

Developing Products People Love



FINANCIAL TIMES
Prentice Hall

CREATING BREAKTHROUGH PRODUCTS

INNOVATION FROM PRODUCT PLANNING
TO PROGRAM APPROVAL



JONATHAN CAGAN • CRAIG M. VOGEL

Foreword by Bruce Nussbaum

Invention is 1% inspiration and 99% perspiration.
—Thomas Edison

The same can be said for 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.

Creating Breakthrough Products

Innovation from Product Planning to Program Approval



FINANCIAL TIMES

Prentice Hall

In an increasingly competitive world, it is quality of thinking that gives an edge—an idea that opens new doors, a technique that solves a problem, or an insight that simply helps make sense of it all.

We work with leading authors in the various arenas of business and finance to bring cutting-edge thinking and best learning practice to a global market.

It is our goal to create world-class print publications and electronic products that give readers knowledge and understanding which can then be applied, whether studying or at work.

To find out more about our business products, you can visit us at www.ft-ph.com

Pearson
Education

Creating Breakthrough Products

Innovation from Product Planning
to Program Approval

Jonathan Cagan | Craig M. Vogel

Foreword by Bruce Nussbaum



Prentice Hall PTR
Upper Saddle River, NJ 07458
www.ft-ph.com

Library of Congress Cataloging-in-Publication Data

A CIP catalog record for this book can be obtained from the Library of Congress.

Editorial/Production Supervision: *Patti Guerrieri*
Acquisitions Editor: *Jim Boyd*
Editorial Assistant: *Allyson Kloss*
Marketing Manager: *TC Leszczynski*
Buyer: *Maura Zaldivar*
Cover Design: *Nina Scuderi*
Cover Design Director: *Jerry Votta*
Art Director: *Gail Cocker-Bogusz*
Interior Design: *Meg Van Arsdale*
Cover Photography: *Larry Rippel*



© 2002 Prentice Hall PTR
Prentice-Hall, Inc.
Upper Saddle River, NJ 07458

The publisher offers discounts on this book when ordered in bulk quantities.
For more information, contact
Corporate Sales Department
Prentice Hall PTR
One Lake Street
Upper Saddle River, NJ 07458
Phone: 800-382-3419; FAX: 201-236-7141
E-mail (Internet): corpsales@prenhall.com

All rights reserved. No part of this book may be reproduced, in any form or by any means, without permission in writing from the publisher.

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

ISBN 0-13-969694-6

Pearson Education LTD.
Pearson Education Australia PTY, Limited
Pearson Education Singapore, Pte. Ltd.
Pearson Education North Asia Ltd.
Pearson Education Canada, Ltd.
Pearson Educación de México, S.A. de C.V.
Pearson Education—Japan
Pearson Education Malaysia, Pte. Ltd.

FINANCIAL TIMES PRENTICE HALL BOOKS

For more information, please go to www.ft-ph.com

Deirdre Breakenridge

Cyberbranding: Brand Building in the Digital Economy

Jonathan Cagan and Craig M. Vogel

Creating Breakthrough Products: Innovation from Product Planning to Program Approval

Subir Chowdhury

The Talent Era: Strategies for Achieving a High Return on Talent

Sherry Cooper

Ride the Wave: Taking Control in a Turbulent Financial Age

James W. Cortada

21st Century Business: Managing and Working in the New Digital Economy

James W. Cortada

Making the Information Society: Experience, Consequences, and Possibilities

Aswath Damodaran

The Dark Side of Valuation: Valuing Old Tech, New Tech, and New Economy Companies

Nicholas Evans

Business Agility: Strategies for Gaining Competitive Advantage through Mobile Business Solutions

David Gladstone and Laura Gladstone

Venture Capital Handbook: An Entrepreneur's Guide to Raising Venture Capital, Revised and Updated

David R. Henderson

Joy of Freedom: An Economist's Odyssey

Dale Neef

E-procurement: From Strategy to Implementation

John R. Nofsinger

Investment Madness: How Psychology Affects Your Investing... And What to Do About It

Jonathan Wight

Saving Adam Smith: A Tale of Wealth, Transformation, and Virtue

Yoram J. Wind and Vijay Mahajan, with Robert Gunther

Convergence Marketing: Strategies for Reaching the New Hybrid Consumer

To DéDé Greenberg and Leslie Frank Cagan

for their support and perseverance

Contents

	Foreword	xvii
	Preface	xxi
	Acknowledgments	xxvii
	Glossary of Acronymns and Terms	xxxii
	Part One The Argument	1
Chapter One	What Drives New Product Development	2
	Redefining the Bottom Line	3
	Positioning Breakthrough Products	5
	Products and Services	7
	Identifying Product Opportunities: The SET Factors	9
	POG and SET Factor Case Studies	12
	The OXO GoodGrips Peeler	14
	The Motorola Talkabout	18
	The Crown Wave	22
	Starbucks	26
	Summary Points	31
	References	31

Chapter Two

Moving to the Upper Right

32

Integrating Style and Technology	33
Style vs. Technology: A Brief History of the Evolution of Style and Technology in the 19th and 20th Centuries	36
In the Beginning	36
The Growth of Consumer Culture	36
The Introduction of Style to Mass Production	38
Post World War II Growth of the Middle Class and the Height of Mass Marketing	40
The Rise of Consumer Awareness and the End of Mass Marketing	41
The Era of Customer Value, Mass Customization, and the Global Economy	42
Positioning Map: Style vs. Technology	43
Lower Left: Low Use of Style and Technology	43
Lower Right: Low Use of Style, High Use of Technology	44
Upper Left: High Use of Style, Low Use of Technology	45
Upper Right: High Use of Style and Technology	45
Positioning Map of OXO GoodGrips	46
Positioning Map of Motorola Talkabout	48
Positioning Map of Crown Wave	48
Positioning Map of Starbucks	49
Knockoffs and Rip-offs	50
Revolutionary vs. Evolutionary Product Development	51
Summary Points	53
References	53

Chapter Three

The Upper Right: The Value Quadrant

54

The Sheer Cliff of Value—The Third Dimension	55
The Shift in the Concept of Value in Products and Services	56
Qualities and a Customer's Value System: Cost vs. Value	59
Value Opportunities	62
Emotion	63
Aesthetics	64
Product Identity	64
Impact	65
Ergonomics	65
Core Technology	68
Quality	68
Value Opportunity Charts and Analysis	69
VOA of OXO GoodGrips	71
VOA of Motorola Talkabout	73

VOA of Crown Wave	75
VOA of Starbucks	77
The Time and Place for Value Opportunities	78
VOs and Product Goals	79
The Upper Right for Industrial Products	79
Summary Points	82
References	83

Chapter Four The Core of a Successful Brand Strategy: Breakthrough Products and Services 84

Brand Strategy and Product Strategy	85
Corporate Commitment to Product and Brand	88
Corporate Values and Customer Values	91
Managing Product Brand	92
Building an Identity	92
Company Identity vs. Product Identity	93
Building Brand vs. Maintaining Brand	95
Starting from Scratch: Iomega	96
Maintaining an Established Identity: Harley	99
Brand and the Value Opportunities	101
Summary Points	103
References	103

Part Two The Process 105

Chapter Five A Comprehensive Approach to User-Centered, Integrated New Product Development 106

Clarifying the Fuzzy Front End of New Product Development	107
A New Way of Thinking	108
iNPD Is Only Part of the Process	109
User-Centered iNPD Process	110
Resource Allocation	132
Allocating the Time Resource: Scheduling	134
Allocating the Cost Resource: Financing	134
Allocating the Human Resource: Team Selection	135
Summary Points	136
References	136

Chapter Six Integrating Disciplines and Managing Diverse Teams 138

User-Centered iNPD Facilitates Customer Value	139
Understanding Perceptual Gaps	142
Team Functionality	146
Team Collaboration	146
Negotiation in the Design Process	148
Team Performance	150
Part Differentiation Matrix	153
Team Conflict and the PDM	160
PDM and the Role of Core Disciplines	162
Issues in Team Management: Team Empowerment	163
Understand the Corporate Mission	164
Serve as a Catalyst and Filter	164
Be Unbiased	165
Empower and Support the Team	166
Let the Team Become the Experts	167
Recognize the Personality and Needs of the Team	167
Use of an Interests-Based Management Approach	168
Visionaries and Champions	169
Summary: The Empowered Team	170
iNPD Team Integration Effectiveness	171
Summary Points	172
References	172

Chapter Seven Understanding the User's Needs, Wants, and Desires 174

Overview: Usability and Desirability	175
An Integrated Approach to a User-Driven Process	180
Scenario Development (Part I)	181
New Product Ethnography	183
Using Ethnography to Understand Customers at Polaroid	188
Lifestyle Reference	190
Ergonomics: Interaction, Task Analysis, and Anthropometrics	192
Interaction	192
Task Analysis	194
Anthropometrics	197
Scenario Development (Part II)	201
Broadening the Focus	203
Other Stakeholders	203
Identifying Users in Non-Consumer	
Products: Designing Parts Within Products	204
Product Definition	205
Visualizing Ideas and Concepts Early and Often	206

	Summary Points	210
	References	211
	Research Acknowledgements	211
	Part Three Further Evidence	213
Chapter Eight	Case Studies: The Power of the Upper Right	214
	Overview of Case Studies	215
	Baseball Moving to the Upper Right	216
	Black & Decker SnakeLight™	218
	Marathon Carpet Cleaner Designed by Herbst Lazar Bell (HLB)	228
	DynaMyte Augmentative Communicator by DynaVox Systems and Daedalus Excel Product Development	231
	Service Industry: UPS Moves Beyond the Package Delivery Industry	238
	Herman Miller Aeron Chair	242
	Apple iMac	248
	Freeplay Radio	251
	Summary Points	253
	References	253
Chapter Nine	Automotive Design: Product Differentiation through User-Centered iNPD	254
	The Dynamic SET Factors of the Auto Industry	255
	The Design Process and Complexities	257
	Breaking Down the Process	260
	Door System	263
	Rear Wiper System for Lincoln Navigator/Ford Expedition	263
	Positioning: Move to the Upper Right	266
	The Move of the SUVs	266
	The Retro Craze	268
	Positioning: Segmentation through Ethnography for Compact Truck Segmentation	275
	Positioning: After-Market Products for Trucks — A Case Study of iNPD at Carnegie Mellon University	277
	SideWinder: Side Worktable	279
	MasterRack: Reconfigurable Rail Storage	280
	NoFuss: Camping Storage System with Rail Guide Technology	282
	Implications of User-Centered iNPD on the Auto Industry	283
	Summary Points	286
	References	286
	Research Acknowledgments	287

Epilogue	289
Future Trends	289
Have Faith in the Leap	292
References	294
Index	295

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. Interpreting these SET Factors leads to the identification of Product Opportunity Gaps 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 and services.

Redefining the Bottom Line

This book introduces ideas and methods for companies that want to be market leaders through the development of breakthrough products. Breakthrough products create new or redefine existing markets, 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 that permeates 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.

There are many companies that 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 jump to a focus on one product concept that they think will become a marketable product if it meets manufacturing quality standards. Product development in this way succeeds only by chance. By failing to maximize the Fuzzy Front End, these well-manufactured products fail in the market because they do not respond to customer's 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 will help you climb through the Fuzzy Front End of the product development process and will give you the tools that make your product more likely to succeed in the marketplace.

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

There are a number of challenges that 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, while companies are trying to realize their stated goals in sales and profit projections, they are also trying to resolve the following issues:

- Finding the right opportunities for new products and appropriate innovation to improve existing products;
- Designing products and services that customers perceive as truly valuable by appropriate integration of style and technology;
- 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;

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

To be successful in meeting these challenges, a shared vision must flow from top management through middle and lower management down to individual members of product development teams. While 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 three decades. During the 1980s and early '90s, 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 has 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. But if, however, a product does not connect with the values of consumers, it will fail.

■ Form and function must fulfill fantasy.

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 excitement and security of driving in an SUV, the comfort and effectiveness of cooking in the kitchen, the relaxation and escapism of sipping coffee in a coffeehouse, or the independence and adventure of using a two-way communication 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 is it that makes some product programs fail and others succeed? How did Black & Decker corner the flashlight market from 1994 to 1997 with a product called the SnakeLight? How could OXO evolve from a single product, GoodGrips, to a full line of products, a significant market penetration, the most prominently displayed product line in stores that carry the OXO line, and reinvent the profit margins in the industry?

How could Motorola develop a major presence in the consumer product category with the hit of one new product, the Talkabout? How could Starbucks, initially a small coffee house in Seattle, reinvent how Americans drink coffee and turn a 50 cent cup o' Joe into a \$3.00 Café Latte Grande (make that skim milk)? How could car companies look to the past for ideas that would sell so effectively in the present, as they did starting with the Mazda Miata, following with the Volkswagen Beetle, and continuing with the Chrysler PT Cruiser?

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 (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 the place to which a company must move and be positioned in order to best differentiate itself from the competition and to succeed. All of the breakthrough products mentioned above 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 will help you get there. We call this approach *Moving to the Upper Right*.

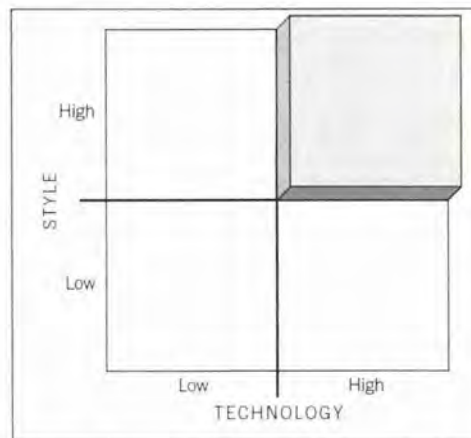


Figure 1.1 Positioning Map of style versus technology; great products are value-driven and found in the Upper Right.

Products and Services

This book primarily focuses on physical products. Products succeed when they play a major role in creating optimal experiences for customers. Service companies need to provide support that optimizes experiences as well. We recognize that the development and realization of products and services require similar approaches. In order to be successful, it is necessary that both approaches utilize the integration of a number of areas of expertise, and a solid understanding of the customer and their desired experience.

A *product* is a device that provides 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” (now “the digital document company”). The service they provide is the production of documents, which they do by producing printing and copying equipment. A *service* is an activity that enhances experience; it 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; one of the highest profit areas for GM is, however, financing automobile purchases, which is a service. Where would UPS, a delivery service, be without their brown trucks, jets, and information management products? We will discuss both products and services in this book, for the issues that make a product or service successful are the same. Both products and services are connected to 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. The number of people and resources that must be brought together to produce a successful product is enormous. 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 man-hours went into the identification, planning, development, production, distribution, and sales. Understanding of the customer can easily be lost in the product development programs in large companies as secondary factors come to dominate decisions about cost, features, and form. While small companies have a better chance of keeping the customer in the loop throughout the process, 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 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). 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. While corporate mission, strategic planning, advertising, and identity programs are all essential, they cannot offset weak, non-competitive products or services.

We have found that there are three key factors that must be present to guarantee the highest potential of success.

■ In order for products to be successful, they must have features and forms that consumers quickly recognize as useful, usable, and desirable.

- 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.
- The 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. In order for products to be successful, they must have features and forms that consumers quickly recognize as *useful, usable, and desirable*.
- Third is a true integration of engineering, industrial 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.

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 trends of the '80s and early '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."

While a number of companies claim they use a customer-centered interdisciplinary approach, 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. In order to stay competitive, they must integrate the way designers, engineers, market

researchers, and market strategists work. Corporations can no longer just rely on large statistical surveys or just search for applications for promising technologies. Instead, qualitative research tools have proven to be an excellent source for deep understanding of the potential customer and product opportunities. This new trend 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

The identification of product opportunities should be the core force that drives 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 consumers and is perceived as useful, useable, and desirable. No one asked for a SnakeLight before it came out and no one in the auto industry expected the success of the Mazda Miata. 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).

