Economics and Philosophy, **28** (2012) 87–113

REVIEWS

doi:10.1017/S0266267112000041

Von Neumann, Morgenstern, and the Creation of Game Theory: From Chess to Social Science, 1900–1960, Robert Leonard, Cambridge University Press, 2010, x + 390 pages.

Von Neumann and Morgenstern's landmark 1944 book, *Theory of Games and Economic Behavior*, has long proven enigmatic. As is well known, the book's immediate impact on economic theory was minor, yet it has been widely cited as the inspiration for game theory as it has infiltrated economics since the 1980s. Yet as game theory's star rose in economics, its founding text became increasingly submerged, to the extent that game theory as it is taught in economics departments today bears vanishingly little resemblance to von Neumann and Morgenstern's original conception. Their book is now rarely cited, and probably even more rarely read – hence, the relationship between this brilliant yet increasingly obscure work and the modern success of game theory in economics is a perennial source of puzzlement.

In *Von Neumann, Morgenstern, and the Creation of Game Theory*, Robert Leonard presents a painstakingly researched and vividly narrated account of the origins of *Theory of Games* in the intellectual culture of interwar Europe. The book opens with a fascinating exploration of the theory and practice of chess in the opening decades of the twentieth century, noting how these discussions formed a key part of the backdrop against which mathematicians including Emile Borel and von Neumann would begin to consider the general mathematics of games. Chapters 2–4 recount the early career of von Neumann as he moved through the world of European mathematics, from Budapest to Göttingen, where, as a student of the famed David Hilbert, he produced his first paper on the subject of 'games' in 1928. Next enters Morgenstern, coming of age in the political tumult of interwar Vienna and falling under the intellectual spell of a series of

mentors, from the Romantic idealist Othmar Spann to the standard-bearer of Viennese liberalism, Ludwig von Mises. Chapters 5–8 thus provide a systematic treatment of Morgenstern's complicated intellectual odyssey during this period: his shifting understanding of the possibility and nature of economic equilibrium, and especially his embrace of mathematical abstraction in economic theory and the close relationship he developed with the mathematician Karl Menger and his Colloquium.

Much of this story has been known in a general way to historians of economics from a long trail of articles and books on the early history of game theory (many of Leonard's own creation) dating back to the early 1990s. Yet the book also reports several major findings that are clearly new. The material on chess and psychology in the writings of chess champion Emmanuel Lasker, psychologist Alfred Binet, and others in the 1920s is fascinating, and doubtless many economists will be surprised to learn of the existence of this particular root of von Neumann and Morgenstern's thought. However, the most conspicuously novel parts of the story (especially chapter 9) address the question of why von Neumann and Morgenstern's collaboration emerged when it did: on the cusp of the Second World War, over a decade after von Neumann's initial paper on the topic. Von Neumann's renewed interest in game theory at this time has attracted a number of explanations over the years which have often focused on factors like the problematic status of the Hilbert's programme for metamathematics in the wake of Kurt Gödel's 'incompleteness theorem', and von Neumann's resulting movement toward applied mathematics instead of axiomatics. Yet Leonard focuses on a rather surprising chain of events: von Neumann's divorce, his time spent in Europe trying to bring his second wife to the USA in the summers of the late 1930s, and through this, his increasing preoccupation with the havoc being wrought by fascism on the central European social world that had nurtured him. Reeling from these events, he reached out to his theory of parlor games – especially the rudimentary theory of multi-player games sketched out in his 1928 paper – and turned it into a mathematical theory of social organization fit for pondering the future of Europe on the brink of war.

A few features of Leonard's narrative are particularly curious for those of us who have followed his earlier writing on game theory closely. For all the attention he pays to Morgenstern's intellectual development, Leonard's story does little to dispel the received wisdom that Morgenstern played a relatively minor role in shaping the content of *Theory of Games*, aside from the economic gloss he provided for the introduction of the book and his encouragement to von Neumann to axiomatize the theory of measurable utility (Chapter 11). This makes Morgenstern's prominent place in Leonard's narrative feel a bit odd, since it seems clear that (with the exception of the final two chapters on game theory's place

