

## ***Chess Robots are still around!***

Yes, that's right, we still have an original Robochess! Long ago, in 1770, the Hungarian baron and engineer Wolfgang von Kempelen built the first chess machine. This machine looked like a big trunk with a chessboard on top and behind that an Arabic looking mechanical man wearing a turban. Because of the appearance of this man, the machine soon was nicknamed the Turk. During the many presentations the machine was shown to the public, and they could see the Turk perform. Before demonstrating a game, Von Kempelen showed the interior of the machine to the public. By opening the doors of the trunk, he convinced the spectators that there really was no one inside. What they actually saw was a complicated mechanical robot consisting of many wheels and levers. The whole thing was a deception, because the machine was constructed in such a way that a chess-master could be hidden in it. When, during a performance, the doors were opened, he could move in such a way that the public could not see him. Man was in the machine and operated the Turk.

The building of a chess-robot has fascinated man throughout all ages. Even now, in the 21<sup>st</sup> century, the fascination for the 'living machine' has not disappeared. Robochess is the new chess-robot of this century. The name of the machine – as you can see – is a junction of Robot and chess. Robochess is the creation of the 46-year old Hans Lammers from Heemstede, a town about 20 kilometres outside Amsterdam. The machine can, as a real robot should, carry out its own moves, but Robochess can also talk. The machine turns out to be a woman. The woman in the robot is not just any woman, but the inventor's wife Lucia! So the robot is a 'she' and not a 'he' and should be addressed as such.

Robochess is 70 cm long en 50 cm wide. With her underarm in resting position she is 1.10 meter high. She weights 30 kilo. The wooden trunk of the robot is too small for a human, so I refrained from asking Hans to open her belly to see what is inside. Hans who has two children, a son and a daughter, a few years ago absolutely never would have dared to dream that he would have another daughter. When I walked into Hans's living room I felt the same fascination at seeing his brainchild. I even was allowed to play chess with her! Naturally I wanted to know more about her. Time for an interview with the father of Robochess.

### ***Hans, how long have you been playing chess and have you ever played with a club?***

I hardly ever play chess. I play one or two games a year at the most, so I am not a chess-club member.

### ***Can you tell me how the idea to make a chess-robot came up?***

First, I wanted to make a robot that could vacuum-clean. But the problem with that is that you can't use a cord because the thing moves all over the room. So you'll have to work with batteries. Also, I heard that they were going to make one in Japan.

A couple of years ago I was with my son attending a special day of the Pharos association in Zeist, a club for highly intelligent people. My son is actually highly intelligent. They had made a miniature traffic situation where everything was operated by a computer, like traffic lights, speed bumps, etc. I found it very interesting to see how the traffic, by means of the parallel port of the computer, was regulated. From this I got the idea to make a robot-arm. I wanted to let the computer express something creative, something you can see and from that it is only a small step to chess. Chess and computers have really always been connected. Chess is a game that asks for a certain amount of intelligence and it takes place on a limited area. So it is pre-eminently suited for a robot-arm.

### ***Are you, like your son, highly intelligent?***

I can't say that for sure about myself, but I think I do have a more than average creative talent. Before I started on Robochess, I was active in the field of music, while I was never taught how to read music. I wrote 11 Rhythm & Blues compositions and offered them to a music publisher. They thought my work was very good, but it was never made into a CD because the titles did not suit the genre they were releasing at the time. I also assembled a guitar myself. But the highlight for me was making a chess-robot.

***Do you actually have a technical background that helps you realise your ideas more easily?***

No, I only finished secondary modern school and obtained a typing-diploma. I have always had a big interest in technique though. I used to be a maintenance mechanic with a firm that imported clocks from Germany and sold them to retailers in Holland. Together with a couple of colleagues I repaired broken clocks and alarm clocks.

***Where did you get the know-how to make a chess-robot?***

I was not knowledgeable about goniometry and you do need that to calculate the positions of the arm. You are actually dealing with combined movements that are performed by three motors. These movements, also known as steps, have to be calculated mathematically. I only ever did secondary school math, years ago, so I just couldn't do it. I had to learn a lot about the technique (digital electronics) to let the steps-motors of the robot-arm communicate with the PC. In addition, you have to be able to write a program that, together with the chess-program and with the help of digital electronics, enables the whole thing to communicate hardware-wise. The robot-arm can then correctly execute the moves of the chess-program and subsequently pass on the moves of the opponent in the correct way to the chess-program. So you need knowledge of math (goniometry), electronics, programming, and wood-constructions. Therefore I borrowed several books from the library and consulted them about goniometry and digital electronics. I also bought a book about the programming-language Visual Basic. Of course I only read the things that were important for the construction of the robot, otherwise I still would not have finished it.

***How long did you work on it?***

I worked 2½ years on it and now it is finished, apart from some minor growing pains. Meanwhile, the control program I wrote in Visual Basic has reached a length of 70 pages A4.

***Can you tell me exactly what is in the wooden trunk of RoboChess?***

In the trunk are two PC-motherboards, each equipped with a 80486-processor and containing 20 and 8 Megabytes of RAM respectively. It is no problem to replace them later by two Pentium-motherboards. The most complicated job actually was to let them communicate hardware-wise. You need a lot of knowledge of digital electronics for that. You have quite a few zeros and ones coming into the picture!

