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CROSS-FERTILIZATION

Two important concepts in the world of science are generalization and specialization. Any researcher who has achieved a research goal by using method X will address the question "is method X applicable in a wider set of domains?" This may be a completely different domain, a related domain, or a domain that is enriched with respect to the original domain (e.g., more complex, more rules, a larger board, etc.). In the section 'future research' of the article to be written on the finding, the researcher is expected to make a strong case at such a generalization.

Some methods seem to be general, almost by nature, but we remark that the first research attempts must have been performed in some specific domain. As telling examples of general methods, we mention data compression, datamining, filtering, profiling, adaptive learning, and agent technology.

Specialization is the other way around. One of the six methods mentioned above may be applied so successfully to a particular domain that it results in a method with its own name, mostly connected to the result of the method. For instance, in the computer-chess world we may speak of Nalimov databases.

In the world of science many breakthroughs have been achieved on the dividing line of two or more research areas, sometimes as a direct consequence of generalization, other times as a result of cross-fertilization. Well-known researchers who have achieved successes by generalization or cross-fertilization are John von Neumann (1903-1957) (from mathematics to computer science), Norbert Wiener (1894-1964) (from mathematics to cybernetics), and Jan Tinbergen (1903-1994) (from physics to econometrics). von Neumann and Wiener were established researchers when they founded a new discipline, but Tinbergen was a Ph.D. student at the time. His supervisor Professor Paul Ehrenfest was not amused when the clever Ph.D. student suggested applying newly-developed wave equations in the world of economics so as to characterize the nature of conjunctural waves. In the end they agreed that the Ph.D. thesis should consist of three parts, viz. the thesis with a new theory on the

wave equations and two appendices, one with an application in physics and one with an application in economics.[1]

In this issue of the Journal we see them all, generalization, cross-fertilization, and specialization. Generalization is shown by Maarten Schadd et al. Well-known methods, such as retrograde analysis and PN search, have been applied to the game of Fanorona. The game is weakly solved, the result is a draw (see pp. 43-44).

A clear example of cross-fertilization is seen in Reijer Grimbergen's article that introduces the use of bitboards for move generation in Shogi. The shogi board is 9×9 and thus differs in size from the chessboard (where the number of squares is conveniently "designed" to fit in a 64-bit word). Yet, Grimbergen succeeded in using the idea of bitboards (of 81 squares) in an analogous way as used by chess programmers. The result is a large improvement in performance, which will inevitably lead to an improvement in the playing strength of Shogi programs.

A form of specialization is found in the article by Ciancarini and Favini, who redefine the concept of a metaposition, earlier introduced by Sakuta and Iida. It is now dedicated to be used efficiently in a game tree of a program that plays the full game of Kriegspiel. So far, in this research domain, most of the programs are restricted to only playing endgames. To show that extreme specialization is also possible, we refer to the article by Cazenave. He reduces the goal of every game programmer "to play the best move" to the effective Go heuristic of "playing the right Atari".

In 1978 Ben Mittman and Barend Swets started the *ICCA Newsletter*. It was specialized on chess. Owing to the series of Advances in Computer Chess Conferences, which in 1999 changed to Advances in Computer Games Conferences, the *ICCA Journal* broadened its scope, too, and published articles on other games. This can be seen as a generalization. As a direct consequence, the Journal was renamed into *ICGA Journal*. Pointing to the successes of this policy we remark that the current issue deals with six different games: Kriegspiel, Shogi, Go, Fanorona, Poker, and Chess. However, the main observation is the successful cross-fertilization as embodied by Reijer Grimbergen's contribution. Continuing this way of research, we may expect a considerable increase of playing strength in all game programs. In the coming years, our Computer Olympiads may prove this expectation. The next Olympiads are in Amsterdam (June 11 to June 18, 2007) and in Beijing (July 27 to August 3, 2008). I look forward to see the performances of the game programs in these events.

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The credits of the photographs in this issue are to: Eric van Reem and Hartmut Metz.

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