

## Teaching Big History in The Netherlands

*Did you know that since September this year the Big History Project has reached continental Europe? In The Netherlands, we started teaching this exciting course with a 'Big Bang': David Christian was there to watch and participate in the 'Big Kick-off' we organized for our 200 students.*

First, let me introduce myself. My name is Constance van Hall, I'm a Philosophy teacher and studied Philosophy and History at the University of Amsterdam. One day, I was watching some TED-talks - I really love to watch those inspiring videos - and saw David Christian's lecture about Big History. Immediately, I was very excited about the project. At that time, we were exploring ways to integrate a new course, Science Orientation, into our curriculum. Seeing David's talk, I knew we found the perfect course to do just that.

Now, the first 'threshold' was of course to get my colleagues and the school management exited as well. That actually went very well, and after writing a few documents explaining how Big History would fit in I got permission to contact America and kindly ask if we could participate as a pilot school. Andy Cook and his team were very kind and willing to open the course content to us, but I never would have dreamed what happened next: I received an email from David Christian telling us he was very happy the project would be taught in Holland and suggesting us he could come and visit our school!

So David was there to launch Big History at our school:



*David Christian gave an exciting lecture*



*Our 200 students who will follow Big History*



*David and me after the Big Kick-off*

The students were very excited and now we faced the huge challenge to fulfill their expectations. Which brings us to our second big threshold: actually teaching Big History at our school. I'll briefly explain how the course is taught to our students.

First, some information about our students: they are around 16 years old and are in the highest level of education - generally they are smart and after graduating will attend university. So it is really important to challenge them, and Big History does just that. Furthermore, they are having a hard time deciding what to study after they graduate - there are so many sciences and disciplines to choose from! Big History offers them a great orientation on many disciplines. And last but not least, it is really important for them to getting used to reading a lot of English, since most of the books and papers they will read at university are in English. Again, Big History stimulates that as well. The course website they have access to is in English and we expect them to read many articles and watch a lot of videos to get used to the scientific lexicon they will encounter at university.

All right, now you know something about our 'audience' I'll tell you a bit about the lessons we gave so far. Actually, we give lectures, very college-like, in which we also explain a lot by showing videos and there is a lot of room for students to ask questions. I have two colleagues with whom I give lectures to about 60 students at a time. We had three lectures as an introduction to Big History, in which we taught about entropy, complexity, goldilocks conditions, scales (powers of ten) and of course the use of thresholds. After that, we began teaching the first threshold, the Big Bang. We have 4 lectures about this threshold, the first lecture was about the development of the Big Bang Theory itself, the second about Einstein and the next two lessons will be about Higgs bosons, quantum theory, string theory and Brian Greene's TEDtalk about the possibility of a multiversum. It is absolutely not our goal they know about those theories in great detail,

nor do they need to know the math behind it. We hope that after these lectures, students will have some basic knowledge about these concepts they encounter when they read the scientific section of a newspaper, appreciate CERN, or can laugh about Sheldon's remarks in the terrific sitcom *Big Bang Theory*. I guess that's what Big History is all about: to get students excited about science and to challenge them to investigate further.



Some slides from our lecture about Einstein

Unfortunately we only have one hour a week to teach Big History, so we encourage our students to do things at home as well. This summer I wrote a syllabus. This reader consists of:

- assignments - to 'force' our students to visit the course website and watch all the great videos David and his team made;
- texts I wrote - to explain the thresholds and concepts in plain Dutch;
- selected texts from different writers - to stimulate students to read a lot of English. Texts I used are from Bill Bryson, Stephen Hawking, Richard Dawkins, Brian Cox, Carl Sagan, David Myers and many more.

Two random pages of our syllabus

**Entropy & complexity**  
 Een vreemde tegenstelling in ons universum is de volgende: terwijl wij om ons heen steeds complexere (levens)vormen waarnemen, is er in ons universum juist sprake van een verval van alles. 'entropie' genoemd. Wat is entropie nu precies? De Tweede Wet van de Thermodynamica beschrijft mathematisch de neiging van alle fysieke systemen om met de tijd naar thermodynamisch evenwicht te streven. Verschillen in temperatuur, druk en energie zullen altijd (zonder invloed van externe factoren) van meer geconcentreerde naar meer diffuse staat bewegen. Dit klinkt ingewikkeld, maar is goed uit te leggen met het voorbeeld van een warm kopje koffie: wanneer niemand daar iets mee doet zal deze altijd afkoelen tot de kamertemperatuur. De hitte blijft bestaan, maar is helemaal verspreid door de kamer. De onvermijdelijke verspreiding van materie en energie van een meer-geordende staat (hete koffie) naar een minder-geordende toestand (de kamer) wordt entropie genoemd.

Brian Cox legt in zijn boek en in zijn bijbehorende prachtige BBC-serie *Wonders of the Universe* het fenomeen van entropie uit met het voorbeeld van een zandkasteel:

"A sandcastle is made of lots of little grains of sand, arranged into a distinctive shape – a castle. Let's say there are a million sand grains in our little castle. We could take those million grains and, instead of carefully ordering them into a castle,



we could just drop them onto the ground. They would then form a pile of sand. We would be surprised, to say the least, if we dropped our sand grains onto the floor and they assembled themselves into a castle, but why does this not happen? What is the difference between a pile of sand and a sandcastle? They both have the same number of sand grains, and both shapes are obviously possible arrangements of the grains. Boltzmann's definition of entropy is essentially a mathematical description of the difference between a sandcastle and a sand pile. It says that the entropy of something is the number of ways in which you can rearrange its constituent parts and not notice that you've done so. For a sandcastle, the number of ways in which you can arrange the grains and still keep the highly-ordered shape of the castle is quite low, so it therefore has low entropy. For a sand pile, on the other hand, pretty much anything you do to it will still result in there being a pile of sand in the desert, indistinguishable from any other pile of sand. The sand pile therefore has a higher

So this is what we are doing at the moment in The Netherlands. There's one big question you might have after reading this article: do your students like it? Well, I'll try to answer this by describing what I noticed so far: Most students pay great attention during our lectures. They talk about Big History at home. We already received some excited emails from parents. Some stay in class after a lesson to tell us they enjoyed it. And they ask a lot of great questions during class. Some really investigate further about some topics and post their findings on our Facebook page. Of course, there are also some students who have to get used to reading and hearing a lot of English or need some more convincing how exciting all of this is. My claim is that most students really do like it. Using the claim testers Bob Bain described in this great video on the course website I'd have to say this claim is based on my gut feeling, since we do not yet have real evidence (for example surveys) to support it. We will however try our best to evaluate and survey often!

My personal goal is to get Big History taught on many more high schools here in Holland, fortunately I get the chance to spread the word: I was on national radio, there will be a documentary about the course and I'm invited to speak at three teacher conferences in November. So far, so good!

'Trailer' Big History in the Netherlands: <http://youtu.be/qExi6S1wbx0> - Email: [BigHistoryNL@gmail.com](mailto:BigHistoryNL@gmail.com)  
 Facebook: [www.facebook.com/BigHistoryNL](http://www.facebook.com/BigHistoryNL) - Twitter: <http://twitter.com/BigHistoryNL>