***Why two motherboards?***

The first motherboard is used for the chess-program Psion (1985) of Richard Lang. Of course, any other chess-program can be used as well. The second motherboard is used for the Visual Basic program that I wrote myself and that takes care of the communication between Psion and the motors of the robot-arm. At first I used one motherboard for both programs. With the help of multi-tasking they each were separately assigned processor-time. This did not work so good however, because subsequently the robot-arm moved less fluently or even faltered. The reason for this was that the one program would for instance be active too long, on account of which the other would perform less than well. With two motherboards there is no interference and both programs function well. This has the additional advantage that two monitors can be connected to them. At the moment I use for Psion a former portable TV that takes up little room and for the Visual Basic program an ordinary PC-monitor.

***What kind of material is RoboChess made of?***

The robot-arm is made of aluminium corner-pieces that are normally used under cupboard-doors. Furthermore it has chains attached to it. Originally I even used the lavatory pull-chain, but that creaked and hooked too much, so I used another one for that. I bought the steps-motors, and many other parts, at an army and electronics dump-store in IJmuiden. The fun part of that is that you can re-use stuff that was actually ready to be thrown out and save a lot of money at the same time. At first, the motors I bought there were much too weak, so that the arm could barely lift the chess-pieces. Then I started again with much stronger motors that did in fact have the ability to give the arm sufficient strength. The robot-arm moves the pieces by means of an electromagnet, a former car-relay. I drilled holes in the upper side of the chess-pieces and put in small metal bolts, so that the electromagnet, that is located in the end of the arm, can lift them. In the bottom of the pieces I also drilled holes and put in magnets that relay the moves of the opponent, via the read-contacts-board, to the chess-program. Then the chess-program, via my Visual

Basic program, passes the countermove on to the steps-motors of the robot-arm, which let the arm carry out the move. I made the wooden trunk out of very fine chipboard. The trunk contains, as I already mentioned, two PC-motherboards which communicate through cables with the steps-motors of the robot-arm.

***During the game I played with her, I noticed a row of led-lamps blinking. What is the meaning of that?***

The lamps go on one by one during the thinking time of the opponent. How fast they go on, depends on the time you set per move. When all lights are on, the RoboChess assumes that the thinking time is over and no further moves are allowed. If the opponent is still in deep thought, then the lamps will just start blinking again. However, if he does make a move and the lamps of RoboChess all go on next, then – the same as with roulette – “Rien ne va plus!” is in order. This is important for the detection-time of the robot. For RoboChess needs to know for sure that the opponent has made a move and next needs to detect this move by means of a ticking mechanism. During that time nothing is to be carried out on the board.

***The voice in the robot is that of your wife Lucia. Can you tell me a little more about this?***

First, I write a number of texts on a sheet of paper. These texts are read and recorded by Lucia, with the help of a PC, microphone and sound-recording software. The computer converts these short texts to WAV-files. Next, I integrate these sound-files in my Visual Basic control-program, which sees to it that the robot completely randomly chooses a text. It works the same as a dice. Suppose there are six alternative ways of saying how a move should be carried out. With alternative 3 the robot says for example ‘I move’ and with alternative 5 she says ‘I do’ and with alternative 2 something else again. This way even I never know exactly what she is going to say. With the help of a soundcard and two small boxes RoboChess can speak the text. Naturally, it is also possible to build in two small speakers. We add to her vocabulary daily, so she gets continually more talkative!

It is important to know that RoboChess is interactive. When you turn her on with a simple switch, she asks you: “What is your name?” Through a microphone you tell her that your name is Rob. She will then ask you: “At what level do you want to play, Rob?” You answer for example that you want to play at level 3. She will then say: “Ok, Rob, we will now play at level 3.” Your voice is actually being recognized by a speech-chip that subsequently sends a code to the Visual Basic control-program. This program then knows what text goes with that code and next speaks the text. In addition, she can give you hints, and if you need to go to the bathroom, you can say to her: “I want to take a break.” She will answer: “Ok, see you in a minute.” She then temporarily stops the game until you, by pushing a button, indicate that you want to continue.

***Do you have any commercial plans with RoboChess in the near future?***

I haven’t investigated this yet, although it is certainly not unimportant. You could for example sell the robot to certain institutions. Perhaps a home for the elderly would be interested in buying her, possibly with municipal subsidy. They could put her in the recreation-room, so that the chess-lovers in the home can enjoy her. This would create a whole new social element, because the elderly can join forces to play against RoboChess.

***Nowadays the production of RoboChess is much too expensive and therefore not attractive to a manufacturer. Besides the price tag for the consumer will be too high. How do you think you can solve this problem?***

If necessary I will make the robot myself, made to order for a customer. It is hard to say for how much money I would sell RoboChess, but a rich eccentric who is really interested certainly might want to pay a substantial amount of money for it. Another idea is that I make her in the form of an assembly kit and have a number of these kits assembled. Recently I have joined the Dutch Order of Inventors (NOVU) and I should be able to pick up a lot of ideas there.

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