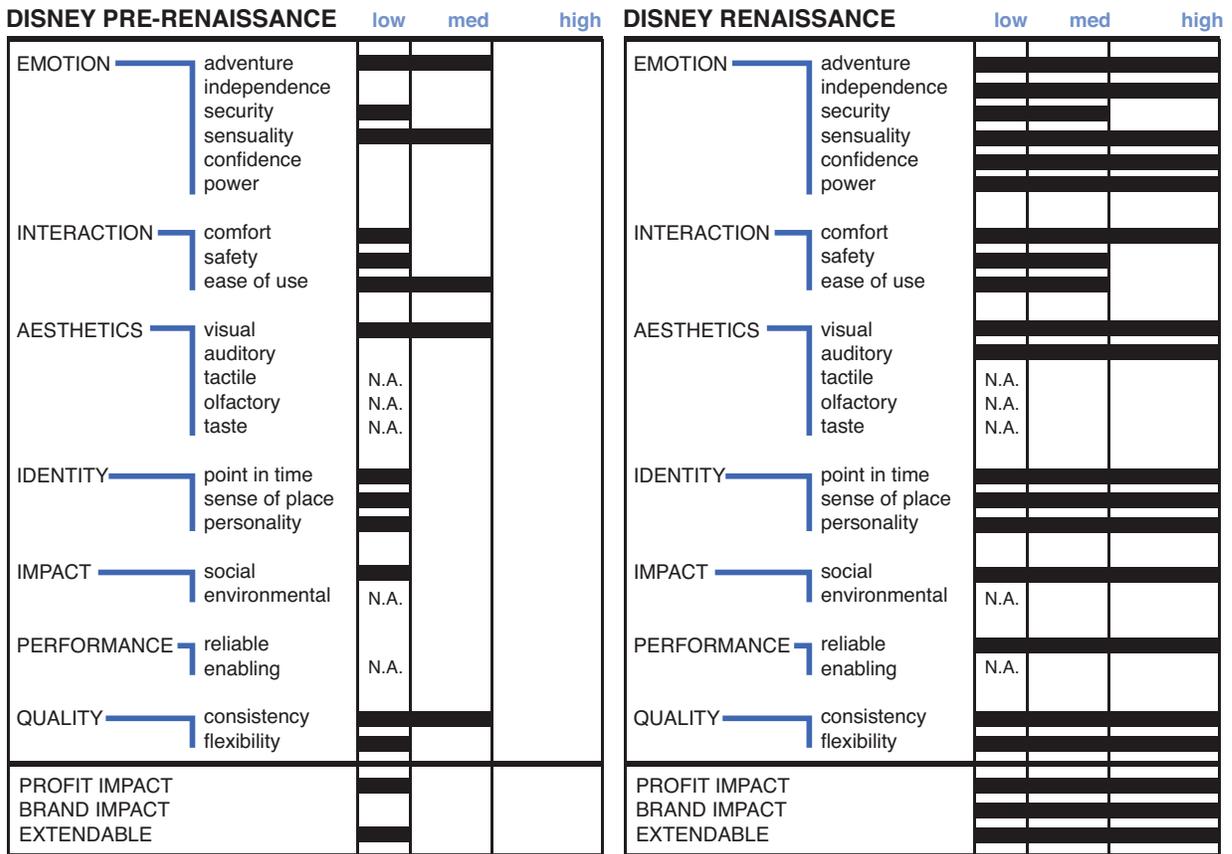


Figure 8.6 The pre-Renaissance and Renaissance VOAs for Disney animated films.

Disney has leveraged the success of its movies to build a cross-platform brand that consists of movies, theme parks, Broadway shows, soundtracks, merchandising, and more. The films of the Disney Renaissance have spawned best-selling and Grammy-winning soundtracks and songs. Additionally, *Beauty and the Beast*, *The Lion King*, *The Little Mermaid*, and *Tarzan* all became Broadway shows.

Disney theme parks bring Disney movies to life. Marketed as “The Happiest Place on Earth,” the parks are maintained to be in pristine condition every day. Successful films are turned into rides and other interactions that allow the user to experience the characters in the movies. In the reverse, many of Disney’s most popular rides have been turned into movies—for example, the *Pirates of the Caribbean* franchise, so successful that the ride itself was then changed to accommodate the lead character, Captain Jack Sparrow. The experiential success of the parks has expanded to the Disney cruise line. This family-friendly cruise was designed to accommodate parents and their children, complete with costumed Disney characters—and unlike on other cruise lines, there is no casino.

Disney has also seen great success through original television programming and the development of the Disney Channel. Here Disney took its cross-platform model into television and radio. The television show *Hannah Montana*, which aired on the Disney Channel from 2006 to 2011, is a prime example. Along with creating a star out of the show's protagonist played by Miley Cyrus, Disney was able to capitalize on the strength of its brand-building machine by releasing best-selling soundtracks, with songs featured on Radio Disney and two feature films based on the show.

Pixar, tightly interwoven with Disney's recent success, is itself a story of Upper Right entertainment achievement. John Lasseter left Disney to head the creative arm of Pixar. Much Disney movie success in the 1990s and 2000s was a result of licensing Pixar films and then merging with Pixar itself in 2006. Lasseter returned to Disney as Chief Creative Officer. Upper Right products have evolved into Upper Right systems, with Disney/Pixar entertainment services, and the physical products that deliver those services, intertwined between different media and companies. It's interesting to find that Steve Jobs, king of the Upper Right product, was in the middle of Disney's more recent success through his purchase of Pixar, his negotiations, and the eventual merger of Pixar with Disney.

Interaction Design

■ The tools and methods for the early stages of product design are the same as those used for interaction and service design.

Interaction design broadly focuses on the interface between people and the product, adapting the product's behavior to the needs, wants, and desires of the user. This might sound a lot like the broader discussion of product design throughout this book, and it is. The tools and methods for the early stages of product design are the same as those used for interaction design. However, according to Jodi Forlizzi, a leader in interaction design at Carnegie Mellon University's Human Computer Institute and School of Design, *interaction design* is generally seen as technological interfaces between the human and the product; a product *interface* is the link between a user and a product that communicates how a product will be used and creates an experience for the people who will use it. Web sites and other digital interfaces, the means to command a technological machine (such as a robot), and the interface with an electronic instrument panel on a vehicle are all examples of interaction design. In terms of a robot, an extreme example, the robot interacts directly with the human, but its *behavior* can also indirectly interact with and impact the human. A robot is a product, just like a vehicle, or the BodyMedia FIT System, or the Frozen Concoction Maker. Although the design of the interface

specifically focuses on the means of interaction, the larger task is to design the product and its way of interacting with people. Thus, the tools for uncovering opportunities and users' needs, wants, and desires apply equally to the design of the interaction, its interface, and the design of the larger product.

Interaction design finds itself as part of the service design chapter. Interaction design, like product design, generally transcends all types of products that people interact with via technology. However, this is particularly critical for services in which interaction takes place via the Web or through another technology.

Consider the interaction designed in the BodyMedia FIT System. Although the user need not do anything except wear the device, when users want to access their data, they use the BodyMedia Web site, where data is automatically uploaded, analyzed, and put into a form that enables easy and consistent information to the user. The current use of Bluetooth technology makes this transfer of data seamless, and the attention to the Web interface makes interaction with the data inviting and cognitively clear.

As with any product, the SET Factors uncover the context of the product while the VOA models the value proposition of the interface for the user. The categories for the VOA attributes are again consistent, with the changes in terminology that align with service design working equally well with interaction design (see Figure 8.2): Instead of speaking about ergonomics, the category is better called *interaction*; *quality*, in this case, is not the manufacturing quality of craftsmanship and durability, but rather the consistency of the interface and its flexibility (and thus durability) over time. For example, the iPhone is an open system. The basic platform allows a consistency across screens and hand interactions. The platform is also flexible, with each user able to mass-customize it dynamically through different apps, home screens, backgrounds, and more. For the general service VOA, the term *core technology* was replaced with *performance*. For consistency, the term is also replaced for interaction design; however, interaction design tends to be based on technology interfaces, so *core technology* is also an appropriate term to use.

Interaction Through a Multisensory Interactive Teaching Tool

See Word is a new multisensory interactive teaching tool. It leverages the best attributes of an iPad with a highly creative interface that blends visual design concepts with learning theory to teach children how to recognize and pronounce letters. See Word was developed by Reneé Seward, an interaction design faculty

member in the College of Design Architecture Art and Planning (DAAP) at the University of Cincinnati (U.C.), in collaboration with faculty in education at U.C.

Children learn in many different ways. The standard method of teaching children how to recognize and pronounce letters is through visual recognition and auditory sounds. Remembering the shape and the sound together usually results after several repetitive rounds, and then children can start to put the letters into words. That process is not the same for all children. Many children need multiple senses to embed letters into their memory as both shapes and sounds. If children fall behind in recognizing letters, they also fall behind in forming words and learning to read.

Computer programs existed that aided but do not free students from their support. Non-tech approaches used printed manuals and books without any dynamic interaction. Finally, contemporary visual teaching tools lacked a solid basis in learning theory. An opportunity existed for an Upper Right product that merged visual design with learning theory and supported the principles of hierarchy, legibility, and composition on a technology platform.

The concept Seward developed is a significant departure from the teacher-intensive methods, rote memorization, and software that already existed. This interactive tool (see Figure 8.7) can help teachers by providing a state-of-the-art design that allows children to become the center of their own learning. Teachers can spend more time on diagnosis and support, and less time on direct teaching. The use of an iPad supports the process by making students feel that they are using the latest product, not an assistive device. The interface is clear, designed to inspire children, and easy to master. The product records learning for teachers, to help them chart progress. Ben Meyer, also an interaction design faculty member, programmed the software that drives the system. The combination of Seward and Meyer allowed them to create the best connection between programming and interaction. Seward was also able to work with faculty in education, to ensure that all appropriate learning objectives were met. Through a testing phase working with teachers and students in Cincinnati schools, the interface showed promise as a new way to teach.

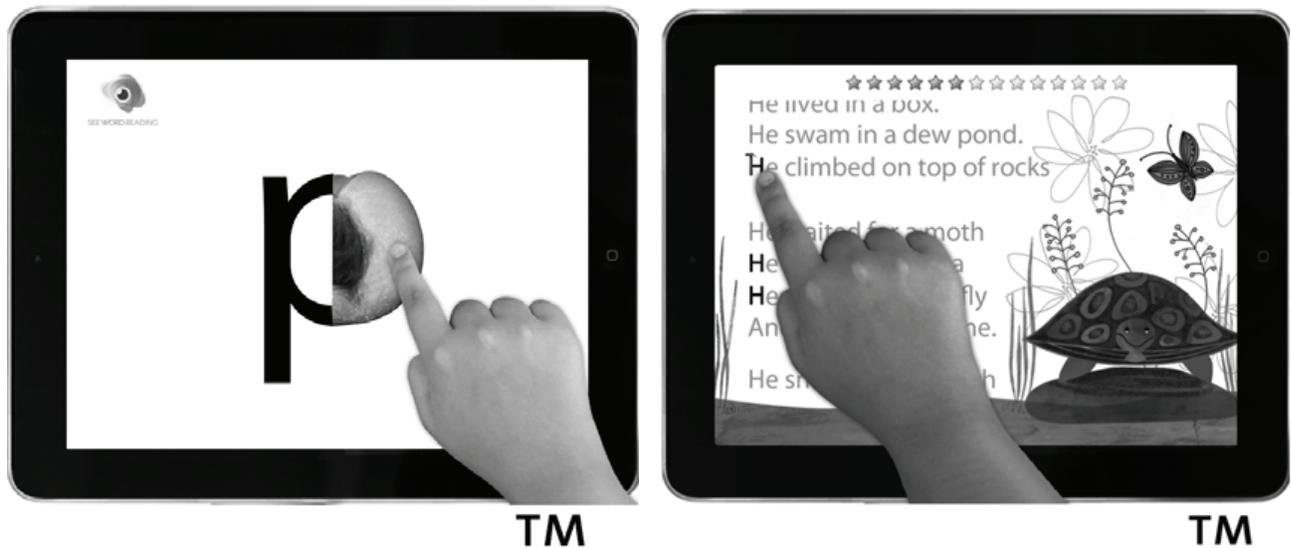


Figure 8.7 See Word. (Courtesy of Renée Seward)

The interdisciplinary development team worked with special education teachers and other teachers in the Cincinnati Public School system to test the concept. The testing process itself was codeveloped concurrently with the interface, helping to ensure greater accuracy in measuring the true learning that occurs. The team went through several rounds of qualitative feedback with early versions before developing the quantitative statistical methods that have provided the next level of proof of concept. It is often the case that early innovation suffers when a new group attempts to develop measures to verify claims without in-depth knowledge of the concept. Proper assessment is as important as the core innovation and is both an art and a science. It is important that evaluation processes be introduced early in the process, with a core development team working with researchers and statisticians to create relevant results. As the team shifts from qualitative to quantitative assessment, the knowledge learned in the early stage becomes the basis for the larger study. This is as true for education as it is for consumer products.

Summary Points

- Services use the same tools and methods as physical products to navigate the Fuzzy Front End.
- Most Upper Right products require intangible services, and services require physical products.

- I An interface is the critical means of connecting products to services.
- I The next level of breakthrough innovation leverages the product–service ecosystem.

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Chapter Nine

Case Studies: The Power of the Upper Right

In this chapter and the next, we present additional case studies of products and companies that have successfully moved to the Upper Right. These case studies epitomize the ideas and methods discussed in this book and serve as benchmarks for any company that wants to create breakthrough products. In this chapter, case studies highlight breakthrough innovation from within the United States. In the next chapter, we highlight breakthrough innovation across the globe. In this chapter, we provide a diverse array of case studies across a broad range of categories: education seating, electric vehicles, football stadiums, machining tools, trucks, and refillable packaging. We have also included the perspectives of two innovative inventors using a term we borrowed from Disney referring to them as the new Innoventors. We close by discussing the new relationship in funded education projects needed between companies and universities. We cite two case studies that demonstrate how universities can support early innovation in companies using interdisciplinary faculty-led iNPD project studios.

Reinventing the Classroom with Upper Right Seating Systems: The IDEO and Steelcase Node

All of us, no matter what our age, recall classrooms filled with standard seating: a small, hard-to-get-into, uncomfortable wooden seat with a small attached tablet desk surface to write on. Backpacks were thrown on the floor, and the space between seats had little room to maneuver around. The classroom seating environment was much like the pre-OXO vegetable peeler, relatively unchanged for, in this case, a half-century or more.

Yet the SET Factors have changed; education is different now than it was a half-century ago. Classes are no longer taught in a static lecture format. Instead the dynamic approach is to intertwine lecture, group work, and individual work in a two-hour period. Having every student sit in a neat row facing the front is not effective when, at times, group work or access to the other three walls of the classroom are desired. Furthermore, students have laptops that must fit on their work surface and be protected when not in use.

Steelcase recognized the opportunity to reinvent the classroom of the (near) future. After considering different segments, the company targeted higher education, pursuing two rounds of ethnographic research to uncover its first opportunity in the education market. Sean Corcorran, General Manager for the new Steelcase Education Division, led the effort. The first round focused on two months of visits at two college campuses, giving them the insights to focus on classroom issues in higher ed. Next came a year-long study through visits to large and small classrooms at different colleges, observing their use and having conversations with students, faculty, and administrators. The team recognized that classroom furniture was poor in ergonomics, did not move, and generally lacked innovation. Secondary research then dove into understanding how people learn, again indicating that the static classroom of yesterday no longer meets the needs of education today. The goal was to target ergonomic seating that resulted in a dynamic classroom environment.

The team then approached IDEO, a global design and innovation firm with a long history of creating award-winning products. Together the design firm and the furniture systems manufacturer created a new type of classroom seating, the Node (see Figure 9.1). The project began with a one-day interactive session resulting in the idea for a new alternative to the tablet chair. The project then moved to IDEO, which led the conceptualization and development of the Node design.



Figure 9.1 The Node by Steelcase, designed by IDEO. (Courtesy of IDEO)

IDEO then created a series of furniture concepts based largely on stakeholder research with students, instructors, and other staff members at community colleges, a key lead purchaser of new classroom environments. During the discussions, one dean pointed to a 50-year-old-design chair and said that the student was “stuck” there. That was telling and verified the insight that there was an open POG to pursue.

After the initial user research, IDEO looked at the classroom with open eyes, exploring new tables and systems. The idea of a compact chair was the best concept to move forward with. In developing the chair, IDEO used a rapid design–prototype–redesign approach. As part of its iterative design process, the team built various full-scale product prototypes (see Figure 9.2), invited students and instructors to test them, and often swapped parts on the fly in response to feedback.



Figure 9.2 Various prototypes in the evolution of the Node. (Courtesy of IDEO)

According to Thomas Overthun, team lead at IDEO, in the design of furniture, comfort of the user comes first; style follows function. The chair is designed to accommodate the 5th percentile female to the 95th percentile male. This is accommodated with a clever two degree-of-freedom system, allowing for the tablet surface to swing out and the entire surface and arm to rotate 110° out of the way for ease of ingress and egress, but with space efficiency. The chair also had to be designed for abuse in a classroom environment, yet light enough to readily move around. The result is a unique style for classroom seating. The Node is a plastic molded seat with a one-piece back and arm. The plastic base is stiff, but the chair

is flexible to accommodate different body types. The original chair is on six caster wheels for stability, and the base is designed to readily hold a backpack or other personal items. The “personal” work surface is nonhanded and large enough to hold a laptop *and* a pad of paper or a book. The result is a product that can be arranged in the traditional row seating, but it can also be quickly and easily moved to reconfigure the classroom dynamically into circles, smaller rectangular groups, and otherwise as needed to optimize the classroom experience through multiple configurations through a class period. The final product, dubbed the Node chair, has received praise for promoting student collaboration, allowing educators to reconfigure classrooms to fit different teaching styles, and enabling institutions to save money by making spaces more flexible and accommodating for varied uses.

Aesthetically, the chair stands out. James Ludwig, vice president at Steelcase, called the design an “odd duck”—weird but good because the chair both looks and *is* different. That it stood out highlighted that the functionality was different, meeting the needs of the college in a new way. The chair is offered in 12 colors for the shells, 3 for the base, and 5 for the work surface, to fit into almost any environment. And as with all good product development, the chair is readily extended to K–12 education and is finding other uses.

The project to develop the Node required an interdisciplinary team across IDEO and Steelcase. At IDEO, three industrial designers and two engineering designers led the effort over a half-year period of time. At the same time, three engineers at Steelcase provided ongoing feedback from a manufacturing and technical point of view. Steelcase’s industrial design department also provided intermittent feedback. After IDEO delivered a fully realized industrial design, Steelcase engineered its production on an accelerated schedule so that the product’s market arrival would coincide with schools’ purchasing cycles. Once turned over to Steelcase, Overthun remained involved from IDEO’s side to maintain consistency as research and concepts were translated into final production form over the next year.

In an education environment, especially a public one, cost is often a driver. Every feature on the chair was analyzed to make sure it was needed and was designed in a cost-effective way. The chair is approximately 50% more expensive than the traditional tablet furniture, but the functional and interactive value added is so much more.

The VOA of the node against the traditional tablet chair (see Figure 9.3) illustrates the breadth and depth of value that the Node adds to the education environment. The only real strength of the tablet is its durability—the same chair you sat in at school might have been used by your grandparent two generations earlier. Other than that, it offered no real strengths and, instead, displayed quite a few

weaknesses. The Node, on the other hand, contributes value across the board. The Node establishes a strong emotional connection for the user, stimulating the educational activity. Its unique identity highlights its innovation and invites the user to interact with the chair. It has an attractive, dynamic aesthetic. The chair encourages social interaction and aligns with Steelcase’s commitment to sustainability with minimal environmental impact by following McDonough Braungart Design Chemistry’s Cradle to Cradle process, where it was certified at the Silver level. The chair itself is built with abuse in mind yet is made of plastic. From the user’s point of view, this is the one area that must be proven over time, particularly whether it is as durable and reliable as its tablet competitor. (In the VOA, this is indicated with the gray line between medium and high, indicating that the potential is there to transform the value proposition as the customer becomes reassured of the chair’s performance.)

The development of the Node is another example of finding an opportunity in a product that has been established and used for a lengthy period, but a contemporary look at the product and the change in SET Factors result in an innovation that can revolutionize an industry.

