

Books

Mass Customization: The New Frontier in Business Competition, B. Joseph Pine II, Harvard Business School Press, Boston, Massachusetts, 1993. 332 pp. (ISBN 0-87584-372-7).

Producing goods upon receipt of an order instead of a forecast has long been a dream of those concerned about marketing, production, and inventory costs. Current and emerging technologies and management practices may now enable firms to mass customize products and services. True "lot size of one" production, while still uncommon, may be the best competitive response where organizations in manufacturing and service industries are bringing new technologies and new ways of managing to reduce costs while increasing variety and customization. The new book, *Mass Customization: The New Frontier in Business Competition* by B. Joseph Pine, offers a detailed analysis of this potential and brings forth a number of methods for bringing the dream to reality.

Mass Customization makes the case that "business as usual" is no longer an option. At the core of the case, Pine presents a motivating model of market turbulence. Market turbulence is measured by factors such as globalization, demand fragmentation, diminishing product life cycles, shifting customer interests, increasing rate of technological change, and other rapidly changing dimensions of commerce. Market turbulence refers to the degree of instability, uncertainty, and lack of control present in markets.

The author argues that when these turbulence conditions emerge, mass customization becomes an imperative. Mass customization is presented as a system for developing, producing, marketing, and delivering goods and services that are individually customized. At the core of this system is a significant increase in product variety and customization without a corresponding increase

in costs. As an organization and management practice, it is a new way of viewing business competition, placing identification and fulfillment of the wants and needs of individual customers in a position that is paramount within the business without sacrificing efficiency, effectiveness, and low cost. Pine employs numerous examples highlighting initiatives across a broad, global spectrum of industries—Toyota, Bally, IBM, Motorola, CNN, Minitel, AT&T, GE, The Limited, Levi Strauss, Du Pont, and dozens of other organizations.

Pine makes the case that in a number of industries, the current degree of market turbulence has increased to a level that will no longer tolerate the historic mass-production approach. The turbulence factors represent a challenge to the stability of demand and the ability to control markets. Pine brings evidence that these factors demonstrate that organizations cannot expect to realize the efficiencies and economies of scale associated with mass production. The companies that Pine profiles recognize this turbulence and thrive on it. These organizations create variety and pursue customization in products and services. The capability emerges through new approaches to management, production, and operations that provide a flexible and responsive organization.

The book argues that sustained advantage comes only through constant innovation and continuously increasing value creation. Pine makes the case for investment in technology and people; leveraging experience and flexibility are essential to success in the changing competitive environment. While the book is not a how-to book, the reader should be able to adopt many of the analytics and methods.

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There are two parts to the book, followed by a very interesting appendix. The first part, "The Shift from Mass Production to Mass Customization" reviews the history of principles and practice of production in U.S. manufacturing. In the first chapter, a parable is used to introduce the industry turbulence and mass-customization themes that are central to the book. The next chapter reviews the evolution of the practice of production, highlighting the limits of historic approaches. The author makes the case that the historic approaches are no longer helpful, in fact are pathological to the emerging competitive environment. Pine examines a number of industries—including the information technology, automobile, beverage, cereal, insurance, fast food, banking, and personal care industries—reviewing how companies have responded to these limits and evolved their systems of management. The fourth chapter introduces the market turbulence model to explain the shift from mass production to mass customization. The model presented (and further elaborated in the Appendix) serves as a diagnostic tool that can be used to evaluate the changing conditions in the reader's market. The final two chapters in the first part of the book discuss the old and new forms of competition.

The second part of the book, entitled "Exploring the New Frontier in Business Competition," provides the link to action in delivering a strategy of mass customization. One chapter presents a number of case histories of global businesses that have developed strategies for customization. The chapter entitled "Mass-Customizing Products and Services" presents methods of mass producing individually customized goods and services and helps the reader build plans of action. The chapter on organization transformation explains how companies are re-engineering processes to achieve high variety and customization. The final chapter considers the limits of the system of mass customization, highlighting dangers that exist, and offers some predictions of the future competitive environment. The reader should not overlook the valuable Appendix that spells out the analysis approach to measuring market turbulence.

