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## **CSS Category: Experiment**

# **The "Dreihirn" Decision Sharing in Chess**

Human versus computer, strategy versus tactics... Why confrontation all the time and not also cooperation? Guided by this idea, CSS reader Ingo Althöfer from Lage/Lippe [in West Germany] created a fascinating symbiosis of human and machine, the **Dreihirn** [pronounce the German number "drei" like "dry" in English - and the "i" in "Hirn" like the "i" in English "winter"].

Every chess and computer freak will have a dream some day: to write the chess program that would be the first artificial intelligence to beat the world chess champion. I was one of these dreamers. "Prepared" by one decade of tournament chess and in the meantime four years of mathematical studies at University, I felt from time to time that I should try to develop an own chess playing program. But after a realistic analysis of cost and expected reward, I had to confess that on the conventional path I would have almost no chance to achieve a big breakthrough in chess programming.

I would likely succeed in hacking "some" program. It would play chess according to the rules. But above average? Unlikely! On the search for new paths I had several negative experiences. Then, finally I tried to combine an observation on the current chess machines with an idea from a non-chess field.

## **Giving the Computer a Plan**

The observation concerned the lack of plan with which chess computers frequently agitated in positions where the opponent played passively and seemingly aimless. A very good example for this is the match over four games between IM David Levy and computer chess world champion "Cray Blitz" back in 1984 (see CSS 2/1984 and 4+5/1984). The IM from Scotland did a masterly job in keeping the positions closed and avoiding all short maneuvers, until the computer had weakened itself so much by aimless moves that Levy had easy wins.

Shouldn't the machine have performed much better when in such aimless phases "somebody" would have intervened and implanted a plan into the computer play?

The second idea - from a non-chess field - can be seen in architecture, for instance. To reach an optimal decision for a certain task, the process of decision making is split on several levels. As an example, consider the construction of a soccer stadium. What will the builder do? Okay, a standard procedure is to make an offering for public tender in which architects can submit their proposals for the stadium. A jury will look at all the proposals and select one which will finally be realized. Perhaps, a combination of different proposals will be selected.

This principle of decision sharing could be realized in a chess computer in the following way: the player (in a chess game) does no longer consist of one computer, but instead of several computers and one control unit. Each computer in this system displays the move it would execute in normal mode. From these different (or in some cases identical) candidate moves the control unit would make the final choice, according to some fixed criteria.

The idea behind this approach is the following:

In an ideal case the chess computers in use propose only moves which realize all short-range (tactical) threads and make no coarse errors which could be refuted immediately.

The control unit makes the final choice amongst the candidate moves according to positional reasoning. In the long run the control unit shall be a computer program. But currently it is not clear for me according to which criteria the unit shall work and decide. So, as an intermediate construction I developed the idea of "**Dreihirn**".

## **Rules for the Dreihirn**

The Dreihirn consists of three parts: chess computer I, chess computer II, human player, called "coordinator" in the sequel. Both chess computers have productive tasks, the coordinator has the final choice between the moves "produced" by the chess computers. When Dreihirn has to make a move in a chess game, the following happens:

The coordinator enters the current position in both chess computers and starts them. When both machines have "made" their moves the coordinator selects one of these two moves and executes it on the board. In cases where both computers propose the same move the coordinator has to execute this one. So, the coordinator is not allowed to execute a move different from the ones proposed by the machines. After this procedure, the opposing player is to move again.

Based on this core of rules, I arranged a private chess tournament with the Dreihirn and eight chess players from clubs in Lippe (Lippe is a small region in the north-eastern part of North-Rhine Westphalia, one of the German states). Each human played two tournament games against Dreihirn (with thinking time 2 hours for 40 moves and thereafter 1 hour for each group of 20 moves). After these two rounds, all players with the best score from their games each one played two more games [against Dreihirn]. At the end, the player with most points would be the winner, receiving prize money. So, there was also a monetary reason to play with full power and not "just only for fun".

My computers in use were Mephisto II and Mephisto III. Time level for both machines was the longest analysis level - with the intention to stop the compute processes in moments which seemed appropriate to me. Doing so, I did not watch the current candidate moves before stopping the machines. In tactically difficult positions, I let the computers work longer, and in positions with little or no combinations only relatively short.

Mephisto II und Mephisto III became my choice for several reasons, amongst others:

1. The devices are easy for transport, as they are not bulky.
2. Because of their small sizes, the devices can easily be put on a normal table, next to the chess board.
3. The devices are not exotic machines but chess computers of the middle class. Many chess players own such machines.
4. In the Mephistos, the display of moves is clearly arranged, and the "take back/undo" function for moves which of course happens frequently in Dreihirn can be done without problems.
5. Me II and Me III have very different programs. So they propose different moves sufficiently often and I as the coordinator have enough to decide.