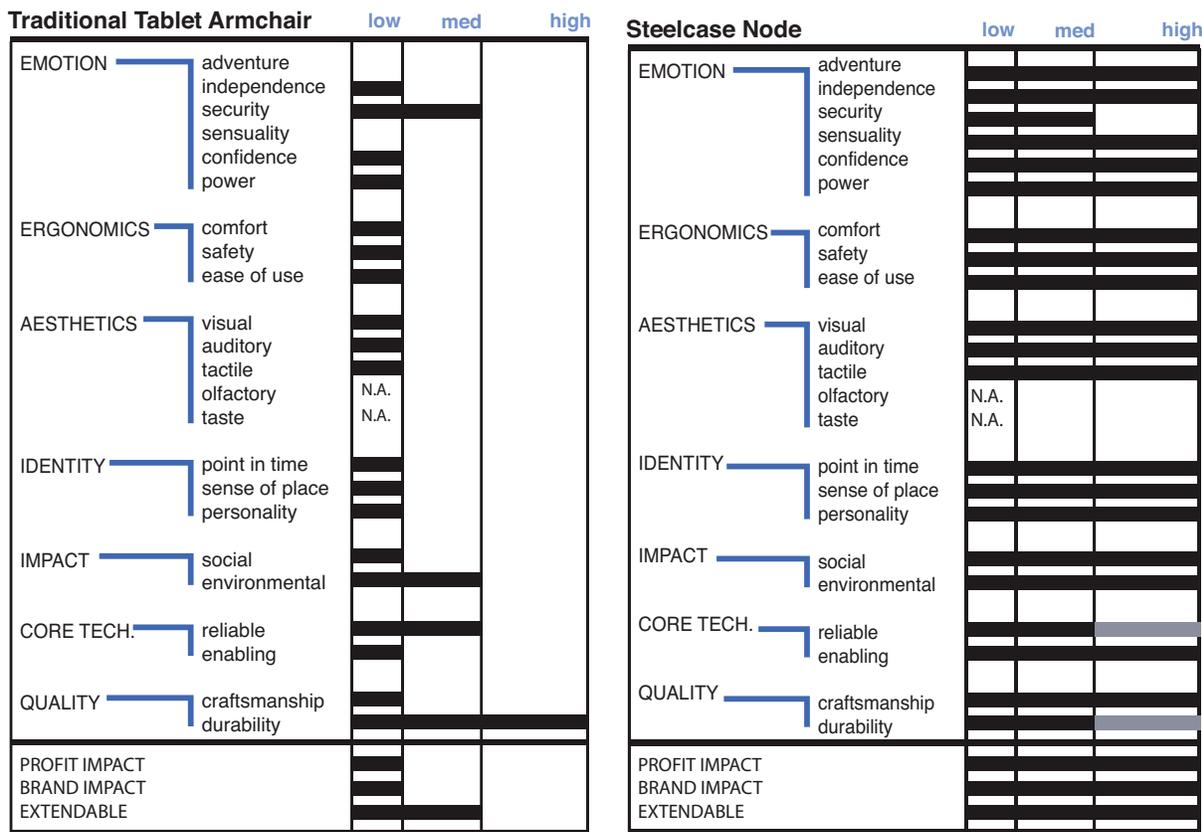


Figure 9.3 VOA of traditional tablet chair (a) and the Node (b).

Response to the chair has been overwhelming. It was released in 2010, and the first year sales doubled expectations—and in the second year, the numbers doubled again. The Node has also won several design awards, including a Silver IDEA award in the category of Office and Productivity, the Spark International Design Award, the NeoCon Innovation Award, and the *Interior Design Magazine* Best of the Year Award. With the expectation that competitors will attempt to knock off the success of the design, Steelcase has submitted half a dozen utility and design patents.

Corcorran commented that the success of the chair, and the success of products in general, is found in the little details; little decisions can make a big difference in the outcome of a project. It is also interesting that Corcorran had been on IDEO's staff for 17 years before taking a position at Steelcase. He understood that IDEO's advantage was to understand and design for the human and technical factors in the project, but as a client, he had to understand the business, the motivation for the product. This was why Steelcase began with its own research into the education environment and determined the type of new product it wanted to introduce before going to IDEO to design the product innovation. The lesson is that all companies need to understand the methods for product innovation generally and have mechanisms in place to uncover opportunities even when working with a design innovation firm; such a basis allows for a more fruitful collaboration, with the right expectations, between product company and design firm.¹

INNOVENTION: THE LONE INNOVATOR INVENTING THROUGH HUMAN INSIGHT

Although most of our case studies are about products developed by large companies, we have also been able to support innovators who have conceived of products on their own, supported by the ideas of the book. In Disney World, a museum called Innoventions highlights technological advancements and their practical applications in everyday life. The methods in this book can help any inventor become an innovator, turning technology into a valued breakthrough product. Here we spotlight two people who went from inventor to innovator by finding a POG that was human driven rather than technology driven and used an empathic approach that led to breakthrough ideas.

Dr. Robert Reynolds has been committed to finding ways to help children and their families manage the challenges of ADHD without the use of medication. Using the methods in this book, he has developed a product system that allows teachers to communicate positive and negative behaviors directly and discretely to students. One part of the system is used by the teacher and is located around the waist; the other part of the system is a wrist-worn product that looks like a watch and is worn by the student. The teacher can send silent messages to the student to recognize positive behavior and to also notify the student of negative activities. Both signals are silent and painless. Currently, the product is undergoing testing to meet FDA guidelines. The ideas and methods in the first edition of the book helped Dr. Reynolds understand how to structure his product concept and determine its value through the use of the VOA. It provided him with a roadmap to get through the Fuzzy Front End and helped him to work with a developer to improve the product and create a prototype for testing.

In 2003, Ryan Eder saw a person in a wheelchair trying to exercise with conventional equipment. He realized how hard it was to use conventional equipment in a wheelchair. The SET Factors indicated a significant increase in the number of wheelchair athletes wanting to exercise. New technology could be used to drive a state-of-the-art design that would allow wheelchair users to exercise with ease and dignity.

Eder developed his initial product idea for his senior project in industrial design. He won a Gold Award in the 2007 IDEA Awards for student projects and won a second Gold for Best Design of the Year, as voted by the IDEA awards committee overall. His design was also voted Best in Show by attendees at the World Design Conference later that year. At that point, Eder began a five-year quest to get the product system manufactured. Using ethnographic and empathic research, he developed an Upper Right design that incorporates an adjustable system for individuals with different arm strength and range of motion, to exercise both arms individually or together. The system accommodates different grip challenges to holding on to the equipment. Eder also designed a bench that allows someone in a wheelchair to get right in front of the equipment and, using digital touch controls, easily set the machine to the desired weight. The Include Fitness system (see Figure 9.4) is the epitome of inclusive design: It does not give any signals of being less than any other equipment to anyone, regardless of ability. After patenting the design, he formed a company through various funding sources and has been bringing the Include Fitness system to production.

By leveraging the ideas and methods from this book, these and other inventors can become innovators, developing meaningful ideas that turn technology into useful, usable, and desirable Upper Right products that change the marketplace.



Figure 9.4 Include Fitness, by innovator Eder. (Courtesy of Ryan Eder)

Ball Parks Play in the Upper Right: The Dallas Stadium and PNC Park

Dallas Stadium (see Figure 9.5) and the Cowboys are part of the NFL entertainment industry, providing a service to millions of football fans around the world. The Dallas Cowboys are an incredibly successful brand. At the core of this service are the players participating in the game itself and the space in which this occurs. As the fans in the stadium watch the game, that core experience is supported visibly and invisibly by a host of subservices and products and thousands of people working in a coordinated effort to create a seamless experience. The Dallas Cowboys are as controversial a brand as the recently revised TV show *Dallas* was. They are the team you either love or hate. The controversy starts with the owner, then moves to the coaches and players, and includes the one-time designation as “America’s team.” All stadiums and arenas are built with integrated systems, but not to the degree of this arena—so it is fitting that the new stadium is also controversial. Owners Jerry and Gene Jones conceived of the ideas that inspired the strategy and construction for the new Dallas Stadium. It has been one of the most discussed and dynamic additions to professional sports in the last decade. It has been critiqued from almost every angle, and people have weighed in on their perceptions of this new sports palace with every type of response, from strong reservations to rave reviews. But no matter how you feel about the stadium, you have to admit that it is a breakthrough solution providing a unique service experience (see Figure 9.6).



Figure 9.5 Dallas Stadium. (© 2012 Ralph Cole/Dallas Cowboys. All rights reserved.)

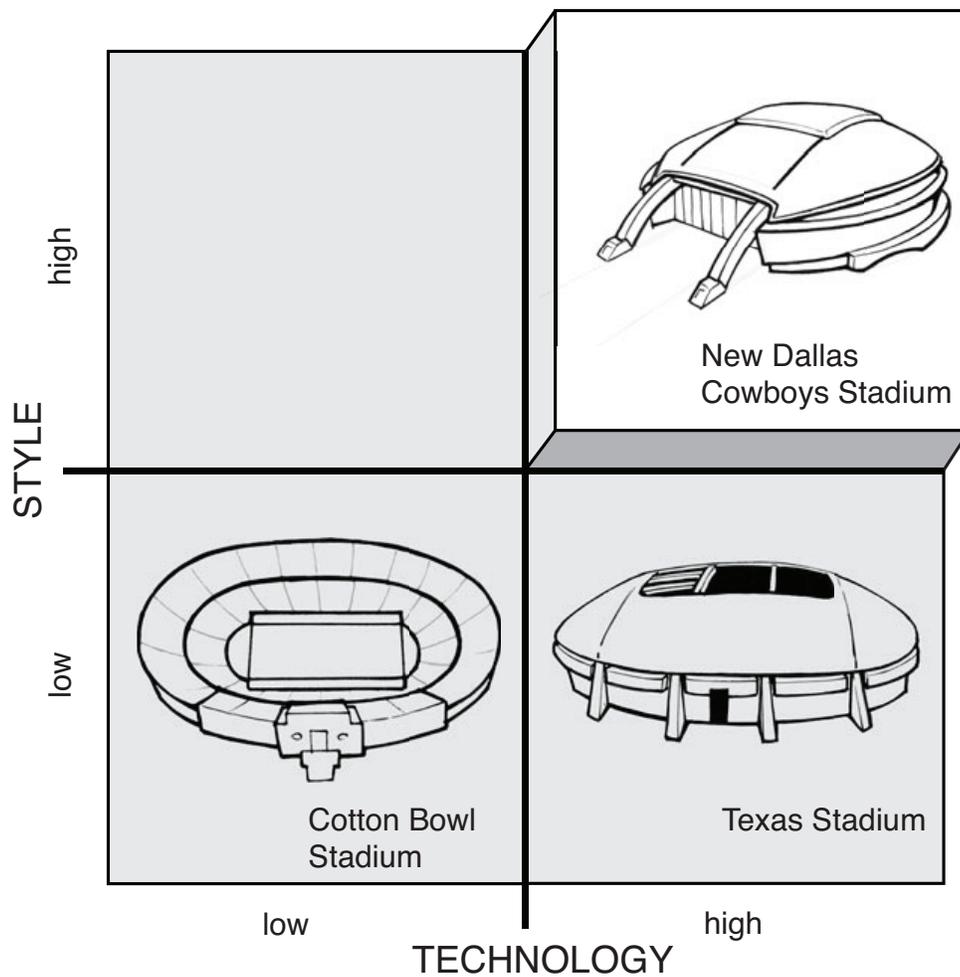


Figure 9.6 Positioning map of Upper Right Dallas Stadium against the Lower Left generic stadium (such as the Cotton Bowl) and Lower Right low style but high use of technology stadium (such as Texas Stadium).

What has made Dallas Stadium a breakthrough sports venue is the blend of the exterior and interior architecture, the 14 art pieces commissioned for the stadium, and the integration of more than 500 monitors. What has not been written about is the fact that Dallas Stadium is the first integrated smart stadium, with screens of every scale all working in a synchronized system developed by AMX. Dallas Stadium has crossed a new line in the relationship between virtual and real—for the first time, the two exist in parallel in an unavoidable relationship. Although every stadium has a “jumbotron,” there is usually just one, and it is located at one end of the stadium. Fans still use these screens primarily for replay. Dallas is the first smart stadium where monitors fully reflect the new duality of humans coexisting in virtual and real space. Everyone talks about the 180-foot monitors that run between the 20 yard lines, but there are few spaces anywhere in Dallas Stadium

where you do not see a screen of some size. It adds a new dimension to the centuries-old argument of simulacra, the relationship to real and the copy of real. Throughout the building, the real players on the field are presented at various scale from small monitors viewed at a distance, reducing players to specs, to the mega screens, where players are viewed on heroic scale hanging in the sky above the field and spectators. All we would need is Wagner's music, and we could be in Valhalla.

In the stadium, huge screens display action just above the field and in real time. An initial problem was resolved when it was realized that one side of the stadium would see the action in the direction it was occurring, while the opposite side would see players going the "wrong" way. This resulted in a new programming solution that flips the image in real time to make sure both sides see the image as consistent with the field.

Bryan Trubey of HKS Architectures, Inc., designed the stadium structure. Both Trubey and the firm are known for designing sports stadiums. The architecture, while referential to the former Cowboys stadium, is a unique visual structure and provides a fan experience that defines a new boundary between virtual and real. The art collection the Joneses have integrated throughout the stadium is also a distinct aspect of Dallas Stadium that separates it from other venues. The art is set in a variety of spaces, from public walkways to private clubs, and the interior design of these spaces is modern in style; it provides a high-end, elegant back drop not at all like the usual over-the-top sports images and graphics present in other football stadiums. Instead, whenever sports images are used, they are produced in a sophisticated way that complements the art and interiors of the building. The building exists in shades of gray and, instead of using large, bold color images, elegantly produced black-and-white photomurals are blended into the interior spaces. The building is open for tours, and you can have your photograph taken with or without a Dallas Cheerleader on the star on the 50-yard-line. This is one of the few traditional tourist activities you can do. The stores for fan memorabilia are also designed with a sense of restraint. The stadium works as a coordinated whole where architecture, technology, and art combine to create an experience analogous to a large high-end family room with a football field on the floor.

When fans used to sit in a football stadium during an afternoon and watch a game on the field, the scoreboard was a minimal part of the experience. The technology required to complement and support the play on the field was minimal as well. We are becoming increasingly dependent on blends of virtual and real working in harmony. This requires the need for sophisticated invisible systems to coordinate that experience. Companies such as AMX will start to become a greater part of our everyday world as we seek to make every experience a blend of virtual and real and to define our own boundary of simulacra.

Contrast the Dallas Stadium with the design of PNC Park, home of the Pittsburgh Pirates (see Figure 9.7). PNC Park is an excellent example of technology in the background and the experience of the game in the foreground. The park was designed to look like the oldest professional baseball parks, Fenway Park in Boston and Wrigley Field in Chicago. When built in 2001, the nostalgia trend had hit every facet of society, and ballparks had become a primary symbol of the phenomena. The difference is that the new fields look like the classic ballparks, but they have a new infrastructure and a state-of-the-art array of amenities. PNC Park, and other new parks like it, brought intimacy back to the game; a smaller park than its previous multiuse stadium, it offered seating closer to the field and brought people in to watch the game, even with one of the worst teams in the league for more than a decade. To augment the fans' experience, the Pirates hired Disney to train the ushers and other greeters at the park.

Similar to Dallas Stadium, PNC Park is in the Upper Right, although it is subdued in comparison. At PNC Park, the high technology is hidden from the fans, such as with the high-performance, sand-based grass, which includes a drainage system that can process 14 inches of water per hour (see Figure 9.8). A decade after it opened, PNC Park is still considered one of the best parks in baseball, drawing fans to enjoy the game and fostering the hope that the Pirates will someday be World Champs again.

Clearly, there are different ways to create great experiences for the fans. Baseball is nostalgic. Football is aggressively futuristic. And with that futurism emerges the ultra-high-tech, high-styled Upper Right Dallas Stadium.



Figure 9.7 PNC Park, home of the Pittsburgh Pirates. (Reprinted with permission of *Pittsburgh Post-Gazette*; photo by Fong)

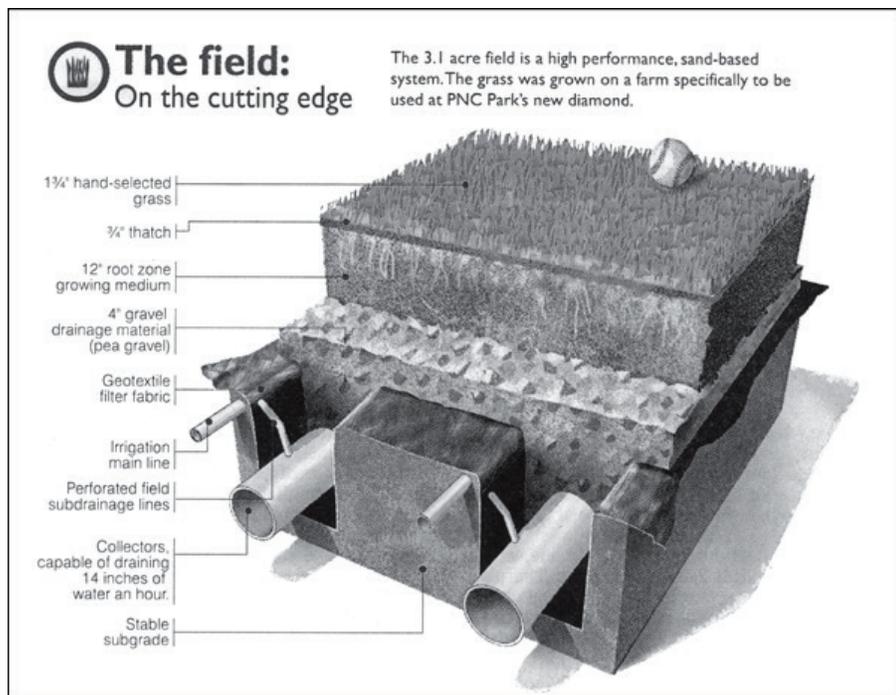


Figure 9.8 Illustration of the high-technology playing field in PNC Park. (Reprinted with permission of *Pittsburgh Post-Gazette*; graphic by Dan Marsula and James Hilston)

Innovation in Machining: Kennametal Beyond Blast Titanium Manufacturing

Consider the world of metal cutting. Although it might not seem to be the most glamorous area for new product development, it turns out that machining is ripe with potential for innovation. Kennametal, one of the world's leading manufacturers of cutting tools, succeeded in targeting the vast opportunity for innovation within the machine tool industry. The product, Beyond Blast, enables faster and more economical machining of titanium. Beyond Blast was developed because of the emerging opportunity for improved titanium machining, based on new product entrants in airplane manufacturing. Titanium is one of the most challenging materials to machine because of the high temperatures and stresses generated on the tool. Boeing was developing the 787 Dreamliner, an innovative concept for airplanes that relied heavily on composites to reduce weight and drag and also maintenance of the plane. The increased use of composites was coupled with an increased use of titanium for the structure. In this case, approximately 200,000 pounds of purchased material comes in and 80%–90% is machined away, resulting in a finished structure to support the composites. The concern from Boeing in 2005 was that, with conventional machining technology, there was not enough manufacturing capacity in the world to machine the volume of titanium required to deliver the number of aircraft at peak production. This was a unique opportunity for Kennametal.

In a typical tooling development project, Kennametal focused on the tool material, advanced coatings, and cutting tool geometry. This time the company took an expanded approach, considering compatibility with machine systems, cooling strategies, and strengths and weaknesses of competitors' tools. In the past, cooling strategies, in particular, were considered to be beyond the company's domain. Yet this broader, nontraditional view of the problem suggested that the combination of cooling and cutting was the key. Approximately 90% of the mechanical energy required to cut metal is converted into thermal energy, which is especially large with difficult materials such as titanium. Typically, a thick stream of metal cutting coolant is aimed toward the cutting zone of the tool from 3 to 12 inches away, to remove heat, lubricate the tool, and wash away the chips that result from the cutting operation. The problem with traditional approaches is that it wastes coolant, is not accurately aimed, and lacks desired effectiveness to sufficiently remove metal chips.

The competitive technologies (see Figure 9.9) included the traditional low-cost carbide turning tool with external coolant (Lower Left), high-pressure coolant systems using more advanced technology (Lower Right), and stylized chip-breaking

geometry in the Upper Left. The Upper Left chip breakers used tool topography to break the chips but could be designed to appeal to the machinist. For example, Kennametal has designed chip breakers in the shape of stars for U.S. customers and the Maple Leaf for Canadian customers, with similar performance.

These factors created an opportunity to fill the Upper Right quadrant. The insight was to integrate the coolant application into the cutting insert itself. This allowed the coolant stream to be better focused where needed, resulting in more efficient cooling, less coolant required, better lubrication, and a longer life for the cutting tool.