Pine brings a special perspective to the issues of production, competition, and management. It may not be the answer for all organizations, but it is an important perspective for all to consider in their analysis of changing markets. The book is truly a cross-industry analysis and is broad in its

images. This is a book about management, strategy, and design. *Mass Customization* is a "must read" for managers thinking about the evolution of their product portfolio and the redesign of production, marketing, and order-fulfillment processes.

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The Silverlake Project: Transformation at IBM, Roy A. Bauer, Emilio Collar, and Victor Tang, with Jerry Wind and Patrick Houston, Oxford University Press, New York, 1992. 214 pp. (ISBN 0-19-506754-1).

There is nothing like a real, or perceived, crisis to force an organization to ask itself, "Who are our customers?" "What do they want?" In the middle of the 1980s, the leadership at IBM's Rochester plant voiced these questions as they organized their development project for a new computer system. While revenues were increasing, market share was rapidly falling. The organization that had helped "make" the midrange computer market in the commercial sector was losing influence in an expanding market. Something had to be done. *The Silverlake Project* is a review of the extraordinary events that played out in the next five years.

As the book tells it, just a few years later on October 10, 1990, Larry Osterwise, the general manager of the IBM Rochester site in Minnesota, was in his office when he received a call from the Secretary of Commerce of the United States. IBM Rochester had just won the coveted Malcolm Baldrige National Quality Award. As word of the award spread through the complex, Osterwise placed a call to senior IBM management, who were attending a semiannual strategic planning meeting. As the news was announced, the senior IBM management team rose to their feet and applauded.

The celebration in Rochester that afternoon was typical of their midwestern setting—an ice-cream social in the cafeteria, the same room where, five years earlier, Tom Furey presented a vision for

the midrange market. The level of skepticism was high in 1985, and the task was daunting. But IBM Rochester had never been conventional.

In December the people that led the quality initiative at IBM Rochester assembled for the award ceremony at the White House. President George Bush hosted the event. In announcing the award, President Bush said, "Most companies catch hell from the competition. But these companies are in the lead because no competitor gave them a tougher time than they gave to themselves."

The authors of this excellent book help us reflect on the management principles that contributed to the success of the Application System/400* (AS/400*) product initiative and the unique turns and paths that IBM Rochester had taken in the last decade. Few outside IBM knew the dimensions of difference that made "Fortress Rochester" a unique organization in the IBM community. Excellence is sometimes born of necessity. The Silverlake Project that led to the highly successful AS/400 computer system was not the beginning of the story, nor was winning the Baldrige the end. However, we are fortunate to have this articulate presentation to offer unique insight into the formation and execution of quality initiatives that transformed one portion of the large IBM organization.

There is great drama in this book. The stories relating the unsuccessful Fort Knox project and the crisis in market position that IBM Rochester faced in 1985 are interesting: The formation of the transformed organization, driven to deliver a milestone computer system with the cooperation of their customers, and the formation of these unique partnership arrangements. The ambitious global product roll-out plan is a classic story with many messages for product managers. Finally, the story of the chase for the Baldrige Award demonstrates teamwork, cooperation, and the benefits of a focused leadership. All serve to help us understand the unique mesh of leadership, drive, cooperation, and tenacity that led to the development of the AS/400 system.

The presentation and flow of the book is based on lessons learned and management principles applied—Leadership and Vision, Putting People in Place, Getting to Know the Customer, Allocating Resources, Breaking the Time Barrier, Forging Outside Partnerships, Empowering People, Re-

inventing the Launch, and Winning the Baldrige. The presentation is retrospective and may be selective in its views of events, but the examples offer strong support to the management principles. The authors clearly make the case that *all* the principles need to be addressed.