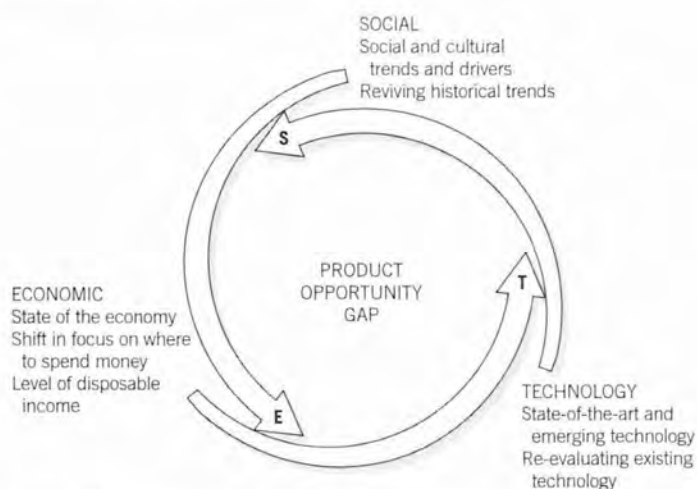


Figure 1.2 Scanning SET Factors leads to POGs.

The Social factors focus on culture and social interaction. The Social factors include

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; every film, however, must hold a person's attention to succeed. 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 theatres and 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 (e.g., the number of single parents with two jobs or double income households with flexible hours),
- health issues (e.g., people living longer with more active lives),
- the use of computers and the Internet,
- political environments,
- successful products in other fields,
- sports and recreation (e.g., X-generation snow boarders creating a new "loose fitting grunge wear" fashion aesthetic and lifestyle),
- sporting events (e.g., the emergence of new, retro state-of-the-art facilities and the athletes who perform in them),
- the entertainment industries including film and television,
- vacation environments (e.g., the fantasy fulfillment provided by Disney World, Las Vegas, and Club Med),
- books (e.g., the Oprah Book Club),
- magazines, and
- music (e.g., from hip-hop to new classic-chic).

ECONOMIC FACTOR: THE '90S BOOM

The economic boom in the 1990s created multi-millionaires overnight through IPOs, stock options, and individual investment in the stock market. Excess disposable cash left a void in material goods meeting the expectations of this young, geeky, intelligent, socially responsible, technology-oriented—and rich—new group of consumers. Recreational SUVs, clothing, and products, PDAs that connect through the web for constant stock price monitoring, and the proliferation of coffee houses until there are half a dozen in one block are all outcrops of this excess and available, lifestyle-directed cash. As the economy goes through a downturn, people's attitudes about spending will shift.

The second major SET Factor is Economics. The economic factors focus on excess income that people perceive they have, or that they expect to have, to give them purchasing power. We call this *psycheconometrics*, namely 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.

TECHNOLOGY FACTORS: COMPUTERS TO GENETICS

Fifty years after the first computers cranked out calculations to help the U.S. win WWII, the always-increasing power and speed of each month's latest PC chip (at the time of this writing we're at 1.5 Gig) has brought computing into every part of modern life, from the home PC to the car transmission to the oven to the stereo. The latest technologies, from micro-electromechanical 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 promise to open up a new century of technological advancement, new products, and new influences on and potential improvements in lifestyle.

■ 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 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 and mechanical innovations, aerospace and military technologies, film and sports entertainment technologies, and micro- and bio-technologies.

This SET of factors generates 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 and a product that comes out either too early or too late can fail even if the opportunity was there 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 the Pacer incorporated became the goal of all car manufacturers in the two decades that followed. The Apple Newton was an early PDA with many of the attributes of PDAs 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 US automotive industry's failure to understand the potential growth in small, well-made, fuel-efficient cars, which allowed Japanese car manufacturers to dominate the 4- and 6-cylinder engine car market for decades. Even today, American car manufacturers generate their profits from small trucks and SUVs, rather than the smaller fuel-efficient vehicles.

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 attributes of use and usability will determine the lifetime of the product. Las Vegas has continued to be successful by complementing the fantasy and dreams of gambling with the quality of a family amusement park; Disney World 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 drink for an entire century while Tang (the drink

of astronauts) was a hit when NASA was a major cultural influence and has now been replaced by Michael Jordan and Gatorade. Barbie has lasted decades; the Cabbage Patch Dolls frenzy lasted for only a few years.

SET FACTORS: GM IN THE '50s

The Post WWII 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 large 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.

SET FACTORS: HEAD SHAVING

In the 1970s, the Beatles and other rock groups let their hair down and soon men everywhere were growing their hair down to their shoulders. This was part of a cultural revolution. But in the last three decades the situation has completely reversed. Why are more men suddenly shaving their heads? The trend started with Michael Jordan and other major athletes. This hairstyle was supported by an X-generation trend toward a more active lifestyle in which long hair became a nuisance. Now anyone can shave their head and "be like Mike" ... and Shaq and Agassi and Jessie Ventura and the list goes on. It should not be a surprise that this Product Opportunity Gap was filled recently by the HeadBlade, a razor designed specifically for shaving heads (see Figure 1.4).

Changes in the SET Factors produce Product Opportunity Gaps (POGs). Once a POG is identified, 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 is the Apple iMac. By integrating the monitor and CPU, and by using translucent plastic combined with a variety of bright candy colors, the iMac has become easier and more fun to use than other computer. Offices and homes look sharp with an iMac on the desk, setup is a breeze, and cable management issues have all but disappeared.

You may 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 user's views is critical to the development of successful products. The SET Factors identify POGs for a targeted user group; that target may 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 studies also give a brief introduction to the issues laid out in the rest of the book and we will 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. While all products in this book are on the market at the time of this writing, some have recently been introduced while others have established an impressive run of market success.



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



Figure 1.4 The HeadBlade. (Reprinted with permission of The HeadBlade Company.)

The OXO GoodGrips Peeler

The kitchen tools designed by OXO GoodGrips were recently awarded a "Design of the Decade" Award by the Industrial Designers Society of America (IDSA) and *BusinessWeek* magazine. These products have won numerous awards in recognition of their usability, aesthetics, and innovative use of materials. Even after designing 350 products, the company continues to win new awards every year. It is important to revisit the basis of the initial success 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 there was 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 that most cooking and food preparation utensils were painful to use. She also found that most of the solutions, because they were ugly, stigmatized the person with disabilities while using them. In addition, these solutions often supplied only minimal relief or support. The opportunity (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 that had the most opportunity for improvement was the vegetable peeler. The generic peeler (Figure 1.5) 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 (aspects of *Value Opportunities* which will be introduced in Chapter 3) that Sam Farber recognized were key to making a better cooking utensil.

In retrospect, the executives in the housewares industry have had to ask why no one else saw this opportunity earlier. It is surprising that it took so long to replace the original design. If, however, someone had observed the potential need twenty years ago, the public may not have been ready for the idea. There were several SET Factors at work here that made OXO the right product at the right time (Figure 1.6). The four primary ones were:



Figure 1.5 Generic potato peeler.

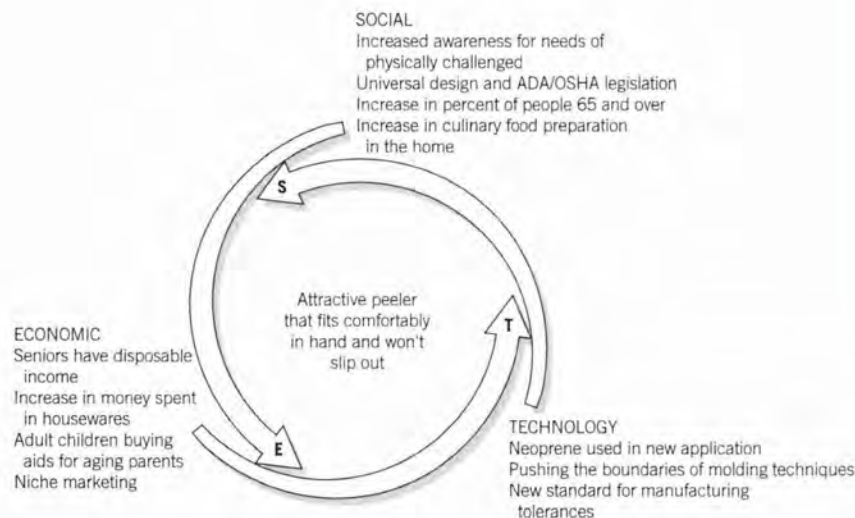


Figure 1.6 SET Factors that led to the GoodGrips peeler.

- The American public became sensitive to the needs of people with physical challenges.
- Those with challenges demanded that products be made to accommodate their needs.
- Another factor was the change in the nature of business: mass marketing gave way to niche markets—the one-size-fits-all mentality that allowed the original potato peeler to last for over a century gave way to a new market segmentation approach.
- The fourth factor was an increase in interest in the best products for use in the home, particularly in food preparation. The economic boom of the '90s fueled this trend. Consequently, spending up to \$7 for a peeler was acceptable.

In essence, trends had changed and people were able to recognize and were willing to pay for the *value* embedded in this product.

The product opportunity was translated into several opportunities 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 19th-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 and 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 would be a new aesthetic that would establish a new trend in products for the home and would be seen as usable and desirable by all potential customers.

The next move was equally insightful. Instead of paying design consultants a large upfront fee, Sam Farber offered to make them partners with a share of the profits. Smart Design, true to its name, jumped at the opportunity to create the GoodGrips peeler (Figure 1.7). After extensive human factors tests, an ideal overall shape was developed for the handle. The overall 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 that would prevent the handle from slipping in your hand when wet. The result was the use of 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.

A number of manufacturers decided that molding the fins was not possible to do in Santoprene. The product development team found manufacturers in Japan who felt the product specs were achievable. Their willingness to work within the high standards that OXO was looking for helped to create the product quality that became such a successful attribute of the product. Subsequently, the standards developed by the Japanese manufacturers were successfully transferred to a less expensive manufacturing company in



Figure 1.7 OXO GoodGrips. (Reprinted with permission of Smart Design.)

Taiwan. This became necessary when the strength of the dollar against the Yen made it too costly to use the original manufacturer.

Figure 1.8 shows that the peeler has attributes that combine aesthetics, ergonomics, ease of manufacture, and optimum use of materials. 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

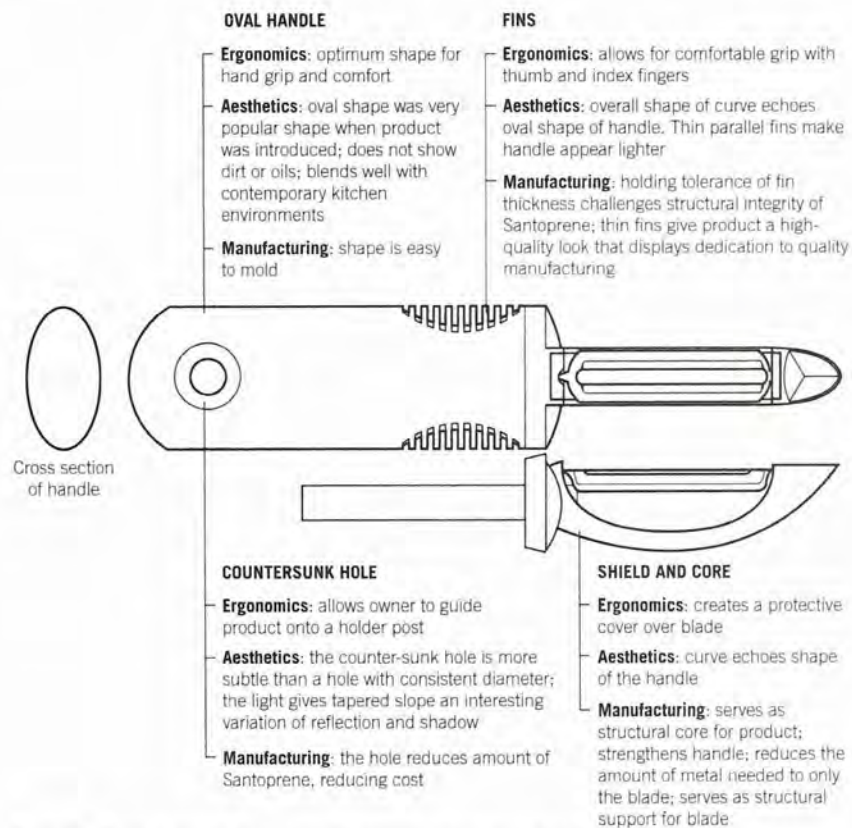


Figure 1.8 Product details of OXO peeler showing integration of style and technology.

fins, gave the product a contemporary look that made it appealing to a much broader audience than originally targeted.

The overall effect is that of a very sophisticated product with a contemporary look that is superior in every way to its predecessor except for one aspect, the cost. As will be shown in Chapters 2 and 3, a comparison of the original peeler with the OXO clearly represents where the opportunities for added value were met and exceeded by OXO. Sam Farber felt that the public would recognize the value designed into the product and would be willing to pay the difference. He had the insight to predict that the public would pay several times the price of the original peeler. He went against the advice of most of his peers. He was right. The SET Factors were in place and consumers were ready to show their appreciation for a useful, usable, and desirable product and were more than willing to pay the difference. This product won numerous awards and, as a result of the positive praise generated by word of mouth, the product has never been 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 be extended to other products. The success of the handle of the OXO peeler established the core competency of the company and became the secondary phase in the brand identity and labeling of the company (OXO GoodGrips). The company decided to build its brand strategy by extending the value designed into the peeler to the grip of every future product that they produce. The core concept has now extended beyond kitchen tools and has been applied to all subsequent products that are held by the hand, which includes teakettles, salad spinners, cleaning devices, tools, and gardening equipment. OXO has introduced a new material into the housewares industry. Santoprene was not perceived as a material suitable for use in the kitchen prior to OXO's success. Since OXO's debut, many other housewares manufacturers have used neoprene, the generic name for Santoprene, in their products to catch up with the success of the OXO brand. The use of new manufacturing techniques for thin features and tighter mold tolerances has also become commonplace. Combining insight, design, material choice, and manufacturing processes led to the creation of a new product that has redefined kitchen utensils.

The Motorola Talkabout

The Talkabout (Figure 1.9) is another excellent example of a manufacturer understanding the change in SET dynamics. Motorola is well known for its communication products. Its reputation was built on high-quality wearable and portable communication,



Figure 1.9 Motorola Talkabout two-way radio. (Reprinted with permission of Motorola.)

primarily for professional applications. With the advent of small portable phones in the '90s, Motorola moved from the business sector to the private sector seamlessly as "business phones" became useful in everyday life. The growth of wireless portable communication became an inexorable trend. Cellular phones generated a new trend that allowed families to "stay in touch," no matter where they were, throughout the day. But the cost of multiple phones and constant calls made this format impractical for constant communication during family activities. The wireless and portable phone was complemented by the use of wireless transmitters and receivers as devices that allowed parents to keep tabs on their infants. These various trends in combination created a new trend: parents wanting to constantly monitor their children. Sensational cases in the media of child kidnapping and murders created an atmosphere of fear that led parents to believe that they needed to monitor their child throughout childhood. At the same time, parents in active families were attempting to include their children in activities both as a way to have more fun and concern for the need to stay in touch as part of the parent-child relationship. These SET Factors created the POG for a new communication product that stood to be a big growth area in an entirely new market for Motorola: hand-held two-way radios, or what used to be called walkie-talkies (Figure 1.10). The advantage of this type of device was that it allowed for communication without having to pay for each call.