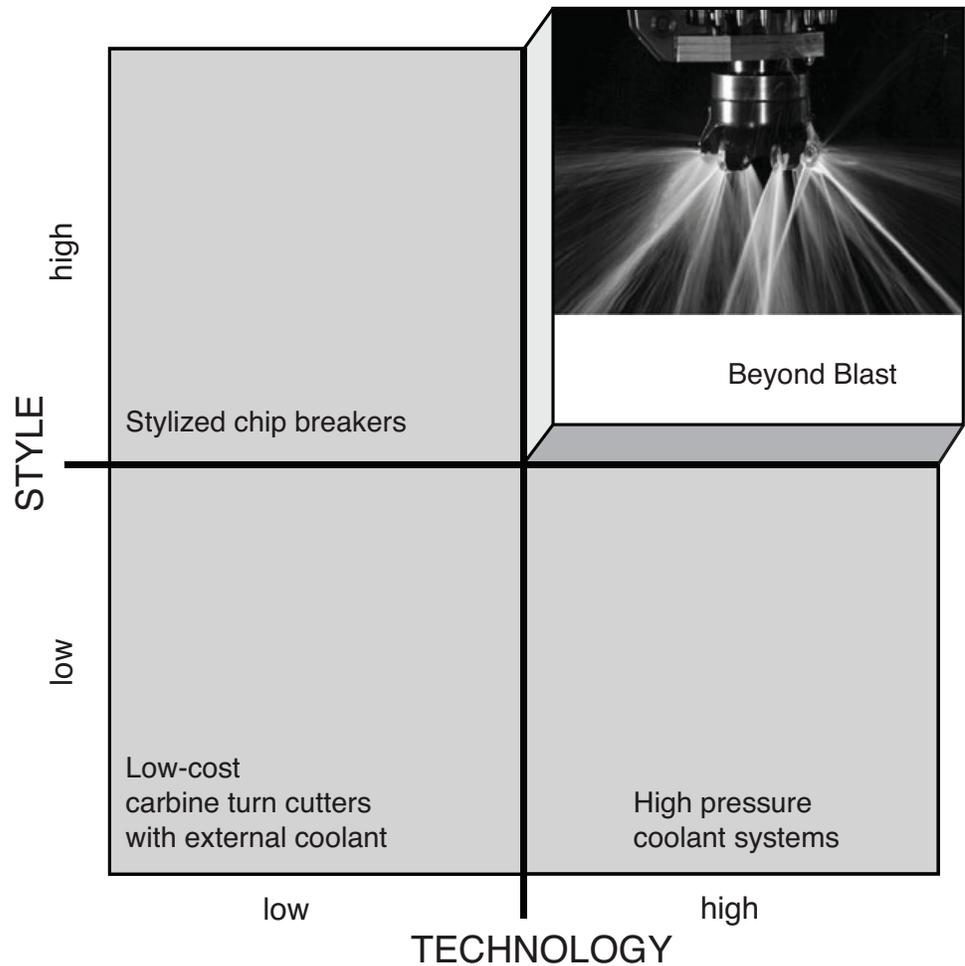


Figure 9.9 Positioning map for Beyond Blast titanium machining. (Photo courtesy of Kennametal.)

The result is called Beyond Blast (see Figure 9.10), an innovation in metal-cutting tool technology introduced by Kennametal in 2010. The unique design enables coolant to be delivered *through* the cutting insert. The technology enables the machine to speed up 50%, making cutting time faster. The cutting insert also lasts 300% longer than conventional tools at standard cutting conditions.

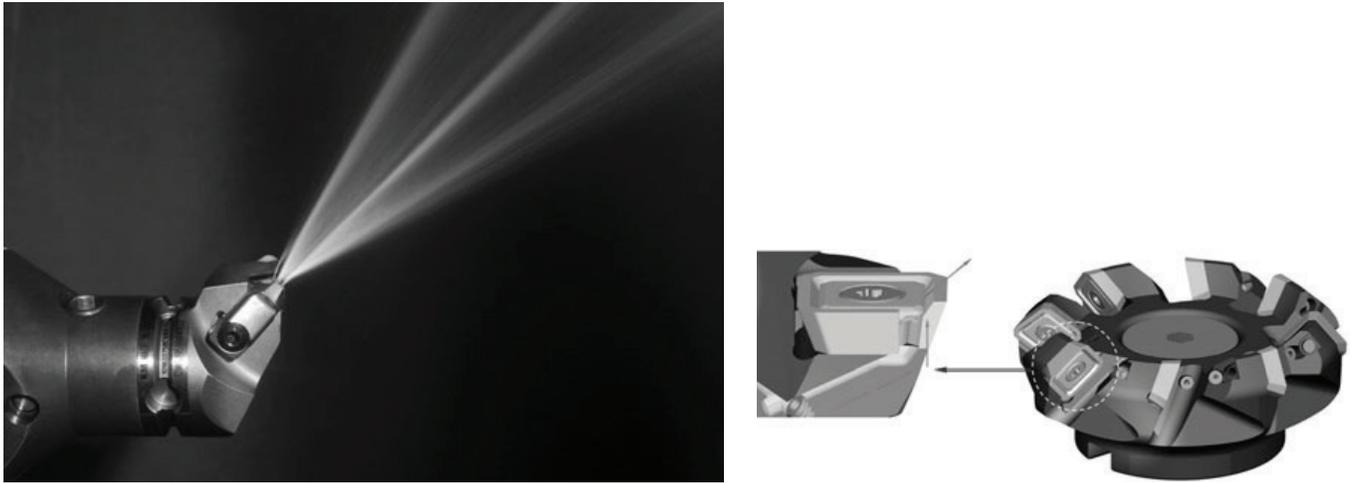


Figure 9.10 Beyond Blast, by Kennametal. (Courtesy of Kennametal)

The VOA (see Figure 9.11) highlights the innovation of Beyond Blast and the value delivered to the customer. The VOA of the traditional approach shows that all relevant attributes are either low or medium in terms of value. *Medium* in this application is taken to mean “industry standard”—it is an acceptable level but doesn’t go out of its way in that attribute. Looking at the Beyond Blast VOA, high levels of value are delivered for some set of attributes in every VO category. A few stand out.

Aesthetics is high. The average person might not be excited by the design of Beyond Blast. But for anyone who works in machining, it stands out as elegant, with a strong form that communicates its unique functionality. The result is a tool with a sophisticated aesthetic that results from an integration of parts, not a kluge that could have occurred by simply connecting the parts. The unique style also results in a high (and highly recognized) identity. In a similar manner, sensuality is high. Again, for those that work on the machine floor and in the context of machining, this product is sexy. The gold color (not unique, but not plentiful in the field) also adds to the overall style of the product.

Yet the quality and core technology are also generally high. The product is far more durable than the competition, lasting three times longer than the standard carbide cutting inserts. The environmental impact is also high: Coolant quantities can be reduced, and the lengthened time before the insert needs to be discarded are both beneficial to the environment.

It is interesting that a customer might feel skeptical about the product because it is new and not yet widely accepted by the industry, resulting in medium levels for security and confidence in the VOA. This is typical for a unique, new-to-the-world

product in the conservative metal-cutting tool market. However, this can be overcome by working closely with customers and communicating successful cases to establish a reputation as a “proven solution.”

The look of the cutter inspires the people using it because it looks like it can deliver. This is a sophisticated version of form and function working in concert, which puts the product into the Upper Right for this market segment (see Figure 9.9).

The profit margins are confidential, but the potential alone for increased market share leads to a high profit impact. The product not only leverages Kennametal’s brand as a premium tool, but also augments the brand through the innovative aspect of the product. Finally, the product is extendable, in that other difficult, high-temperature machining applications and materials—for example, those that generate high heat and failure due to heat, such as stainless steels, superalloys, and high-alloy steel—are candidates for the application of Beyond Blast technology.

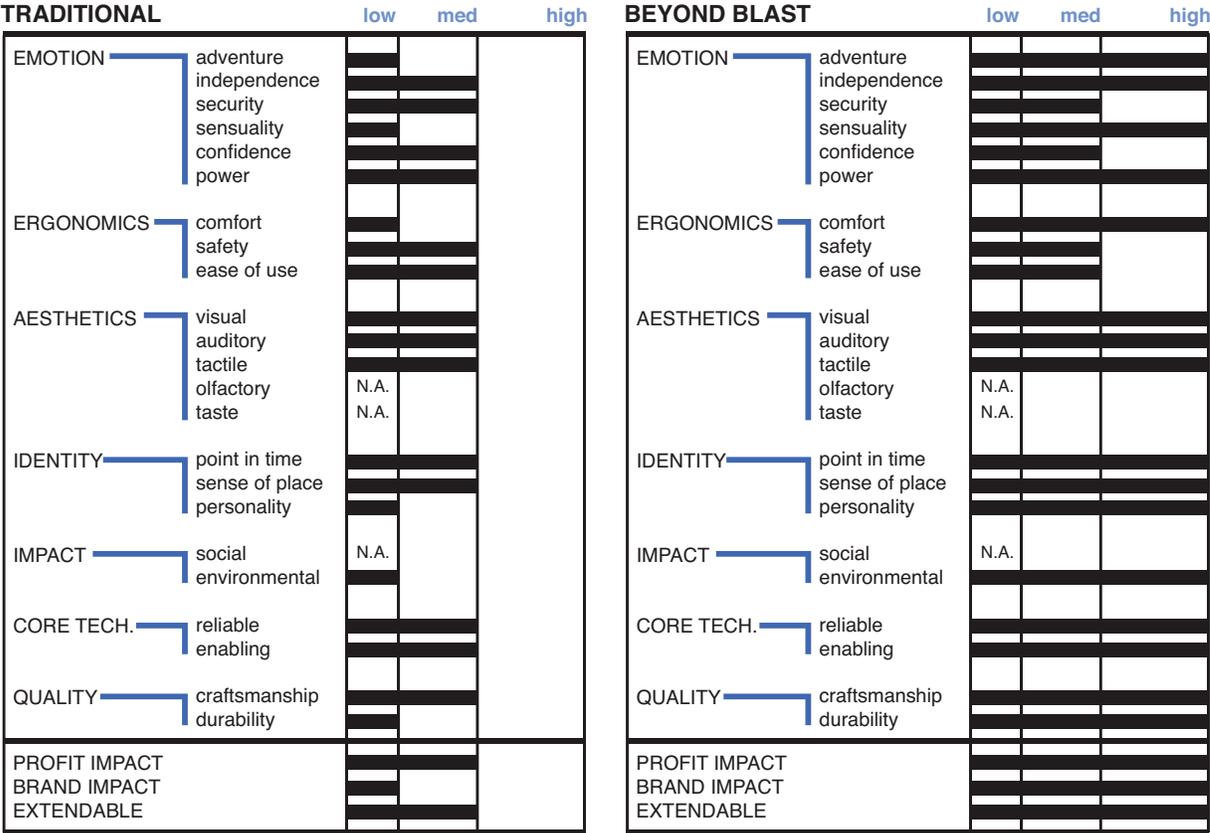


Figure 9.11 VOA for traditional machining and Beyond Blast innovation.

At the direction of Kennametal management and product marketing, Innovation Ventures Engineer Paul Prichard and Breakthrough Technology Manager Tom Muller led a multidisciplinary team of talented engineers and technologists in the process to innovate and develop Beyond Blast. Using tools from this book and conceptualization methods, they identified the opportunity and envisioned the Beyond Blast system. Kennametal recognizes the value of its breakthrough. At the time of writing, several U.S. patents had been issued and patent applications were pending. The product also has inspired employees within Kennametal to think differently about problem-solving approaches. The success of Beyond Blast marshaled resources for new innovation projects, and the freedom to pursue something this innovative has become an icon for the new “Different Thinking” advertisement campaign. Kennametal has been recognized for its innovation in the machine tools industry, and the company won the Innovator of the Year Award from PDMA in 2010 largely because of Beyond Blast.

The biggest takeaway from this case study is that innovation is not just for consumer products. If breakthrough innovation can be found in a seemingly mundane and mature business-to-business industry such as metal-cutting tools, it can truly happen anywhere.

Electric Vehicle Innovation: Bringing Upper Right Transportation to the Twenty-First Century

For many readers, electric cars seem like a new invention. Yet electric vehicles (EVs) go back to the nineteenth century, with popularity that surpassed internal combustion (IC) engine-based cars in the early twentieth century. However, cheaper oil prices, mass production of the internal combustion engine, and systems of roadways that resulted in longer travel distances allowed the fossil fuel-based vehicle to prosper while the electric vehicle for many years became an after-thought.

With the recognition of global warming and its impact from burning fossil fuels, and increased fuel prices in the twenty-first century, a new opportunity for electric-based vehicles has emerged (see Figure 9.12).

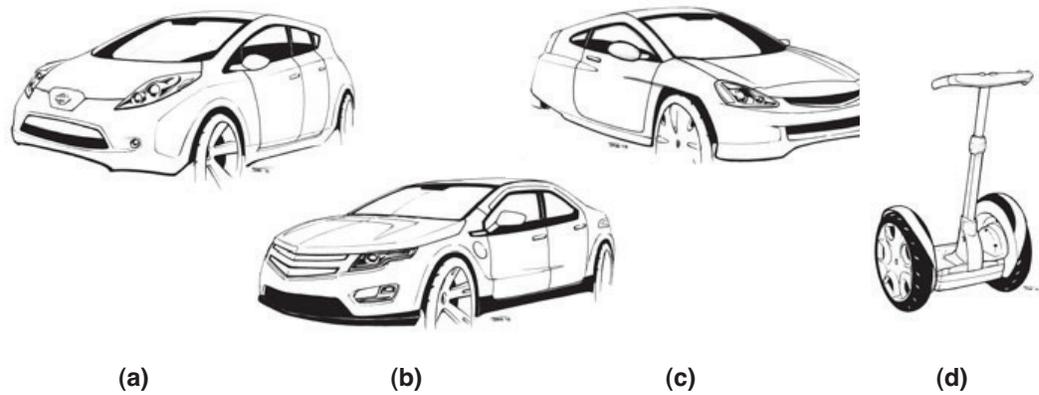


Figure 9.12 Electric vehicles at different levels of value: Nissan Leaf, Chevy Volt, Honda Insight, and Segway.

Tesla Motors showed with the introduction of the Roadster in 2008 that, for a hefty price, electric vehicles can be fast and sexy. Yet a new class of vehicles that began to emerge after 2010 will take the EV from niche to mainstream. The evolution of battery technology has allowed the development of these vehicles, most notably the Nissan Leaf, the first mass-produced electric vehicle introduced in 2010. The Leaf strikes a critical value proposition that leverages the social consciousness of people's desire to reduce their carbon footprint (see Figure 9.13). The vehicle's parts are 99% recyclable, adding another level of satisfaction to improving sustainability. The design of the car itself is basic and contemporary, emphasizing affordability over style. The technical reason the Leaf is accessible is the evolution of battery capacity. The Leaf's ability to travel 100 miles between charges provides a range well beyond what most Americans drive in a day. Realistically, except for long trips, the car can fulfill most people's daily needs. However, the Leaf and other EVs still need to overcome people's fears of running out of charge. As people hear about the lack of problems with charge capacity by Leaf owners and they begin to see new charging stations available at work, malls, and supermarkets, they will feel more secure about the vehicle.

The Leaf will probably continue to have its best success in urban and suburban contexts in moderate and warm climates. The other concern, especially for those in mountainous topographies or snowy climates, is whether the car will have the horsepower to work reliably in challenging environments. With half the rated horsepower over a similar IC vehicle, customers might feel a lack of security, an issue that tests and reviews from other customers will alleviate.

NISSAN LEAF		low	med	high
EMOTION	adventure			(oil)
	independence		(travel)	
	security			
	sensuality			
	confidence			
	power			
ERGONOMICS	comfort			
	safety			
	ease of use			
AESTHETICS	visual			
	auditory			
	tactile			
	olfactory	N.A.		
	taste	N.A.		
IDENTITY	point in time			
	sense of place			
	personality			
IMPACT	social			
	environmental			
CORE TECH.	reliable			
	enabling			
QUALITY	craftsmanship			
	durability			
PROFIT IMPACT				
BRAND IMPACT				
EXTENDABLE				

Figure 9.13 VOA of Nissan Leaf.

A different approach to improving fuel efficiency is the hybrid vehicle—part electric, part internal combustion. Toyota’s introduction of the Prius in 1997 in Japan and 2001 worldwide, was the first widely accepted alternative to the straight internal combustion car. The Prius uses electricity at low speeds, captured from energy waste during braking, but still a traditional internal combustion engine at higher speeds. A new class of vehicles that began to emerge commercially in the 2010s is the plug-in hybrid, most notably the Chevy Volt, introduced in 2011. Here the car works as an electric vehicle until the battery is drained and then reverts to a small IC engine, working like a traditional vehicle. The Volt has a range as an EV of only 35 miles, enough for the average American to travel to and from work, but the IC that kicks in gives an overall range of 375 miles, allowing the Volt to be taken on long trips. So although the Volt doesn’t provide complete independence from

fossil fuels, it does overcome the security issues that hinder the broad acceptance of EVs (see Figure 9.14).

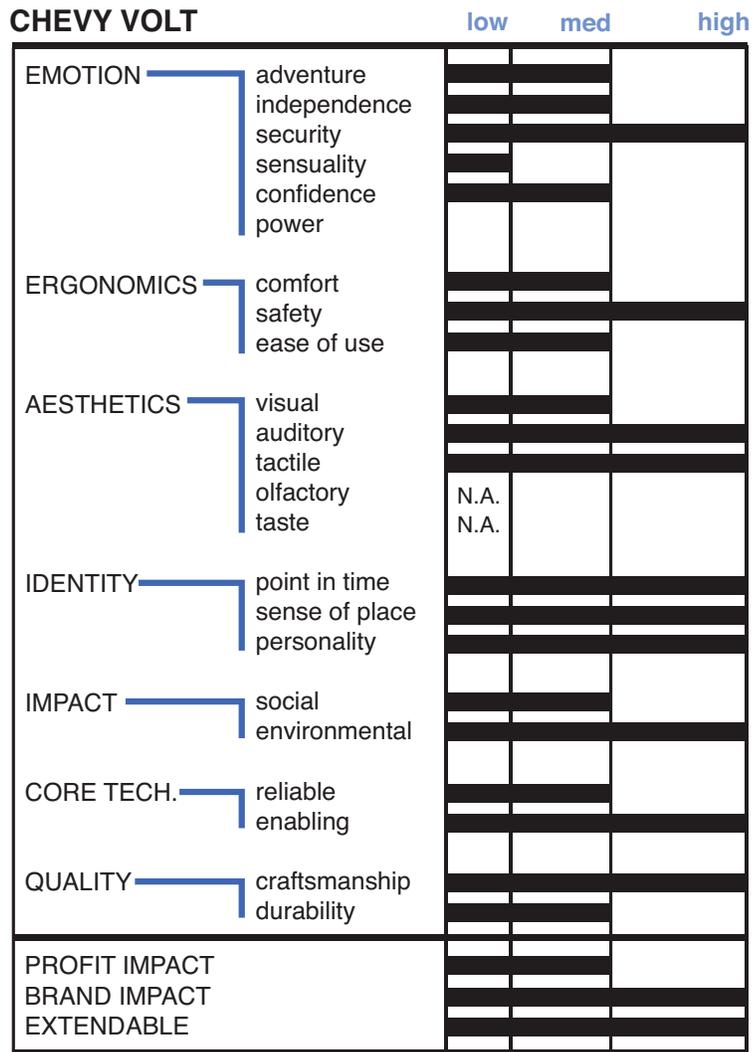


Figure 9.14 VOA of Chevy Volt.

Both the Volt and the Leaf maintain an overall form and aesthetic look that resembles traditional IC vehicles. In this way, they reach the broader market that desires an environmentally friendly, or at least fuel-efficient, vehicle without a stigma. Still, the companies targeted different initial buyers. For the Leaf, Nissan targeted environmentally conscious, middle-aged owners with a good income and their own home, where they can charge the vehicle, and who are looking to move on from their hybrids. GM sought a more mass-appeal initial market for the Volt, targeting the techies rather than environmentally driven drivers, using the marketing campaign, “More car than electric.”

The social VO attribute is worth noting. Both vehicles have interesting potential in the social arena. First, when relatively new, the vehicles become a focal point for conversation. People want to learn more and find out about the experience of driving EVs and plug-in hybrids. For the Leaf, in particular, future charging stations could be a conduit for social interaction with others while vehicles are charging. Imagine a new type of rest stop—not just on the highway but in cities—as well as an economic infrastructure built around the vehicle charging activity: eateries, sundry stores, gaming environments, and more.

Earlier electric-based vehicles set the stage for the success of the Leaf and Volt but themselves failed. In 1999, Honda introduced the first commercially accessible hybrid, the original Insight. When the Insight was first released, its sales were flat. Although the SET Factors for an environmentally friendly vehicle were emerging, gas prices were still relatively low and the car's styling communicated that it was different but in an odd-looking way, essentially limiting the market to those few early adopters who were driven by environmental issues. Honda then redesigned the vehicle and became positioned to tap into the larger market and cross the chasm as economics and environmental awareness increased the potential value of the hybrid vehicle.