in wartime operations research and at the RAND Corporation after the war) this book is principally about the creation of *Theory of Games*, the book, as opposed to the 'creation of game theory' more broadly. Certainly, Morgenstern would become a prominent (if mathematically shaky) promoter of game theory after 1944, as von Neumann's interests ran in the direction of computers and numerical methods and his career took him toward administration and public policy. Yet it is precisely in thinking about this period that the early history of Morgenstern's career can shed some light on the patterns of development of postwar 'game theory' more broadly. Morgenstern was a persistent (if often imprecise) critic of existing economic thought, a massively oversized personality, and most important, an exceptionally skilled salesman of ideas and facilitator of intellectual collaborations. These patterns were already visible in his role in stimulating economic theory in interwar Vienna – in the way he accepted tutoring in remedial mathematics from Abraham Wald, and in the close relationship (if not quite a collaboration) he developed with the mathematician Karl Menger and members of his Colloquium. Morgenstern's ability to forge connections and nudge along the research of other, more mathematically gifted individuals would probably be his most significant contribution to the development of game theory after 1944.

Another theme, hinted at in some of Leonard's earlier scholarship yet less fully developed here, concerns the place of 'games' and a particular related style of mathematics and theory-building in the modern social sciences more broadly. Games of chance have of course served as focal points for deliberating the nature of reason and belief since at least the seventeenth century, but the twentieth century saw an explosion of interest in games as a way of understanding social interaction between individuals, and taking individual interaction as the basic building block of broader 'social' phenomena. From Johann Huizinga's history of game-playing in *Homo Ludens* to Wittgenstein's notion of 'language-games' to Erving Goffman's sociological theory, the game motif seems to be everywhere. However, the prospect this fact would seem to open for uncovering a fundamental feature of twentieth century social-scientific inquiry here disappears as a result of Leonard's strong focus on von Neumann and Morgenstern. This larger history of twentieth century social science is of course beyond the task that Leonard has set himself at the outset of this book, yet it is hard not to feel that some of the work's early promise (for example, in the chapter on chess) remains unfulfilled.

Even so, Leonard has introduced a number of other tantalizing themes that pique the reader's interest and carry his story forward. One persistent if unannounced motif of the book concerns the relationship between psychology and mathematics. Psychology crops up in at least two distinct ways. The first flows from the fact that games are clearly

rich sites for the application and exhibition of psychological phenomena such as intelligence, personality, mind, motive and will. This comes across especially clearly in Leonard's chapter on chess, where we see psychologist Alfred Binet investigating the techniques of visualization used by expert players to remember the state of the board in rounds of blind chess, and where we learn of chess master Emanuel Lasker's insistence on the supremacy of psychology over any mechanical chess 'system' in the quest for victory. The role of psychology in games also proved to be a central element of difference between von Neumann's theory and that of Émile Borel, the French mathematician who developed a 'théorie des jeux' contemporaneously with von Neumann. While Borel suggested that the study of games could lead to 'a new chapter in the theory of probability … a new science, where psychology will be no less useful than mathematics' (p. 61), von Neumann was persistently *anti*-psychological, insisting instead on the primacy of mathematical 'simplicity' in the analysis of games (p. 215). This implicit contrast both Lasker and von Neumann draw between calculation (or logic) and 'psychology' of course has a long history, dating back at least to Gottlob Frege, Edmund Husserl, and the critique of 'psychologism' by the nineteenth century mathematical logicians. Given this fact, it might have been interesting to see this theme even more fully fleshed out and grounded, perhaps, in the perennial disciplinary struggles waged between mathematicians and psychologists for authority over the study of logic, calculation and reasoning both practical and pure.

The second theme (somewhat ironic in light of the foregoing discussion) that pervades the book concerns the wellsprings of mathematics in individual and collective psychology. The psychoanalytic language of 'trauma', 'therapy', 'projection' and 'catharsis' hovers over Leonard's assessment of the intellectual activities of the book's protagonists. Writing of Karl Menger's exploration of the mathematics of social organization against the backdrop of Viennese political unrest, Leonard asserts that 'Menger's [work] was one troubled mathematician's response to social disorder and it served a meditative, therapeutic function for the man himself' (p. 135). Von Neumann's return to game theory in the late 1930s likewise comes off as a therapeutic practice, a balm during those dark nights of the soul that he must have experienced following the shock of his divorce and his ringside seat for the destruction of the central European mathematical community that nurtured him in his formative years. Interestingly, Leonard seems to suggest that von Neumann's eschewal of psychology in building a theory of games might have been 'projections of his own desires, signs of his hopes for order beyond the European cataclysm …' (p. 215). And finally, commenting on the game-theorizing and game-playing activities of the RAND mathematicians, he writes 'It is difficult to escape the impression

that, for all the professed rationalism of the times, these collective experimental activities spoke to other, deeper needs … it is difficult to escape the impression that these collective activities bear characteristics of ritual and therapy: collective meditations, so to speak, at a time of anxiety and strain' (p. 343).

