Philosophy Presentation

December 1, 2006

So, I want to tell you something about Changeux and Connes's conversation in chapter 5. I'm not going to summarize everything they said, I only highlight some parts and give my point of view. And later on, Pia is also going to tell a bit about this chapter. In this chapter, they're discussing how the human brain is dealing with mathematical problems and how topology can be helpful to make a machine that can think like a human. Pia is going to tell you all about it later. But let's first look at how the human brain is functioning according to Changeux and Connes. They therefore introduce three so-called levels.

The first level is the level of understanding, where there is only one way to approach the problem. If you add one and one, two is the only solution possible. If A implicates B and A is true, then of course B is true, just like Mr. Koetsier mentioned last week. Nobody is going to deny this, say that it is just half true of not true at all.

This is possible in the second level, however, the level that I like to call the level of "trial and error". You observe the problem and then translate it into a mathematical model, thereby applying specific parts of your scientific knowledge. Unlike the first level, there are more ways to solve the problem. The challenge here is to pick the best one. But how do you do this? This is where Changeux and Connes introduce the term "strategy": which parts of the scientific knowledge should be used and cohere best with each other. Each strategy yields a result, one strategy better than the other. You criticize them and ask yourself which one is the most satisfactory. A so-called evaluation function helps make the decision.

Then there is the third level, the level of "illumination". This is where you experience new knowledge, new ideas, that you did not know of before or never looked at it like this, but it fits with your current knowledge and so you accept it. This is what I believe is one of the things that make mathematics interesting, more or less like Connes said. But the thing that makes mathematics really interesting to me, is the feeling you get when you are able to solve a problem with your mathematical skills, where it is not possible for non-mathematicians or at least not that well. I guess artists also get a content feeling when painting pictures. And those abstract paintings, where you don't know what you're supposed to look at. You just see a bunch of colors. And then somebody's trying to explain to you that it's not just a bunch of colors, but they all have a special meaning. It all makes sense. If you think of it, it's not that diferent from mathematics, where also everything makes sense. But when someone sees the picture, he or she could say "Hey, a little kid cn paint this." And even if someone tries to explain that it's the idea behind the painting that makes it so special. But he or she still thinks the same way in the back of his mind. I believe that's the difference between this and mathematics, like the relativity theory of Einstein. Nobody is going to say that a kid could do this.

Anyhow, now we have a picture of how the brain deals with mathematical problems. Then you, as a scientist, might be wondering if there is a way to make a machine, a sort of "hyper-computer" that can also think like this. I have seen things over the past years that I am quite stunned about, like those miniscule cell phones or mobile phones with tons of applications: games, cameras, mp3 players, internet browsers or even a TV. I am wondering why do people even need to watch TV in a really tiny screen and pay for it. And what about those dvd players, navigation systems and so on, things that just exist just five or ten years and we already are dependent on them. So, maybe, someday people are clever enough to build them, or even build robots that can act and think like human beings. Who knows?

But then Connes is getting in the picture, trying to convince us by telling "Oh, it is possible, you can use mathematics, topology in particular, to do this." Now, I must say that I agree with

Changeux this time when he says that these "simplicial complexes" Connes is trying to explain, is not the answer, because you can't implement it. Now you maybe get to the conclusion that I pick Changeux' side. Well, I agree with Changeux now, but I do not agree when he claims that mathematics is solely in the brain, that there is no such thing as a external mathematical world, independent of the human brain. In my opinion it is just like saying "I believe in God" or "I don't believe in God". I think that mathematicians that are religious, people who believe in God, also believe in a mathematical world. Let's put this to the test, shall we?
- How many of you believes in God and believes in a mathematical world?
- How many of you do not believe in God and do not believe in a mathematical world?
- Who did not raise their hands?
- Okay, for the people that do not believe in God, is there are particular reason why you don't believe in God?

You can say "I don't believe in God", but to say "because there is no exact proof" is rather naive in my opinion. Why you ask? Let's take this coin, for example. You aim for this table, throw it in the air and then it falls and eventually they hit the table or the floor. You pick it up, throw it again and indeed, it falls again. But can you prove that there is no positive probability that it doesn't fall the 100th time you throw it, but stay in the air, for example? Of course you would say no, it is not possible due to the law of gravity. But this law is based on empirical research and statistical data. To exclude the possibility that it can float in the air, you have to repeat the experiments for an infinite amount of time and that's clearly impossible. You could say that it's a super-task. So the proof is not as exact as you think it is.
People sometimes say "I don't believe in God, because I can't see him." Then I respond: "Well, can you see gravity then?". Okay, you see the coin falling, but you can't see gravity. Gravity is the reason the coin falls. But maybe it's not gravity, but molecules that are pulling the coin down. You know it's not true, but you see the point I'm making?

Why am I telling you this? Because you also cannot prove exactly there is a mathematical world, but you also can't prove there is not. You can give arguments, but they are based on speculation and assumptions. However, the mathematical constructions are so well crafted, that I find it hard to believe that it is just a human creation. I believe that you can only see this if you study it. So now I agree with Connes. See, that is why at one of the presentations we had about a month ago, where everyone has to choose between Changeux and Connes, I had a hard time picking just one of them. I did choose Connes in the end, because I agree with him more often than I agree with Changeux.

So, to summarize everything. There are three levels: the level of understanding, where there is only one way to approach the problem, there is the level of "trial and error" where there are more ways and the level of "illumination" where you learn new insights. I believe there is a mathematical world. And yes, I do believe that mathematics can be used in the future to make these clever machines that can think like in the three levels, but no, I do not believe that "simplicial complexes" are the answer. But let's see if Pia here can convince me with her story.