Another electric vehicle that failed to achieve broad adaptation is the Segway two-wheeled personal transportation vehicle launched by inventor Dean Kamen in 2001. The two-wheeled vehicle uses an advanced control system to be easily steered while standing up; all the user needs to do is lean in the direction of travel. Expectations were that the Segway would replace cars in urban environments. Kamen stated that the Segway “will be to the car what the car was to the horse and buggy.”² However Kamen, a brilliant inventor, misread the SET Factors necessary for breakthrough innovation. Its biggest problem was that it was neither a road nor sidewalk vehicle, and many municipalities outlawed its use on the sidewalk. Its hefty price tag of \$3,000 in 2002 significantly limited interest in the marketplace.

At times, radically new products that misread the SET Factors set the stage for future successes. In their book *Reinventing the Automobile: Personal Urban Mobility for the 21st Century*, the late architect Bill Mitchell, from MIT, and Chris Borroni-Bird and Lawrence Burns, from GM, presented an argument for a podlike two-person vehicle for use in urban environments.³ They argued that information technology, control systems, and electric motor technology were ripe for developing such a vehicle that could significantly improve congestion and pollution in crowded urban areas.

The SET Factors in car design change quickly, yet the design of the vehicles takes time due to their complexity and the number of parts that must be integrated. At the same time, the large capital commitment to produce the vehicles prevents rapid change in fundamental platform structure for the vehicles. The current and emerging landscape is very different than when the first edition of this book was released in 2001. At that time, getting companies to think seriously about the environmental attribute of the VOA was difficult. The public still did not understand the real impact on the environment caused by the IC engine. And although 9-11 occurred just a few weeks before the book was released, fuel prices were still generally low. The first edition of the book emphasized case studies around the design of SUVs and other larger family vehicles.

However, the SET Factors have changed, all for the better for the environment. Customer and company alike understand the issues with carbon footprint. People rightly fear dependence on fossil fuels and recognize that their availability is limited. The price of fuel has risen, with no reason to expect it to go significantly down. And no longer is it generally accepted to drive a large vehicle for no real reason. Arguably, the focus of American car companies to allocate their profits to the larger vehicles partly led to their economic crash in 2009. As these companies came out of bankruptcy, they began to focus on smaller, fuel-efficient vehicles, leading to their renewed profitability. Thus, appropriately, the SUV is replaced with the EV in this second edition of the book.

Upper Right Open Innovation Partnerships between Companies and Universities

In the realm of open innovation, symbiotic partners essentially offer a service to each other, providing a capability that the other could not efficiently provide itself. Although the topic of open innovation has been written about extensively, in this section, we cover a particular type that positions a unique opportunity for both partners: university and industry partnerships in the area of product innovation. Universities, especially from a technology research perspective, serve a role to society in general and often companies in particular by uncovering discoveries, innovations, and new technologies that have the potential to provide new capabilities for society-at-large. The transfer of technology is not always easy, but it does enable the creation of new companies or performance capabilities within a product line.

Companies can have a different type of relationship with universities. Companies often want to explore new markets and new opportunities, but their resources are limited; it would be a luxury to be able to invest the resources (personnel and money) internally to explore such opportunities. On the other hand, universities that include an educational focus on innovation have bright, motivated students who are keen to learn the process of product innovation and excited to uncover new understandings and new opportunities that are real. The match between such university programs and companies can lead to a fruitful and mutually productive relationship.

There are important aspects of finding a good match between company and university. If innovation is truly sought, the company must propose an open-ended problem and be comfortable that the university will explore the innovation space in a way that balances the company's needs and its educational mission to the students. In addition, the university program and student participants must have the correct skill set in the area needed to explore the problem space. The benefit to the students is a real-world application of the concepts being learned and the potential to deliver meaningful, and potentially patentable, solutions to the sponsor. But the sponsor must realize that, in the end, it is funding a course and not hiring consultants. With the right match, companies will be pleasantly surprised by the ideas, research, and way of thinking about their product space delivered to them. The result is open innovation in a new way, with the university providing the service of innovation thinking and the company providing the service of introducing ripe problems for students to solve.

Such university programs are emerging. Two examples are found at our universities. Carnegie Mellon University has a Master of Product Development program, a one-year professional degree in design thinking and innovation.⁴ The program, now a decade old, was one of the first of its kind. Its capstone course is the Integrated Product Development course, which has been taught at Carnegie Mellon for nearly a quarter-century. The course follows the iNPD process laid out in Chapter 5, "A Comprehensive Approach to User-Centered, Integrated New Product Development." Integrated teams of engineers, industrial and communications designers, and MBA students work through the four phases of iNPD based on an open-ended, corporate-sponsored project. The course begins with an open problem statement that often explores new market areas for a company. At the end of 16 weeks, a complete product concept that is ready for program approval results. Dozens of patents and commercial products have resulted from the course.

The Live Well Collaborative (LWC) is a nonprofit C6 formed by P&G and the University of Cincinnati.⁵ In the past five years, the LWC has been involved in 30 projects with member companies. The companies include General Mills, LG, Giti Group, Kraft, Boeing, Duchossois, and Hill Rom. Gil Cloyd, the former chief technology officer of P&G, and Nancy Zimpher, former U.C. president, appointed a team with representation from the University of Cincinnati and P&G to build a new model for university and corporate collaboration. The team chose a theme of responding to the needs of consumers age 50 and up for two reasons. It was seen as an underserved consumer market by P&G with significant potential, and the theme of inclusive/universal design was of interest to the lead college of DAAP at the U.C. The unique attribute of the LWC is that the IP developed in studio projects goes back to the company to feed the pipeline of innovation. No debate arises on who owns the IP. This IP relationship is possible through the unique master agreement forged by the university and the corporate members and built into the umbrella of the C6 nonprofit. Jeff Weedman, the vice president of Global Business and Development at P&G, recognized this master agreement when he awarded the U.C. and LWC the award for best university partner in 2009.

The next two case studies are examples of specific projects that were done at Carnegie Mellon's MPD program and University of Cincinnati's Live Well Collaborative in collaboration with industry.

Innovation along the Highway: Navistar International LoneStar

The trucking industry has begun to see new lifestyle innovations, with truck concepts never before envisioned and new concepts finding their way to the marketplace. Arguably, the reality of these new commercial products began with the introduction of the LoneStar, an innovative new long-haul truck introduced by International Truck with a new paradigm for the lifestyle-savvy, professional driver. The vision for a new, paradigm-shifting truck began with Dee Kapur (who authored the Foreword to this book) as incoming president of Navistar's International Truck Group. Kapur realized that the truck industry needed a new way of thinking. He turned to the Carnegie Mellon Master of Product Development (MPD) program to begin the process of uncovering new opportunities for significant innovation in the long-haul truck market and the conceptualization of potential solutions using the iNPD process.

The 15-month project began with a summer internship in which five students worked at Navistar under the guidance of MPD faculty using the first two phases of the iNPD process in Chapter 5 to identify the opportunity for that lifestyle-savvy, professional driver. Before then, the trucking OEM industry (and buyers) focused primarily on the business aspect of the truck: fuel efficiency, weight, and driver capabilities. The trucking industry had not thought as much about the lifestyle of the driver as he is away from his family for a week or two. The Carnegie Mellon team uncovered convincing user research that the quality of life for the driver during off-hours time was critical to the overall satisfaction of the job. The team also uncovered that the driver, often thought of as a menial labor worker, was a professional who desired the respect that other professionals demanded. The SET Factors highlighted the social expectations of drivers, their need for technology and connectivity, the economic realities of the business side (such as fuel costs), and the more than 100% driver turnover every year in fleets due in part to unsatisfied driver lifestyle.

Ethnographic research found that the living space behind the driver's seat was overly constrained. In this tiny space (the footprint the size of a two-person tent), the driver had to sleep, eat, work, and relax, even though there was only an uncomfortable bunk mattress and no kitchen, table, lounge furniture, or office. There was minimal storage, and the truck was cluttered with personal belongings and electrical cords. Drivers who owned their truck tried to personalize it and make it feel more like home; for example one driver installed hardwood flooring in the cab. The team next created a VOA (see Figure 9.15) that highlighted the opportunity for a high-valued truck experience for the driver during those 14 hours when he was not driving. After looking not only at International's own trucks, but at all of the competitors, the team demonstrated that there was a real opportunity for a differentiating Upper Right truck that fulfilled the value proposition laid out by the VOA. During the summer, constant communication with Navistar personnel assured the team that it was focused in the right directions and gave the company new and ongoing insights to influence the overall product development.

Lifestyle - Professional Truck		low	med	high
EMOTION	adventure	█	█	█
	independence	█	█	█
	security	█	█	█
	sensuality	█	█	█
	confidence	█	█	█
	power	█	█	█
ERGONOMICS	comfort	█	█	█
	safety	█	█	█
	ease of use	█	█	█
AESTHETICS	visual	█	█	█
	auditory	█	█	█
	tactile	█	█	█
	olfactory	█	█	█
	taste	N.A.		
IDENTITY	point in time	█	█	█
	sense of place	█	█	█
	personality	█	█	█
IMPACT	social	█	█	█
	environmental	█	█	█
CORE TECH.	reliable	█	█	█
	enabling	█	█	█
QUALITY	craftsmanship	█	█	█
	durability	█	█	█
PROFIT IMPACT		█	█	█
BRAND IMPACT		█	█	█
EXTENDABLE		█	█	█

Figure 9.15 VOA for a lifestyle-savvy, professional truck.

Next, a project course was run at Carnegie Mellon where MPD students dug further into the needs, wants, and desires of the truck driver (and other key stakeholders) and conceptualized a solution that could deliver on the value attributes (see Figure 9.16a). The design resulted in three patent applications for Navistar and highlighted several innovations: a bunk that converted to a couch, a kitchenette, an office, a separation of living and working space, and integrated storage areas. All of these features were the foundation for aspects of the forthcoming LoneStar. A further collaborative course among engineering, design, and business (the Integrated Product Development course) explored several new feature opportunities in depth. Both project courses engaged Navistar engineers and designers as critics and advisors to the process, providing insights to make sure that the resulting designs would be feasible and practical, yet also allowing the students to be innovative while uncovering new insights for the company.

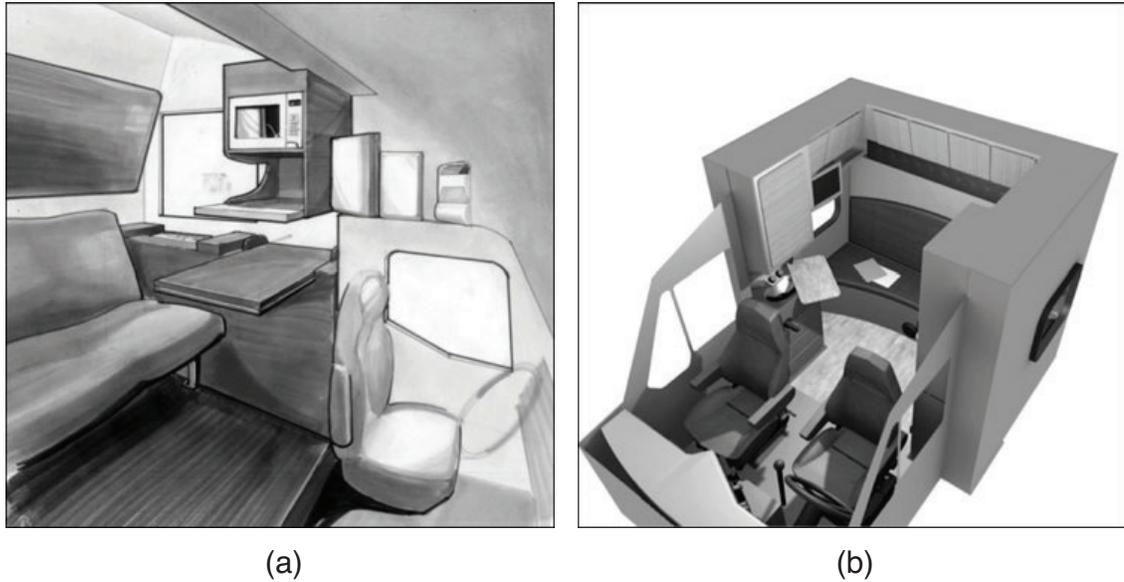


Figure 9.16 Evolving concept for breakthrough truck interior from Carnegie Mellon–Navistar open innovation partnership.⁶ (Image b with permission of Navistar)

In another summer internship, MPD students working with the faculty and the Navistar team uncovered the features the market most wanted and how they could be integrated into a final feasible concept (see Figure 9.16b). The biggest risk for the design and the company was to totally remove a bunk for a second passenger; in reality, the team found that few drivers ever had a passenger overnight, and that the second bunk typically became a storage facility. Instead, the second bunk was replaced with airline cabinets to improve storage and access to the driver's belongings. The bunk-to-couch concept then evolved into a full-size Murphy bed. A kitchenette was included—not one to cook a full meal, but one to prepare a sandwich, have a snack, or microwave a dinner. And in recognition that the driver wanted a separate place to live in, separate flooring finishes were used in the living and driving space.

Navistar was actively involved in the conceptualization process, again providing feedback to the team, but also building full-scale prototypes that were tested at a national truck show. This made for ease of transitioning the concept and design intent to Navistar, which embraced the concept and then took it through its own product development cycle to bring it to production and commercialization. The company looked at which features were cost effective and which were critical. Some of the features in the concept were removed; others were developed further and integrated into a cohesive style. Figure 9.17a shows the resulting commercial breakthrough product. At the same time, the Navistar designers created a beautiful retro-futuristic design for the exterior (see Figure 9.17b) while working in an

integrated fashion with engineers to deliver what was arguably the most aerodynamic, classic “West Coast” styled truck on the planet when it was introduced as the LoneStar. The LoneStar won the American Truck Drivers first Truck of the Year Award in 2009.



Figure 9.17 Navistar International Truck Group’s LoneStar truck—interior (a) and exterior (b). (Courtesy of Navistar)

This case study not only lends insight into the development of an innovative truck, but also demonstrates the power of open innovation through a close partnership between a company and a university. The company benefited from innovative, well-researched ideas. The students benefited from a unique real-world educational experience.

The 50+ and Environmental Responsibilities: Designing a New Refillable Sustainable Packaging System

One of the unanticipated positive results of the Live Well Collaborative was the focus on packaging related projects from the member companies. Haney PRC, a packaging resource center for companies, is located in Cincinnati, Ohio. The faculty leading LWC studios soon realized that Haney was a great local resource for packaging support and prototype production. After conducting several packaging projects for individual companies, the LWC ran a studio supported by several member companies to understand how 50+ (age 50 and above) consumers responded to issues of sustainable packaging. 50+ consumers, particularly women, control most of the consumer spending in the United States and form a

significant percent of the purchased packaged products for the home. A faculty-led studio was formed of students from the design and business colleges at the University of Cincinnati to understand the attitudes and opportunities for reuse and recycling in the Baby Boomer population.

The studio divided into three teams. One team focused on understanding consumers' various points of view. The second focused on a new system for recognizing companies that have been active in green design. The third focused on the idea of refillable packaging. The rest of this case study focuses primarily on the refillable package team.

The studio followed the four phases of the iNPD process, which was adapted to fit a ten-week quarter. The faculty team came to the project with a general opportunity gap. The POG was to understand the perceptions of sustainability of current Baby Boomers and develop a response to that insight. The student team chose to focus on the specific POG for refillable packaging for home products. The team then went to expert advisors from each participating company to get the background they needed. They conducted secondary research on the local and global issues of refillable packaging. Then when the team was functionally literate, it began to interview consumers and conduct home visits.

The goal of the home interviews was to understand consumers' current methods of purchasing, using, and discarding/recycling existing product packaging for the home. The team also received information from the other two teams in the studio during this research phase. Figure 9.18 shows an overview of the various personas developed in the preliminary qualitative research to gain an understanding of the various attitudes about recycling in 50+ consumers. The pie chart reflects the percentage of those perceptions. This was part of the research that led to the refillable pouch solution. Faculty advisors played an important role as facilitators, as coaches, and in helping to connect to companies for additional insights and connections. At the end of the research phase, the team presented its understanding of the opportunity to the corporate representatives and to the Baby Boomer consumers.

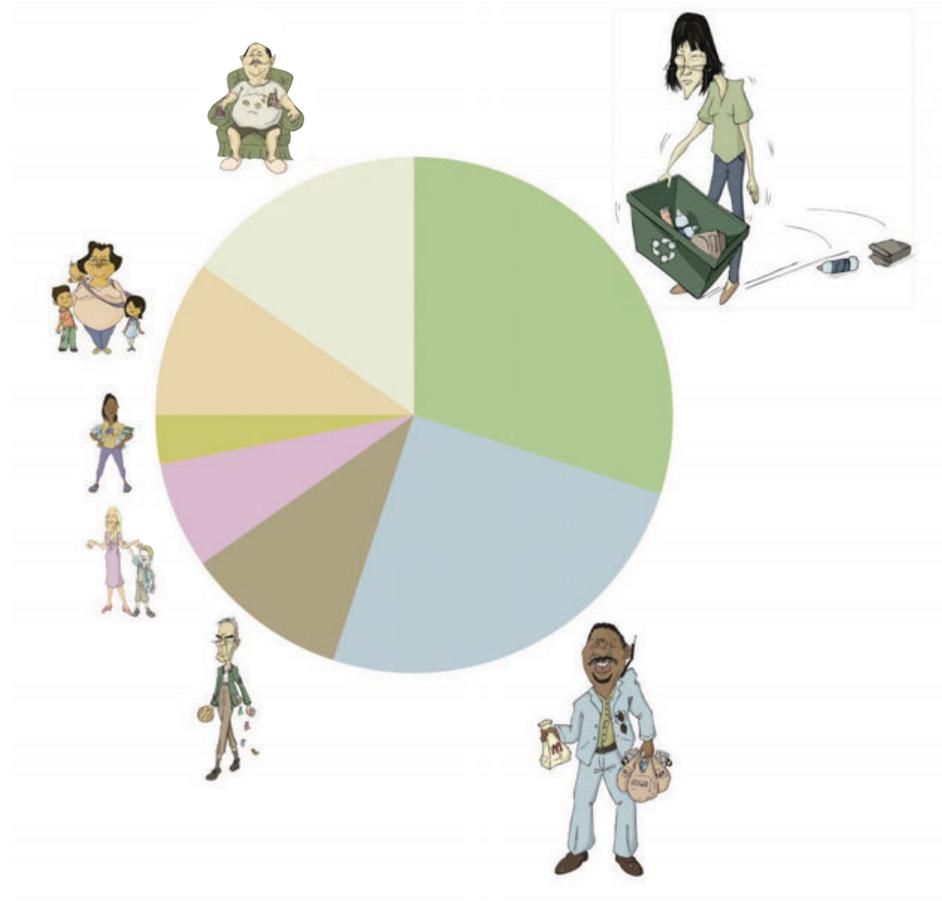


Figure 9.18 Attitudes about recycling in 50+ consumers.⁷

The next step was to translate the research phase into initial concepts and then to conduct several cycles of conceptualization and evaluation. The refillable packaging concept was thought of as a comprehensive system. The touch point would be the product and refillable unit, illustrated in Figure 9.19. That unit had to be the beginning of a series of actions that would inspire a consumer to use a refillable solution over other conventional options. At the same time, the pouch had to be part of a manufacturing and distribution system that could easily compete in cost and time with traditional package shipping. Finally, the interface for the system was in the purchasing environment; the refillable unit had to be easy and cost effective to use, and appealing to the stores that would house them.

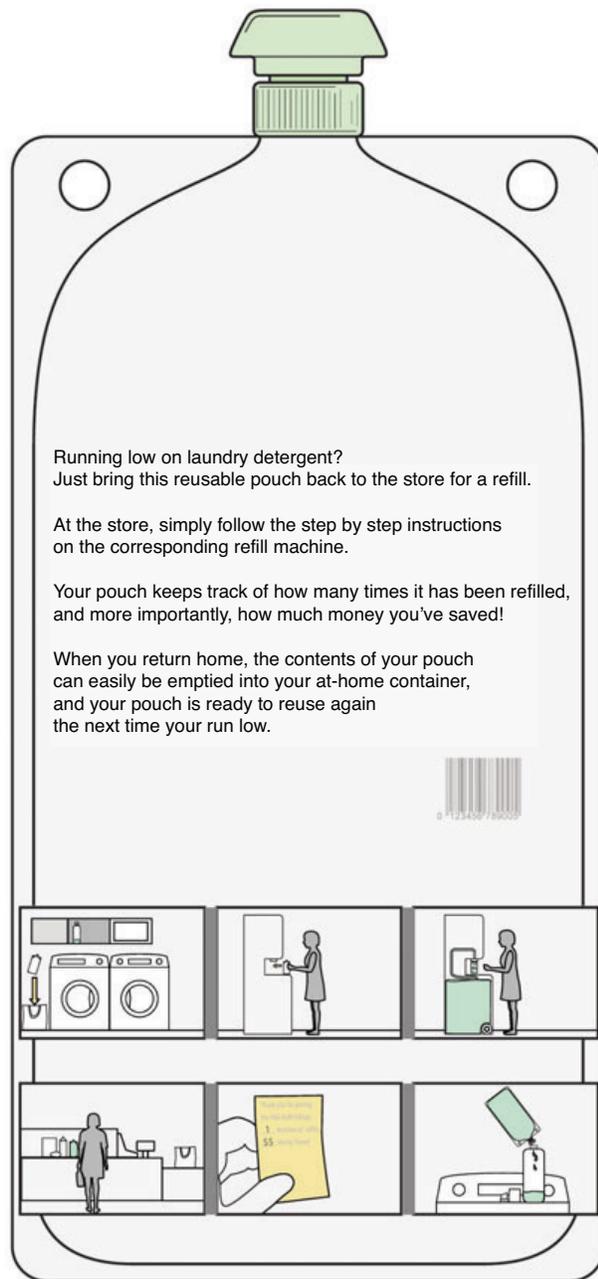


Figure 9.19 Refillable pouch developed for university–industry exploration of attitudes and possibilities for reusable packaging for the Baby Boomer market developed in the Live Well Collaborative.⁸

The resulting system design addressed all of those issues and created a value proposition that would allow it to compete with existing packaging solutions. Companies that produce packaged products and the retail chains that sell them are all involved in trying to fulfill the goals of the new corporate triple bottom line of

people, planet, profit. The team combined that knowledge with the fact that a percentage of Baby Boomers are trying to leave a minimal footprint in their lives. These consumers have energy-saving features in their homes and usually purchase vehicles that are either electric, hybrid, or at least small cars with excellent MPG.