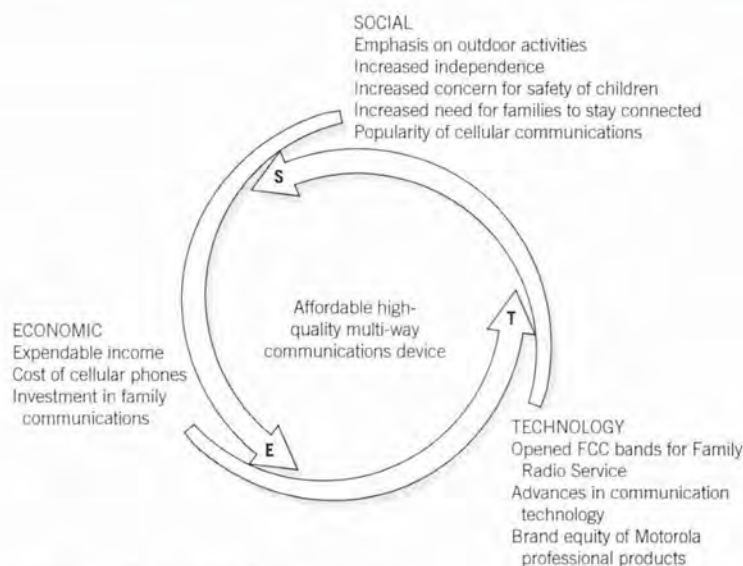


Figure 1.10 SET Factors that led to Talkabout.

However, at that time walkie-talkies had limited range and a low number of frequencies available. These were some of the obstacles Motorola had to overcome.

The challenges were finding the right value opportunities and then combining the right features, look, and cost that would allow Motorola to gain a fast penetration into the consumer market, as consumers had come to expect high-performance, compact wireless communication. The product opportunity was the gap between high-cost, professional two-way radio systems used by police, fire departments, and the military, and the low-cost, poor performing walkie-talkies serving a small market niche. The existing consumer products did not have the range, nor were they rugged enough or contemporary enough to fit into the current market opportunity. There were several challenges to finding the right level of value and quality that would allow Motorola to extend its established professional brand identity into a consumer market. The cost of Motorola's professional products was much higher than the products purchased by consumers. While the perceived value for these products had increased, the gap between the cost of professional products and consumer products was significant. There were two questions the development team had to answer. The first was how much would consumers pay. The second was how much could Motorola afford to redefine its technology, i.e., from supporting "mission critical," namely use in

extreme situations where people's lives are at stake, to augmenting lifestyle. They also had to be sure not to damage their brand equity in the professional sector at the same time. Motorola also had the legislative challenge of obtaining new frequencies for two-way public communication from the FCC.

Because consumer walkie-talkies were considered to be of poor quality, the team decided to benchmark against other product categories that were comparable in feel and level of expression, rather than in application. So they looked at expensive athletic shoes, inline skates, the Walkman, and the Discman. For aesthetic benchmarking, they drew from outdoor products that were rugged and dependable. They also looked at icons of American culture: the Jeep, Levis, Coke. The team successfully lobbied for and received permission from company management to develop a new way of looking at commercial products for integration into the consumer world. Motorola anticipated that the increase in the number of public radio service frequencies would come in time for product introduction, and also worked with the government to make this happen. This example demonstrates both a scanning of the SET Factors and an ability to influence change in those factors by a large company. The program could only start with the confidence that Motorola could get the approval in time for the proposed product launch.

As illustrated in Figure 1.11, the Talkabout nicely integrates state-of-the art technology into a carefully designed form. The rounded bottom presents a palm-friendly shape and the large display and push-to-talk button communicate to the user that it is an easy-to-use device. The push-to-talk button is located on the front center of the product; the location made the function obvious and the oversized button makes it easy to locate visually and by feel. The visual and tactile aesthetics were designed to fit into an active, outdoor, wireless consumer lifestyle, while the textured black details capture the look of contemporary X-generation products. This is a product that fulfills the motto "high tech, high touch."

■ Finding the right level of core technology and visual interaction in the product produced the right fit for the evolving market.

Through the appropriate reduction of cost and performance features from professional products, designing the right look and feel, and the approval of their Family Radio Service band, Motorola was able to fill the POG perfectly. The shift in social dynamics created the opportunity for a new communication device. The successful economy created the purchasing opportunity allowing consumers to buy an array of communication products for every phase of life. Finding the right level of core technology and visual interaction in the product produced the right fit for the evolving market. As you will see later, the Motorola product development team improved the value of the product significantly over the competition and successfully differentiated the product from its own line of professional products, creating a new family-targeted communications category.



Figure 1.11 Product details of Talkabout showing integration of style and technology.

The Crown Wave

The Wave, developed by Crown Equipment Corporation, is another success story that supports the SET theory. The Wave, which stands for Work Assist Vehicle, is a new product for Crown and a new product in the lift truck market (Figure 1.12). In fact it is not really a lift truck in the traditional sense. Crown produces lift trucks and devices for use in industrial settings, particularly warehouses and retail environments. While a relatively small company by international standards, this privately owned company, based in New Bremen, Ohio, holds a significant market share in battery-powered lift equipment. Tom Bidwell, Executive Vice President, was the visionary who saw the POG for



(a)



(b)



(c)

Figure 1.12 Crown Wave: (a) product shot, (b) operator controls, (c) product in use. (Reprinted with permission of Crown Equipment Company.)

a new type of lift device. He had been at a warehouse and seen the difficulty the employees had in using rolling ladders to get parts. He then spoke to Dave Smith, a long-term design consultant for Crown, who worked with Bidwell to clarify the product opportunity emerging from a number of Social and Economic factors. Social factors included changes in employers' attitude toward workers in the warehouse industry, changes in policy by insurance companies and OSHA (Occupational Safety and Health Administration), while Technology factors included changes in the types of warehousing for parts and packages and the compression of technology (see Figure 1.13).

The incidence of repetitive stress and injury as a result of falling and lifting has become a major concern for employers, insurance companies, and OSHA. The result of these injuries has created a loss of work time, limitations in worker effectiveness upon returning to the workplace, significant lifelong injuries, and the need to constantly replace workers as they "burn out."

Crown is a company that creates products which allow people to move heavy objects. However, it has a core competency that is slightly broader. Crown moves people and/or objects with the goal of redistributing goods with the safest and most effective interaction between the operator and others in the work environment. The Wave concept was a new POG that fit in that slightly broader brand identity.

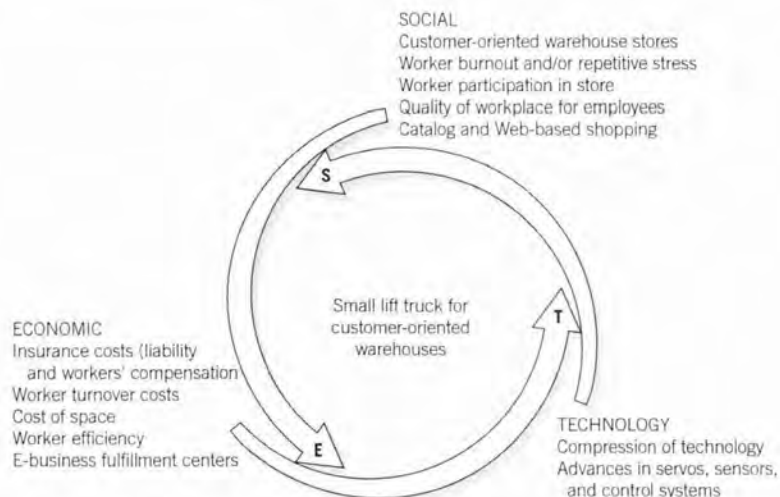


Figure 1.13 SET Factors that led to the Wave.

There have been numerous products developed to fill this POG including orthotics designed to give support and protect areas of the body most often affected. Ten years ago, companies would not have seen the economic value in having a product that could address the needs of a small parts picker or a restocking employee. Even with the orthotics, high turnover was a common trend in this type of occupation and employers accepted the economic consequences of that turnover. However, the cost of doing business and attitudes toward turnover have since changed.

Employees in warehouse stores are often experts in and are expected to perform multiple tasks. It is harder to find people to fill the jobs in stocking and picking, particularly when paying insurance and training new employees can have a significant impact on stores that are working on a small profit margin. Reducing injury and repetitive stress and creating more meaningful work environments are the new mission for store managers. In many ways, this trend began at Disney theme parks, where every employee is a performer and the environment is their stage. Every aspect of a store employee's performance and attitude should contribute to a positive atmosphere for consumers, who view shopping as a form of entertainment. Home Depot's employees are all trained to be expert advisors on their area of the store. Target has made the biggest move toward the Disney philosophy and has been a major investor and supporter of the new Wave. It makes good sense; employers realize that long-term employees are more invested in the success of a store and can develop better relationships with customers.

As a result of changes in products and methods for storing parts, a new type of warehouse has emerged. These new warehouses store small parts in smaller aisles that cannot be easily serviced by current lift equipment, which is designed for larger aisles and heavier parts and packages. The development of new warehouse store interiors with 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. A "just in time" mentality has also 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. In addition, there is the need to constantly change merchandise on shelves to match seasonal changes and new product promotions. During this evolution, storeowners have used a variety of solutions. As noted by Dave Smith, this ranged from roller skates to rolling ladders. Sometimes companies have used palette trucks inside of stores, distracting and annoying customers with the constant watch for the beeping lift trucks moving down the aisles or backing away from a shelf.

In order 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 "skunk works" offsite interdisciplinary team for 10 months to develop the initial product concept. The co-located team consisted of one engineer, two designers, plus a design intern, and a part-time marketing and manufacturing person. Once 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 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.

Comparing the value of the Wave and previous attempts to accomplish the same task demonstrates how successful Crown has been. They have created a product that improves employee sense of security and makes a series of dull tasks enjoyable. The product is safe, easy to learn to use, and reduces time. It successfully blends a sense of ergonomics, aesthetics, and technical performance consistent with the performance of Crown's other products. The Wave product identity is distinct and the use of the word "Wave" in conjunction with a swish of color gives it a lighter contemporary look. Crown has strategically chosen to make its corporate identity secondary to the product for the first time in its history.

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 the job usually done by two people. The Wave has been used in a variety of new tasks. The product has spawned a new company line and other variations are in development to build on the success of the Wave.

Starbucks

Starbucks is an example of a service company that provides an optimal experience to the customer. Starbucks recognized the possibility of taking a core part of the American culture and integrating it with the style and attitude of an Italian café. The act of drinking

coffee has been transformed from a quick, mindless experience into a major new form of cultural interaction and entertainment. Starbucks is an interesting hybrid between a product and 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 then internationally. It has had the same effect at the end of 20th century that Coca-Cola had at the beginning and McDonalds had at mid-century. It is our latest global export. What were the factors that allowed Starbucks to become the last great food specialty retailer of the century? If you have ever traveled to Seattle, you will notice that it is 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 a common situation that most commuters have to deal with, especially in Seattle's climate. Drinking coffee is a custom that many Americans use to ramp up for the day, to maintain momentum during the day, and to 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, 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 1.14). It is now possible to get a café latte in local neighborhoods and on university campuses and on turnpikes and now in Taipei and London (see Figure 1.15). Now that is what we call a global brand!

In lower Manhattan, there is an area known as Little Italy, just north of Canal Street. Canal is the street that separates Little Italy from China Town. Both areas are favorite sites for New Yorkers and tourists. For a long time, there have been a number of little restaurants where you can order espresso and dessert, often after eating dinner in China Town. This concept never expanded outside of Little Italy, except in other Italian neighborhoods in other big cities.

Berkeley, California, home of UC Berkely and the '60s revolution, has for years had coffee houses in which students and faculty pontificated, studied, and hung out. Pete's Coffee

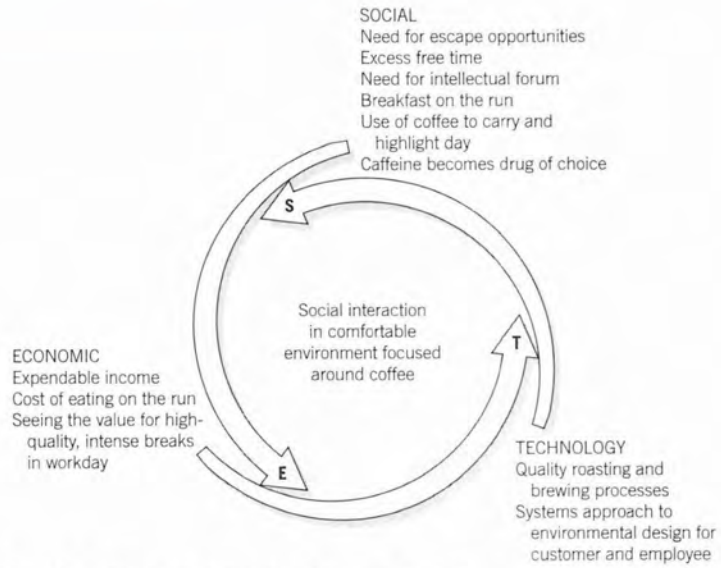


Figure 1.14 SET Factors that led to Starbucks' success.



Figure 1.15 Starbucks' global positioning shown through unique mug designs from international cities: London, New York, Taipei, Vancouver, and Boston.

began there in 1966 and preceded Starbucks. As a matter of fact, Alfred Pete trained the founders of Starbucks in the art of roasting arabica coffee beans. An addiction of locals, Pete's is well known to anyone who has lived in or visited Berkeley. Once a Berkeley resident rented a ski chalet in the Swiss Alps; it turned out the chalet owner had lived in Berkeley and regularly mail ordered Pete'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 Pete's would become the coffee of choice for the Au Bon Pain bakery chain, why wasn't Pete'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, they also have to be scanned, interpreted, and developed with a vision.

Part of the technology of Starbucks is 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 coffee house including sophisticated contemporary colors, graphics, and furniture. It 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 one to go, you can leave with a sense of the store experience while holding onto a cup with a protective corrugated holder that clearly states that it is made from recycled paper. It doesn't get any better than that. Starbucks has developed a flexible brand identity (discussed in Chapter 4), which uses a consistent color theme that allows for variation in secondary graphics for packaging, products, and store interiors (Figure 1.16). 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 new, lucrative market. As traditional coffee makers have responded to the trend, Starbucks has countered by extending their products into grocery chains by offering dark arabica coffee beans and even a range of ice cream flavors.

In his book *Pour Your Heart Into It*,¹ Schultz chronicles the evolution of Starbucks. Starbucks is a company that epitomizes the characteristics found in a company in the



Figure 1.16 Starbucks store interior and logo. (Reprinted with permission of Starbucks Coffee Company.)

Upper Right. They see their product as the coffee, the people who work for the company, and the experience of buying and drinking coffee in their stores. The company maintains a high standard of values, from the CEO to each employee, and connects to the values of their 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 the company's long-term success is dependent on high standards for both. Each employee of the company is called a "partner" and given stock options. Even part-time employees are given full health care benefits. Starbucks has relied on the power of its experiential brand, loyally conveyed by its customers, to promote the company, rather than falling back on advertising. 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.

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.

Summary Points

- ☐ Social, Economic, and Technology (SET) Factors lead to Product Opportunity Gaps (POGs).
- ☐ Breakthrough products merge style, technology, and value.
- ☐ It takes a combination of vision and sound methodology to succeed in developing breakthrough products.
- ☐ These ideas and methods are applicable to both tangible products and services.

References

1. Schultz, H., and D. J. Yang, *Pour Your Heart Into It*, Hyperion, New York, 1997.

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 process. We then apply this process to the case studies introduced in Chapter 1. Every product development team must conduct a Value Opportunity Analysis, which evaluates the current state of products in the market and projects areas where the new product requires significant improvement. 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 that brings clarity to the Fuzzy Front End of the product development process.

The Sheer Cliff of Value—The Third Dimension

As you look through the Positioning Map diagrams shown in Chapter 2, 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 product; we illustrate this in the 2D 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, only comes into play 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; rather 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 to ascend that begins with commitment and planning and

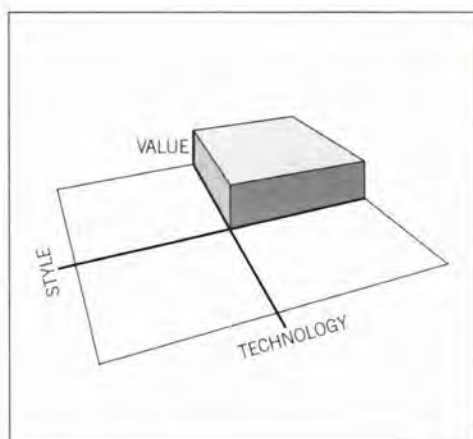


Figure 3.1 The three-dimensional Positioning Map showing the Upper Right Value quadrant.

ends with a user-centered integrated approach to product development. As discussed in Chapter 1, the product development process is akin to rock climbing. To create products in the Upper Right, you must climb the Sheer Cliff of Value.