I strongly recommend this book. *The Silverlake Project* is well written and holds the reader's interest in several dimensions. There is much to learn here. We learn a bit about the making of computers. We learn much about the competitive dynamics in the volatile computer industry. We are informed on the overall transformation of IBM. However, this book is mainly about *making a difference*, and how to "manage" to make a difference.

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MIT Project Athena: A Model for Distributed Campus Computing, George A. Champine, Digital Press, Bedford, MA, 1991. 282 plus xxii pp. (ISBN 1-55558-072-6).

The Massachusetts Institute of Technology's Project Athena** is a seminal implementation that attempts to answer fully the question "What can a distributed computing environment based on the client-server model *do* for an organization?" The book provides a remarkably candid assessment of both the project's guiding vision and the achieved reality.

In a world where the themes of open systems and connectivity are repeated ceaselessly, the book is especially valuable to the reader seeking an open discussion of the design goals and objectives, the problems encountered in the implementation, and the lessons learned. Project Athena has advanced our knowledge of distributed computing in a large organization. Champine provides an excellent discussion of both the bold technological leap forward and the problems and the benefits of joint cooperation with industry sponsors. The lessons

learned are described and guidelines for future interactions are offered.

The book is easy to read and is well written. In eleven chapters the author covers the issues of development, pedagogy, technology, and administration. Champine focuses remarkably well on the "big picture" issues. The "small picture" issues are covered in a set of six appendices; a comprehensive bibliography covers the relevant technical and administrative literature. The index is unusually thorough.

After a cursory discussion of the vision of Project Athena and an assessment of the reality achieved (Chapters 1 and 2), the author addresses how the system would be used (Chapter 3) and the people problems encountered (Chapter 4). Since Project Athena was to serve largely as an instructional system, Chapter 3 is devoted to discipline-specific concerns ranging from writing to thermodynamics. Of special value is the discussion of the specific course topics addressed. The associated faculty involvement is detailed in Chapter 4. There is no universal agreement about the computer's role in education and Champine presents diverse points of view. Similarly, there is no universal agreement about the computer's role in the organization of the future. The implications are worthy of serious attention.

There is an understandable discussion (Chapters 5-7) of the technology issues—both hardware and software. The reader seeking further technical detail is well served by ample reference citations.

The last section (Chapters 8-11) address issues of administration—finance, benefits to participants (students, industry sponsors, and faculty)—and future directions.

Champine has no neat and simple answers. The reader is given one person's unbiased view of how one organization attempted to solve some specific problems with a specific computing model. Obviously, any such picture must be incomplete but there are similarities to many organizations as well as differences. *MIT Project Athena* offers helpful insights to many of the shared similarities. If any of the papers in this issue of the *IBM Systems Journal* has caught your interest, *MIT Project Athena* is well worth reading.

