Printing Chess Computers, fantasy or reality?

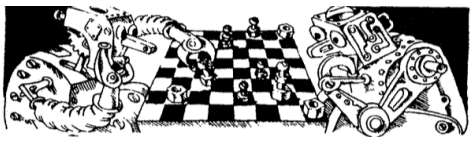
3D printing, "a third industrial revolution." On the Internet I came across this statement several times. Words of praise for this new phenomenon and the many possibilities it offers. No more an ordinary inkjet printer that is only able to squirt ink on a piece of paper and provide text or images, but a machine that can print real objects!

A 3D printer is, as the name says, a three-dimensional printer that uses new production techniques. The printing process is carried out with a variety of materials such as plaster, vegetable substances, bioplastic, polyester etc. For some mechanical applications, a ceramic powder is used. This new way of printing can print out powder in layers, so that it takes a solid form. Also, materials such as plastic can be made liquid in the print head and printed out in a solid form, layer by layer. By using UV-light in the print head, liquids such as photopolymer can be converted into a solid layer.

Novag 2Robot & Novag Robot Adversary

Before the 3D printer can print the desired object or component, much work has to be done! A digital blueprint must be made on the computer using CAD (Computer Aided Design) software. When the 3D design is completely finished, a 3D printer can print it with suitable materials. Most people do not have the required software, and only have an ordinary inkjet printer. This problem is quickly solved, since there are several internet companies that can take over these tasks. However, this comes at a price, although the technique is gaining ground and prices are expected to fall in the coming years.

The creative possibilities are almost limitless! How about printing a pencil box, a case for your iPhone, a bracelet, or self-designed new Chess Pieces that hopefully will rise your Elo rating rapidly?



Specific components can also be printed. Medical science has already responded enthusiastically as, for example, manufacturing bones and cartilage can be done much more advanced with 3D printing than with the current technology. The "National Aeronautics and Space Administration" (NASA) works together with specialized companies and developed a 3D printer that can be used in space. In this process various problems need to be overcome because of the absence of gravity. The International Space Station (ISS) already has a 3D printer that is capable to print all kinds of equipment, such as tools and components, in weightlessness.

The Naturalis Biodiversity Center in the Dutch city of Leiden is the proud owner of a 67-million-year old Tyrannosaurus rex named Trix. The skeleton is still largely intact, but for reconstruction of the missing body parts, such as the left leg, a 3D technique was used. By scanning the right leg digitally, the left leg was reconstructed and could be printed mirrored with a 3D printer.

If a leg of a T. rex can be printed, would it be possible to repair a broken arm of the notorious and famous Novag Robot Adversary with this technique?

Our active and innovative CSVN chairman Ruud Martin came some years ago in possession of this rare chess robot by an exchange with a German computer chess collector. The Novag Robot was manufactured in 1982 by the firm of Novag from Hong Kong.

Ruud Martin and Rob van Son during a special chess robot tournament

Ruud: "The Novag Robot has found a good home with collector Hein Veldhuis. The robot had a small problem with the chess piece recognition. A field on the chessboard of the robot sometimes got stuck and then the machine would no longer play. The robot has magnets in the chess pieces and under the pressure sensors. The magnets hang 2 mm beneath these sensors (actually a pressure switch). When a piece is placed on the chess board, the magnet in the piece attracts the magnet underneath the field and thus presses the sensor between these magnets.

The robot knows there is a piece, but more important. the piece is nicely centered on the field because the magnet under the field is also fixed in the center. Underneath the 64 squares of the chessboard, there are as many small round cases containing magnets. Directly above, there are 64 flat pressure sensors. The metal plate with the fine print of the chessboard covers the whole. On the left and right-hand side of this board there are fields for the pieces that have been beaten. In this robot there was a defect in one of the fields between the magnet in the base of the piece and the magnet under the field. The two magnets covered the field insufficiently to flatten the sensor. I solved this by putting a small cube magnet on the underside of the existing magnet in the round mini case (under the sensor). Through this, the magnetic attraction strength was corrected sufficiently and the defect repaired."

