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Book Reviews

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 Book Reviews

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In *Book Reviews*, we review an extensive and diverse range of books. They cover theory and applications in operations research, statistics, management science, econometrics, mathematics, computers, and information systems. In addition, we include books in other fields that emphasize technical applications. The editor will be pleased to receive an email from those willing to review a book, with an indication of specific areas of interest. If you are aware of a specific book that you would like to review, or that you think should be reviewed, please contact the editor.

The following books are reviewed in this issue of *Interfaces*, 46(6), November–December 2016: *Only Humans Need Apply*, Thomas H. Davenport and Julia Kirby; *Success and Luck: Good Fortune and the Myth of Meritocracy*, Robert H. Frank; and *Multiobjective Linear Programming, An Introduction*, Dinh The Luc.

DAVENPORT, THOMAS H., JULIA KIRBY. 2016. *Only Humans Need Apply*. HarperCollins Publishers. 288 pp. \$29.99.

In *Only Humans Need Apply*, Thomas Davenport and Julia Kirby openly acknowledge that “knowledge workers’ jobs are at risk” (p. 5) and observe that “experts engaging in the current debate... fall into two camps—those who say we are heading inexorably into permanent high levels of unemployment and those who are certain new job types will spring up to replace all the ones that go by the wayside” (p. 8). However, rather than offering yet another opinion on the macroeconomic impact of these ever smarter machines, the authors endeavor to describe the relative strengths of smart machines (e.g., rigorously following rules, doing repetitive tasks quickly and consistently, and rapidly reviewing large volumes of data in search of patterns) and humans (e.g., contextual understanding, integration of information, complex communications, empathy, and creativity), with the core of this book focused on particular steps that individuals might take to leverage these relative strengths in a world in which the pace of technological change continues to increase.

These steps are based on two fundamental ideas. First, the authors observe that it is specific tasks, rather than particular jobs, that are vulnerable to being automated. Second, as more and more routinized tasks are automated, technology will produce

opportunities for higher-order activities that leverage humans’ unique strengths. “Augment, don’t automate!” is one of the book’s key mantras, reflecting the authors’ metaphor of smart machines as wheels for the human mind.

Most people reading this review are likely to be engaged in what the authors call *stepping forward*: developing the cognitive technologies of the future. The book’s *Stepping Forward* chapter reads like an ethnography of today’s technology industry, highlighting not only technical jobs in software engineering, data science, and research, but also roles in product management, marketing, consulting, and entrepreneurship, which are essential if these technologies from research and development are to reach the potential customers. This chapter also includes a nice profile on Zahir Balaporia, a long-time INFORMS member and leader within the Analytics Section, describing his work in facilitating the deployment of smart systems at trucking giant Schneider National. Balaporia is cited as an archetypical internal automation leader, an increasingly important role that interfaces directly with those who are *stepping in* and *stepping up*.

Those that step in are the frontline employees and managers who develop a deep understanding of how new cognitive technologies work, an appreciation of their potential, and an awareness of their limitations. These are the power users and change agents who have the skills, motivation, and inclination to

dig under the hood to understand the model logic, identify its weaknesses from a business perspective, and communicate potentially valuable improvements. These are people working hard in the trenches to help their organizations capture the promised return on investment associated with new technologies.

In contrast, step-up people are business leaders who constantly scan the horizon to understand emerging technologies and potential applications, make high-level decisions about the smart solutions in which they should invest, and manage the myriad challenges of organizational change, all while looking for the next set of big technology-driven opportunities. These are big jobs; although they may be few in number, they are hugely important. As the authors succinctly state, “they’re deciding what smart people do, what smart machines do, and how they work together” (p. 91).

The other two steps described in the book are *stepping narrowly* and *stepping aside*. The authors describe stepping narrowly as finding and cultivating a deep niche for which the opportunity is too small to attract substantial investment for automation. My prototype here is my friend’s small Midwestern law firm, a worldwide leader in cases associated with garage-door opener technologies. The book points out that today’s online search capabilities enable such experts to develop, maintain, promote, and deliver services based on their specialized expertise.