The touch points of the system for the consumer are in the permanent package dispenser and the refillable unit at home and in the refillable process at the point of purchase. The proposed refillable interface at the store consists of a designated area where refilling stations would be located. The design allows these stations to visually complement and not to create a stigma for being green. The refilling stations have an easy-to-use mechanism. The company system was designed with easy-to-ship modules that would efficiently store in a truck to optimize shipping and that then would be easy for the delivery person to unload and restock. The delivery person would then bring the empties back to the shipping center to be refilled.

It is often the case that one step in a system is designed as a standalone solution and, in isolation, seems to make sense. When that component of the larger system needs to be fleshed out and integrated with the other aspects of the system, making those connections is often difficult, costly, and time intensive. When creating service system solutions, all of the aspects need to be developed together. The design developed by the student team is an excellent model for helping companies to see the full process and how, in ten weeks, a team can scope out and connect all key elements of a system.

Making University–Industry Innovation Partnerships Work

The Live Well Collaborative at the University of Cincinnati and the Master of Product Development at Carnegie Mellon University are two of many experiments being conducted by companies and universities. In the current global economy, the concept of R&D and funded research has changed. In medical research, NSF is developing the idea of translational research to help get ideas from the lab table to the bedside table faster than ever. Companies are using open source solutions to find external partners to complement their internal R&D and innovation capacity. P&G went from more than 80% internal-driven innovation to 50%. If universities are going to remain competitive and produce graduates ready to step into opportunities, they must be able to stay connected in direct ways that enable academia to contribute and learn about the rapid changes occurring in industry. This model is emerging at universities across the country and throughout the world.

For university–industry innovation collaborations to succeed, the company needs to be engaged, yet not direct or limit the student exploration; instead, the company serves as an advisor to the process. The company needs to have the end target in mind and plan for integrating the aspects that the university explores into the overall design that the company explores, in a holistic and unified manner. The company can also learn from the university research, not only about the aspect of the product that the students develop, but also about how that research can inform the other aspects of the design that the company pursues in sequence or in parallel.

Summary Points

- The Upper Right includes a broad range of products, services, and product–service systems.
- Each breakthrough new product or service is clearly differentiated from the rest of the field.
- An opportunity for innovation partnerships between companies and universities leverages the strengths of each and contributes new capabilities to the other.

Endnotes

1. IDEO designers of the Node were Thomas Overthun, Larry Cheng, Elger Oberwelz, and Joerg Student.
2. J. Heilemann, “Reinventing the Wheel,” *Time* (2 December 2001).
3. W. J. Mitchell, C. Borroni-Bird, and L. Burns, *Reinventing the Automobile: Personal Urban Mobility for the 21st Century* (Cambridge, MA: MIT Press, 2010).
4. For more information, go to www.cmu.edu/mpd.
5. For more information, go to www.livewellcollaborative.org.
6. Students involved with concept design (a) were Bill Bernstein, Derek Blitz, Andrew Kilb, Megan Stanton, and David Wynne. Students involved with concept design (b) were Zachary Beard, Jenny Cargiuolo, and Lisa Troutman. Faculty advisors were Peter Boatwright and Jonathan Cagan.

7. Students involved with concept design were Alisha Budkie, Masha Fedorov, Katie Garber, Andrew Howell, Miguel Sanchez, Emma Sartini, Giulletta Tripoli. Faculty advisors were Chris Allen and Peter Chamberlain.
8. *Ibid.*

Chapter Ten

Case Studies: The Global Power of the Upper Right

In this chapter, we present additional case studies of products and companies that have successfully moved to the Upper Right. This time, however, they are case studies from or about companies across the globe. We include case studies from three of the BRIC countries, highlighting their emerging impact on the marketplace through breakthrough innovation. One of those examples is a global project in which U.S. designers worked in India through a nonprofit to fulfill one of the goals of Victor Papanek's book from the 1970s, *Design for the Real World*, focused on designing for the bottom of the economic pyramid. We also cite Singapore as a country that runs as if it is an integrated innovative company. This chapter supports the ideas of Thomas Friedman's concept of a flat world where innovation is a globally decentralized ability, and it can come from any country, company, or individual. New hybrid models of innovation are emerging around the world. They are challenging and broadening the traditional G7-based global economy.

The BRIC Countries

In 2001, Jim O’Neil, Chief Economist for Goldman Sachs, first conceived of the term *BRIC nations*. He was the first to see Brazil, Russia, India, and China as an economic block and predicted that they would become four pillars of the global economy by 2039. Goldman Sachs soon adopted the concept after O’Neil published an internal paper *Building Better Global Economic BRICs*.¹ Since then, the term has gained global acceptance, and the economies of these four countries continue to grow and influence the global economy and their own growth in the way that O’Neil predicted. In a 2010 article for *Financial Times*,² Gillian Tett wrote that O’Neil saw the similarity in the economies of Brazil, Russia, India, and China. These emerging economies would become a new global force that would change the balance of global economic power in the twenty-first century. All four had large populations, emerging economies, government support for sustained growth, and the interest and ability to interact on a global scale.

Case studies in this chapter reflect the innovation and growth of BRIC countries: Embraer and Positivo from Brazil, Haier in China, and Design Impact, a nonprofit with an initial focus in India. We have also written about Be Green, a company that started in the United States but codeveloped its core material and manufacturing with China. Finally, beyond the BRIC countries, we have written about Singapore, a country with a national initiative in design and innovation.

Brazil: Innovation and Growth in South America

For the last two decades of the twentieth century, Brazil was an unstable country with a volatile economy. A constant flow of articles and news focused on how Brazil was destroying the rainforests. This destruction was viewed as having a global environmental impact and locally destroying the habitat of both its indigenous people and a number of endangered species. That view of Brazil changed dramatically when Curitiba became known as one of the most environmentally responsible cities in the world. The redesign of Curitiba started in the 1970s. By 1990, under a plan started by Jaime Lerner, the city's mayor, the city had become so successful that it was given the United Nations' highest environmental award. The concept developed by Lerner relied on the citizens of the city to participate while given imaginative but low-cost incentives. Curitiba started the shift in the perception of the Brazilian economy and innovation capability. After almost four decades of investing in an ethanol-based fuel economy, Brazil ranks second to the U.S. but has more effectively integrated ethanol into the fuel infrastructure of Brazil. The country has designed flexible-fueled vehicles that can run on a combination of ethanol and gas. What is common to both Embraer and GrupoPositivo is their integration of technology, market strategy, design, and commitment to ethics.

Embraer: Growing One of the World's Largest Airline Manufacturers in Brazil

In the 1990s, under the Collor and Franco governments, privatization increased dramatically. One of the resulting companies was Empresa Brasileira Aeronautica, now known as Embraer. Since then, Embraer has become the fourth-largest manufacturer of aircraft in the world. The company started producing military and agricultural aircraft in 1969. When the company privatized, it shifted its focus to executive and small aircraft for 120 and fewer passengers. Embraer read the SET Factors. The company was not going to compete with Boeing, Airbus, and Bombardier manufacturing large airliners. Embraer also anticipated correctly that regional routes would grow in several parts of the world, requiring smaller, more fuel-efficient aircraft to create more effective use by having fuller aircraft for each flight.

As a company in a BRIC nation, Embraer had the ability to build on its heritage as a government-owned aircraft company focused on military and agricultural aircraft and the emerging aircraft market in Brazil, and then move into international competition. Its two best jets are the EMB-110 Bandeirante, for 19 passengers, and more recently, the EMB-120 Brasilia, for 30 passengers.

Embraer's technical advantage came in the development of subsystems for quality manufacture and its CAD integration throughout manufacturing. The company developed a human resources system that provided a sufficient level of pay and work environment to attract high-quality labor. It also developed a strategy to leverage a government-supported research center and develop appropriate market strategies to compete in global markets.

Embraer understood the need to push the value component based on style (see Figure 10.1). In 2010, Embraer partnered with BMW Designworks USA to design the interior of the Embraer 100 and 300 Phenom executive jets.³ The design has focused on all aspects of the interior and brought sophisticated detailed interior design to the cockpit as well as the passenger area. The steering controls have been elegantly redesigned with an appropriate blend of style and ergonomics. The control panels have been redesigned to reduce visual clutter and deliver an overall design layout with a composition that focuses on the appropriate hierarchy of controls. This design approach has since extended to the design of Embraer's commercial regional jets.



Figure 10.1 Sketch of Embraer plane.

Positivo: Creating a Multinational Computer Manufacturer in Brazil

It is not surprising that the most successful computer company in Brazil can trace its origin to an innovative education program that started in Curitiba in the 1970s. This small business that evolved into GrupoPositivo has three main areas: education, publishing and graphics, and information technology. The company has grown from a single-classroom cottage industry for college prep tutorials in 1972 to a company with more than 3,000 employees. The company is the largest seller of computers in Brazil, and its own laptop is the number one seller in Brazil. Just as Apple has learned to work from the consumer, to the interface, to the product, Positivo has used an education-centric approach to develop its products.

The company built its computer products as an extension of its education content and software, and now sells more than one million units per year. It sells all types of computers but designed them to be economically accessible. Positivo was a

pioneer of the “family PC” concept and plans to deliver computer systems to low economic families with incomes of only about \$270 per month. “Each part of the family, they are a part of the computer,” stated CEO Helio Rotenberg. “There are a lot of families that have the desire to buy their first computer, and now they can.”⁴

In 2011, the company introduced the Positivo Ypy, the first tablet developed exclusively for Brazilian consumers, including digital content in Portuguese. Positivo also began selling their computers in Argentina and captured market leadership there within a few months.⁵ During the last 17 years, Positivo has consistently read the SET Factors to meet the needs of the emerging market in computers, software, and IT for education, corporate, and small and medium businesses.

China: Haier, The First Major Chinese Global Brand

If you look at the list of appliances available in Frank Gehry’s new skyscraper, New York by Gehry, at 8 Spruce Street, Haier appliances are listed alongside Sub Zero, Bosch, and GE products. In 2008, the Haier refrigerator won a Red Dot award, with a specific callout for the U-home interface embedded in the door.⁶ These two benchmarks were the result of more than two decades of work by Haier Group. When Zhang Ruimin became CEO in 1984, he started to slowly build Haier into the global leader it is today. He focused on quality and avoided just being the cheapest in the market. Within 30 years, Haier has gone from the brink of bankruptcy to one of the strongest brands in world. In 2004, a *Fast Company* article about Chinese companies stated, “Haier Group, China’s poster company with strong management and a modern U.S. factory, is the only company close to global scale—but its revenues are just \$9 billion.”⁷ Haier also became the top refrigerator manufacturer in the world that year.

In March 2003, *BusinessWeek* Beijing Bureau Chief Dexter Roberts conducted an interview with Zhang. Zhang discussed why he wanted to compete in established markets in Europe and the U.S. He stated that the challenge for Haier was to meet the standards of these markets and to find ways to compete and differentiate. Just selling products in emerging markets was easier, but this forced the company to improve to compete. When asked about the company’s advertising strategy, Zhang stated that Haier was committed to innovation through design differentiation based on consumer insight. He felt that advertising came second: “If you do not have innovative products, the best ad agency won’t help you.”⁸

Haier’s initial Product Opportunity Gap in the U.S. was focused on refrigerators for students living in college dormitory rooms. Zhang stated that the company saw this as a market where Haier could compete and win, to establish a foothold in the

U.S. market. The company quickly became number one in the college market, thanks to their design and pricing. Haier has been consistently pointed to as one of the few original brands to come from China and compete and expand as a global competitor. We often talk about U.S. firms attempting to gain market share in China. Haier is the first Chinese company to enter the U.S. with a clear brand strategy. For example Haier reached 60% market share for wine coolers in the U.S. when they introduced free-standing models to respond to the need for coolers in living and dining rooms, not just built-ins for wine cellars.

Haier started to export its small refrigerators to the U.S. in the 1990s. The company made a strategic decision to increase sales and breadth of product offerings in the U.S. when it built a state-of-the-art manufacturing facility in Camden, South Carolina. The facility began operation in 2000 and was the first plant built in the U.S. by a China-based company. Zhang stated in the 2003 *BusinessWeek* interview that manufacturing in the U.S. forced Haier to meet the demanding U.S. standards, and this knowledge transferred back to all of Haier's manufacturing facilities. The company has taken an approach similar to that of Sony, Toyota, Panasonic, and Honda, when Japanese companies started competing by being the cheapest. Now all of these companies have strategically built their brand from low end to premium, and have gained significant brand loyalty. Then Toyota moved into the luxury brand with Lexus, and also produced the first popular hybrid, the Prius, as well as the small car brand Scion. LG used to sell products under the name Lucky Goldstar, with its products all competing on price. When the company shifted from Lower Left to Upper Right consumer focused, it rebranded using LG. Haier has now achieved what Japan and Korea have been able to with products featured through the success of the Gehry building and Red Dot. Zhang has always felt that Haier can compete by being the fastest to react to opportunities in the market, turning insights into products faster than the competition: "[T]he positioning strategy of Haier cannot simply be defined as aiming at the medium, low, or high end of a market. Our strategy is to satisfy our consumers as quickly as possible."⁹

The recent news for Haier is focused back in Asia. Haier purchased the Sanyo white goods division from Panasonic in 2011. Haier will move its Asian headquarters and R&D unit to Japan. This purchase is also the first time a Chinese corporation has purchased major business units from a Japanese company. This business decision gives China access to the highly protected Japanese market and allows Haier to sell under the names Haier, Aqua, and Sanyo throughout Asia. It continues to give evidence to the potential power of the BRIC nations' potential impact on the global economy.

Two products are important to discuss as case studies: the Aqua washing machine and the Haier refrigerator sold under the Casarte brand. In May, 2012, Haier announced a new Aqua washing machine design that emulates the traditional hand washboard scrub board. The design contains a plastic molded component that resembles an updated version of the traditional wooden scrub board used in hand-washing clothes (see Figure 10.2). This design is an attempt to connect traditional methods with new technology. Most of Asia is experiencing a rapid transition from an agricultural economy to a manufacturing, then service, and next information economy. Traditional approaches to household responsibilities have been achieved through hand methods using centuries' old products. The product opportunity was in perceiving the need to create a product that connected traditional methods to contemporary appliances.



Figure 10.2 The wooden scrub board and inspired blade from the Aqua washing machine by Haier on the left and the Aqua machine on the right. (With permission of Haier)

The Casarte Brand is a hybrid name connecting home (*Casa*) and art (*arte*) to create an Italian-inspired brand. The three-door refrigerator/freezer design (see Figure 10.3) combines high-end exterior styling with an elegant inside and open design. Haier used new manufacturing methods and quality with an interactive RFID screen that connects to other products and the Internet through its U-Home system. The result is a high-value product that addresses many of the value opportunities around emotion, aesthetics, ergonomics, personality, and quality (see

Figure 10.4).The Red Dot Web site observes the following in describing the positive attributes that won the award for the Refrigerator:

“The independent design concept of this fridge-freezer emphasizes the high functionality of the innovative appliance. ... Only a display, positioned at eye level, indicates the additional value of use: this combination of devices uses the innovative RFID technology, which identifies the stored food and registers the corresponding data. In combination with an internet platform, the user is also able to request online data such as recipes or nutritional analyses. ... [For] the manufacturing process, an especially developed method was applied for this refrigerator, which is also responsible for the strikingly high-grade design of the interior.”¹⁰



Figure 10.3 The Casarte refrigerator/freezer, by Haier. (With permission of Haier)

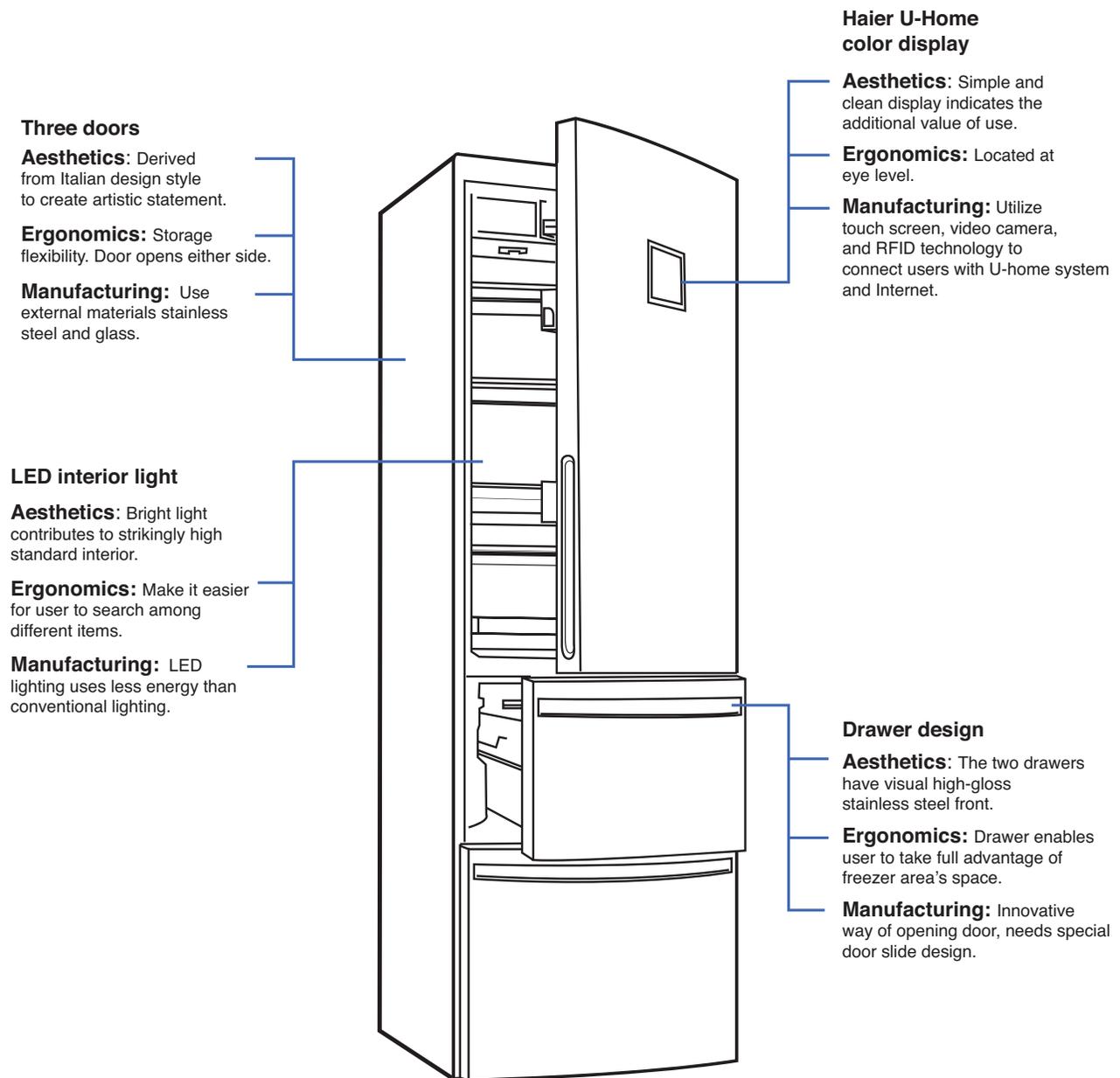


Figure 10.4 Product details of Haier U-Home (Casarte) refrigerator-freezer, with product details integrating style and technology.