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 and 5 will 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, profits moderate, 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 like Wal-mart and K-mart. 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, when it 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, which together 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, OH, 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*, i.e., have value in that they are perceived as excellent in a number of factors.

■ The cost to make a high-valued product increases less rapidly than the amount people will pay for it.

While cost is still an issue in the era of market segmentation, the more powerful factor is the consumer’s need to connect their product purchases with their own 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, i.e., their values. The product must support that value base. The more the product does support that base, i.e., 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, and thus the profit increases with higher value. The OXO GoodGrips 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 SUVs. Although the SUV may cost twice that of the 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. (See Chapter 9 for a further discussion of SUVs.) This is the first way that Upper Right products lead to increased profit.

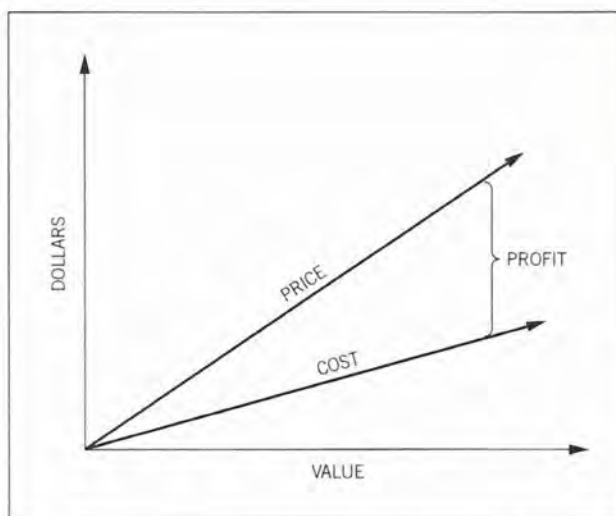


Figure 3.2 Price and Cost versus Value—Profit increases with added Value.

There are instances of high-value products that, due to manufacturing costs and the expenditure for emerging technologies, 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 sales price and resulting profit per item. 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 customers do not value their quality and will never pay a premium for this product.

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 will result in higher profit per item over competitors in the other quadrants, it is sometimes a strategic decision to produce an Upper Right product. This decision is made to establish a long-term relationship with the customer. Once an Upper Right product fulfills the expectations of a customer, he or she will be more likely to return to the brand for future purchases. As will be 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 a competitor who 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 the introduction of the new Beetle. The features and style of the product met and generally surpassed the value expectation of their customer. Although VW did not charge an exorbitant amount for the vehicle, their goal was to move customers into future, higher priced lines, such as the Passat, with future purchases. The same was true for the Mazda Miata, the PT Cruiser, and the Ford Focus. It is the current approach of Apple with the iMac enticing customers to move up to the G4.

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 use of 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 allowed them to acquire a strong share of the market yet keep their products at competitive prices.

Qualities and a Customer's Value System: Cost vs. 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 ISO9000 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," one where 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 (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,



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

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.

As stated earlier, it is no longer form following function. That 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 ethic and 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 another group.

In the 20th century, 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 like 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 the *Star Wars* series, *The Matrix*, and *Star Trek* on products, fashion, and digital imaging. We now have products that look like three-dimensional cartoons (like Graves products for Target) and cartoons that look real (like the toys in *Toy Story*, where the Buzz Lightyear action figure toy is created from the same type of digital representation used to create the cartoon character in the movie). We can watch videos while driving, talk to anyone anywhere in the world, and we have on board navigation systems telling us where we are on the planet at any moment in time and where to go next to arrive at our destinations.

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

In the Upper Right are those 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.

The argument for the experience economy is also presented by Rolf Jensen in *The Dream Society*.³ Jensen argues that the information society will give way to the dream society (or we would say, the “fantasy” society). The future economy will be based on companies’ ability to tell and sell stories. Our approach is to understand peoples’ fantasies (or dreams) and to create products and services that create experiences closer to those dreams.

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 deep-rooted, from religious and righteous 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 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 “no 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”² (p. 24). In other words, people have a capacity that limits what they can afford. The point is that people will pay for value beyond what they pay for commodities. But the key is to understand what that limit is and what a given market looks for in a product, and then to add in 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 the SnakeLight adds value and enhances experiences beyond the basic flashlight, Starbucks provides a richer experience than the local diner, the GoodGrips boosts the cooking experience beyond the generic peeler, and the Talkabout enhances communications beyond the walkie-talkie. People have paid a significant cost increase for the added value of these experiences. It has been argued that if there are two identical products on the market, then won’t the one that costs less succeed? We respond that in practice there are no two identical value-oriented products 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.

If, however, you are going to charge more than the competition, then the customer 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 it must be recognized that you are creating Lower Left products and 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 connect a product's features to that value. Since products enable an *experience* for the user, the better the experience, the greater the value of the product to the consumer. In the ideal, 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 Value Opportunity 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, may make the same VOs irrelevant tomorrow. Also, interpretation of the VOs is based on the SET Factors for a target market; what attributes one group finds important may be uninteresting to another.

The ergonomics, core technology, and quality Value Opportunities each address the satisfaction of the product during use, both immediately and 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 Value Opportunity attributes, this breakdown can be augmented as needed. For as cultural needs change, new value needs will emerge. This list, however, is fundamental and will generally support the analysis of value for most product classes, including all of the products discussed in this book.

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 all and only those Upper Right products are strong in all three categories. Although all Value Opportunities may not be targeted by an Upper Right product, at a minimum 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 of the Value Opportunities support the product's ability to contribute to the user's experience, however emotion defines the essence of the experience; the emotion contribution defines that fantasy aspect of the product. For our purpose the emotion Value Opportunity is the *perceptual experience* of the consumer when using the product. Different fantasies distinguish different products. We break the attributes of emotion into:

- 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 his or her 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 confidence and security in picking small parts in a warehouse using the Crown Wave. Think about the sense of security and independence that families have when communicating with the Motorola Talkabout on the ski slopes in Tahoe. Products can utilize more than one emotional attribute toward value. This will be true for each Value Opportunity. 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 will be shown later in this chapter and in Chapters 8 and 9.

■ 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.

Aesthetics

Aesthetics, the second Value Opportunity, focuses on sensory perception. The five senses are all important attributes of this VO. Many products only focus 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 competitor's products lack this focus. The range of senses involved with aesthetics supports the emotion Value Opportunity, especially the sensuality attribute. The aesthetic attributes are:

- 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, primarily 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 only emit 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 may otherwise be placed in the mouth (e.g., 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 identity of the product supports the emotion VOs and the consumer's fantasy in owning and using the product. The identity of the product also supports its brand identity (see Chapter 4). Three attributes of product identity are personality, point in time, and sense of place:

- Personality: The two main issues in a product personality are 1) the ability of a product to fit among yet differentiate itself from its direct competition, and 2) the connection that a product has to the rest of the products produced by that company.

■ In order for a product to be successful, it has to capture a point in time and express it in a clear, powerful way.

- Point in time: In order for a product to be successful, it has to capture a point in time and express it in a clear, powerful way. Point in time is a tricky combination of features and aesthetics.
- Sense of place: Products must be designed to fit into the context of use.

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. The company, however, 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 effecting changes in how people communicate and interact with each other. This Value Opportunity and its related social and environmental attributes are probably the least explored of all the VOs. Yet they continue to have a growing effect on product development.

- 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 sidebar).
- Environmental: The effect of products on the environment is becoming an important issue in terms of consumer value. Design for the environment, or "green design," focuses on minimizing negative effects on the environment due to manufacturing, resource use of the product during operation, and recycling (see sidebar).

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 will be discussed in Chapter 7. Ergonomics has both a short-term and long-term effect on the perception of a product. Consumers look for comfortable

Social Impact VO

Both social consciousness and social interaction provide opportunity for added value in a product. Three products highlighted in this book that have a strong effect on social well being are DynaVox's DynaMyte augmentative communicator, designed by Daedalus Excel, which enables people who can't speak to communicate (Chapter 8); the Baygen Freeplay Radio, which allows people in underdeveloped regions without electricity to use a radio to obtain news and health bulletins (Chapter 8), and the OXO GoodGrips, originally designed primarily for elders with arthritis. The GoodGrips, however, 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 like Pat Moore have crossed these bounds through the design of products and interfaces.^{4,5} 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 could work for everyone without stigmatizing anyone.

Other products may not target social conscientiousness directly, but still affect the interactions among people. Starbucks created a non-alcoholic way for people to meet and enjoy each other's company in a public setting. The Talkabout enables groups to stay in contact even when physically apart. The Crown Wave changed the attitude of the workers that use it; they now actually enjoy work that used to be stressful, tedious, and dangerous. And they are now in a better position to interact with, rather than avoid, customers in a warehouse environment. Even Harley-Davidson created an entire new subculture of social interaction. While the Harley was once associated with a criminal fringe lifestyle, the company has refocused 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 comradery and escapism. (See the case study in Chapter 4.)

fit 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 Value Opportunity:

- **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, and manipulate.

Environmental Impact VO

Design for the environment, or "green design," presents an opportunity to improve product value with very broad societal implications. Black & Decker is beginning to make their products recyclable. Herman Miller, in chairs designed by Tom Newhouse, now lists materials in the recycling information on the bottom of the chair. Companies like Ford are openly struggling with the balance between their environmental concerns and the performance of their vehicles. Many companies in the U.S. lag behind Europe in terms of concern for environmental impact. Consumer attitude and government regulations, however, are both leaning toward more stringent requirements (government) and expectations (consumer) for environmental friendliness. This Value Opportunity, still ignored by many companies, provides another opportunity for differentiation from the competition.

In Europe, legislation towards 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 with a specific recycled content (around 85% with an increase up to 95% scheduled) focuses the design of products with great reference to the environment. In the U.S., no such legislation exists. Thus use of recycled components and materials, and recyclable components and materials, are limited. 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 rather than use 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, they 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 re-built parts, they 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.

Bosch, an international company, 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. Their design strategy takes into account aspects of the environment such as choice of material, disassembly sequences, and separation of material in their products. One aspect of their 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 (since they are designed for disassembly) or resell them after refurbishment. It turns out that many tools have only been used for a short time. Those are the tools best suited for resale. Bosch has introduced a chip into 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, rather than dispose of them.

- Safety: A product must be safe to use. Moving parts should be covered, sharp corners eliminated, and internal components shielded from users.
- Comfort: Along with ease of use and safety, a product should be comfortable to use and not create undue physical or mental stress during use.

Core Technology

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 to expectations, and it must work consistently and reliably. People may 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 may 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 high level of performance over time.

Quality

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

The final Value Opportunity is quality: the precision and accuracy of manufacturing methods, material composition, and methods of attachment. Although related to technology, the focus here is on the manufacturing of the product itself—not the process, but the expectation of the process. Products should be perceived to be of high quality when purchased and they 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 plastic parts of the computer monitor, or the way the rubber sleeve attaches to the head and tail of the SnakeLight. Although not an easy task, manufacturing technologies and assembly methods have progressed to the point that this goal is obtainable. A major argument of this book is that by spending the time up front to create a product that meets customer expectations, the downstream manufacturing detailing 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. 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.

Value Opportunity Charts and Analysis

We use the Value Opportunities to evaluate how products successfully Move to the Upper Right. Figure 3.4 shows a Value Opportunity Chart. The chart lists each Value Opportunity 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 (or target) any level of that attribute, no line is drawn. (There is an assumption that if there was any intent to focus on an attribute, then there would be at least a low measure of success; if not, then the blank line indicates failure.)

Below the chart are listed *profit impact* (across the company), *brand impact* (on company brand), and *extendable*. Although 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

		Low	Med	High
EMOTION	adventure independence security sensuality confidence power			
ERGONOMICS	comfort safety ease of use			
AESTHETICS	visual auditory tactile olfactory taste			
IDENTITY	point in time sense of place personality			
IMPACT	social environmental			
CORE TECH.	reliable enabling			
QUALITY	craftsmanship durability			
PROFIT IMPACT BRAND IMPACT EXTENDABLE				

Figure 3.4 Value Opportunity Chart.

in a number of ways. The argument is that products may cost more but people will pay for value. Companies can increase market share and gain stockholder and investor confidence. They can generate sales that are greater 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 like 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. It takes the combined insight of the team and management with the appropriate feedback from customers to make this decision. It has been said that only one company can be the cheapest; the rest have to compete using design. We would add that they must compete using integrated design that produces value.

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. While 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 to accomplish this. Swatch Watch, Nokia, and VW have been successful with this approach. Establishing a consistent approach to product development and then applying it creatively in different products is another. OXO, Polaroid, and Tupperware have been successful developing new products with this technique.

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

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 there are many important factors that 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.

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

Products in the Upper Right often lead to expansions into other versions of the same product or other product lines. The GoodGrips handle is now used in over 350 products including pizza cutters, knives, and gardening tools. Starbucks has expanded in number of store locations, but also environments where their coffee is sold and product types (such as ice cream) that focus on coffee. Lack of extendability will not prevent a product from Moving to the Upper Right, but the Value Opportunity attributes are generally so strong that such extensions are natural.

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

We now apply a Value Opportunity Analysis to the GoodGrips, Talkabout, Wave, and Starbucks.

VOA of OXO GoodGrips

First consider a Value Opportunity Analysis of GoodGrips versus the generic metal vegetable peeler (Figure 3.5). 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 things going for it are that it lasts forever (durable) and has reasonably good reliability and craftsmanship. Due to its cheap price, there is very little profit per item. Companies that make the generic peeler make money through high sales volume. Although the peeler has been around for over 100 years, its generic form is made by many nondescript companies and it has not led to any further product lines.

The GoodGrips 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 has very strong social impact which stems 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 and the generic peeler explains how OXO is able to charge several times the cost of a generic peeler with great success.

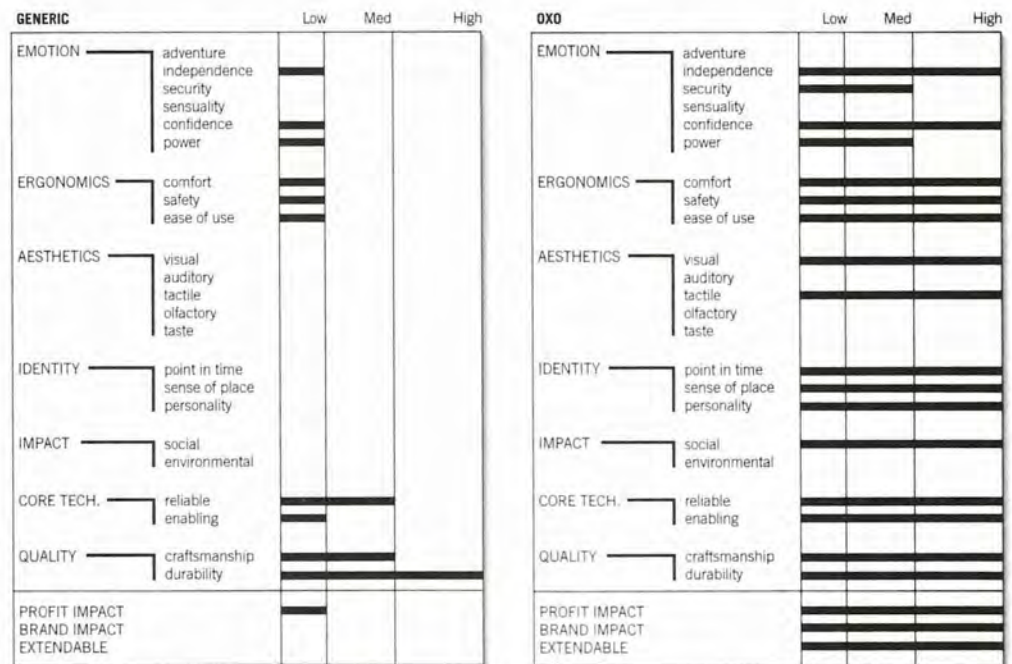


Figure 3.5 Value Opportunity Analysis of GoodGrips versus generic vegetable peeler.