To step aside is to find and (or) create a role comprised largely of tasks for which humans have a distinct long-term advantage over smart machines. The authors cite entertainers, artisans, therapists, writers, and designers as examples. They also point out that smart machines can enable step-aside people to leverage their human strengths, by freeing them from repetitive tasks and enabling them to do vastly more of what they do best.

Despite all the disruptions that increasingly smart machines are already having on the world, the authors are largely optimistic that organizations will adapt in ways that are positive for people:

“As we move more fully into the age of machines...the key to firms’ competitiveness is not the efficiency that automation provides but the distinctiveness that augmentation [of people] allows...they [organizations] will have to attract highly capable people, engage them, and retain them” (p. 224).

I am more ambivalent. As our economy recovers from the Great Recession, job growth has continued to be sluggish, and wages for the middle class have been largely stagnant for quite a long time (Brynjolfsson 2016). Toward the end of the book, Davenport describes a recent conversation he had with an insurance company executive whose desire to deploy automated claims processing technology is driven by the opportunity to please Wall Street by decreasing labor costs. This mindset seems typical of executives in today’s world; as a result, many of yesterday’s entry-level positions have already been automated (or sent offshore). Not coincidentally, these issues have also been a large focus in the 2016 U.S. presidential campaign.

As I came to the end of the book, I was struck by the amount of creativity, judgment, and entrepreneurial skill individuals will require as they go forward. Our broader challenge is to figure out how to pass these lessons on to the members of the next generation to help them avoid getting stepped on or stepped over. My sense is that in addition to reading this book, they would be well served to study the contents of *The Startup of You* (Hoffman and Casnocha 2012). In the future, as both of these books suggest, we will need to see ourselves not as employees, but rather as technology-enabled creative ventures.

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FRANK, ROBERT H. 2016. *Success and Luck: Good Fortune and the Myth of Meritocracy*. Princeton University Press. 187 pp. \$26.95.

In the United States and in many other nations of the world, successful people commonly believe that economic success is primarily the result of talent and sustained hard work. In addition, such people often

pay no attention to luck and claim that luck plays either no role or at best a minuscule role in the attainment of economic success. Robert Frank's basic objective in this book is to challenge these twin beliefs.

Frank begins by making a salient point—individuals who believe that success is a function of only talent and effort and have an unwarranted sense of how talented they truly are “may find it easier to muster the kinds of effort necessary for success” (p. 12). That is, in a perverse manner, false beliefs may be adaptive. So far so good...but the author's next point is somewhat harder to fathom. With regard to current consumption patterns in many societies, Frank says that “it's *lucky* to be wasteful because the mere existence of waste *always* implies opportunities to make *everyone* better off” (p. 16, emphases added). Being wasteful is typically the result of conscious choices; hence, seeing how being wasteful is lucky is difficult. Second, even if it is lucky to be wasteful, it is not obvious at all that this state of affairs implies that opportunities for the betterment of all—as opposed to some—will always exist.

Frank provides many personal anecdotes, and he credibly contends that apparently trivial random events can play a major role in determining the outcome of competitions that have a large number of participants. This notwithstanding, the author rightly points out that the best advice to give someone seeking economic success would be to “develop expertise at a task that others value highly...[and then understand that] expertise comes not from luck but from thousands of hours of difficult effort” (p. 39).

The role that luck plays in determining market outcomes is particularly significant in so-called winner-take-all markets. These are markets in which new technologies and the related institutions “have been providing growing leverage for the talents of the ablest individuals” (p. 41). In this regard, Frank notes that in contests with a large number of participants, there frequently will be someone who is almost as talented as the most talented participant, but much luckier than this ablest participant. Therefore, even when luck accounts for a very small fraction of total performance, “the winner of a large contest will seldom be the most skillful contestant, but will usually be one of the luckiest” (p. 66).