In *China's Design Revolution*, Lorraine Justice makes clear that changes in China and their approach to product development have the potential to make China a major player in new product innovation.¹¹ Haier is an example of what is possible. In the last two decades, Haier has emerged to become one of the most successful manufacturers of appliances in the world. It has moved from a Lower Left company to the Upper Right. Haier has moved up the experience economy ladder, from commodity to differentiation, through experience. The company is partnering effectively through open innovation and acquisition. Haier is reading the SET

Factors and making adjustments for every market it chooses to compete in. The company is a benchmark for all Chinese consumer product companies as the country begins its evolution from a supplier to an originator of competitive products, with strategies to compete globally on value, not just price. If you watch any sport show on TV, you are likely to see a Haier commercial. Its tag line is, “you can go Haier (higher)” playing on the pronunciation of the name and the good luck of having a name that has a perfect English homonym. Given the consistent global expansion of the company, it will be interesting to see just how high Haier can go and how soon other companies will follow its lead.

India: Design Impact and Social Responsibility in India

During the second half of the twentieth century, the husband-and-wife team of Charles and Ray Eames were seen as design leaders in a post–World War II economy focused on their furniture, exhibit designs, and films. They were responsible for helping Herman Miller develop the modern design strategy that made them a global leader for high-end furniture in the home and the business environment. They were early proponents of integrating engineering, experimenting with materials, and understanding consumers and how they worked in the office environment. Their films for IBM and Polaroid helped to convey how these companies’ breakthrough products interpreted the SET Factors. In 1972, Victor Papanek wrote *Design for the Real World: Human Ecology and Social Change*, making the argument that designers were designing for the top 10% of the world’s population and neglecting the 90% who needed it.¹² His work was the first step in what has become known as *socially responsible design*. McDonough and Braungart brought this further into consciousness by writing *Cradle to Cradle*.¹³ Kate Hansian and Ramsey Ford have conceived and built Design Impact¹⁴ in the tradition of the aforementioned innovators. After their initial work in India helping to codesign a new method for producing more efficient cooking fuel, they started their second phase. Design Impact now has an educational service whose goal is to attract and educate design interns to work in underdeveloped countries emulating the process they developed.

Hansian and Ford are a complementary team that started their nonprofit company with support from Kaleidoscope, a product design firm, and its CEO, Matt Kornau. Hansian had experience in running a nonprofit, and Ford is an industrial designer who wanted to both start his own company and focus on addressing a global need in an underserved emerging economy, a vision that Hansian shared.

Hansian and Ford decided to start their work in India and chose to work with the Organisation of Development Action and Maintenance (ODAM), based in Tiruchuli, Tamil Nadu. O DAM became the interface and support Design Impact needed in India to find an appropriate context and opportunity to start its first project: food preparation. Women spend significant amounts of time cooking over an open flame. The fuel they used was usually a combination of wood and kerosene, an inefficient and unhealthy resource that produced noxious fumes.

In the area where Design Impact initiated its services, the major economic activity is producing charcoal from trees. However, a considerable amount of charcoal turns into waste during the production process. O DAM decided that it could reuse this waste and combine it with readily available clay soil, pressed into a brick-shape charcoal for domestic cooking. Not only would this process create jobs for villagers, but the briquette could replace the firewood used in homes and could significantly improve the health of the community by reducing indoor air pollution. Thus, O DAM began to develop a press machine, although it did not know how to make this economically viable and was not sure how to convince users to adopt this new product. In this phase, Design Impact came to play. Hansian and Ford not only helped O DAM to develop a new press machine, but they also helped identify the target markets and assisted in delivering the product to those markets. In the beginning, O DAM was looking at only the rural market around the organization. But people in those areas had access to readily available and free wood and did not want to pay extra for charcoal. Design Impact helped shift the target group to urban areas, where people were actually paying for their fuel (see Figure 10.5). The resulting product prevents respiratory illness, appeals to users, and raises the standard of living for those who produce it.



Figure 10.5 Charcoal briquettes made locally in India with the Design Impact briquette maker. (With permission of Design Impact)

Be Green Packaging: *The World Is Flat Meets Cradle to Cradle in Connect+Develop*

Be Green is a success story that merges the best ideas in Friedman’s *The World Is Flat*¹⁵ with McDonough and Braungart’s *Cradle to Cradle*. In two years, the “glocal” company has gone from a small start-up to a successful multinational company and is the first packaging company to get Cradle to Cradle Silver Certification. Its first breakthrough package was made for Genji, Inc., selling sushi in Whole Foods. In 2011, the company won an award for best P&G Connect+Develop (open source) partner from Jeff Weedman, vice president of P&G Global Business Development, when it reduced the plastic in the Gillette Razor package by more than 70%.

Be Green’s eco-social commitment is at the core of its mission, as stated clearly on its Web site:

“Be Green Packaging is a triple bottom line company dedicated to people, planet and profit. This philosophy is embedded in our mission, our goals and in how we measure our success. At Be Green Packaging, we strive to uphold the highest green standards to ensure product quality and performance. We also consider it a priority to maintain a beneficial presence in our local and global communities. We believe our Eco-Social commitments set us apart from our competition and help build a strong foundation for our relationships with our customers, our employees and the community at large.”¹⁶

The raw material was originally sourced from China and is a rapidly renewable fiber that does not require chemical treatment or color additives. The company helped to create a fair trade relationship with the source city in China, increasing the quality of life there. Be Green is also building a manufacturing plant in South Carolina, where it will harvest and process renewable saw grass.

The Value Opportunity for this company is as significant a breakthrough as OXO GoodGrips was for universal/inclusive design. The beige color of the basic package (see Figure 10.6) has shifted inexpensive packaging from white Styrofoam with the eco challenge it presents, to a new ecoaesthetic, with the sensual feel of the material complementing the color. The social impact of the work with China and the environmental impact is significant. As the company continues to develop, it becomes able to make more complex shapes. The growth potential for the company is now endless. One challenge that will be coming is competitive companies who want to get into this area. It will be interesting to see how Be Green's IP will work in defending infringement. On the positive side, its breakthrough should trigger innovation in package recycling in new ways by emerging competitors who will seek to draft off Be Green's success. This case study is similar to OXO, who has both sued competitors and also opened the category of kitchen tools to endless types of innovation that are unique, not to mention the explosion of the use of neoprene. Although neoprene is not as environmentally friendly as the materials in Be Green, the potential for extending the core products is just as strong.



Figure 10.6 Be Green sustainable packaging. (Courtesy of Be Green)

William McDonough often makes the statement that the concept of “away” is no longer valid—it never was. We cannot throw things away in a finite world and atmosphere. Packaging of all types is one of the major offenders of this perception. Several vortexes have formed in the oceans, are collecting the output of our global consumer society, and much of it is from packaging. The approach taken by Be Green begins to make a positive impact in this seemingly inexorable trend of environmental irresponsibility.

DesignSingapore Council: The Third Component from the Little Country That Can

Singapore is committed to transforming its culture from a service economy to an innovation leader in Asia. Singapore is the opposite of a BRIC country; its small size, history of success, and government allows it to make changes faster than larger nations with more natural resources and larger populations. After receiving independence from Malaysia in 1965, Singapore went through a rapid modernization program to become one of the best service manufacturers, banking areas, and shipping ports in Asia. With the growth of the BRIC nations in 2000 and other emerging economies in Asia, the focus on low-end service manufacturing was no longer viable. Using its resources, the government formed the Economic Development Board (EDB) as a front-end structure to grow the economy internally and spur foreign corporations to establish their Asian base in Singapore. The government, education, and business are all strategically integrated to make the small country an innovation culture that both attracts and builds multinational companies. The country is changing its K–12 education structure. It built a new innovation-based pretertiary (middle and high school level) School of the Arts (SOTA). It has a new Singapore University of Technology and Design, developed collaboratively with MIT, which integrates the concept of design and innovation through research and engineering in the university.

The DesignSingapore Council, founded in 2003, is a significant component driving the shift from supplier economy to an innovation culture. The mission of the council is to develop Singapore into a global city for design where design innovation drives economic growth and enhances the quality of life. The Council promotes and develops the design industries as a creative cluster, encourages the

adoption of design by enterprises, and nurtures a climate of co-creation and innovation through design. It is also using design to help its successful medium-size companies become multinational million-dollar-plus corporations. Singapore could be described as Singapore, Inc., and it is now strategically growing on three core strengths. It has a strong economic and business culture that has grown out of its service history and banking base. It has a strong commitment to technology and R&D, evolving from its history of manufacturing, the growth of research universities, and a traditional structure of polytechnics providing practical education programs. The country is essentially an interdisciplinary corporation.

The DesignSingapore Council, the national agency for design in Singapore, supports design, provides innovation education for companies, and communicates examples of successful design through its publications and Web site. In our conversation with Jeffrey Ho, Executive Director of the DesignSingapore Council, Mr. Ho cited Khoo Teck Puat Hospital (KTPH) as an example of a public hospital that has adopted design innovation effectively. Design has been used in a variety of ways to develop a new approach to health care for Singapore citizens. Singapore wants to be seen as a leader in health care in Asia. It has a significant aging population that it describes as 60-plus—because everyone retires at age 62.

Khoo Teck Puat Hospital is part of the Ministry of Health's ambitious effort to upgrade all public hospitals and create new facilities to meet increasing health care needs. Opened in June, 2010, KTPH (see Figure 10.7) is the beginning of an integrated health care hub in the north of Singapore. Designed as both “a hospital in a garden” and “a garden in a hospital,” KTPH challenges the stereotypical view of health care environments. Roof gardens and a community garden are tended by residents living in the area. Wards were deliberately placed at the breeziest sections of the site, for optimal natural ventilation, and the hospital faces an adjacent pond to draw in the surrounding nature. The building's scale and height were designed to integrate into the local neighborhood. Public spaces within the hospital provide a welcoming and inclusive environment for the community.



Figure 10.7 Singapore Khoo Teck Puat Hospital (KTPH). (Courtesy of DesignSingapore Council)

A multidisciplinary innovation team is in place within KTPH, with a mix of clinicians and designers to coordinate further innovation efforts within the organization. KTPH seeks to craft human wellness through design. As one example, the hospital was designed around a simple but effective way-finding approach that ensures direct lines-of-sight from the point of entry to key visitor destinations, making the building easy to understand and move through.

Beyond physical spaces, KTPH has used design to improve its quality of health care delivery and enhance the experiences of patients, again using integrated teams led by doctors who would coordinate with the required specialists. KTPH is also incorporating state-of-the-art technology to enable health care to be delivered off-site through the use of telehealth equipment, increasing the amount of time that doctors can spend with patients without requiring them to travel to the hospital. Design of patient care flow management includes coordination and communication between doctors, pharmacists, and even housekeeping staff so that, after discharge, the rooms can be cleaned and turned around quickly to reduce bottlenecks. In addition, patient flow through the Accident and Emergency department is addressed by prioritizing patients' conditions and sending those with less critical needs to other more appropriate clinics. Bottlenecks are again reduced, allowing more attention and care to be focused on patients who require immediate attention. To manage the patient's expectations during waiting time in the Accident and Emergency department, empathetic touch points (such as blankets and fruits) are provided to patients,

and patients are updated regularly on anticipated wait times to help manage their expectations. Within the hospital, deliberate decisions were made to co-locate related clinics; for example, the geriatric, eye, and diabetes clinics are close to one another so that an elderly patient going for a regular check-up at the geriatric clinic or having his diabetic condition monitored can be referred by the attending doctor to have his eyes checked at the clinic next door.

Finally, KTPH promotes a healthy lifestyle to staff, patients, and the public, with interactive and informative installations in public spaces that engage visitors and patients, such as a means to measure body mass index to motivate overweight people to take steps toward reducing their weight. Another example includes promoting independent living for the elderly within their own homes. The Geriatrics Department established Able Studio to inspire solutions for facilitating everyday living for the elderly. Ideas for improving independence are collected from the public, patients, and staff on a regular basis, and the studio implements the best ideas, to demonstrate how design and creativity can be applied to improve the quality of life for the elderly.

Summary Points

- Breakthrough innovation is rapidly occurring across the globe, redefining the emergence of innovation.
- The BRIC countries are taking an organized approach to create economically viable, socially relevant, and system level approaches to innovation.
- The BRIC countries are fulfilling their projected potential set forth by O'Neil through innovation of new products.
- While BRIC countries are capable of global distribution, their own domestic markets are also growing.

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Chapter Eleven

Where Are They Now?

Even the best breakthrough products need to remain current. Yesterday's breakthroughs can become outdated with new technologies, new social and lifestyle expectations, and lack of evolutionary innovation by the company. This chapter highlights the current state of products featured in the first edition of *Creating Breakthrough Products*. Some products are no longer on the market, some are no longer as popular, and some are as popular as ever.

Changing SET Factors

Many products featured in the first edition of this book did not make it into the current edition. We have tried to keep only the case studies that have evolved in some way, have continued to capture the marketplace, or have not been overly discussed and published since the first edition was released. In some cases, the products became outdated, their technologies cannibalized by new technological inventions. In other cases, we include a more contemporary example. The SET Factors have changed, bringing new trends and new capabilities. When the first edition came out, MP3 technology had been invented, but there was no iPod. Smartphones were just being developed—neither the iPhone nor the Palm Treo (which was cannibalized by the iPhone) had been introduced. There were no jump drives for data storage. There was no significant social media. SUVs were the rage, and the current genre of electric vehicles had not been introduced. Given these and other changes, choosing new case studies and retiring outdated ones made sense.

Two exceptions are the OXO GoodGrips products and the Crown Wave. Both of these were major case studies in the last book, and both still have a strong presence in the marketplace. OXO, in particular, continues to be a leader in kitchenware, with continuous innovation of new products, and the company is used as reference throughout the book. However, we moved both OXO and the Wave to this chapter, to make room for newer, fresher case studies that address the current SET Factors. OXO has been featured and well covered during the last decade; the Wave still sells well but has not evolved significantly at Crown as a product. Instead, Crown has focused its innovation on other lift trucks in the product line.

Here we include a status update on each of the case studies retired from this book. We begin with detailed case studies, updated as available, for the OXO GoodGrips and the Crown Wave; then we summarize the other case studies retired from the first edition.

The OXO GoodGrips Peeler

The kitchen tools designed by OXO GoodGrips won a Design of the Decade Award, presented by the Industrial Designers Society of America (IDSA) and *BusinessWeek* magazine. OXO products have won numerous awards in recognition of their usability, aesthetics, and innovative use of materials. Even after designing more than 850 products, the company continues to win new awards. OXO and its first product, the vegetable peeler, were the subject of a major case study in the first book. It still is a significant example of reading the SET Factors; understanding the competition; identifying how to differentiate and meet the needs, wants, and desires of the customer; and integrating the design team. We moved this case study to the start of this chapter to open up the book to new examples that illustrate breakthrough innovation. Revisiting the basis of the initial success is important, to understand how this company has continued to maintain its competitive edge in the marketplace.

Sam Farber is a successful entrepreneur who has owned several companies. He sensed a product opportunity in the housewares industry. The insight for this opportunity came from his wife, who had developed arthritis in her hands. She liked to cook but found most cooking and food-preparation utensils painful to use. She also found that most of the solutions were ugly and stigmatized the person with disabilities while using them. In addition, these solutions often supplied only minimal relief or support. The opportunity (the POG) was not just to design cooking utensils that were comfortable to hold in your hand; the products also had to set a new aesthetic trend that would not stigmatize the user as “handicapped.” The product with the most opportunity for improvement was the vegetable peeler. The generic peeler (see Figure 11.1, Lower Left) was the technological evolutionary equivalent of the alligator; it had existed since the beginning of the industrial revolution without change. Comfort and dignity were two attributes that Farber recognized were key to making a better cooking utensil. At the same time, peelers low in style but mechanically driven were difficult to use and tended to remove more than just the peel when used, as shown in the Lower Right.

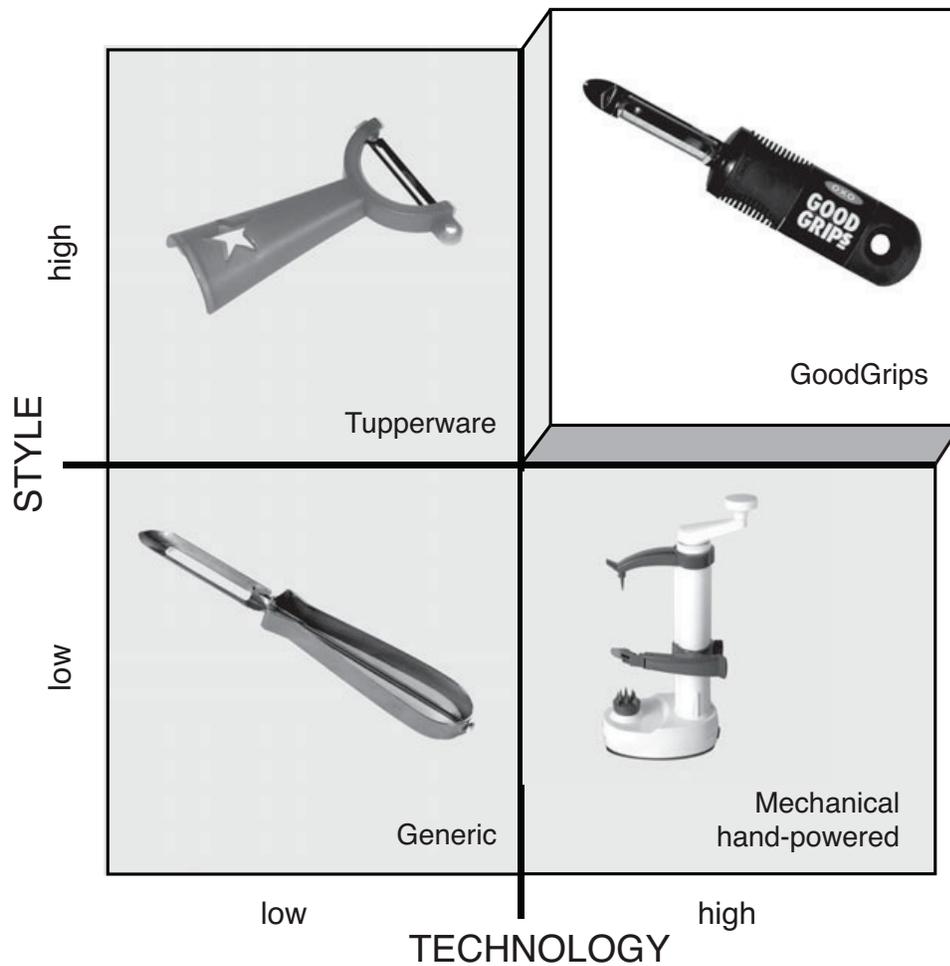


Figure 11.1 OXO Positioning Map.

The OXO peeler (and many of the company’s other products) is an excellent example of looking for opportunities by finding long-standing products that may do the job to the level people are used to, but not to the level that they would truly like. The SET Factors (see Figure 11.2) were right—the public had become sensitive to the needs of people with physical challenges, people with those challenges demanded effective and engaging solutions, and people were not opposed to spending their resources on higher-end kitchens and products to fill them.

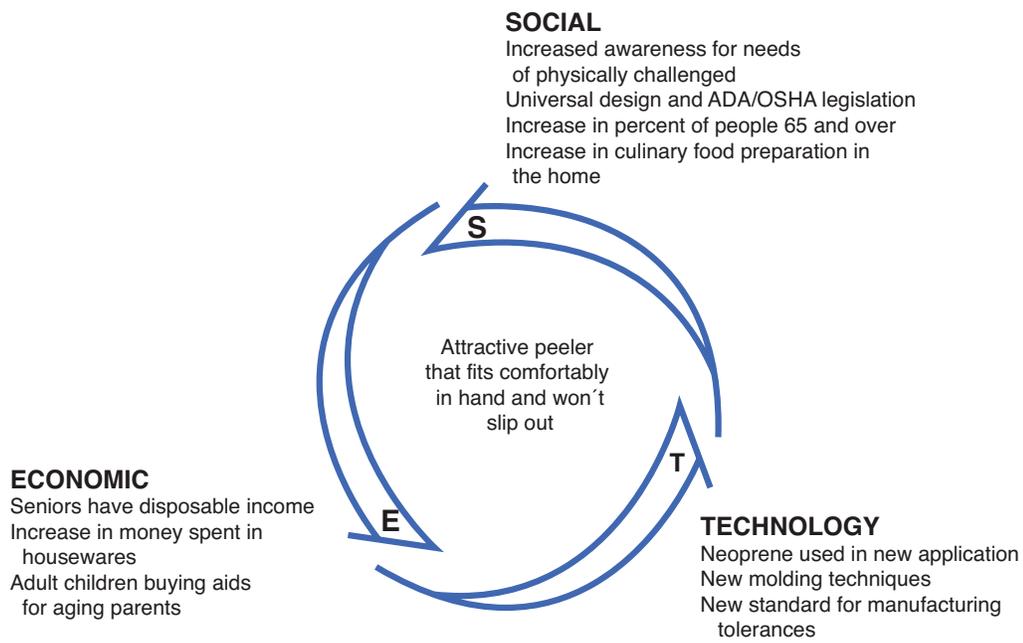


Figure 11.2 SET Factors that led to the GoodGrips peeler.