The weak spot in the robot arm

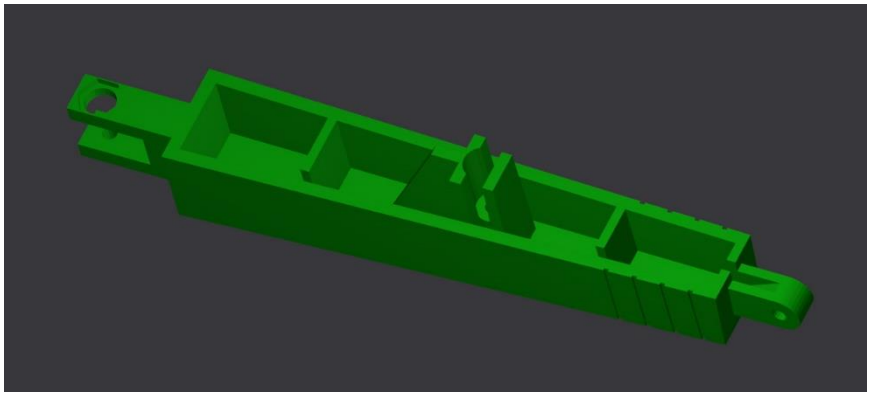
Like many computer chess collectors, Ruud is impressed by this rare, noisy, impressive, but also trouble sensitive chess robot, of which since 1982 only 2,000 copies were made by the firm of Novag. Most of these have disappeared from the earth and the remaining machines are often defective. "Meanwhile I have three other Novag robots at home which all have a defect. I came in possession of these defective robots from various purchases of spare parts on the Internet. Usually the gripper arm is broken at the elbow. That's a real weak part! Also the three spare machines have this defect. The weakness in the arm of the robot relates to the lower part of the two carriers that are attached to the metal arm.The lower arm part breaks off where the axis in the elbow is. The axis is the lower one of two shafts that are visible as two metal rounds on the side of the elbow. In fact, the gripping arm is too heavy for this fragile piece of plastic."

Obtaining a replacement part to heal the broken arm of the Novag Robot is an almost impossible mission. As mentioned before, there are only a few well-functioning robots in possession of collectors, who absolutely will not sell this part, and certainly not their entire chess robot! Unless it's already broken, is no longer used, and the buyer offers an attractive price for it. Ruud: "Go to auction sites like eBay, make a bid of 750 euros for a broken robot and buy the computers from people who actually don't want to sell it, but are interested in the money. And still you need to really look if you want to find something..."

Since, as Ruud already mentioned, the weak point is often in the 'elbow' of the arm; chances are that this very part of the robot which you managed to buy is also broken. Does the 3D printer provide a solution here?

Ruud: "3D printing does provide a solution to these problems; since it is very expensive to have components made by molding, this is a good alternative. Molding works by pouring liquid plastic in a metal mold. By taking apart the parts of the mold, you have a plastic 3D arm. I decided to manufacture the weak part of the robot arm by a 3D printer, using the powder method. For a further explanation of the different methods, I want to refer you to Wikipedia, see the link below."

http://en.wikipedia.org/wiki/3D-printer



3D Prototype robot arm part

As the designer of the Resurrection and Revelation chess modules and computers Ruud has the necessary equipment in house, so perhaps he has also already purchased a 3D printer? "No, I did consider this, but the investment in a good one is still over 2000 euro. You can buy cheaper models, but the quality of these is still extremely poor. You have to think of margins of error in a 10 cm long model that may reach more than 2 mm. However, I do think a good and affordable 3D printer will be available in the Netherlands within three years. I first tried to design a 3D model on my computer, but that was too difficult for me! I then decided to have this carried out by a professional company. I sent one of my defective components as an example to that company. After three weeks they sent me a CAD drawing. I corrected a few mistakes and agreed with the customized design. They had it printed by a partner company. I now have three replacement arms. However, the costs are still impressive. The drawing cost me 300 euros and the 3D printing another 500 euros. For three components of no more than 30 grams each quite expensive! But the parts are fine and fit perfectly into the robotic arms."

The (repaired) Novag Robot Adversary with the white 3D part

3D-printing is often used with 'Rapid Prototyping.' This means the rapid production of a first model of a product, in which all components and functions are tested before going into production; the so-called prototype. For Rapid Prototyping various techniques are available.

On Wikipedia you can read more about these techniques:
http://en.wikipedia.org/wiki/Rapid_prototyping

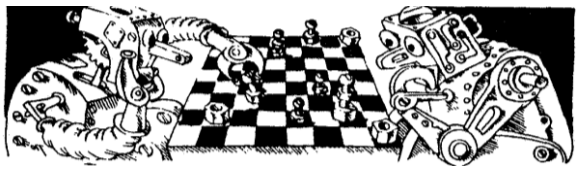
In 3D-printing, an object can be made of different materials. So you have, for example, fine powder of gypsum, fiberglass, plastic, bioplastics and epoxy materials. In the manufacture of an object or part, a 3D printer can first liquefy material in the print head and then build the object layer by layer.

