## Jörg Bewersdorff

*Glück, Logik und Bluff. Mathematik im Spiel – Methoden, Ergebnisse und Grenzen*
Wiesbaden: Vieweg, 1998; 357 pp.

In this book the author provides a thorough mathematical treatment of games. The main title of the book reflects the subdivision of the domain into the following three subdomains, according to three criteria: (1) *chance games* like Roulette, when chance is the dominant factor; (2) *combinatorial games* like Chess, when the most important factor determining how difficult a game is, is its complexity; and (3) *strategic games* like Poker, when imperfect knowledge is prevailing. For all three game types Bewersdorff gives relevant mathematical approaches on complexities, frontiers and playing strategies.

For the *chance games* these theories are rooted mainly within the probability theory. The player still has to made his or her own decisions, but the decisions have to be based on events in the game that cannot be influenced. Typical games in this domain are dice games, where the outcomes of the dices determine strongly the outcome of the games. Of course, for the interesting games the relation between these outcomes is far from obvious, and difficult probability calculations are needed. Almost all important theories from probability theory are treated, including normal distributions, Poisson distributions, Monte-Carlo methods and Markov chains. The author succeeds in making these difficult theories accessible and understandable for a large audience.

*Combinatorial games* are typified by the openness of the game. No hidden information occurs, no chance is involved. A game is completely determined by decisions by the players, who always have full information during the course of the game. The decisions that can be made are fully determined by fixed, simple rules. The complexity of the games only results from the large number of options from which a player can choose. Most games in this area are board games, like Chess, Checkers, Go, and Othello. For combinatorial games no unified theory is available, but a plethora of techniques are available. Sometimes mathematics provides special “tricks” to analyze combinatorial games completely, e.g., for Nim. Sometimes games can be treated as sums of smaller games, which enable the analysis of games by concepts as temperatures and thermographs. Recently, also techniques emerging from the fields of computer-game playing and artificial intelligence become available. The most important one is the minimax strategy and especially its enhancement, the alpha-beta algorithm. Only for easy games these tools enable the complete analysis of a game (“solving the game”), but otherwise these techniques in combination with many heuristic improvements make it possible to have a good valuation of positions. Since such games are perfect-information games with fixed rules and without chance, where the dominating factor is the large number of moves available to the players, it is easily understandable that especially in this domain the computer has made large progress. Bewersdorff even provides insight in how computers tackle such problems by providing easy-to-grasp algorithms in computer pseudo code.

When imperfect information is the dominating factor, games are denoted as *strategic games*. Imperfect information has to be distinguished from chance, though both deal with uncertain information. In the former case the uncertainty stems from the fact that the information on some state of the game is different for the players, but the remainder of the game will only be influenced by player decisions and not by chance. In the latter case all players have full information about some state of a game, but the uncertainty stems from factors outside the players. Notable examples of strategic games are several card games, like Poker and Bridge, where a player only sees his own cards. For other strategic games the imperfect information stems from the rule that the players have to make their decisions simultaneously, like in Rock-Paper-Scissors. For strategic games the (economic) game theory gives relevant background, with as basis again the minimax strategy. Moreover, concepts from cooperative and non-cooperative game theory, Nash equilibria, coalitions, etc., are clarified to the reader.

All in all I think this book is an excellent one. It is very well written, combining the completeness of an encyclopaedia with an entertaining style of writing. Although a book on games can of course never be complete, almost all mathematical background theories on games where I can think of are treated in the book. Moreover, the selection of games treated is large and well balanced. Even more, besides all mathematical details the author provides many historical and geographical data and gives game variants, if applicable. Notwithstanding this striving for completeness, the book never becomes dull or dry. The author captures the reader by introducing every chapter with a puzzle, problem or otherwise striking statement, which is clarified by the material in the chapter. The examples chosen are intriguing and I noticed that on reading almost any chapter I had to suppress the inclination to start playing the games treated.

To summarize this book in a few words can only be that this book is a must for every game enthusiast, be it a player, a mathematician or a computer-games researcher. There is only one serious drawback, which I hope the author will eliminate as soon as possible: since the book is in German, many people will be unable to read it and to value its worth; they have to wait impatiently for an English translation.

Jos UITERWIJK

Department of Computer Science
Universiteit Maastricht

This book review of Jos Uiterwijk was published in:
Board Games Studies, **3** ( 2001).
Informations concerning this journal can be found at
http://www.boardgamesstudies.org/studies/issue3/contents.shtml