The product opportunity was translated into several attributes to add value. The product function was already established as useful: A peeler is a necessity for any kitchen. The two major areas for improvement were the limited usability and the ugly “form follows function” nineteenth-century aesthetic of the generic peeler. The product had to be usable by a broad range of people. The handle had to be comfortable to grip for short and long periods of use, and it had to be able to be held securely when wet. The latter feature, in particular, was responsible for the higher costs, so it needed to be perceived as being of much higher quality and innovative. The product had to be desirable. If the product ended up looking clumsy and awkward, the core market would have rejected it. The optimum result was a new aesthetic that would establish a new trend in products for the home and that all potential customers would see as usable and desirable.

Farber partnered with Smart Design to create the GoodGrips peeler (see Figure 11.3). After extensive human factors tests, an ideal overall shape was developed for the handle. The handle shape included fins carved perpendicular to the surface of the handle that allowed the index finger and thumb to fit comfortably around it and added greater control. A suitable material was sought for the handle that would make a comfortable interface between the hand and the peeler and would also provide sufficient friction to prevent the handle from slipping in the hand when wet. The result was to use Santoprene, a neoprene synthetic elastomer with a slight surface friction—soft enough to squeeze, firm enough to keep its overall shape, and capable of being cleaned in the dishwasher.



Figure 11.3 OXO GoodGrips. (Reprinted with permission of Smart Design)

The peeler has attributes that combine aesthetics, ergonomics, ease of manufacture, and optimum use of materials (see Figure 1.16 in Chapter 1, “What Drives New Product Development”). Taking full advantage of the surface friction of Santoprene, the handle was press-fit around a plastic core. The core extended out of the handle to form a protective curve over the blade and ended in a sharp point that can be used to remove potato eyes. The plastic guard also serves as the holder for the metal blade (the only metal part left), and the blade is made out of high-grade metal that is sharper and lasts longer than the blade on the original all-metal version. A final detail was a large counter-sunk hole carved into the end of the handle, to allow owners to hang the peeler on a hook, if they preferred. This hole also added an aesthetic detail that offset the large mass of the handle and, along with the fins, gave the product a contemporary look that appealed to a much broader audience than originally targeted. When looking at the competition, it is clear that OXO defined the new Upper Right for the peeler market (see Figure 11.1).

Consider a Value Opportunity Analysis of the GoodGrips peeler versus the generic metal vegetable peeler (see Figure 11.4). From a Value Opportunity perspective, the generic peeler ranks low in the emotions of independence and confidence, and meets a low level of each ergonomic attribute. The main pros are that it lasts forever (durable) and has reasonably good reliability and craftsmanship. Due to its cheap price, very little profit is realized per item. Companies that make the generic

peeler make money through high sales volume. Although the peeler has been around for more than 100 years, its generic form is made by many nondescript companies and it has not led to any further product lines.

The GoodGrips peeler excels in its ability to meet strong emotion VOs in independence, confidence, and even security, especially for the original target market of elderly or arthritic users. The product also excels in all aspects of ergonomics, identity, core technology, and quality. The GoodGrips product has a very strong social impact, stemming from the success of the handle that enables people to hold the product with a greater sense of security. Finally, an additional part of its success is the result of the highly refined visual and tactile aesthetics. A comparison of the VO Chart for the GoodGrips peeler and the generic peeler explains how OXO is able to charge several times the cost of a generic peeler with great success.

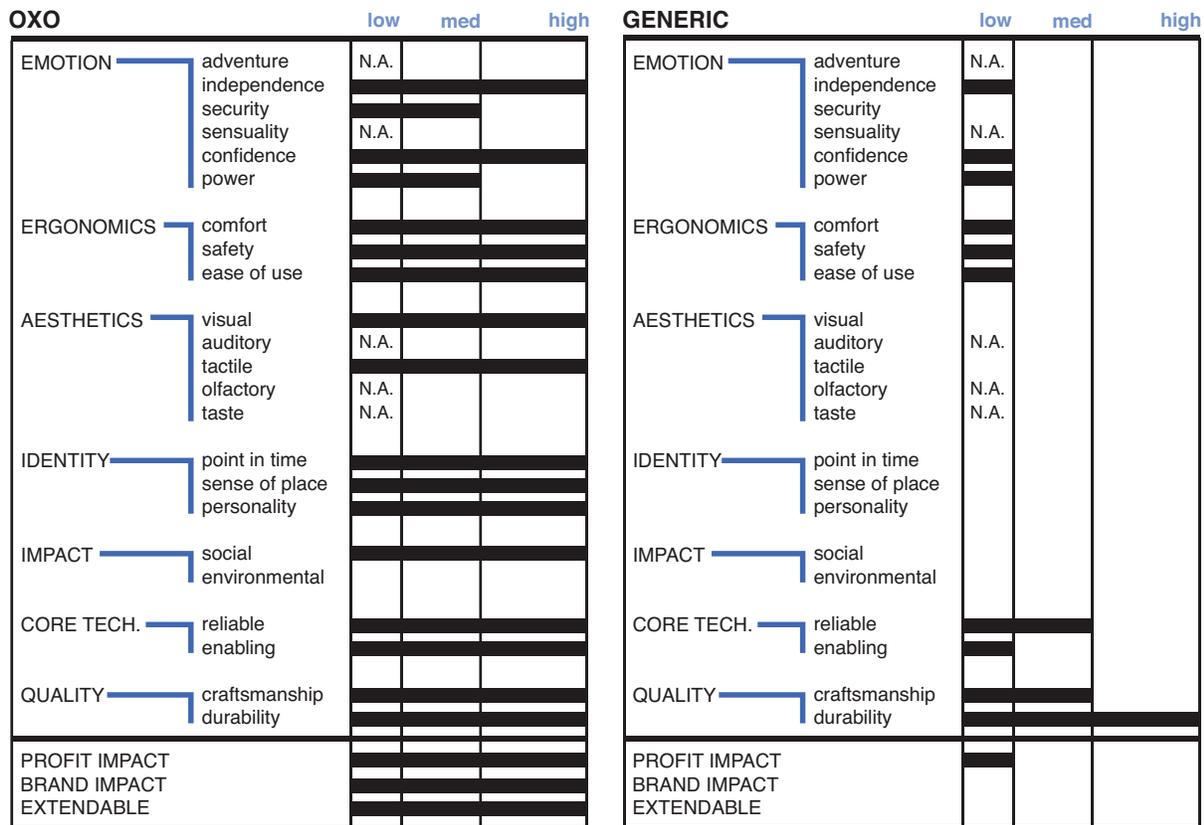


Figure 11.4 Value Opportunity Analysis of GoodGrips peeler versus generic vegetable peeler.

The OXO peeler won numerous awards, and as a result of the positive praise generated by word of mouth, the product was never aggressively advertised. As adult children bought the product for their older parents, they found that they liked the product as well. Younger children found it more fun to use and more comfortable to hold. The market swelled and the momentum grew.

The OXO peeler is also a good example of how one successful product can become a brand strategy that can extend to other hand-held products, including teakettles, salad spinners, cleaning devices, tools, and gardening equipment. Figure 11.5 shows the clever integration of style and technology into the OXO salad spinner, which can spin with the push of a button, allowing use with a single arm or an arthritic hand.

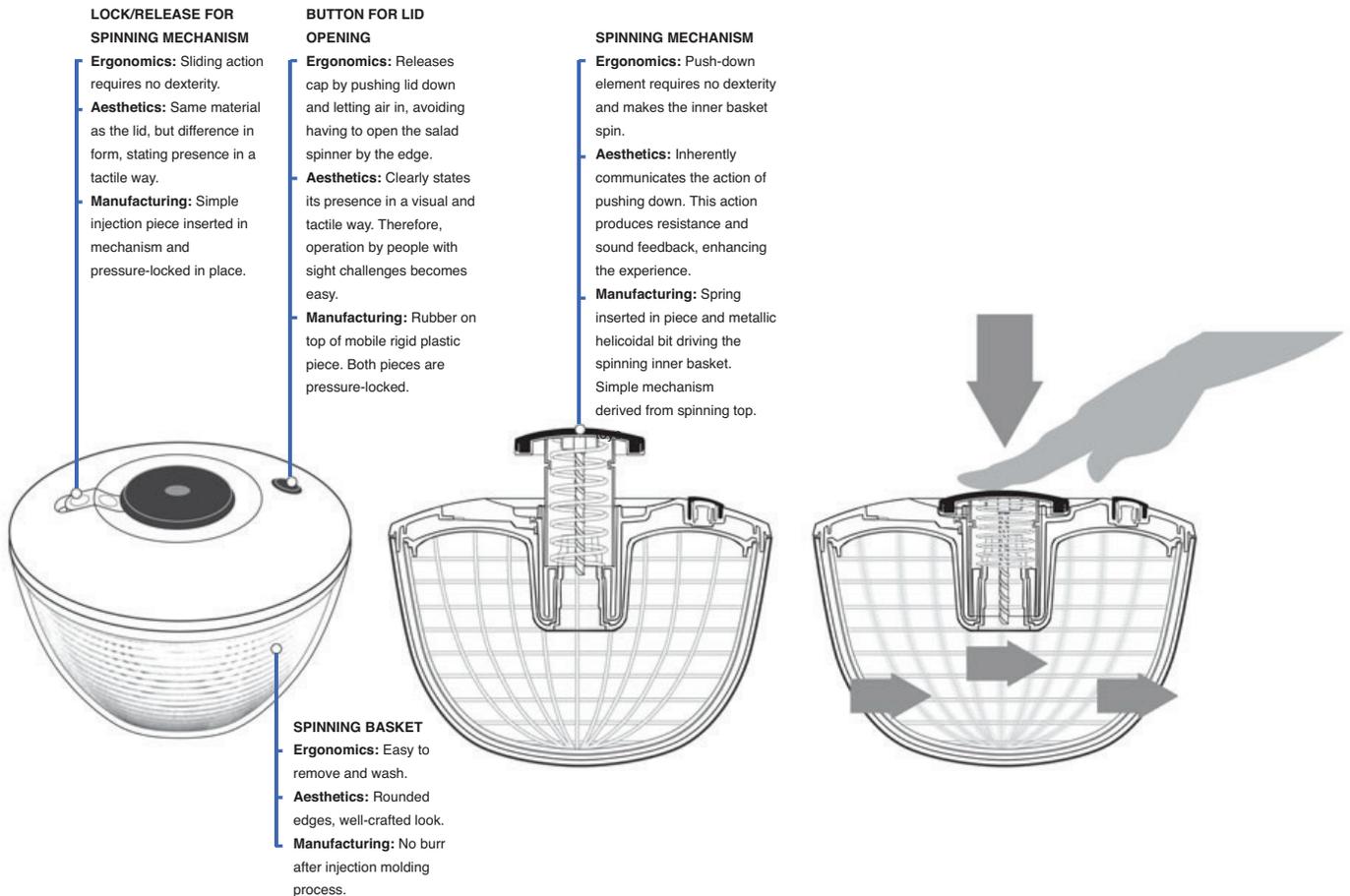


Figure 11.5 Product details of OXO salad spinner, showing integration of style and technology.

After OXO's initial success, a number of other housewares companies tried to copy the successful design (see Figure 2.12). Just about all of them compromised on one of the three aspects of ergonomics, lifestyle, or performance and tried to undersell the GoodGrips. Many that sought to be different attempted to create an artistic expression in the Upper Left (see Figure 11.1), significantly sacrificing the ergonomics and technology.

Sales of the peeler put OXO in the black in the first year. Through good design, the OXO brand has staying power—more than a decade later, it is still a leader in

the kitchenware industry. Combining insight, design, material choice, and manufacturing processes led to the creation of a new product that has since redefined expectations on kitchen utensils.

The Crown Wave

The Wave, developed by Crown Equipment Corporation, is a success story that was featured in the first edition of the book. A decade later, the product is still selling strongly. It is a great illustration of the methods of this book. The Wave, which stands for Work Assist Vehicle (see Figure 11.6), was a breakaway product for Crown and a new product in the lift truck market. Crown management recognized that, at warehouses, the employees had difficulty in using rolling ladders to get parts. At the same time, the SET Factors highlighted that warehouse stores were growing in popularity while costs due to employee injuries were also growing. Crown turned to longtime design consultant Dave Smith to explore this emerging opportunity.



Figure 11.6 Crown Wave: product shot and product in use. (Reprinted with permission of Crown Equipment Company)

A “just in time” mentality put pressure on store managers to maintain an active relationship between storage and retail shelves, with restocking being a constant job, not just for after-store hours. The development of warehouse store interiors with narrow aisles but large shelves and storage typically located on top of those

shelves created the need for new lift equipment that can work effectively while safely operating in areas with customers in retail environments. Employers realized that long-term employees, free of injury, are more invested in the success of a store and can develop better relationships with customers, contributing to a positive atmosphere for consumers, who view shopping as a form of entertainment. During the evolution of the warehouse, storeowners have used a variety of solutions. As noted by Smith, this ranged from roller skates to rolling ladders and running shoes (Lower Left of the Positioning Map—see Figure 11.7). Although they were inexpensive, they were also an exhausting and potentially harmful experience for the stock employee. Higher-tech Lower Right solutions included scissor lift trucks, which were large, cumbersome to operate, annoying and distracting to customers, and expensive to purchase; hydraulic lifts, which were difficult to move; and robots, which were also expensive and difficult to fine-tune. A clear opportunity emerged.

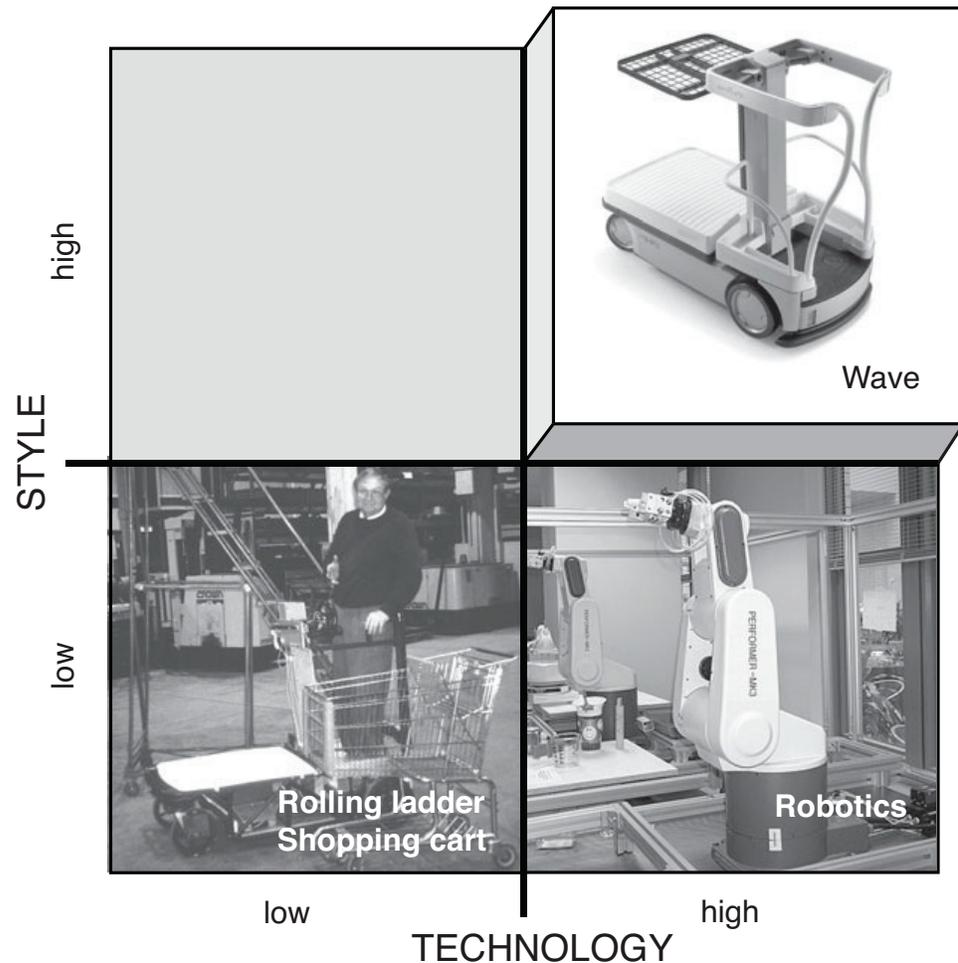


Figure 11.7 Crown Wave Positioning Map. (Image of Wave and lead designer Dave Smith with Lower Left solutions reprinted with permission of Crown Equipment Corporation)

To respond to this new POG, Crown needed to develop an entirely different product. It had to be an extension of Crown's core ability, but at a scale and weight that Crown had not been used to. Dave Smith ran a "skunkworks" offsite interdisciplinary team for ten months to develop the initial product concept. The colocated team consisted of one engineer, two designers, a design intern, and a part-time marketing and manufacturing person. When the product concept was acceptable to both the company and potential customers, the product development process was brought back into Crown for design-to-manufacture. Creating a light-duty lift vehicle that can lift and move an operator with a minimal footprint proved to be a significant challenge for Crown. In addition to the aesthetic design impact (the visual design, product graphics, and choice of material), the team took advantage of emerging technology in the industry to add safety, nimbleness, and control to the design. Innovation came from unusual places, such as borrowing the simple two-finger control mechanism from electric wheelchairs.

A Value Opportunity Analysis of the Wave indicated the need for a series of value-added attributes. The Wave needed to promote high independence, confidence, and adventure, with very high ergonomics, appropriate aesthetics, and a strong product identity. Although the product would cost more, the technology needed to be reliable and high quality, and reduce injury. The Wave also needed to improve employee sense of security and make a series of dull tasks enjoyable and safe.

The Wave (see Figure 11.7, Upper Right) met the value proposition and introduced an original solution targeted with a midpriced, easy-to-use lift device that can maneuver through store aisles and lift a person up to 8 feet in height. The result has surpassed the original projections for the product and created a new market for Crown. Employees in stores and warehouses that use the product are reporting more effective and less stressful completion of their tasks. The product has led to higher morale and job satisfaction and is fun and easy to operate. It has allowed one operator to do a job that previously two people had to do. The Wave has since been used in a variety of new tasks.

Retired Case Studies

Here is an update on the other case studies retired from the first edition:

The Motorola Talkabout (see Figure 11.8) was a wonderful example of integrating style and technology to meet a clear need: family communication. A high-end walkie-talkie with its own frequency range, the Talkabout enables families in

amusement parks or on the ski slopes to stay in contact. Motorola had significant off-shore competition yet did not evolve the technology, capabilities, or interaction experience with the Talkabout. This may have been because of technological evolution: with the proliferation of cellphones and text capabilities, the need for walkie-talkie-like communication became limited. The Talkabout is still for sale, but with the evolution of the SET Factors, it has run its course as a breakthrough product.



Figure 11.8 Motorola Talkabout two-way radio. (Reprinted with permission of Motorola)

The HeadBlade (see Figure 11.9) is a razor designed for people who shave their head. A decade ago, head shaving was in vogue. Today's audience is more limited, yet the HeadBlade is still for sale; recently, one of us saw an ad for it on a display in Manhattan featuring Telly Savalas, the icon of baldness.



Figure 11.9 The HeadBlade. (Reprinted with permission of The HeadBlade Company)

The Zip Drive (see Figure 11.10) was a state-of-the-art approach to external data storage and transfer a decade ago. The IT industry is constantly in rapid evolution as new technologies cause last year's capabilities to be outdated. And so the Zip Drive went the route of breakthrough to junkyard as external flash memory quickly grew to storage levels well beyond the Zip drive's capabilities. The Zip Drive could not survive because it was quickly outdated due to cost, physical size, complexity, and storage capabilities.



Figure 11.10 iomega Zip Drive and disk. (Reprinted with permission of iomega Corporation)

The Herman Miller Aeron Chair (see Figure 11.11) was a breakthrough in seating in the 1990s. A breathable mesh seat with an ergonomic frame, the Aeron came not in secretary, manager, and executive styles, but rather in small hips, medium hips, and large hips sizes. The Aeron represented flat management and the IPO boom of the 1990s. The Aeron is still a popular choice for office seating. Herman Miller's innovation has focused on developing new chairs rather than evolving the Aeron. However, in this version of the book, we present a new innovation in a new area for seating: the Node, by Steelcase, with a focus on the education market.



Figure 11.11 Aeron chair. (Reprinted with permission of Stumpf Weber Associates)

The DynaMyte (see Figure 11.12) augmentative communications device designed by Daedalus Excel (now Daedalus) for Dynavox, was a breakthrough in capabilities for people who cannot speak. The case study is a nice example of how good design can make a technology successful in the marketplace. Dynavox still makes augmentative communication devices.