While it is not clear what the per item profit is, it is clear why this product has become the first of a line of 350 and counting (See Figure 3.6). The sales figures put OXO in the black in the first year and the overall value and lines of the company have continued to grow during the last decade. Every company that produces products for the kitchen has been forced to play catch up. Instead of taking a cost reduction approach, OXO has chosen to create one new innovative product after another. The recent additions include a salad spinner that can be used with one hand and a line of hand tools that are well balanced, have simple and clean forms, and, of course, are more comfortable to grip. The product itself is core to the company's brand, with the featured black Santoprene handle becoming a part of the corporate name, "OXO GoodGrips."



(a)



(b)

Figure 3.6 Studies for original handle (a) and extension of GoodGrips line shown through selection of handles and products (b). (Reprinted with permission of Smart Design.)

VOA of Motorola Talkabout

Next, consider a Value Opportunity Analysis of the Motorola Talkabout versus both the previous walkie-talkie and Motorola's own professional wireless communications products (Figure 3.7). The generic walkie-talkie did allow people to communicate while apart (giving medium adventure, independence, and security VOs) and they were reasonably easy to use. Their poor aesthetics and larger size, audible static with almost any interference, and lack of personality, however, limited their overall appeal and hampered their use. The poor manufacturing quality and limited styling and interface had no effect on the manufacturing companies' brands. The profit per item of the walkie-talkies was low and there was very little else you could do with them.

The Motorola professional products have strong VOs in the independence, confidence, security, and power emotions—they work well and consistently and people know that they do. They have very strong core technology and quality VOs and a strong auditory aesthetic. The previous professional products were reasonably comfortable and easy to use; they had a strong identity, though they did not adapt to any particular trend. Their use in mission-critical situations had strong social impact. Motorola certainly had high profit per item for their professional product. Their products had a strong brand impact, but areas of expansion for those products had reached a plateau. The team, however, needed to take advantage of the company's brand equity and technological expertise in developing the new consumer product.

WALKIE-TALKIE		Low	Med	High
EMOTION	adventure			
	independence			
	security			
	sensuality			
	confidence			
	power			
ERGONOMICS	comfort			
	safety			
	ease of use			
AESTHETICS	visual			
	auditory			
	tactile			
	olfactory			
IDENTITY	point in time			
	sense of place			
	personality			
IMPACT	social			
	environmental			
CORE TECH.	reliable			
	enabling			
QUALITY	craftsmanship			
	durability			
PROFIT IMPACT				
BRAND IMPACT				
EXTENDABLE				

MOTOROLA PROFESSIONAL		Low	Med	High
EMOTION	adventure			
	independence			
	security			
	sensuality			
	confidence			
	power			
ERGONOMICS	comfort			
	safety			
	ease of use			
AESTHETICS	visual			
	auditory			
	tactile			
	olfactory			
IDENTITY	point in time			
	sense of place			
	personality			
IMPACT	social			
	environmental			
CORE TECH.	reliable			
	enabling			
QUALITY	craftsmanship			
	durability			
PROFIT IMPACT				
BRAND IMPACT				
EXTENDABLE				

TALKABOUT		Low	Med	High
EMOTION	adventure			
	independence			
	security			
	sensuality			
	confidence			
	power			
ERGONOMICS	comfort			
	safety			
	ease of use			
AESTHETICS	visual			
	auditory			
	tactile			
	olfactory			
IDENTITY	point in time			
	sense of place			
	personality			
IMPACT	social			
	environmental			
CORE TECH.	reliable			
	enabling			
QUALITY	craftsmanship			
	durability			
PROFIT IMPACT				
BRAND IMPACT				
EXTENDABLE				

Figure 3.7 Value Opportunity Analysis of Talkabout versus walkie-talkie and Motorola professional two-way radio equipment.

The Talkabout maintained the perceived technology VOs (at least for the needs of the target market), but went after the identity, appropriate aesthetics, ergonomics, and emotion VOs. The product clearly went beyond the generic walkie-talkie in every value facet, and went beyond previous Motorola products by appropriately targeting the needs of the consumer market. Bruce Claxton, design director of the Talkabout project, stated that the design awards that Motorola received resulted in advertising worth several million dollars to the company. The value of this Upper Right product is reflected in the fact that the Talkabout has been awarded one of 12 Gold Design of the Decade Awards from the Industrial Designers Society of America (IDSA) and sponsored by *BusinessWeek*. It introduced Motorola two-way communication products to an entirely new consumer market and is now core to Motorola's brand identity. Today, millions of units are sold in a business that did not exist three years ago. The success of the product has produced line extensions that have built on the Talkabout's success. Sales of this product set a record for the consumer walkie-talkie industry and continue to climb. Motorola products now have primary shelf space in a greater range of stores. Departments in stores that carry the Talkabout promote Motorola quality and innovation in new ways. Motorola could have canceled this project as too risky for a company that has made its name in the professional sector. This one decision has opened up an unlimited range of new product opportunities and broadened the brand equity of the company.

VOA of Crown Wave

We turn now to a Value Opportunity Analysis of the Wave versus the previous solution: a rolling ladder (Figure 3.8). Although it is obvious that a higher-priced product would be more attractive than a simple ladder to perform a task, it took an analysis of what value and needs the potential (and resulting) product would fulfill versus a ladder to justify the development of the product. Although the developers did not directly use our method, the VOA is enlightening. The rolling ladder is cheap and lasts a long time, but there is no pleasure or security in using it. There had been several deaths from people using it in small parts pick environments. It allows a mundane task to be accomplished in a mundane and tedious way. Like the generic vegetable peeler, many nondescript ladder manufacturing companies make money through high volume versus high profit per item. And there is reasonable expandability from different sizes and features (such as extensions and trays).

The Wave creates a series of value-added attributes. It allows one person to work effectively, efficiently, and safely. It decreases worker mental and physical repetitive

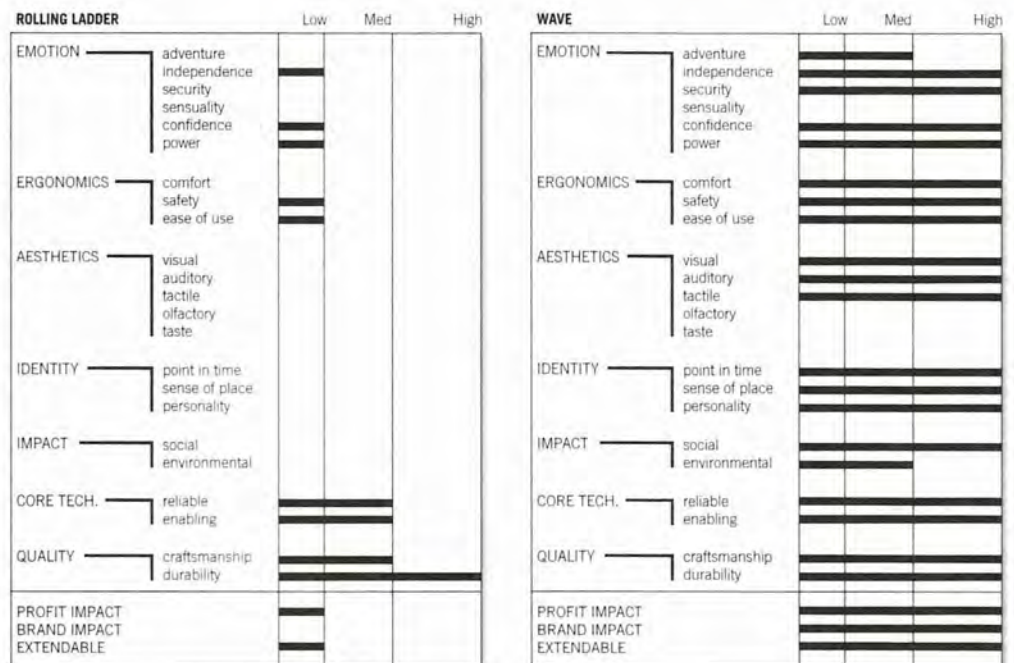


Figure 3.8 Value Opportunity Analysis of Wave versus rolling ladder.

stress and increases worker safety. It is easy to learn and fun to operate, increasing worker satisfaction and enjoyment on the job. In terms of VO, the Wave promotes high independence, confidence, and adventure, with very high ergonomics, appropriate aesthetics, and a strong product identity. Although the product costs more, the technology is reliable, of high quality, and reduces injury. The product provides a new profit area for Crown. The new product brand strategy gives the parent company an identity that takes their products out of the warehouse and puts them into consumer environments, broadening the brand equity. This new area can be the beginning of an entire new product line for the company as they explore small part picking and retail store applications.

VOA of Starbucks

Finally, we turn to a Value Opportunity Analysis of Starbucks (Figure 3.9). 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 didn't consider it a leisurely environment, particularly inviting, 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.

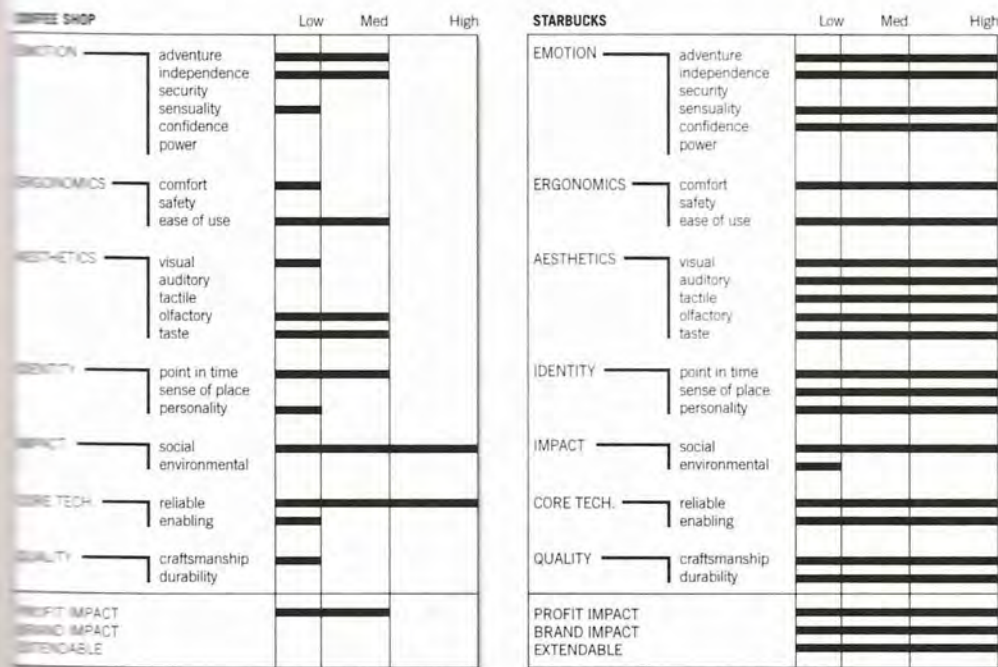


Figure 3.9 Value Opportunity Analysis of Starbucks versus a coffee shop.

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 there was an opportunity for Starbucks to create a new solution that promoted coffee first and food second. Their standard was higher and so was the cost. The environment was 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. They 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, *all* aesthetics, complete identity, core technology, and quality VOs are at a maximum. Their ability to capitalize on all Value Opportunities is an indication of their success. They even have strong impact VOs, with their creation of a social gathering place and their concern for the environment through recycled paper goods. The result is that Starbucks has high profit margin on their products (as of today, we pay between \$2.95 and \$4.85 for coffee and milk under such names as latte, cappuccino, and double espresso). Starbucks has clearly demonstrated how value and strong identity enabled their expansion into 2,500 stores in 13 countries, with products available in airports, turnpike rest stops, and supermarkets.

The Time and Place for Value Opportunities

Just maximizing the Value Opportunities isn't enough to guarantee an Upper Right product. There are two critical issues that 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 end user's perception of value. Further, 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 succeed in reaching a complete design requires a vision, and usually a visionary. There is often a core team or even an individual with the vision of what the product should be, not in the detailed sense but in the POG sense. In large companies, the visionary is often not part of the core team, but rather a manager in the position to fund and protect the core team.

Upper Right products don't just satisfy POGs, rather 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

Figure 3.10 shows specific goals for each VO attribute for the Wave. The VOA does not generically apply 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. It would be easy to just claim that a new product will maximize all of the VO attributes. To be useful, the team must determine how the product will serve to maximize each relevant VO.

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 is one example of a product category that previously had no understanding of the need for style and value. The Marathon carpet cleaner in Chapter 8 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 separates their 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 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 will add to the experience of using their product and separate them from the competition. By improving the balance and feel of a common laboratory tool, technicians can feel better about their work and themselves.

WAVE

EMOTION	- adventure – Continuation of the quality of experience expected of personal products (car, bike, motorcycle) - independence – Freedom to move effortlessly through and up and down within work environment - security – Feeling of safety and stability - sensuality – N.A. - confidence – Feeling of certainty to perform required tasks - power – Ability to have control over one's work environment
ERGONOMICS	- comfort – Satisfying and enjoyable experience while using product in standing position when lifting and reaching; controls must be comfortable to hold - safety – Operator must be securely enclosed in vehicle particularly when in lift position; product must not pose significant threat to others in warehouse/ retail environment - ease of use – Ingress and egress of vehicle must be accomplished through a few simple movements; operator controls must be easy to learn and easy to react to; vehicle must be easy to maneuver
AESTHETICS	- visual – Product should have appropriate look for lightweight lift vehicle that may be in retail space - auditory – Product must be quiet when in operation and use sounds effectively for warning and emergency situations - tactile – Interactive surfaces must have appropriate material and finish to promote effective use - olfactory – N.A. - taste – N.A.
IDENTITY	- point in time – Must establish a new visual aesthetic for the area of light duty lift assist products - sense of place – Design must be appropriate to retail environments - personality – Serious but fun and give the appearance of being light and nimble; must be a departure from the look of Crown's heavy lift equipment
IMPACT	- social – Should have a positive impact on the quality of worker experience and retention and be consistent with OSHA standards - environmental – Must be produced with the environmental standards for other Crown equipment
CORE TECH.	- reliable – Product must perform consistently and be easy to service and repair. - enabling – Product technology must fulfill claims of product by safely and smoothly moving and lifting operator to perform tasks
QUALITY	- craftsmanship – Must maintain the integrity of all Crown products, not being seen as cheaper but rather lighter - durability – Must be able to maintain function and appearance appropriate in retail environment throughout life of the product
PROFIT IMPACT – Create new profit stream for Crown	
BRAND IMPACT – Create a new brand identity that places product identity over company	
EXTENDABLE – Capable of generating a variety of new off shoots from original design	

Figure 3.10 Value Opportunity Goals for Crown Wave.

VistaLab Designs the First Ergonomic Pipette

For over 35 years, VistaLab Technologies has made pipettes and other liquid-handling products. Their original pipette is a 30-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 they are still using it many years later (see Figure 3.11). The current market is competitive and cost-driven. VistaLab's original product is still made from metal while the competitors use plastic and tend to have much lower production costs.



Figure 3.11 Original VistaLab pipette product.
(Reprinted with permission of VistaLab Technologies.)

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 where the technician controls the liquid distribution electronically, rather than 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 rather than over-automate the liquid handling process.

The design team hired Frogdesign from New York (how else to leapfrog the competition?) and worked closely with the firm to create the ergonomic pipette shown in Figure 3.12. The goal was a radical departure from the standard design, capturing a creature-like 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. They 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*.



Figure 3.12 VistaLab's new ergonomic pipette.
(Reprinted with permission of Frogdesign and VistaLab Technologies.)

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 their own personal purchases? Think about an ergonomic clamp or bolt, much like 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 iMac, where translucent exteriors means that the aesthetics of the interior of the product now matters. End users now see each and every component so the style of their assembly becomes 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 Original Equipment Manufacturer (OEM) parts to complete 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.