Pointing to the rising costs of the average American wedding, the author perspicaciously notes that today's more expensive weddings have not made married couples any happier. Therefore, he remarks that an across-the-board rollback in wedding expenditures will likely leave wedding celebrants no less happy than before; hence, this specific rise in expenditures “qualifies as pure waste” (p. 111). The author contends that by replacing the present progressive income tax with an even more progressive consumption tax, most of today's wasteful societal expenditure can be eliminated.

Although this is an interesting idea, two points about it deserve mention. First, because the rich do not use many of the public goods whose quality decline Frank laments, it is not clear whether a progressive consumption tax will alter the incentives proved to the rich today. Second, since such a tax will exempt savings from taxation, the marginal tax rates on the highest consumption levels will most likely need to be much higher than the present income tax to obtain comparable amounts of revenue to the government. The political acceptability of this feature of a progressive consumption tax is certainly open to question.

In summary, the author rightly first emphasizes the role that luck plays in determining economic success today. However, luck can be both good and bad and forward-looking agents are able to insure against certain kinds of bad luck. Therefore, this book would have profited from a more nuanced discussion of the role of luck, keeping this dichotomy in mind. Second, the subtitle of the book is a little misleading in that there is no myth of meritocracy. As the author notes on several occasions, one cannot attain economic success today without possessing merit. The key point is that merit alone is not enough to attain success—one also needs to be lucky to some degree. Third, the term moral luck, created by the philosopher Bernard Williams, describes circumstances in which a moral agent is assigned moral blame or praise for an action or its consequences, even if it is clear that the agent in question could not or did not have full control over either the action or its consequences. What are the nexuses between the term luck as used by Frank and the notion of moral luck as formulated by Williams? In particular, does moral luck have a role in determining market outcomes? This is a potential avenue

for future research on the subject of this book. These three points notwithstanding, I would be remiss in my duties if I did not say definitively that this is a fine book that provides a thought-provoking and engaging account of the role that luck plays in determining economic success in contemporary times.

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LUC, DINH THE. 2016. *Multiobjective Linear Programming, An Introduction*. Springer. 325 pp. \$99.00.

Multiobjective optimization is one of the most active research subjects in optimization. Many publications on the topic are available; however, the presentation of linear and nonlinear multiobjective optimization in the monographic literature and in textbooks differs substantially. As the author of the considered book claims: “Apart from Zeleny’s classic 1974 work entitled ‘Linear Multiobjective Programming’ and Steuer’s 1986 book ‘Multiple Criteria Optimization: Theory, Computation and Application,’ nearly all textbooks and monographs on multiobjective optimization are devoted to non-convex problems...” (p. vii). The author is correct that the books on methods for nonlinear, and especially for nonconvex, problems prevail. Nevertheless, in addition to the books mentioned above, other books on linear multiobjective programming, are available; one example is Shi (2001), which I reviewed in Lev (2003). An introduction into multiobjective linear programming also constitutes an essential part of Ehrgott (2010). Luc’s book complements the existing library of books on multiobjective linear programming.

The subtitle, *An Introduction*, tells us that this book’s orientation is to an audience that is inexperienced in optimization; indeed, a reader with a minimal mathematics background can benefit from reading the book. In addition to basic theory and algorithms, it presents some new research results. Its presentation is also useful for professors who wish to select parts of the material to include in some mathematical optimization courses. The author recommends the book for “use in the first part of a course on multiobjective optimization for undergraduates or first-year graduate students in applied mathematics, engineering, computer science, operations research, and economics” (p. viii).

The book consists of three parts: Part 1: *Background* (76 pages); Part 2: *Theory* (153 pages); and Part 3: *Methods* (67 pages). In Part 1, the author introduces basic concepts and results on convex polyhedra and linear programming. The material and presentation are typical of textbooks on linear programming: the main results are formulated as theorems and illustrated by elementary examples and exercises. To avoid any misunderstanding of the text below, I make two comments on the terms used in the review: a point in objective space satisfying Pareto optimality conditions is called a Pareto optimal solution, and the corresponding point in the space of decision variables is called the Pareto optimal decision.