Figure 11.12 DynaMyte designed by Daedalus. (Reprinted with permission of Daedalus; photos by Larry Rippel)

The Breuer/Tornado Marathon Carpet Cleaner (see Figure 11.13), designed by HLB, was an excellent example of design and technology integration in which the delivery of technology innovation made for an easier and lighter solution for industrial carpet cleaning. The Marathon is still available but has not evolved significantly since its introduction.



Figure 11.13 Marathon cleaner. (Reprinted with permission of Herbst Lazar Bell)

With the Kodak Single Use Camera (see Figure 11.14), Kodak did not see the change in the SET Factors and the future of digital photography. The company, once an icon of American ingenuity, went into bankruptcy at the time of the writing of this edition. Its reusable cameras are still available in tourist locations, but their prominence has become as insignificant as the silver halide technology it uses to make film. Digital camera capabilities in people's smartphones results in higher quality than the 400 ISO film in the reusable cameras. The case study was an illustration of how products can become more sustainable. Sustainability is now more common (in conversation, if not in practice), and the Be Green case study is a more contemporary example of sustainable design.

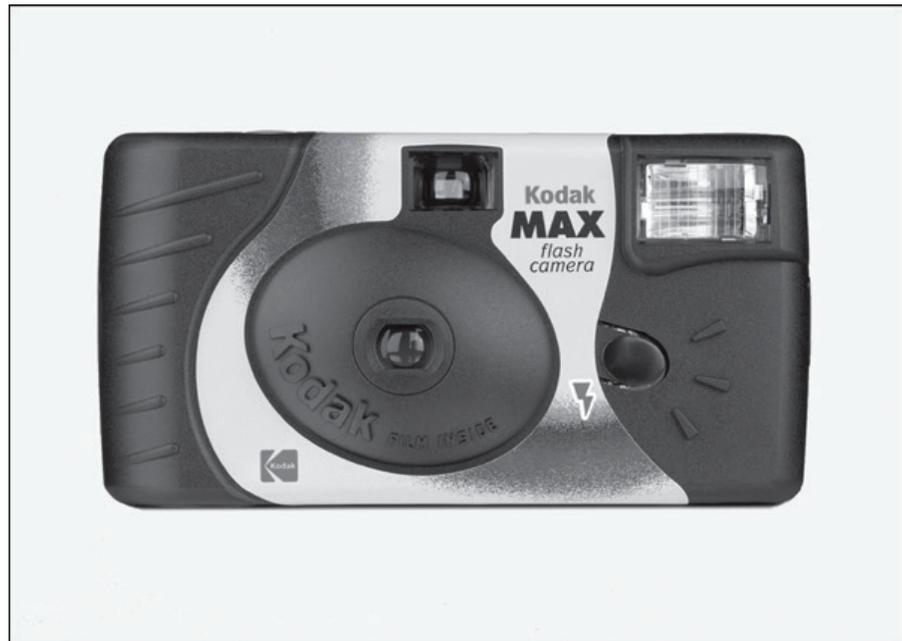


Figure 11.14 Kodak Max Single Use Camera. (Reprinted with permission of the Eastman Kodak Company)

The Black & Decker Snakelight (see Figure 11.15) was a breakthrough in hands-free task lighting and an excellent example of open innovation between the company and its supplier of the flexible core. Off-shore knockoffs and the company's lack of evolution of the product make it an interesting example of how a product can become outdated to the marketplace.



Figure 11.15 Black & Decker Snakelight. (Reprinted with permission of Black & Decker)

The Freeplay Radio (see Figure 11.16) is a product designed to enable underdeveloped communities without electricity to have access to information through a windup radio. The case study is an example of a product able to not only meet that targeted need, but also find crossover into markets in developed nations that sail or camp, or otherwise want a radio that does not need an electrical outlet or battery. Still available, the Freeplay was replaced in this book with Design Impact's charcoal briquette maker for rural India.



Figure 11.16 The Freeplay Radio: product image and internal schemata. (Reprinted with permission of Freeplay Group)

In the area of SUVs, pickup trucks, and minivans, a bit more than a decade ago, the U.S. hadn't experienced 9-11. Fuel prices were low, and consumers thought they would stay that way. Sustainability of the environment was not really a concern to the masses (assuming that it is now), and oil availability was not an issue. The U.S. auto industry was in its heyday; no one imagined GM and Chrysler going into bankruptcy. Americans were buying SUVs, large pickup trucks, and minivans at a growing rate. We had studied the design of the SUV and pickup in a major auto company, and a chapter was devoted to the auto industry. All that has changed, and although people still purchase these vehicles for strategic reasons (instead of buying a large gas-guzzling pickup just because it is cool to do so), in this edition, the SET Factors point to the growth in electric vehicles. Thus, the Leaf and the Volt are discussed in this edition.

A decade ago, the Retro Craze was in. The Mazda Miata (see Figure 11.17) is still available as a sports car at an accessible price. Its design is an excellent example of integrated design for the experience. Even the muffler was engineered for an appropriate sports car sound. Another retro car, the PT Cruiser (see Figure 11.18), didn't enjoy the same staying power. Its retro craze had its peak, and production of the Cruiser came to an end. The PT Cruiser was an early crossover vehicle. Interestingly, it had a strong market in middle-aged women, even though it originally targeted the younger buyer. The VW Beetle (see Figure 11.19), a third retro car, is also still in production a decade later, with a redesign. The car was incredibly popular in the U.S. The Beetle brought the car from the 1960s to Baby Boomers (and others) looking to re-experience their youth.



Figure 11.17 2001 Mazda Miata. (Reprinted with permission of Mazda)



Figure 11.18 Chrysler PT Cruiser. (Reprinted with permission of DaimlerChrysler Corp.)

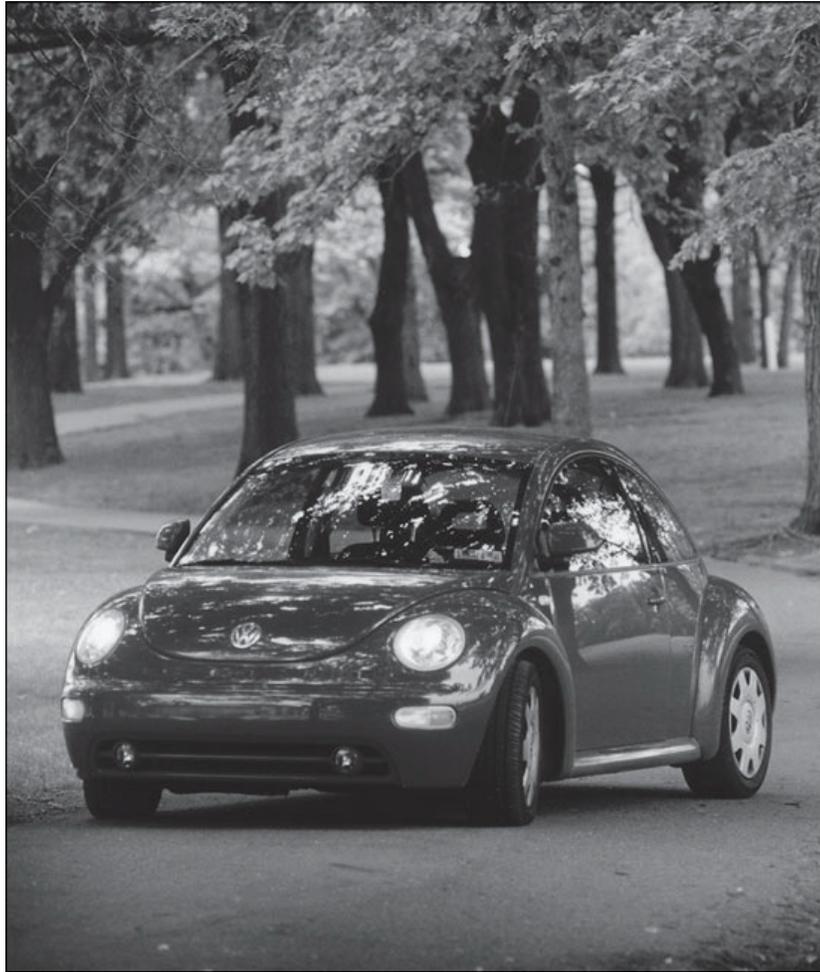


Figure 11.19 VW Beetle. (Photo by Larry Rippel)

As for the Apple iMac (see Figure 11.20), need we say more? The iMac redefined contemporary technological aesthetics in the home and office. The original one brought color into the computer industry and brightened up the office. Each one that followed defined a new aesthetic. The iMac and all of its descendants are still the leader in lifestyle-based computers. Apple innovates over and over again.

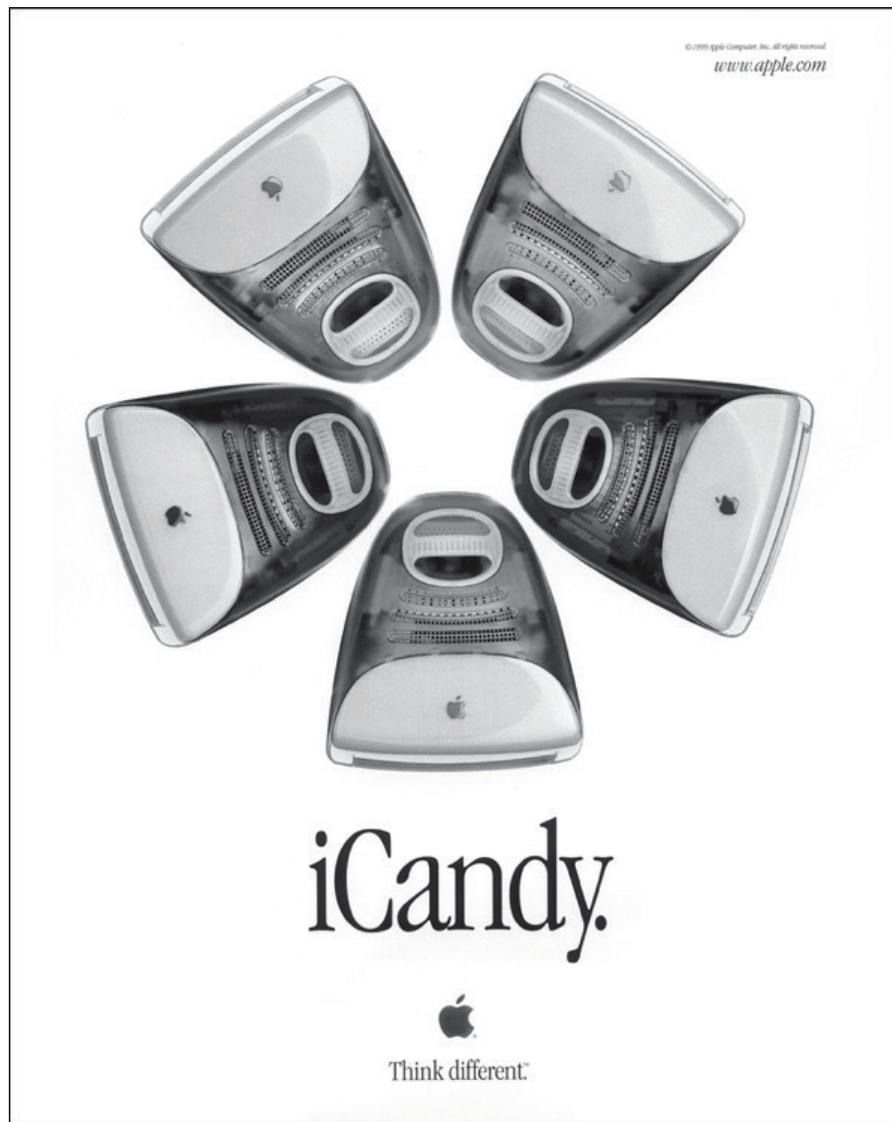


Figure 11.20 The original iMac. (Reprinted with permission of Apple Computer and TBWA Chiat Day)

Summary Points

- Upper Right products and services can remain there only by injecting new innovations that are considered useful, usable, and desirable.
- Even the best breakthrough products can have a limited life if new technologies emerge.
- Breakthrough products can also have a limited life if social and lifestyle expectations change and the product does not accordingly evolve.

Epilogue

Future Innovators

In our various roles as educators, researchers, and consultants, we have been privileged to meet and work with a variety of extremely bright and creative individuals. We have watched people take risks and push their company's comfort zones to develop the next innovation. These innovators have been in a wide variety of industries and at different positions and ages. Innovation is understood to be critical for the future well-being of the U.S. These are the people who will and who are changing the products and technology that people buy and use. Innovation is needed not only in the U.S., but in any developed or developing nation that seeks to maintain or advance its economic well-being and the well-being of the world in which its people live. We hope that the tools, methods, and ideas in this book will help you become the next innovator.

We are seeing a new class of innovators (see Figure E.1). Many are young people in or recently graduated from college. These Echo Boomers have a different outlook and set of goals driving them. As a cohort, they are driven not so much by profit, but rather by society and the world around them. They are interested in being involved in roles with clear social and environmental impact. They also want to do what is possible and have no fear in trying something new. They are comfortable pushing and integrating technology and lifestyle, and envisioning new possibilities. They are comfortable transcending bounds, working across disciplines, and even redefining their own discipline.

Many of these young innovators are entrepreneurial and starting their own company cooperatives. They need a new venture capital model to help them get started. Other young innovators are working in traditional companies and need management to fully empower them to maximize their value and potential. These managers need to recognize that traditional job functions might constrain the innovation they seek in their business. An opportunity also exists for universities to open up educational constraints for collaborative programs that redefine the way designers, engineers, and marketers are taught. The university is where these young innovators will begin to determine what they can and cannot do, what is possible, and how realistic their dreams are.

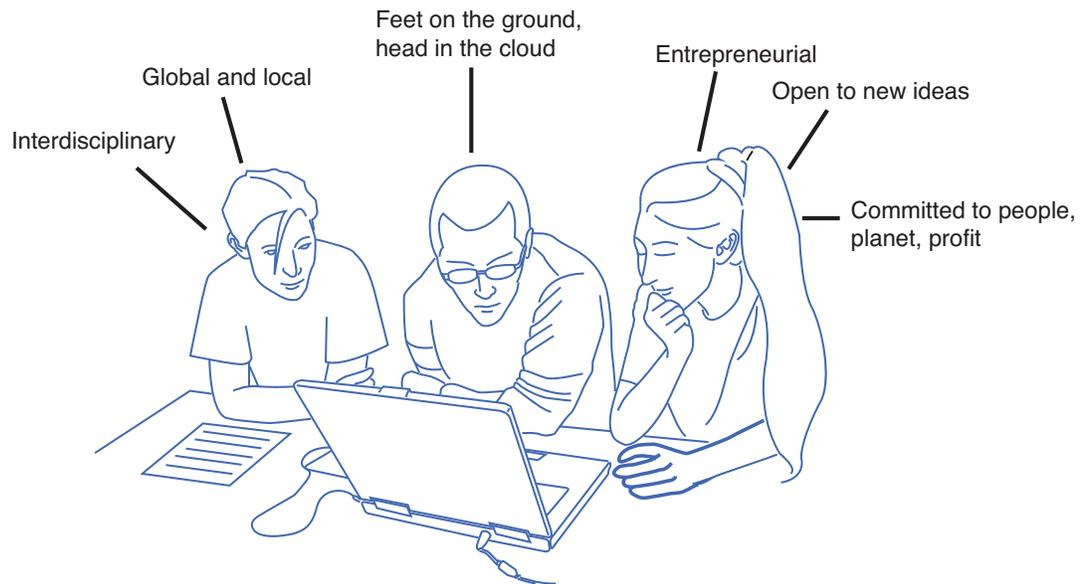


Figure E.1 Characteristics of today's innovator.

At the other end of the spectrum, humans are living longer and also staying in the work force longer. Experienced employees and entrepreneurs have the wisdom to see the entire playing field. We need to develop new structures to take full advantage of the value that people over 65 can bring to the complex problems we face today. In the third tier of workers, we see a percentage dip in the age group of 35–50 in the population of all developed nations. This group is between the Baby Boomers and the Echo Boomers. This means that companies do not have the necessary numbers of midcareer employees to evolve into leadership roles, as was common during the 20th century. Companies need to accelerate young employees to prepare for management roles. Creating the right level of continuing education for both empathic and rational decision making will be key if today's companies are going to continue to stay innovative.

■ At the end of the day consumers of products and services, regardless of age or ability, are not interested in how companies leverage different skill sets. They care about how the result affects the lives they lead and the world they live in.

Regardless of the age of an innovator, as the SET Factors change and new opportunities become promising or new crises strike, innovators will need to design the product, interface, or service that delivers the value proposition that society seeks. In 2008, the National Academy of Engineering proclaimed 14 “Grand Challenges” that must be solved to maintain the quality of life that people expect personally and as a society. These Grand Challenges include making solar energy affordable, providing access to clean water, restoring and improving the urban infrastructure, advancing health informatics, and preventing nuclear terror, among others.¹ Professional design organizations such as the International Council of Societies of Industrial Design have societal goals with an emphasis on universal/inclusive design. From a business point of view, Jim Stengel’s book *Grow*² describes the challenge for marketing to become more consumer driven and to embrace a people, planet, profit approach. It will take a multidisciplinary approach to create useful, usable, and desirable solutions for these and any new critical problems that society addresses. At the end of the day, consumers of products and services, regardless of age or ability, are not interested in how companies leverage these different skill sets. They care about how the result affects the lives they lead and the world they live in. Products and services must be viewed as enabling and empowering by consumers, and that requires the integrated synergy of all the dimensions of a company working in harmony. Achieving those goals is the ultimate challenge.

Have Faith in the Leap

At the end of every movie is a long list of credits. Only a few people stay to watch them. The credits give you a sense of the number and types of people it takes to produce a movie, as well as the location and authorities involved—sometimes whole towns are acknowledged. Next time you get in your car to drive home, think about how many people it takes to produce the product you are driving. The list of people it takes to develop the products you own is as long as the list of people it takes to make a movie. Every product should come with a list of credits, just like movies. Mazda produced a book chronicling the development of the Miata (and was available for purchase as a part from the company).³ The book highlights roughly 70 different people in the back that were instrumental to the development of the car. It is the only publicly available list we have ever been aware of that conveys the range of people required to develop a product.

A movie and a physical product have a lot in common. Both need to make a profit. Both are the result of technical and creative forces working together. The relationship that connects script, actor, camera, director, editor, stunt people, special effects, sound, and music is as complex to manage as any product. Finishing a picture in time and under budget is equally challenging. Both rely on distribution channels and advertising. Movies focus on a target audience and are timed for release at certain key points during the year.

Dreamworks has become particularly adept at identifying and producing movies that are blockbuster hits. Building on the history of the three principals, Dreamworks (particularly Spielberg) produces movies that are in the Upper Right. They combine elements of technical competence, visual/auditory sophistication, quality acting and directing, and the right level of storytelling to captivate and entertain a broad audience base. A shared vision at the top flows down to the director, actors, and crew. The company supports making movies with a balance of cost and quality. It does not make the cheapest movies, yet the studio makes significant profits.

The best products do not only support our lifestyle, but also enhance it and help us create situations in which we reach a state of flow. Whether it is as mundane as shaving or as thrilling as mountain climbing, we are looking for experiences that aid in fulfilling our expectations. Watching an entertaining movie for two hours allows us to escape into a fantasy state of flow. We should be able to achieve the same level of satisfaction while driving a car, riding a mountain bike, or preparing a meal.

■ The ultimate win/win for companies occurs when the people developing the product feel as satisfied with the result and process as the end customer does with the product.

The ultimate win/win for companies occurs when the people developing the product feel as satisfied with the result and process as the end customer does with the product. The goal of companies should be to not only develop successful new products, but to also replicate successful product programs. Methods create clarity and allow for communication and vision that produces the emotional element to inspire people to do great things. The best programs combine these attributes to push people to places they never thought possible and to position the result of their labors in the Upper Right.

This book has been a proof of process. It was based on the idea that a book needed to explain how to navigate the Fuzzy Front End of new product development (our POG). We did our research with a target audience in mind. We developed a network of lead users and expert advisors. We wrote prototypes and put them out for review and feedback. We then reworked the book in several iterations until we felt that it was complete. Finishing this book required the participation and support of

a number of people. They are listed in our credits, the book's Acknowledgments. The book has impacted the product development process, both directly and indirectly, in companies and universities across the globe. The first revolutionary innovation (aka edition) had strong staying power. However, to remain in the Upper Right, the book needed some evolutionary input. The result is this second edition. We hope that it has the same impact and the same staying power that the first edition had.

Developing Upper Right products is exciting and rewarding. Any company can succeed in doing so if it makes a commitment to the process. We hope that you find this book relevant and useful. We now see the world through the eyes of the Upper Right, identifying breakthrough products that are differentiated from the competition through the merging of style, technology, and value. You will see the world this way, too, when it becomes a part of your way of thinking about product development. Good luck in the process—and remember, have faith in the leap; it's not a leap of faith.

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