There is certainly some justice in many of these characterizations. At the time when he produced *Moral, Wille, und Weltgestaltung*, Menger was clearly suffering under tremendous mental strain. And some of the psychologizing clearly comes directly from the historical actors themselves. Even von Neumann, who tried so hard to eliminate the psychological element from his theory of games, would turn to psychology to explain the exceptional mathematical creativity displayed by himself and his fellow central European Jews, citing 'a feeling of extreme insecurity in the individuals, and the necessity to produce the unusual or face extinction' (p. 200). At the same time, as a historiographical framework, an emphasis on individual psychology can potentially overlook other spurs to creativity (and also selective pressures operating on the ideas thereby generated) that go beyond the individual mind and life-history. Mathematics and economics are not simply avocations: they are also a kind of work, in which someone must pay the bills, certain activities must be performed and things produced, careers must be cultivated and maintained. And work is always performed in the context of institutional and social structures that define what is relevant knowledge, good and bad mathematics, quite apart from larger battles of ideas and political considerations.

This emphasis on the significance of individual psychology rather than on the role of larger economic and institutional structures as forces shaping the production of knowledge is especially striking in the final two chapters of the book (12–13). These cover respectively von Neuman's wartime activities and game theory's earliest appearances in operations research, and some of the activities pursued in connection with game theory in the early years of the Air Force-funded RAND Corporation in the late 1940s and early 1950s. Here, we are treated to an exhibition of some true gems from the history of operations research and the postwar social sciences (for example, the aerial combat studies of the wartime Applied Mathematics Panel, the 1947 RAND Conference of Social Scientists, among others) yet like a discoverer of hidden treasure rich beyond reckoning, the author seems content to let these intellectually momentous episodes slip through his fingers with a sigh and a caress. Moreover it is here that the explanatory framework of the book seems to lose its coherence. How do we bridge the gap between *Theory of Games* as the product of two minds responding to the intellectual and political currents of their times, and 'game theory' as a research tradition among groups of postwar mathematicians and social scientists working with

military support and encouragement? It seems unlikely that some of the great research and development agencies of the wartime and postwar world would commit their immense resources to game theory simply in order to salve the troubled souls of their staff mathematicians, and just as unlikely that game theory would assume such a central role in these organizations for its relatively narrow practical contributions to the finding of submarines or the modelling of aerial combat. Explaining game theory's postwar career would involve greater attention to the networks of patronage that sustained game theory during this period, the appeal of game theory to military sponsors, and just as importantly, the precise nature of the attraction of game theory to postwar applied mathematicians, operations researchers and social scientists.

Nevertheless, Leonard's *Von Neumann, Morgenstern, and the Creation of Game Theory* clearly stands as *the* towering work to date on the history of game theory. The book's historiographical discontinuities in some ways only add to its interest. The emphasis throughout is on understanding the minds of two individuals who had a profound influence on economic thought, yet the book is not exactly a double biography (it barely touches on the later careers of either von Neumann or Morgenstern). Likewise, while Leonard can be read as providing an account of the creation of a key intellectual tradition in economics and the social sciences, the complexity and non-linearity of the narrative makes this much more than a simple history of intellectual origins and genesis – a fact which may come as a disappointment to those historians of economics who are more interested in illuminating the roots of 'game theory' as it exists in contemporary economic theory. What is clear is that the book represents immense achievement in the way it links the histories of science, economics, and cultural and social history through the early careers of John von Neumann and Oskar Morgenstern. To a broader audience, its attention to social and political context will make parts of the book read like a page-turner, while it will remain a rich resource for the scholarly initiate.

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doi:10.1017/S0266267112000053

The Handbook of Rational and Social Choice: An Overview of New Foundations and Applications, edited by Paul Anand, Prasanta K. Pattanaik and Clemens Puppe, Oxford University Press, 2009, xi + 581 pages.

There is something about this book. My copy went missing twice in the last months, once at the London School of Economics and once at Erasmus University Rotterdam, due to people borrowing it, keeping it