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.

- ❑ There are seven basic Value Opportunities to 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.

References

1. *Webster's New Collegiate Dictionary*, G. & C. Merriam Company, Springfield, MA, 1973.
2. Pine, B.J., II, and J.H. Gilmore, *The Experience Economy*, Harvard Business School Press, Boston, 1999.
3. Jensen, R., *The Dream Society*, McGraw Hill, New York, 1999.
4. Pirkel, J., *Transgenerational Design: Products for an Aging Population*, Van Nostrand Reinhold, New York 1994
5. Covington, G., and B. Hanna, *Access by Design*, Van Nostrand Reinhold, New York, 1997.

Chapter Seven

Understanding the User's Needs, Wants, and Desires

In order 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 that 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, 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 “discovery and exchange of knowledge concerning the characteristics of human beings that are applicable to the design of systems and devices of all kinds.”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 will learn in this section, there are many other members of the product development team, beyond human factors specialists, who 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 WWII. The three main types of research were anthropometrics, interpreting and managing 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 understanding of how to best place and equip personnel from an aptitude and size point of view. The D-Day invasion is one of the most complex events of the 20th century. It required a scale of logistical organization of men and material that was unknown prior to the beginning of the war. At 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 WWII. 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. While this post-war focus gave rise to the formation of HFES in 1957, 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 of 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 20th century, there is a much broader concept of human factors emerging. This new version is in response to the recognized need for a deeper insight into customers' patterns of behavior. It is starting to involve qualitative research methods and to explore 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.

There are a number of new trends that are beginning to change the way companies attempt to know their customers and their needs, wants, and desires. Many companies are using ethnography as a research tool in early stages of product development. Ethnographic techniques are qualitative processes that take methods from cultural anthropology and apply them 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, many companies realize that giving a product a strong brand identity is a clear competitive advantage. The book *Marketing Aesthetics* by Schmitt and Simonson³ 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, which merges the logo, core product (motorcycle), and complementary lifestyle products (clothing and gear) with the way their 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 as a result of the emergence of interaction design. Interaction design is a new area in human factors research and is based on human-computer interaction (HCI). This group recognizes that there is a need to create more humane interactive products that cross hardware and software boundaries. It is also clear that quantitative research is not enough to solve these problems alone. 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).

While the human factors discipline is comprised primarily of professionals and faculty from the fields of systems engineering, physiology, and cognitive psychology, 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 may have lacked the formal research and forum for dissemination of their methods through academic journals, recently their methods for abstracting behavioral models and likes and dislikes of their customers have found important relevance in industry and research. The newer view of human factors by those in the field reaches out to this view of what it means to characterize and interface with the human. A human factors/ergonomics conference held in Singapore in the Summer of 2001 used the term "Affective Human Factors" as the theme. The conference was endorsed by the International Ergonomics Society and was an attempt to bridge the two schools of thought about usability and desirability. The work of interaction designer Pat Jordan⁴ deals with this new area human factors, which has not been otherwise covered extensively in the literature. His book delves more directly into issues that Don Norman introduced several years ago.⁵

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 or 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.

The SET Factors have changed, the pace of industry has accelerated, and 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

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

attempting to understand the needs, wants, and desires of ever smaller and rapidly changing markets. 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 an example of attempting 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, while it incorporated style and technology, it did not properly respond to the Value Opportunity attributes of pinpointing time and sense of place. As we have discussed in the earlier case study on Crown Equipment, 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 help it to be 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. While the method of task analysis is a more commonly accepted method used by human factors experts, 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 takes the generic term "customer" and translates it into a person (or persons) with a name and personality attributes and places him or her 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 reduce 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 is usually not anticipated by customers. They instantly fill a need no one knew they had. No one predicted that car buyers were interested in buying a two-seat retro convertible with rear wheel drive. Not even Mazda realized how big the market was when they 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 sensed 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. While a successful product must reduce the likelihood of injury and misuse, it must simultaneously make a person feel that the product enhances their experience. The PT Cruiser is an example of how human factors research has been used in the design of the interior, while at the same time the exterior look and feel of the vehicle is pure emotion. 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 through seating that allows reconfiguration for optimum storage. The design of 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 Chrysler as the interior safety. The design of the deployment of an airbag is critical to the safety of a driver in an accident. Failure to design this with the 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, cognitive understanding of controls, and understanding how the hand interacts with a circular form with a round cross section. The driver looks at the steering wheel and uses it every time he or she drives the car; its design is critical to the driving experience. The airbag only deploys in an emergency and it is hoped that 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 it could affect others when 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, while the airbag is in the secondary lifestyle impact lower right cell. However, both are important to the overall success of the product.

In all the products we have reviewed, there is a balance between the type of human factors that is the result of research and testing and 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.

An Integrated Approach to a User-Driven Process

■ The interaction of the product with the user and the quality of the resulting activity create the overall user experience.

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 vegetable peeler, drive the SUV, or drink the cup of coffee. The product enables the user to do something he or she 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 user experience. If the experience is good, people will buy your product, recommend your product, and use your product. If it is poor, the consumer will be let down, frustrated, and negative. The goal is to understand how to create a product that facilitates a positive user 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 the 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 as *psycheconometrics*, 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 (Figure 7.1, middle loop). The way that the look and feel of a product is perceived by the user is 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 focus 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 shown in the figure, these manifestations map directly into 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.

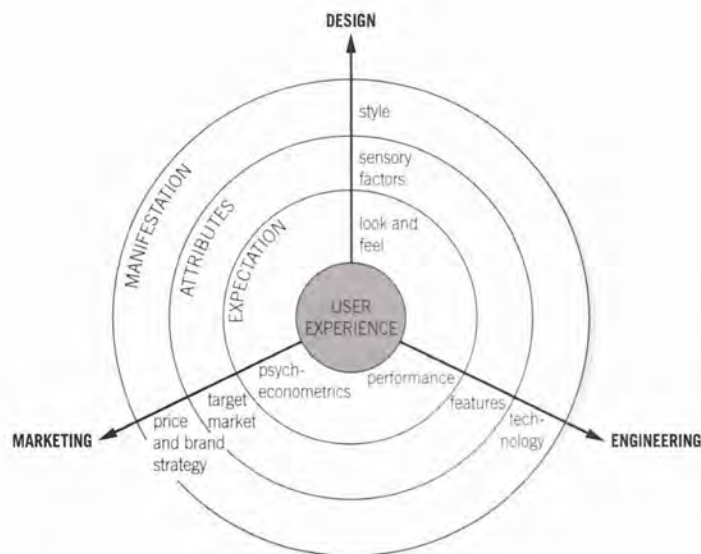


Figure 7.1 User-centered design — the user's expectation sets up attributes that are manifested through the disciplines.

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. Once that opportunity is identified, the first step in qualitative research is to create a scenario, or story, about a typical user in the targeted activity, and how the lack of a product makes their 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, and when of a situation. In other words, *who* is the target customer, *what* is their need, *why* do they have that need, *how* is the task currently accomplished, and *when* does this happen?

For example, a scenario that eventually led to a product concept and a patent application for the product by Ford Motor Company was:

Ron is an independent contractor. He typically works alone or with a crew of one or two. When Ron arrives at the work site 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 truck, he often uses the tailgate as a cutting or work surface, even for eating lunch. Ron's truck has side-mounted toolboxes that he installed and both a ladder rack and towing hitch that were installed professionally. This means that Ron has no free space within his truck bed and that his tools often have to be put on the ground during unloading, which 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;

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 there is a wonderful opportunity here 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, that many contractors have these same problems every day.^{T1}

The project surrounding Ron and his needs, wants, and desires will be used throughout this chapter as an example to illustrate several of the methods of user-based research. Chapter 9 will revisit Ron and this project and see how this scenario eventually led to a superb and innovative after-market product for trucks. This product, being patented by Ford Motor Company, resulted from a 17-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 and 3, the SET Factors and Value Opportunities will change over time. If the product meets a wider range of needs, wants, and desires, then it will stay in the Upper Right for a longer time. The scenario can help to create a more robust Upper Right product, one that is not sensitive to slight variations in the SET Factors and resulting VOs. Once the core scenario is stated, then it should be considered under different environments. For Ron, how would the scenario change if the consumer base became more "green" (i.e., 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 will help 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 may get more refined, it is critical at each step along the way to revisit the scenario and make sure that the evolving product meets the who-what-why-how-when of the scenario. If at any time the product deviates from this description, then the design team must decide if 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.

Once an initial scenario is completed, the next task for the team is to seek to understand in detail the activities, needs, and preferences of someone like 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 20th 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 using 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 New product ethnography, however, 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 into a powerful new area for predicting consumer preferences for product features, form, material and color, and patterns of use and purchase. In other words, ethnography can help to 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 be used to identify and understand 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. Broad surveys and focus groups, however, 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. Rather 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 keyhole 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 vegetable peeler and the GoodGrips line, the walkie-talkie and the Talkabout, and the coffeeshop and Starbucks. These insights can help car companies understand why some people prefer a basic pickup truck while others prefer an SUV.

The turnaround time between identifying the need for a product and seeing the product on the market is anywhere from six months to four years. There are huge financial commitments that must be made from cost of design and engineering to manufacturing equipment, labor, marketing and sales. Given the significant amount of money and resources at stake, it is critical that the product designed today will be successful one to three years down the road. How can a company commit its resources to a guess as to 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, then the product development team can gain insights into what needs, wants, and desires people will shift to in the near future.

Rather than 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 in which people live, work, and play. Understanding the essence of the lifestyle and patterns of use of the 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 GenXers like to skydive and bungee jump? Why are the PT Cruiser and Beetle so popular when their styles have been “out” for so long? When will DVDs overtake VHS as the forum of choice for movies (probably by the time this book is printed)? Why did the style and ease of use of the iMac succeed when consumers had 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:⁹

- 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 using video and sound recording for later analysis. One product ethnography firm pays people to keep a camera in their 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 relationship to that part of their lifestyle. Stories about situations and objects are desired in order 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 of the user and overall target experience. The emergence of the Web and Internet research tools have opened up this medium as an interview option.

- **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 disposable cameras and diaries/journals where people record what they think is important in a defined setting. This setting may 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.

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 make them 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 — obtaining medicine from a pharmacy, herbalist, or anyplace else. This may involve further education from the dispenser.

Managing the medicine — integration of the medicine into people's lives by creating or adopting routines.

Remembering to take the medicine is required to move to the next step.

Taking the medicine — consumption of medicine, possibly with other requirements such as with food.

Recording that 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.¹²

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

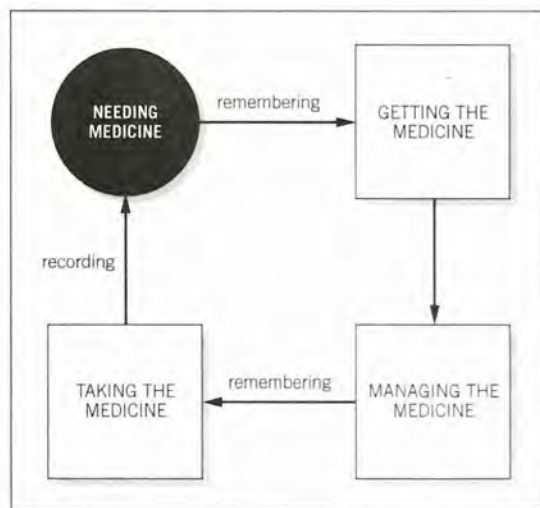


Figure 7.2 Behavioral model of medicine-taking and storage in the home derived from ethnographic research.

terms of their 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 does not interfere with the present configuration of the contractors' trucks.

All of the people interviewed had a make-shift workspace that they themselves 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 only used with that one tool (i.e., 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:

- 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 Customers at Polaroid

There are several Fortune 500 companies already using ethnography as a source for understanding their customers. Companies have used the results of ethnographic research to understand the customer in broad general terms and in a more targeted way to understand how to develop specific products. This section presents a case study that illustrates how ethnography helped Polaroid better understand their customers. Polaroid hired E-Lab, a consumer research consulting firm that was recently purchased by Sapient, to carry on this research. In this study, E-Lab used the methods outlined in the previous section to better understand how consumers feel about the experience of photography in general and instant imaging in particular. The results of their research helped Polaroid verify the appropriateness of some of its current projects as well as identify some new product and service opportunities. These new opportunities strongly connected with the brand identity of Polaroid in the market, demonstrating that insightful user research strengthens the relationship of a company's brand strategy with the products they produce.

In this study, E-Lab used visual stories, observation, and shadowing, along with in-depth lifestyle interviews and reference, to better understand how people integrate photography, especially instant photography, into their lives. This included 28 detailed two-to-three hour interviews and tours within people's homes — observing photo displays and understanding how people take pictures, display and store them, and how they exchange photos with others. One aspect of note was what photos people value and why. E-lab's research team also observed several participants during photo-taking events with an emphasis on how people compare instant pictures to 35mm images. Visual stories were also taken by participants to capture what and when they used their own photo equipment in the course of a week. Finally, field observations in several localities documented tourists at zoos and other tourist sites using cameras.

The result of this effort was a clearer understanding of why people take photos, namely to record and give form to personal experiences. Photos allow people to exchange information about themselves to others and to maintain and strengthen those relationships over distance and time. People take images of many everyday activities and special

events, leading to an understanding of what technologies people need for different activities. The more people are able to successfully integrate photos into their lives, the more likely they are to take even more images, thus promoting the idea of ease of use for not only taking, but working with and storing images. A gap was found between what people desired and what products actually gave them. This gap defined areas (POGs) where new products could be developed.

The ethnographic researchers integrated the observations into a model of the photographic process proprietary to Polaroid. The model differentiates between taking and using photos. In general, photo companies have successfully focused on the process of taking photos. However, products to support the process of how people use photos were less explored. Both 35mm and instant photography relied on an exchange process that took place through printing the picture. With Polaroid's cameras, this happened instantaneously and bypassed the more traditional delay of an independent processing medium. Digital photography allows for an array of new opportunities to directly exchange, display, manipulate, and store images.

This research provided a new and fresh look at the photographic market and helped to indicate Polaroid's specific role in it. As stated earlier, the study validated some of the directions Polaroid was already going. For example, the Olympus C211 camera was a partnership between Olympus and Polaroid where a digital image could be instantaneously printed with Polaroid's digital printing technology. According to the E-lab study, digital offered more flexibility that consumers want but lacked the ability to easily get hard prints. This combination in the C211, already under development before the E-Lab study but confirmed by it, was exactly what consumers indicated they wanted.

The research also influenced future projects at Polaroid. By concurrently re-examining Polaroid's customers' needs, wants, and desires (through the ethnography study) and Polaroid's approach to brand, the company was able to think more broadly about the current and future state of the photography product world as they move into the digital age. Polaroid sees itself as the "Apple Computer of the camera world" — they take a different approach to photography than all of the other camera companies and always have. They were "differentiated at birth." Thus they found it easy to think differently about how they were to address digital photography.

New products will eventually emerge as a result of this new way of thinking about the photographic product space and as a result of the ethnographic research. This ethnography study helped Polaroid further understand that for people to take more pictures, the camera must be readily accessible in their ongoing world. An example of this is a digital camera concept that mimics the cordless phone by residing in a living environment, charging in a cradle (as shown in Figure 7.3). By always being in the living area

e for
aphic.
I way
y that
laroid
ed by
in the
f pho-
search
well as
rongly
nsight-
with the

with in-
ate pho-
detailed
oto dis-
and how
alue and
o-taking
images.
sed their
a several

s, namely
tge infor-
tionships
id special

and Desires



Figure 7.3 Polaroid concept model. (Reprinted with permission of Polaroid Corporation.)

■ A deep qualitative understanding of the customer can lead to an innovative new product concept.

and always charged, it is always available for spontaneous photography, a unique characteristic of Polaroid. And rather than having to place the photos in albums, the camera, when not being used to take pictures, constantly displays the pictures in its memory on its viewing screen, behaving as a live picture frame. In context of the behavioral model of the photographic process developed from the ethnographic research, the camera supports taking a picture and jumping immediately to using it in the picture frame mode. This case study shows how a deep qualitative understanding of the customer, through ethnographic research, can lead to an innovative new product concept positioned in the Upper Right.