Part II starts with the introduction of the concept of Pareto optimality, focusing on convex polyhedra. The results discussed substantiate the further analysis of the linear problems of multiobjective optimization. It includes proofs of the relationship between the Pareto optimal solutions of multiobjective linear problems (MOLPs) and the solutions of the corresponding scalarized problems. Next, it includes analyses of the duality, sensitivity, and stability of the MOLP solutions. These themes require special consideration since the generalization of the corresponding results on the single-objective linear programming to the multiobjective case is not straightforward. In single-objective linear programming a (primal) maximization problem is associated with a (dual) minimization problem, and the solutions of these problems are related as follows: a feasible solution of the dual problem is an upper bound of the primal problem. This relationship is called weak duality; although it has a similar sense in the multiobjective case, it is not uniquely generalizable to MOLPs. The chapter on duality considers three versions of the weak duality for MOLPs. The first version is based on the dual sets in the objective space. The second version is defined via a Lagrangian function associated with the primal MOLP. The third version is based on polar cones and normal cones in the objective space. The relationships between these and some other versions of duality are illustrated by numerous examples at the end of the chapter on duality. In the chapter on sensitivity and stability, the dependence of solutions of a MOLP on a small perturbation of problem data is considered. In particular, such a dependence is analyzed assuming

that the matrix of the coefficients of objective functions, the elements of the matrix of constraints, and the elements of the vector of right side of the constraint inequality depend continuously or smoothly on a parameter that is slightly perturbed. Frequently, a user is interested only in such Pareto-optimal solutions, which are not sensitive to perturbations of the objective matrix (i.e., when the objective matrix is perturbed either by an addition or removal of some of its rows, or by its combination with another matrix of the same dimension). In the subsection “*Post-optimal Analysis*,” the necessary and sufficient conditions of the robustness of a Pareto-optimal solution are derived, and a radius of robustness is evaluated. Various ways to specify robust solutions are illustrated by examples.

Part III considers three types of algorithms. The multiobjective version of the simplex algorithm is similar to the standard simplex algorithm. In the first step, a feasible basis is found. In subsequent steps, the moves between the adjacent vertices are controlled by a tableau, which is a simple extension of the tableau of the standard simplex method. In the chapter on simplex method, several theorems are proved to substantiate the generalized tableau, which correctly controls the moves between the Pareto-optimal adjacent vertices in the decision space, and ensures finding all those vertices. The next method, which is described in the *Normal Cone Method* chapter, specifies both Pareto-optimal vertices in the decision space and the whole Pareto optimal sets in the decision and objective spaces. This chapter includes several proofs of theorems on normal cones, presents pseudocodes of subalgorithms, and provides exercises to illustrate the performance of the methods described. The third chapter in Part 2 addresses the mapping of the set of Pareto optimal decisions to the objective space to construct the set of Pareto optimal solutions. The former set is, for example, computed by the multiobjective simplex method; however, the latter is of interest

to a human decision maker who may be finalizing a decision.

As the introduction states, a minimal mathematical background (e.g., basic matrix algebra) is sufficient to understand the book’s material. However, the rigorous and detailed presentation of proofs implicitly requires that the reader have mathematical maturity. These presentations are well suited for students in mathematics and theoretical computer science courses; however, they are less suitable for engineering students. Including some informal descriptions with clear illustrations (Springer encourages the inclusion of color illustrations) and formulating the exercises similar to real-world applications would be helpful to engineering and economics students. For that audience, some information on the successful solution of real-world problems, the results of testing them, and the specification of most favorable applications of the algorithms introduced normally is no less interesting than the proofs of various theoretical details. However, no textbook can be equally good for all members of such a broad audience as an advertising abstract is intended to be. As I already state, *Multiobjective Linear Programming, An Introduction* is useful for students of mathematics and theoretical computer science. Finally, I note that Springer recently published a book (Antunes et al. 2016) whose contents and intended audience are similar to that of Luc’s book.

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