REVIEW

A TRANSFERENCE OF BONES

The Nature of Minimax Search
Ph.D. thesis Don Beal
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Reviewed by Dap Hartmann[1]

"The average Ph.D. thesis is nothing but a transference of bones
from one graveyard to another."

J. Frank Dobie (1888–1964)

Over the past two decades, Don Beal has written more than a dozen papers on computer chess, which were published in *Artificial Intelligence*, the *ICCA Journal*, and in the *Advances in Computer Chess Series*. He edited three volumes of *Advances in Computer Chess* and has been secretary/treasurer of the ICCA for the past seven years. Between the late 1970s and mid 1980s, Beal's Chess Program (BCP) played in a number of major computer-chess tournaments. Usually running on modest hardware, it generally finished somewhere in the middle of the pack. Since 1975, he is a lecturer at Queen Mary College (now Queen Mary and Westfield College) in London, where he got tenure in 1977, and became senior lecturer in 1983. His main research is in artificial intelligence, but he teaches courses ranging from neural networks to VLSI circuit design. Until a few months ago, Don Beal did not have a Ph.D.

"You have so many published papers and scientific credentials — you should make a Ph.D. from your results", Jaap van den Herik told Don Beal two years ago. A very appropriate invitation, I think, to put a crown on the great contributions he has made to computer-chess research over the years. Being appointed a university lectureship with just a Master degree, Beal probably never had the time or the incentive to work on a Ph.D. thesis — something that has become a standard requirement for such a position nowadays. Beal accepted the invitation and came to Maastricht to rework some of his best papers into a thesis. On June 11, he successfully defended his thesis titled *The Nature of Minimax Search*, and was awarded his long awaited doctorate, from the Universiteit Maastricht.

Let there be no misunderstanding: this is *not* an honorary doctorate, the likes of which are handed out all too frequently to world leaders or captains of industry. Personally, I think it is a disgrace to award titles of scientific merit to people such as Bill Clinton, Nelson Mandela or Bill Gates. What kind of message are we sending to aspiring young scientists when Bill Gates, who dropped out of Harvard but went on to become the richest man on the planet, receives his doctorate without even having achieved a Master degree? If Bill Clinton deserves a degree, it should come from Larry Flint, not from the dean of Princeton University. When the Universiteit Nyenrode awarded an honorary doctorate to Dutch grocery mogul Albert Heijn, two Utrecht professors (André Klukhuhn and the late Piet Vroon) returned their Ph.D. degrees in protest. Nyenrode has also awarded honorary doctorates to Bill Gates (for giving the world *Windows* and the *General Protection Fault*), and to Nelson Mandela (for being in prison for 30 years). Ph.D.s are intended to accolade scientific accomplishment, and should not be handed out like evaluation copies of Windows 2000 or OBEs.

The Nature of Minimax Search must be appreciated in the spirit in which it was conceived. The original material that Beal reworked into this thesis dates back quite a few years. The majority of this work was originally published between 1980 and 1986. Only Chapter 5, *An Integrated-Bounds-and-Values (IBV) Numeric Scale for Minimax Search*, is recent (1995), while Chapter 10, *A Generalized Quiescence Seqrch Algorithm*, is from 1990. As a consequence, many of the chapters are somewhat dated. Chapter 8, *Minimax and*

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Retrograde Minimax Using Patterns, takes up almost a quarter of the entire thesis, and presents a case study for handling Minimax with patterns instead of individual positions. The case study is the KPK endgame, and in an Appendix there is even a FORTRAN program that determines for any given KPK position whether it is won or drawn. A very nice accomplishment in 1980, and the reader should keep that in mind instead of dismissing it as trivial. For me, the highlight of the thesis is Chapter 10, in which the concept of the *null move* is introduced. It is the fourth leg of the table where upon (re)lies game-tree searching: minimax, alpha-beta, transposition table, and null move.

Despite my true conviction that the material presented in this thesis fully deserves the Ph.D. degree, I do have a few points of criticism. Basically, the thesis consists of 9 slightly edited papers that were previously published, supplemented with a brief introduction and a chapter of conclusions, which is a rewritten version of the introduction. Of course, all material is now collected in a single volume, uniformly typeset and all. However, adding a brief introductory paragraph to each paper appears to be most of the editing involved in turning it into a chapter of this thesis. The thesis would certainly have benefited from more rigorous proofreading, as there are many typographical errors, an occasional sentence missing, and at least one incorrect chess diagram.

In a perfect world, I imagine that *The Nature of Minimax Search* would have been a monograph on the minimax algorithm and its refinements. Don Beal has contributed enough original material to the field to justify that such a monograph, together with a list of his original papers, passes for his Ph.D. thesis. It would undoubtedly have been a valuable addition to the computer-chess literature, and a pleasure to read, as Beal writes with great clarity. The major disadvantage of the present shape of his thesis, is that each of the chapters is an entity, and thus there is no logical transition from one chapter to the next. There are some attempts (especially in Chapter 9), to refer to other chapters in the thesis, rather than to the original papers. However, the work as a whole lacks continuity, a 'leading thread' if you will. But, at the end of the day, Beal's 4th proposition explains it all: "We are limited not by what we can see, but by what we have time to see". (In The Netherlands, a Ph.D. candidate must also provide a list of propositions that he/she is able to defend along with the thesis itself).

If the *Mephisto Award* had been instituted 20 years ago, I am convinced that Don Beal would have received it at least once. (He was, of course, also recipient of the 1988-1989 *Mephisto Award* for his Editorship of ACC5.) As it is, he has earned himself a well-deserved doctorate, and I am pleased to offer him my sincere congratulations!

Photo by Jaap van den Herik

SCHREDDER, THE NEW WORLD CHAMPION
Bruce Moreland (FERRET) congratulates Stefan Meyer-Kahlen (SHREDDER).
The 9th WCCC, Paderborn, Germany, June 19, 1999.