Lifestyle Reference

Why do so many products for some target markets have the same look and feel, even though they are made by different companies? Clearly companies try to copy successful and current styles. Some companies are leaders and some are followers. It is best to be a leader, but that can only happen if the new styles that you introduce anticipate and meet the expectations of the market. New styles and trends start in industries where style changes each year or even 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 cartoon-like products Michael Graves has designed for Target. The Bengal is a new sports car designed by Buick to capture the spirit and style of its primary spokesman, Tiger Woods. New products in one industry or product line are influenced by products from other lines. The wrap-around design

of the clear plastic cover for the Black & Decker SnakeLight discussed in Chapter 8 was inspired by the contemporary wrap-around headlights in cars. Finally, although a company wants to be the leader, it is critical that it doesn't miss an opportunity identified by a competitor or related market.

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 an understanding of 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 into the world of the user. General Motors blasts the music of the target customer and creates areas filled with products being used by the target generation in their concept studios. Ford has huge picture boards with a variety of images including product photos. The idea is that the music, colors, styles, and looks each 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 targeting your market segment. For example, magazines for an older, upper class economic group might include *Gourmet*, *Architectural Digest*, *Golf*, and travel magazines, while X-Generation magazines might include magazines about mountain biking, snowboarding, *Spin* magazine, *Gear* magazine, and *Wired*. From the magazines, create a collage of the key lifestyle images and typical products. The collage can be organized by subject, color, or randomly put together to give an interpreted snapshot of the user. An example collage is shown in Figure 7.4 that represents issues surrounding the task of shaving the head for the X-Generation crowd. Figure 1.4 showed the HeadBlade, a product to meet just that opportunity.

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



Figure 7.4 Lifestyle reference collage of X-Generation head shaving (b is close-up of part of collage in a).

■ If the team tries to reach too broad a market with a given product, at least initially, then the product may not gain enough buy-in from any one group to succeed.

using a product gives you a sense for the current use of materials, accents, and touch and feel of the products.

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 trans-generational. In that case, a mix of reference materials is necessary. Be careful, however. As 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 a market with a given product, at least initially, then the product may not gain enough buy-in from any one group to succeed.

Ergonomics: Interaction, Task Analysis, and Anthropometrics

Interaction

Ergonomics refers to the dynamic movement of people and their interaction with both static and dynamic man made 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 a consumer looks at a product, it must be consistent with cognitive models that he or she has already developed. If the product is perceived as cognitively dissonant (inconsistent with former patterns), it will be difficult to use and often rejected. Computer screens are a good example of cognitive dissonance. The use of menus and function keys only add to the confusion. When many older consumers (above 60) look at a screen, it is usually unfamiliar to them and they only see one layer of the information. In contrast, a book or magazine has a front cover and table of contents, and both can be quickly scanned. The entire product is visible and parts are instantly accessible by physically thumbing through. The logical order used is linear. While the Web is a very useful resource, it is not deemed as usable by many people who are confused by the interface currently required to gain Web access. And, once on the Web, people are often confused by the complexity of a particular website. A product interface must account for a variety of users that vary in language, age, ability, gender, education, and cultural norms. In the medical field, a product may be used by a sixty-year-old doctor, a twenty-five-year-old nurse, and a thirty-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 very high. It is a challenge to develop one interface that all these

potential users will find easy to navigate and in the medical profession an error can easily be fatal. That same product may 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, there is also the issue of physical comfort and ease of operation. 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 very uncomfortable for tall or overweight people because the interior comfort and space is often compromised for aerodynamics. Food is often packaged in sealed containers that are difficult to open. Reaching an ATM machine from a car window is often a very uncomfortable activity. Office chairs are now designed to provide a stable mobile 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, pins and needles) that can occur when seated for too long.

It is important to understand the physical interaction of the product in use. 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 will often design it for themselves and not for the general public. They will under-design 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 Moore's book, *Crossing the Chasm*. 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. While Moore clearly describes the problem for high-tech products, he does not give the whole solution. The method in this book, using ethnographic customer-centered research and integrating design, engineering, and marketing, will give a product a much higher chance of success in the larger market. This scenario is clearly illustrated in the Iomega case study presented in Chapter 4, where a high-tech product failed in the mass market until an appropriate interface and identity were established. If ergonomic problems are not predicted and 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 in physical product features or warning labels will compromise the look and trust of the consumer.

■ Products must be easy to understand cognitively and comfortable to use physically.

Discomfort can be immediate or 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 where workers will fall victim to an array of injuries that occur when the same action is repeated non stop for days, months, or years. Carpal Tunnel Syndrome is the best known example of repetitive stress injury and can appear in the computer industry or the factory. Scanners in supermarkets were causing a high incidence of Carpal Tunnel until the scanners were redesigned to be handheld. These new ergonomically correct scanners allow cashiers to hold the product and scanner. It reduces the number of repeat attempts and prevents the need to continually use the same motion — dragging items over the static glass window. It is now common to have a masseuse come into computer intensive environments to release the tensions in the neck, shoulder, and arms of people who work at keyboards most of the day. 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. It may 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, then how does that person's process differ from those without physical challenges? Here the task analysis is performed for both types of people and the differences compared. Of course one may question if the process is ideal for even the "normal" person. For example, consider the design of the OXO GoodGrips. 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? Further, consider the non-arthritic person. How effective is the action of peeling with a generic peeler? Are there any aspects of the process that are uncomfortable? This type of analysis led, eventually, 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, even the non-arthritic user as well. A task analysis of the GoodGrips 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 video-taped and the video is used to break down the task. Usually several people are each videotaped and their processes analyzed together. The task sequence is written down step by step. If different people perform parts of the task differently, then branches in the sequence occur to show the different options. If the sequences converge again, then 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.

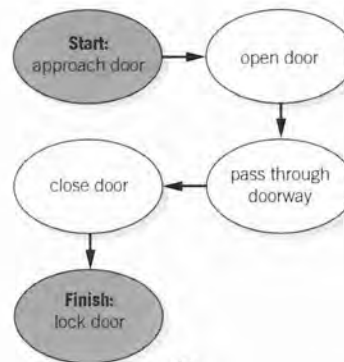
Once the task breakdown is completed, the resulting flow chart or step sequences are analyzed to indicate what is good or ineffective about the process. Also, how does one process differ from another in number of steps, number of alternatives, and number of places of difficulty? The goal in developing 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 to the company, investors, or user the value of the product. 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.

Consider an opportunity to create an automated door opener/lock for the home. One aspect of the research is to understand how people negotiate unlocking and opening a door in the current state and how a product that addresses the opportunity might improve the experience. A task analysis of a person carrying packages attempting to unlock and open a door is shown in Figure 7.5(a). Twelve distinct steps are found in the process. Figure 7.5(b) shows a task analysis of the same person using an automated door opener — the desired process is reduced to 5 distinct steps. Such an analysis clearly articulates the benefits from such a system and the requirements for the product (it must unlock and open the door without further intervention).¹³

Another use of task analysis is to help organize and model process information. Consider the opportunity to clean all of the nooks and crannies in the kitchen like the grooves inside Tupperware lids, holes in cheese graters, or blades of egg beaters. An analysis of over 30 such objects led one team to a form representation of the majority



(a)



(b)

Figure 7.5 Task analysis of opening and unlocking a door in the current situation without (a) and in the desired situation with (b) an automated opener.

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.^{T4}

Finally, a task analysis of Ron the contractor in the scenario above showed a significant number of activities centralized around the beginning and end of the workday. Contractors typically work in small or solo teams. 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-sized 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 would include cutting, planning, and elevating supplies.

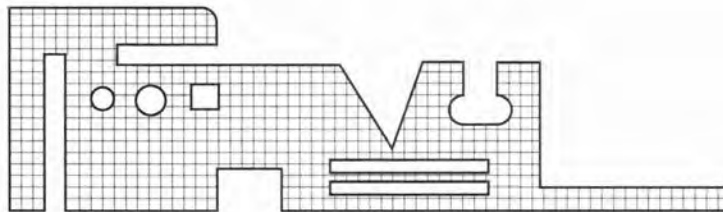


Figure 7.6 A representation of nooks and crannies found in the kitchen.

Anthropometrics

During WWII, issues of man-machine relationships became critical. Given the size of armies and the mass production developed to equip them, it became critical to design equipment to be usable by the largest range of soldiers and to understand the limitations of use. It was an early version of what would evolve into mass marketing during the 1950s. Boots, uniforms, and bunks were designed for the average soldier, what would become 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 are examples of the type of equipment that were designed for function only and thus limited the height and weight of the soldiers that could work comfortably in those spaces. After the war, the information from this field was then applied to manufacture of industrial and farm equipment and office work environments.

A seminal book in this area is the *The Measure of Man and Woman: Human Factors in Design*, by Henry Dreyfuss.¹⁰ The book is the third version of a publication developed by the design firm Henry Dreyfuss and Associates and originally published in 1959 and titled *Measure of Man and Woman*. Henry Dreyfuss was a pioneer in the use of ergonomics for seating and work environments. While the original version relied heavily on data gathered by the military, the newest version represents decades of research gleaned from the work of the firm in a variety of product programs which include 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 (e.g., 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.

slots
rather

ficant
action
e sup-
g, and
d as a
ce and
close
ies.

Desires

Creating Breakthrough Products

197

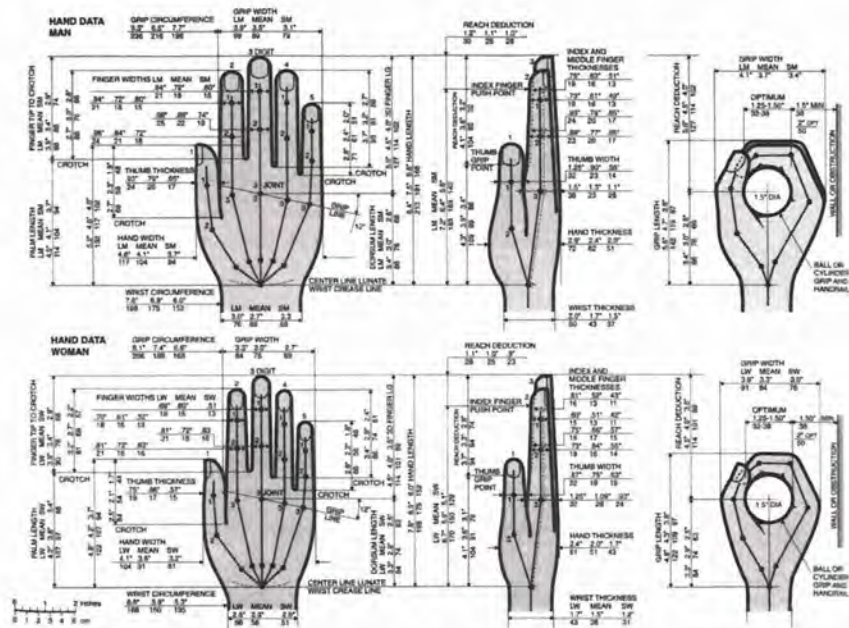


Figure 7.7 Example Dreyfuss anthropometric chart. (Reprinted with permission of Henry Dreyfuss Associates.)

The team focusing on space for contractors to work on used the Dreyfuss charts to determine what anthropometric constraints their design would need to take into consideration. The data covers 95 percent of the population ranging from the first percentile female to the 99th percentile male:

- Table height will range from 32" to 36".
- As the height decreases, the easier it becomes to lift heavy objects. This translates to a height of 6"—8" below the user's elbow.
- Table depth can range from 18" to 36", 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 that 6 feet, allowing for use on different-length trucks.



Henry Dreyfuss

fuss charts to
take into con-
the first per-

cts. This trans-

each across the

and potentially
se on different-

The use of anthropometric analysis in product development is complemented with 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 Frogdesign, 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. A snapshot of that analysis is shown in Figure 7.8. As shown in Figure 7.9, in the development of the Aeron chair (presented in Chapter 8), designer Bill Stumpf performed a detailed study of 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.

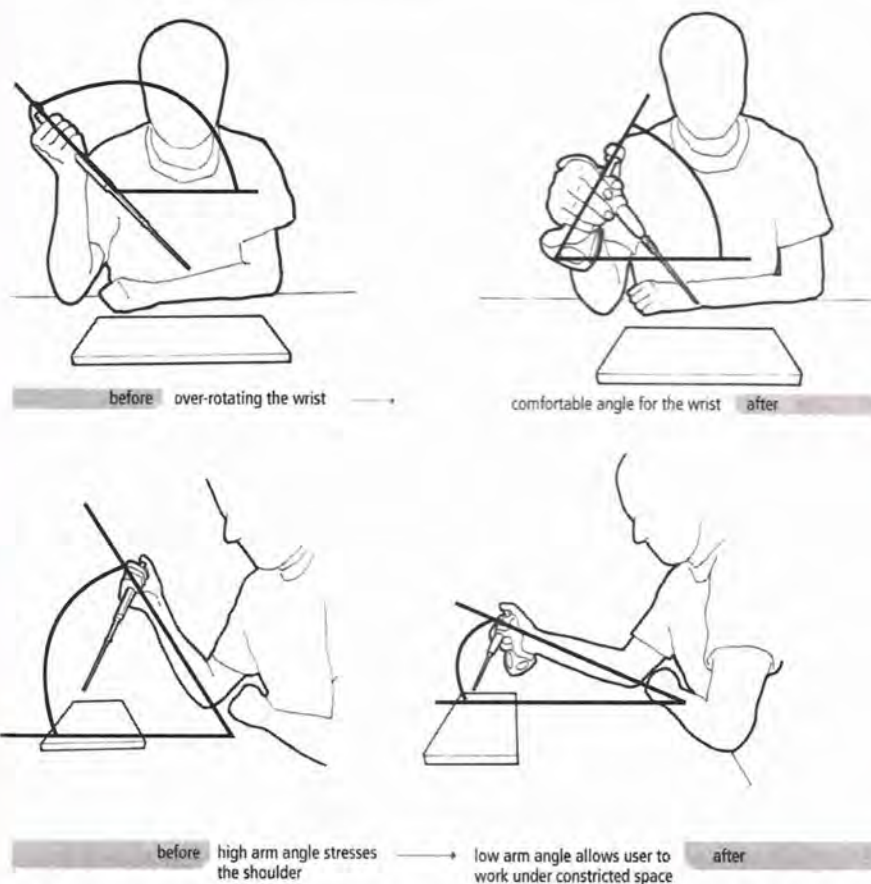


Figure 7.8 Task and biomechanics analysis of the use of the original and new pipette for VistaLab. (Reprinted with permission of Frogdesign and VistaLab Technologies.)

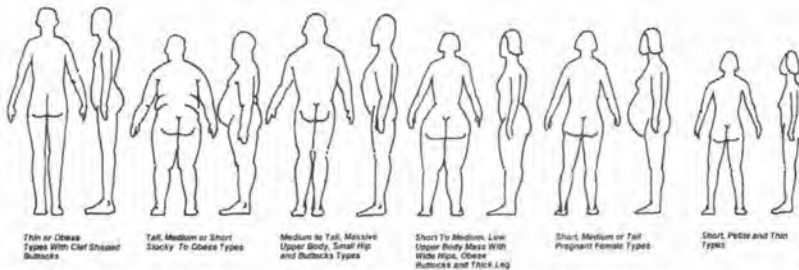


Figure 7.9 Illustration of the variation in body types of people who might sit in the Aeron Chair. (Reprinted with permission of Stumpf Weber Associates.)