## Thrilling Games

With only a few exceptions, the 20 games were interesting and thrilling. One reason for this was my coordinating style: in any case with a choice I opted for the sharper alternative. Altogether, Dreihirn won 7 games and lost 13. Not a single one of the 20 games ended in a draw.

One of the most thrilling games of the whole tournament was the last final game against Axel Boldt from Bad Salzflun. After the opening, White (=Dreihirn) reached a winning position with two extra pawns. But Black's counter attack against the spot g2 is very strong. Finally, Black won by a queen sacrifice that was behind Dreihirn's horizon.

### Game Dreihirn vs Axel Boldt

In each line the move number, the candidate moves by Mephisto II and Mephisto III, the move of Dreihirn, and the move by Axel Boldt are given in this order. Stars indicate which candidate computer moves were selected.

1.	e4*	e4*	e4	g6
2.	Nc3*	d4	Nc3	Bg7
3.	d4*	d4*	d4	d6
4.	Bc4	Nf3*	Nf3	c6
5.	Be2*	Bf4	Be2	Nd7
6.	0-0*	0-0*	0-0	Ngf6
7.	Bg5*	Bf4	Bg5	h6
8.	Bf4*	Bc1	Bf4	a6
9.	b3*	e5	b3	b5
10.	e5*	e5*	e5	Nh5
11.	Bd2*	Qd2	Bd2	dxе5
12.	Be3	Nxe5*	Nxe5	b4
13.	Nxc6*	Na4	Nxc6	Qc7
14.	Na4	Nxb4*	Nxb4	Bxd4
15.	Bxh5*	Bxh5*	Bxh5	gxh5
16.	Ncd5*	Nbd5	Ncd5	Qc5
17.	c3*	c3*	c3	Be5
18.	Be3*	Qxh5	Be3	Qb5
19.	f4*	f4*	f4	Bd6
20.	Bd4	a4*	a4	Qb8
21.	Nc6*	Nc6*	Nc6	Qb7
22.	Na5*	Na5*	Na5	Qb8
23.	Bd4	Qxh5*	Qxh5	e6
24.	Bd4*	Nb4	Bd4	Rg8
25.	Qxh6*	Nf6+	Qxh6	Bb7
26.	Nc3*	Nc3*	Nc3	Be4
27.	b4*	h3	b4*	Qc7
28.	Nac4*	Qh4	Nac4	Qxc4
29.	Nxc4	Bc5*	Bc5	Nxe5
30.	Nxc4	bxc5*	bxc5	Bxc5
31.	Rfe1	Qh3*	Qh3	Bxe3+
32.	Qxe3*	Qxe3*	Qxe3	Rxg2+
33.	Kh1*	Kh1*	Kh1	Rg3+

White resigns

Times used: 1 hour 48 minutes by White / 1 hour 33 minutes by Black

Instead of 25. Qxh6 the move 25. Rae1 would have won directly (25... Rg6 26. f5!). When selecting move 28. Nac4 I had completely missed the queen sacrifice 28... Qxc4 together with the mate on g2. After 28. Qh4 Be7 29. Qf2, followed by queenside castling of Black, the position would have been unclear.

## Conclusions

The following points sum up miscellaneous advantages and possible extensions of the Dreihirn principle.

1. It should be simpler to refine two given chess computers to a Dreihirn by a self written control unit instead of writing a completely new chess program.
2. The setting with two chess computers and a human for the coordinator job is also interesting in its own light and offers itself for miscellaneous applications:
  - a) The chess understanding of two human players A and B could be compared by a match Dreihirn I vs. Dreihirn II, where Dreihirn I = (Computer I, Computer II, Player A) and Dreihirn II = (Computer I, Computer II, Player B).
  - b) A chess game in the role of a coordinator is less straining than a normal one, but in contrast to "only-operating" a chess computer in normal mode the coordinator is not in a passive role.
  - c) When a person wants to buy a chess computer and is still undecided between model X or model Y he can play a Dreihirn game with proposals from X and Y to find out which moves he likes more in the average.
  - d) In Dreihirn mode, it is possible that players take the role of the coordinator which do not understand much about chess, yet. They might develop their positional feeling by observing the consequences of their move choices.
  - e) Frequently occurring error types in games of Dreihirns with different chess computers indicate weak spots in chess programming in general.
  - f) I presume that in correspondence chess already today chess computers are used in similar ways.

I want to conclude the report with an outlook on possible variants of the Dreihirn principle: Perhaps someone will adopt the task to really program a coordinator unit for two or more existing chess computers. Highly interesting would of course be a chess computer which outputs several candidate moves instead of a single one - giving the coordinator the chance for his choice.



**Mephisto II (links) und Mephisto III (rechts); Fotos: Sascha Warnemünde**

Finally there comes the question, if perhaps a Dreihirn with Belle/Cray Blitz/IM Levy would have good chances against a chess grandmaster.