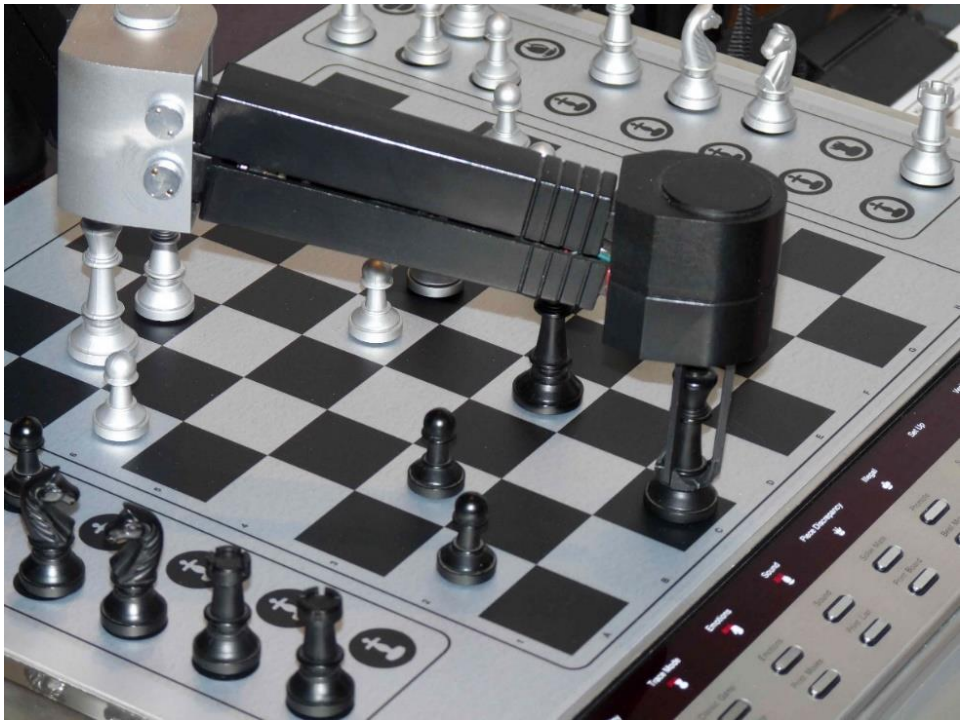
Ruud: "The cheaper printers, including those for home use, make use of a plastic wire that is made liquid in the print head. However, the problem is that here the deviation is less than 0.5 mm and that is too high for the robot part. I therefore had the parts printed on a powder printer. The groundwork is a large container with - I think ceramic - powder, which by means of a laser turns the powder in certain places into a solid substance. This also delivers the right hardness of the material. The fracture surface of the old part is exactly where a small screw is in the plastic. Since I have an exact copy of the same thickness but made of much stronger material, it is still unclear whether it will have the same strength in the long-term. In any case, I am satisfied with the printed results. It feels a bit like very fine abrasive paper. I tested the component and it works great! You can watch a movie on my website with two Novag robots in action. One features the new white 3D printed part in the robot arm and the other plays with the original arm."

http://www.phoenixcs.nl/index.php/en/news/161-novag-robot-adversary-revisited

Two Novag Robots, on the left with the white 3D part and on the right the original one

It would be a good thing if in a few years, when the 3D printer has become affordable, chess computers lovers can print their defective parts themselves. "Yes, I think home printing will be a common thing in five years time. You don't have to buy small stuff anymore, but can print it yourself. Where you nowadays pay for new shoes, you will soon pay for a design of the shoe and print it out at home."





A close-up of the grasping arm

We are slowly climbing out of a long economic crisis. Many shopkeepers went bankrupt, among other things by the increase in the number of purchases of consumer goods over the Internet. You're talking about the printing of shoes. May I conclude that the crisis will last longer if consumers are going to manufacture their own stuff at home? Ruud: "No, it will simply produce a new way of thinking, but I believe that you don't have to buy ready-made products anymore but only the design to print it afterwards at home."

Some years ago, the department store 'De Bijenkorf' sold a Cubify 3D printer for 1,050 euros. The regular price would have been 1,299 euros. Cartridges had to be ordered for $ 45 each through an American website. This printer is not available on their website anymore. How long do you think it will take before the 3D printer is accepted by the general public? Ruud: "At the Bijenkorf, the Cubify 3D-printer was only for sale during three special sales days. These kind of printers are suitable for printing small objects in one color. Actually just to have fun to print some toys, but for purposes discussed in this interview, no, that's not going to work. I think it will take a few years before you can buy an inexpensive high quality 3D printer!"

I wonder if Ruud cannot embellish his current creations with the 3D printer. I am thinking of designing brand new chess pieces for the chess computer Revelation, which customers could buy at additional cost. Ruud: "My idea of a chess computer is still using real wood and veneer. Plastic, no thank you, but if I ever need to repair a grasping arm of the Novag Robot, I will want to use the 3D technique. But you can also use this technique to create a model for chess pieces and then manufacture them in wood. For now, I find the technology only interesting for the robot parts. I think that within 10 to 15 years we will be able to print a complete chess computer, including the electronics. Imagine printing a complete TASC R30 operator module or even better, a Novag Robot Adversary! Can you imagine? I CAN."

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Author: **Rob van Son**. This article originally appeared in the Dutch Computer Chess Magazine 'Computerschaak' no. 3, September 2013 and has been slightly modified for the website www.schaakcomputers.nl. Computerschaak is a publication of "The Computer Chess Association Netherlands (CSVN)."

First Published on October 14, 2016 – Size: 1.727 KB