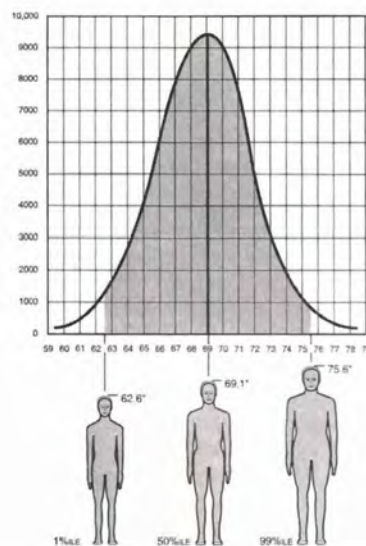
The AT&T Dreyfuss Phone

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 their 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 WWII 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 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. There was no longer a need to contact an operator to make phone calls. People 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. Today, Nokia, a small company in Finland, is one of the most successful producers of mass communication products. Nokia uses the latest concepts in mass customization. They also need to design phones with a set of interaction symbols to compliment the original dial mode. Their use of postponement allows them to match the latest style trends with the latest technology. The evolution from the original Dreyfuss phone for AT&T to the contemporary designs of Nokia 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.)



FREQUENCY DISTRIBUTION CURVE

Figure 7.11 Bell-shaped distribution showing the 50th percentile used by Dreyfuss. (Reprinted with permission of Henry Dreyfuss Associates.)

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

■ The scenario is a reference point for the entire product development process.

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. 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 helping 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, like siding or roof shingles, not to mention a variety of tools. While he can hold most of his smaller tools in the side toolboxes, his larger tools like the break, miter saw, compressor, and saw horses fill the bed of his F-150 such 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 work site 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 saw horses 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, reading drawings, or even eating 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. He also worries about accidentally cutting into the tailgate and damaging his saw blades. So, even though it is convenient to work on the tailgate, 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 were installed professionally. 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 has to be placed on the ground before being loaded into the truck. This means that it might get mud or dirt in it and that Ron 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 what the difficulties are and what opportunities exist for products to improve Ron's daily activities.

Broadening the Focus

Other Stakeholders

Our focus has been on the user. Fundamentally the end customer is the one who will use the product and, generally, will pay for the product. Of course there are multitudes of people that 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, then the company might need to spend money and time to redesign trailers. Similarly, shipping of many products is a significant added cost. Truck sizes are standard and 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 are given some responsibility for the disposal costs of products. By taking into account the disassembly and disposal costs of a product during its development, the overall cost effects can be reduced.

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. Many times, especially in the medical industry, support individuals (nurses, family, etc.) need to operate the product in addition to, or even instead of, the targeted user. In terms of purchasing, there are many situations where 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 is critical. Otis Elevator not only needs to be concerned with the use of their products by people entering a building but also the interface with the building's construction methods, 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 understood early. If secondary stakeholders are significant, then their input should be directly included in the process, possibly by inclusion of a representative from that area on the team. Otherwise, the team should at least understand the requirements and desires from these other downstream disciplines to reduce 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 Non-Consumer Products: Designing Parts Within Products

The focus of this book is on consumer-oriented products and services. The ideas and methods introduced in the book, however, are applicable as well to products within products. OEM 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 like 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 PDA that organizes 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* may not be as relevant here. Instead the words *interface* or *interaction design* may be more appropriate in that the parts must be designed to be used or interacted with. The notion of value here may focus on the quality, core technology, and ergonomics VOs, although creating a part's corporate identity or aesthetic attribute may differentiate an OEM part from that of other suppliers in the field (as is done by Intel).

■ Every part, no matter how simple or small, 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 in what context their parts 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, at least, must be included with manufacturing in the part development team is a critical step toward creating successful parts. Every part, no matter how simple or small, has a user and must be designed with the needs, wants, and desires of the 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 use of the product. An understanding of 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, further, what the customer *expects* and *values*. The research offers a basis to define the Value Opportunities (VOs) of the product and perform 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, insights 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?

What are the major competitors? Specify competing products or alternative products that the market spends money on. Motorola had no competition in equivalent products when developing the Talkabout. Instead their competition was a set of rollerblades and a Walkman of comparable prices and interest to the target market.

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 an anticipated 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 GoodGrips "contemporary" and "comfortable," and the iMac "friendly" and "cool."

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?

In our training sessions with companies, we teach teams how to understand the user, sometimes through just a half-day exercise. We provide a product opportunity statement, the history of similar products, an 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 prior to 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 once the product is established in the market.

Chapter 9 will show how this team used their product definition from their user research to develop an exciting new product. Other case studies in Chapters 8 and 9 will further illustrate how a fundamental understanding of who the user is and what drives successful product development.

Visualizing Ideas and Concepts Early and Often

As the product development process evolves, the team must constantly research who the user is and what he or she desires. The research in this chapter helps in creating a model of the user's characteristics and behavior. As the process moves into Phases III and IV, product concepts and forms are created based initially on this model. Research continues, as these products are constantly tested against the target user group and refined. All of this information must be processed by the team so that all team members

have a shared understanding of the user and the product concept. This shared understanding is critical if they are to communicate the product to people outside of the team as well.

Whether it is a case of dealing with inter- or intra-team communication, visualizing early and often is essential to develop that shared understanding. Keeping a record of the evolution of the ideas is also important and requires a visual representation to do so. The important thing is that ideas are represented in a clear way that everyone sees. While quality programs have promoted the use of communication through written ideas, they have not stressed the use of visualizing concepts of products in two and three dimensions.

Already we have seen clear visual representations of tasks, behavior, and lifestyle reference. Visualization continues to be critical as the process unfolds. There are a host of ways to visualize ideas that are efficient and essential to testing ideas and making improvements. Even developing information on a whiteboard, large pads, or using Post It Notes are some of the many methods. Once ideas have been developed in simple ways, they can be transferred into computer images with software that is easily shared between design and engineering. Many design firms have employees that fill the gap between engineering and design. These computer technicians can help to translate computer-aided design images into engineering files for technical development and manufacture.

■ Early in the process, it is important to start to visualize the product and then to run the representation through a number of evaluations.

Early in the process, it is important to start to visualize the product and then to run the representation through a number of evaluations. There are two basic directions for representation: drawing or three-dimensional models. Designers have the ability to develop a range of visual representations as early in the process as a set of constraints can be determined. This type of anticipatory imaging has become essential to the product process. While designers in the past often gave preliminary ideas to engineers to develop and had little say in the final detail and manufacture, in the case of the breakthrough products we have analyzed this was not the case. The shift in the use of visualization is based on the fact that concepts must go through cycles of review and refinement. In the best cases, designers work with engineering, marketing, and manufacturing from beginning to end to constantly modify and reconfigure the product as it evolves. Visualization in the early phases is often simple and allows for customer and stakeholder input. As the process evolves, the two-dimensional and three-dimensional representation become more detailed and focused.

Early drawings may be made by hand and may even be cartoon-like. This stage is accompanied by the development of lifestyle boards. For example, Figures 9.6 and 9.7 in Chapter 9 show cartoons discussing the evolution of the SET Factors for the redesign of the Mazda Miata. These cartoons helped the team understand how their work was

targeted toward a unified set of design goals. Figure 7.12 shows studio renderings of the Miata. These sketches helped management understand what the product would look like and the team understand how their parts would integrate into a theme. Some ethnographic researchers actually use a technique where 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 truck dashboard could invite truck drivers to a concept development session and give them pieces that represent components and ask them to lay out the dashboard themselves. The truck drivers could give interesting potential solutions. What they also provide is the reasons why they want to change and what problems they are having with existing versions. 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 between design, engineering, and manufacturing. This establishes the tension between the external configuration and the internal components. Current software allows designers to work in traditional free-hand methods and quickly convert to computer-based imaging software to enhance images in three-dimensions. Some companies tend to rely on computer-generated images but quick, free-hand sketches still have value.

Rapid prototyping is a term that is used to refer to the variety of computer-aided methods used to make three-dimensional models of products. Stereolithography, NC milling, and wax deposition are some of the primary processes usually used. There is another type of



Figure 7.12 Studio renderings of the Mazda Miata. (Reprinted with permission of Mazda.)

modeling that works well in the early phases. This process is often referred to as *desktop modeling*. Using a variety of inexpensive materials that are easy to cut with hand tools, designers can produce quick and inexpensive representations of products. These 3D models can be used with drawings to give team members and customers an idea of the potential directions that are being considered. The advantage is that early in the process the team has a physical concept that can be touched and “used.” The less time and economic commitment a team makes to imaging and modeling, the easier it is to make changes. As concepts become clearer, the use of more expensive computer-driven processes is an excellent way to refine a product idea. Larger companies, like Motorola, have full capability for this in house. They can quickly go from rough prototypes to wax deposition then to stereolithography. They can even produce short-run functional prototypes. This capability allowed them to shorten the product cycle time in the development of the original Talkabout and all subsequent versions. In the early phases of the DynaVox DynaMyte, simple block models made out of lead-weighted blocks of wood were used to test the size and interface of the product (shown in Figure 5.4). Figure 7.13 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. 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 to

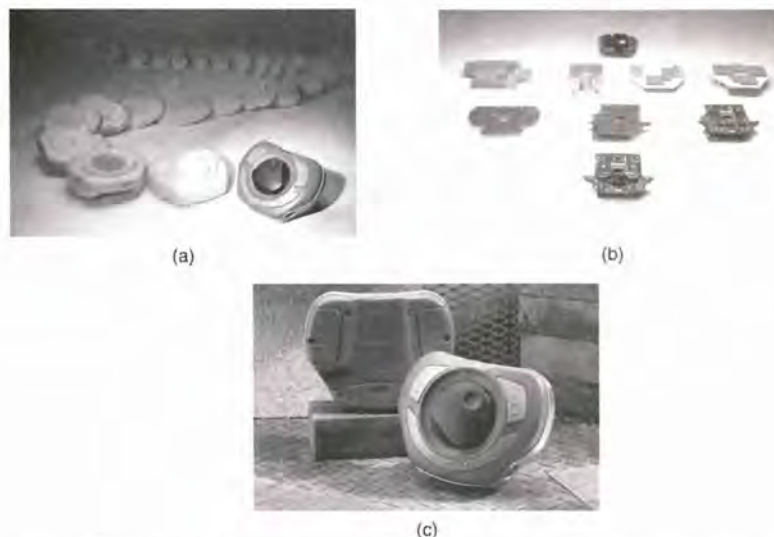


Figure 7.13 Evolution of a wearable computer through various iterations of prototypes; a) form prototypes; b) breadboard prototypes; c) final “VuMan 3” developed at Carnegie Mellon University. (Reprinted with permission of Dan Siewiorek, John Stivoric, and Chris Kasabach.)

processes. You can do some effective modeling early without a major time expenditure or costly investment.

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 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 the different types of representation of the door together. They needed to see the clay models to determine where the interior details were to 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 that 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. Everyone was finally on the same page.

Creating shared understanding is more challenging than it seems. Visualization of information and concepts is one way to overcome perceptual gaps within a team. Visualization in the form of two-dimensional images and three-dimensional models is essential for marketing, engineering, and design to get feedback from customers. Later versions of full working prototypes can be used to refine elements of products. The process must move from simple and suggestive representation to refined, highly detailed representations. This method allows teams to stay in an improvisational framework and react and refine rather than get down to details too early.

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: scenario development, new product ethnography, ergonomics (interaction, task analysis, and anthropometrics), and lifestyle reference.

- ❑ Human factors as a field is growing beyond physical interaction analysis to begin to include issues of desirability.
- ❑ A successful product will balance usability and safety with desirability and fantasy.
- ❑ Visualizing concepts early and often helps the product evolve consistently through the team, management, and potential customers.

References

1. Human Factors Ergonomics Society web site: www.hfes.org, initiated 1995.
2. Taylor, F.W., *The Principles of Scientific Management*, W.W. Norton & Co., New York, 1967 (originally 1911).
3. Schmitt, B.H., and A. Simonson, *Marketing Aesthetics: The Strategic Management of Brands, Identity and Image*, The Free Press, New York, 1997.
4. Jordan, P., *Designing Pleasurable Products: An Introduction to the New Human Factors*, Taylor & Francis, London, 2000.
5. Norman, D.A., *The Design of Everyday Things*, New York, Doubleday, 1990.
6. Fetterman, D.M., *Ethnography Step by Step*, Sage Publications, Newbury Park, 1989.
7. Cain, J., "Experienced-Based Design: Toward a Science of Artful Business Innovation," *Design Management Journal*, Vol. 9, No. 4, pp. 10–16, 1999.
8. Wilcox, S.B., "A Tool for Design Research," *Innovation*, IDSA, Summer, pp. 10–11, 1996.
9. Robinson, R., and J. Nims, "Insight into what Really Matters," *Innovation*, IDSA, Summer, pp. 18–21, 1996.
10. Dreyfuss, H., *The Measure of Man and Woman: Human Factors in Design*, Watson-Guptill Publications, New York, 1993.

Research Acknowledgements

Credit for user research in this chapter to understand opportunities:

T1 This scenario and other reference to this product opportunity were created by designers Josh Guyot, Mark A. Ehrhardt, and Emily Gustavsen, engineers Scott Froom and Richard Bohman, and market researcher Dan Darnell.

T2 This ethnographic research was done by designers Freddy Anzures, Matthew Modell, and April Starr, engineers Cormac Eubanks and Kristo Kreichbaum, and market researcher Eric Hoffman.

T3 This task analysis was done by engineers Noah Brinton, Jay Chu, and Alper Ozturk, designers Robert Suarez and Sanjay Vora, and market researcher Eric Close.

T4 This task analysis was done by market researchers Mark Brownlee, Paul Cinquegrane, and Alex Cook, engineers Stacey Gabor, Thang Ngo, and Jenny Williams, and designers Francine Gemperle and Peter Sellar.



CREATING BREAKTHROUGH PRODUCTS

INNOVATION FROM PRODUCT PLANNING
TO PROGRAM APPROVAL

"Cagan and Vogel have nailed it! This is the first book I have read which addresses the three key areas of modern product development: understanding the value dimension, understanding the branding dimension, and understanding the consumer dimension. The authors successfully knit these concepts together into an effective and readable continuum that provides usable insight and tools that anyone in a product development role can use."

—Charles Jones, Vice President, Global Consumer Design, Whirlpool Corporation

"Anyone interested in the design of everyday things in our lives would appreciate this book. It shows how good design can be made and why there is no longer any excuse for not having it in all the things we love to use."

—Bruce Nussbaum, Editorial Page Editor and Design Editor, BusinessWeek

"Cagan and Vogel's Creating Breakthrough Products is an engaging and insightful look at innovation. The authors have chosen their case studies widely and wisely, and they have produced a book that should find a receptive readership among the diverse membership of successful product development teams."

—Henry Petroski, Author of *Invention by Design* and *The Evolution of Useful Things*

"Cagan and Vogel have written a straightforward, easy-to-follow book that describes the how to's of great product development. Full of case studies and examples, their book provides important insight for the novice as well as the veteran product developer."

—Nancy Philippart, Director, Product Development, Accessories, General Motors Corporation

"In a business where the shelf life of your product is a weekend, I found the book's approach to a disciplined strategic team concept (iNPD) to be an invaluable tool in marketing strategies where identifying and targeting customers is paramount. Essentially every firm is a new product and "breakthrough product" is the name of the game. Now, thanks to Cagan and Vogel, there is finally a mantra for the next millennium: form and function must fulfill fantasy."

—Anthony Sella, Executive Vice President of Advertising and Marketing, Creative Director, Twentieth Century Fox

"Whether you're new to the game and don't want to break something on the way to the next salary grade, or you are experienced and want to push your company to new levels of performance and innovation in today's marketplace, I highly recommend spending time with this book."

—Lou Lenzi, Vice President, New Media Services SBU, Thomson multimedia Inc.

"As one of the participants with Professors Cagan and Vogel in the Carnegie Mellon Integrated Product Development course work, we have seen first hand the benefits of the "breakthrough conceptualizing" and "movement to the Upper Right" tools expounded in this book. Clearly the case studies presented speak for themselves and provide a business model for innovation in any industry."

—Gurminder S. Bedi
Vice President, North American Truck, Ford Motor Company



X003YL1B8X

New - Creating Breakthrough Products: Innovation from Product Planning to Program Approval

\$29.00 U.S./\$44.95 Canada

www.ft-ph.com



An imprint of Pearson Education