Daniel Rosich

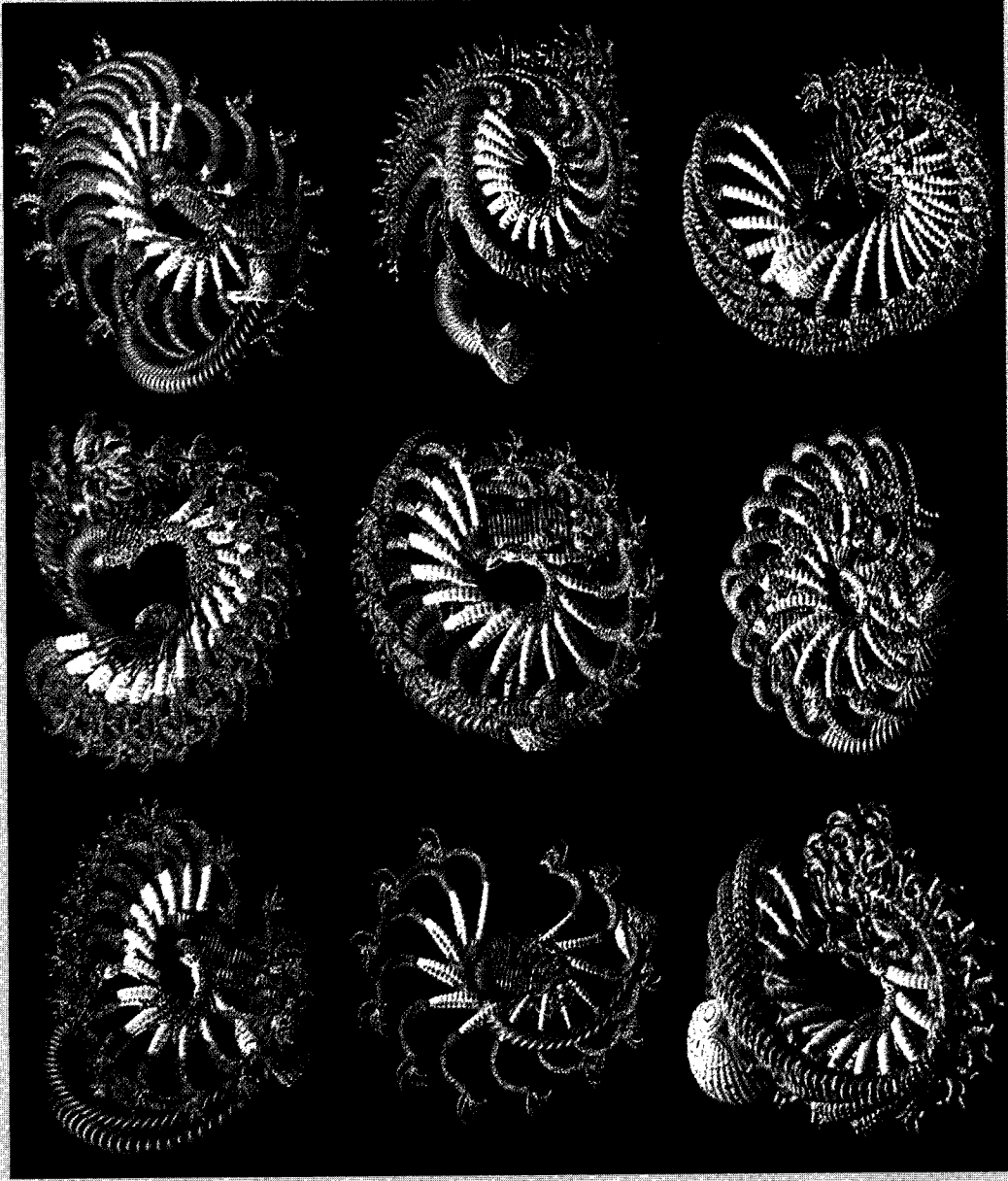
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Evolutionary Art and Computers, Stephen Todd and William Latham, Academic Press, London and New York, 1992. 224 pp., plus 32 pp. of color plates (ISBN 0-12-437185-X).

Evolutionary Art and Computers by Stephen Todd and William Latham documents the artistic process through which Latham creates and animates his life-form-like computer sculptures. Latham is one of the leading *algorithmic artists of our day*. That is, he uses the computer in the most interesting sense: as an indispensable partner in the creative process; not merely as a new palette, paintbrush, and canvas, but as an entirely new, hitherto-inconceivable medium. Latham's fantastic "ghosts of sculptures" resemble a menagerie of life forms from an alien paleontology; Cambrian beasts-that-never-were. Todd is a mathematician and programmer, who acts as Latham's voice throughout the book. He is largely responsible for the technical aspects of the computer systems Latham uses, systems that were developed at the IBM Scientific Centre at Winchester, England. The book is a high-level, yet detailed description of the overall methodology of the software that spawns Latham's works. Specifically—and most interestingly—it describes the *genetic algorithms* used in Latham's creative process.

Genetic algorithms borrow from the biological models of genotype (the encoding of form), phenotype (the expression of encoded form), mutation and sexual reproduction, and (un)natural selection, for simulating "evolution" of form and/or function. Genetic algorithms have been used for some 15 years or so, as an optimization technique. The genetic method is related to those of simulated annealing, steepest ascent, and Monte Carlo optimization. Todd and Latham are among the first to employ genetic algorithms in the service of art. In this application, the not-so-natural selection favors aesthetically pleasing forms, as the "most fit" for survival, reproduction, and continued evolution. This reviewer's personal experi-



Nine mutations from *Evolutionary Art and Computers*. Reprinted with permission by William Latham.

ence with Karl Sims' genetic software has shown the approach to be an astonishingly fecund creative process.

Todd and Latham label their artistic process "evolutionism." It splits the creative task into two distinct parts: that of the *artist-creator*, who creates the software system from which the forms issue, and that of the *artist-gardener*, who weeds and cultivates, being in charge of the subjective aesthetic selection that determines which forms evolve and which become extinct. (As they point out, these parts may be executed by two different individuals.) The artist-creator must devise both the genome and the rules for its expression and modification (essentially a programming task). The artist-gardener is a user of that system, who essentially "plays God" in the evolutionary process and determines the character of the final form. Latham and Todd cooperate in the first part; Latham (the artist) takes over for the second. The text, of course, concerns itself mainly with the first part, aesthetic preferences of an artist being nearly impossible to describe.

The book sports a particularly careful, clear motivation and description of the essential problem genetic algorithms address: searching n -space for local maxima (or minima) of some gradient function defined over that space. In their case, n -space is the bounded space defined by n independent parameters, or input variables. The gradient function is Latham's subjective aesthetic preference. Todd and Latham describe some clever methods for "steering" the (essentially random) search of this space. A graduated evaluation of the "goodness" of several variations of a given form is used to generate what is essentially an evolutionary momentum vector, which determines the magnitude of "progress" (or movement) in a particular direction in parameter space. This guiding vector speeds convergence upon desired traits, but simultaneously helps ensure "convergent" (as opposed to "divergent") evolution, which may limit diversity in the resulting forms.

Todd and Latham are quite concerned with matters of the human/computer interface (HCI). How is a software program tailored to the thought processes and working preferences of an artist? Genetic methods afford an attractive abstraction, which frees the artist/operator from the picayune concerns of input and programming language syntax and semantics; something that may be useful

in a wide variety of applications. It cannot only free the operator from the need for specific training or guidance, but greatly speeds progress toward the goal through both a very high-level interface and the inherent power of a stochastic search process.

The book is written at a very high level and requires no prior knowledge of computer graphics, programming, mathematics, or algorithms. It is profusely illustrated and features many helpful diagrams (though these are not always accurate, as in the labeling of coordinate axes in Figure 2.16 on page 29). The language may seem a bit colloquial, to American readers at least, particularly in the usage of technical terms, which at times vary with the standard North American jargon. Complexity of the subject matter is handled in a nicely incremental fashion, with more difficult and/or detailed descriptions deferred to later chapters. These later chapters (Chapters 6 through 11) provide what nearly amounts to a primer in computer graphics. Chapter 8 is a high-level (as opposed to formal) description of "Form Grow," their shape-generator, detailed enough to provide much of what one would need to know to reproduce the system.

Evolutionary Art and Computers provides thorough documentation of an important aspect of the emerging field of algorithmic art, and a nice presentation of a particular application of the powerful optimization method of genetic algorithms. The number of crisp color plates of Latham's wonderful works and fine black-and-white reproductions of his wild hand-drawn "FormSynth" trees alone make the book worth owning. While Todd and Latham's claim to fatherhood of the use of genetic algorithms and aesthetic selection may be a bit obtuse—they in fact exist in a continuum starting with Richard Dawkins' "The Blind Watchmaker" and carried on independently by other researchers as well—this book will serve as a landmark in the early history of a promising field.

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Note—The books reviewed are those the Editor thinks might be of interest to our readers. The reviews express the opinions of the reviewers.