Dies Natalis Lecture TU Delft 2008
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Prof. R. (Inald) Lagendijk (RLL):

If I were one of the buildings of TU Delft, I would worry about my future. The labs and class rooms that have served students and teachers so well over the past decades, are falling out of fashion. Look around you, dear audience, and you will soon realize that the size of our campus is relentlessly shrinking. A naive passerby may suppose renovation and rebuilding. But maybe there is a deeper meaning to all this destruction? Maybe the university of tomorrow no longer *needs* a campus?

Quite recently, TU Delft opened her first buildings on the *virtual* campus in SecondLife. Living and teaching in the virtual world doesn't require buildings of *con*crete, steel and glass at all. The hardware of reality is being replaced by its software counterpart, built on the terabytes and gigahertzes of modern information and communication technology.

Of course, the demolition of buildings of the TU Delft and the rise of its virtual campus is just a metaphor. A metaphor for the increasing virtualization of education, social structures, society and maybe even of ourselves. Until recently, we were restricted by our physical hardware – our body – and our physical location – our reality. But thanks to the rise of internet, computer games, pseudo identities, and immersive human-computer interaction technology, these restrictions are becoming less and less relevant.

Virtualization makes it possible for individuals and information to coherently exist while being dispersed in time, in space, and even in identity. We increasingly use this capability not only to hang around in a worldwide computer network, but also to browse and discover information about almost any subject you can think of. The world behind computer screens and game consoles often attracts us more than reality.

Our university is confronted with a generation of students for whom interaction with internet and virtual worlds are a part of their reality. For these students, the world of the web, Google, chat, wii's, role-playing games and 3-D displays may well be a more genuine world than reality itself. A world that is moldable through the glasses of digital technology. A world in which they move around oh so easily. For the teenagers of today, the line between reality and virtuality is vague at best, has become increasingly intangible, and it is sometimes completely absent. Someone or something that cannot be found on the internet, does not exist.

The university of tomorrow must obviously act upon this mega-trend. TU Delft can be found on SecondLife, and therefore it *does* exist. But it is not just the campus that is being virtualized. The way in which students and the academic community interact, is also changing radically. E-learning environments, e-mail and chat provide twenty-four-seven (24/7) contact between student and teacher. On-demand, any-time, any-where streaming electronic classes furnished with exciting high-tech visual effects, substitute stifling classrooms. The digital and highly virtualized university of tomorrow slowly replaces the university of the past. Imagine, a completely virtual TU Delft in SecondLife, with virtual classrooms in which we find only virtual students and virtual teachers?

It is obvious *which* tomorrow lies ahead of us. Thanks to information and communication technology, everything and everyone has been connected. A pervasive digital infrastructure has been created that serves as fertile soil for blurring of the line between reality and virtuality. Thanks to modern ICT, we feel like digital gods, creating highly desirable virtual worlds that are vastly superior to our reality. Virtuality is 'hot' and reality is 'not'.

But then, virtual worlds are inherently distorted reflections of our reality. Distorted to the point of being completely unreliable and untrustworthy. How well are we aware of that? Internet and virtual worlds *do* invite us to forget about that distinction.

Avatar of Plato (P):

Come on! We all know that the reflection of reality is not the reality itself. I have debated so before, two and a half thousand years ago.

I said to my students, "Picture men dwelling in a cave. Conceive them as being restrained from childhood, so that they remain in the same spot, able to look forward only. Picture also a fire burning higher up and at a distance behind them. Between the fire and the prisoners is a road along which a low wall has been build.

"That is all that we see", my students said.

"See also", I said, "men carrying past the wall all sorts of objects that rise above the wall, as well as human and animal shapes".

"A strange image you speak of", they said, "and strange prisoners".

"Like to us", I said, "for do you think these men would have seen anything of themselves or of one another except the shadows cast from the fire on the wall of the cave that confronted them?"

"How could they", they said, "if they were compelled to hold their heads unmoved through life?"

"And again", I said, "would not the same be true of the objects carried past them?"

"Surely", they said.

And I said, "If they were able to talk to one another, do you not think that they would suppose that in naming the things that they saw, they were naming the passing objects?"

RLL: By Zeus, they would.

P: Then in every way such prisoner would deem reality to be nothing else than the shadows of the objects.

RLL: Quite inevitably. The shadows of objects *are* their reality.

P: Consider, then, when one was freed from his restraints and compelled to turn his head around. What do you suppose would be his answer if someone told him that what he had seen before was all a cheat and an illusion?

RLL: He would be speechless.

P: Do you not think that he would he would regard what he formerly saw, as more real than the things now pointed out to him?

RLL: Far more real. And that is exactly the point, my dear Plato. Welcome to the year 2008. What brings you here?

P: I am here to help you to sort things out. You seem to be a bit confused about this reality versus virtuality thing, right?

RLL: Well maybe not confused. But I *do* feel uneasy about the growing blurriness between reality and virtuality. We are becoming increasingly dependent on information and people in virtual worlds whose trustworthiness I know nothing about.

P: *Please*, internet and digital technology have brought you so much! But hang on, the 21st century technology that you are now talking about, is very much beyond me. Give me a second to fix that.

Avatar of Inald Lagendijk (A):

Ahh, I feel so modern!

RLL: Do I know you?

A: You know me as well as yourself.

RLL: Well, you were saying …

A: Yes, as I said, internet gives us access to a worldwide virtual library and worldwide communities. The size of this library is mind-boggling; five billion web pages, 1 billion photos, and hundred million users always on-line. The world is at your fingertips. What more do you want?

RLL: Very true, but do we consider the downsides seriously enough? Terabytes of information and millions of users may be available on the web or in virtual worlds, but have you ever tried to find precisely that piece of information or that individual that you are interested in?

A: That's what we have search engines for. Just google a bit and done you are.

RLL: True, but what if your googling does not produce a result? If you cannot find a particular subject with Google, then the conclusion is that nothing has been written about it. If you cannot find the name of a scientist in GoogleScholar, then that scientist is irrelevant. And a company without Google-advertisements is on its way to bankruptcy. In this way, Google and its alikes create a new reality.

A: And that reality we will trust! After all, the power of open internet is that cheating is immediately punished. Google can only exist because it gives trustworthy results.

RLL: It is exactly this kind of reasoning that blurs the line between reality and virtuality. Take the analogy of car navigation systems such as TomTom. We trust it will show us the way. No need to bring a map. No further thinking needed about what the route will be in reality. But what if my navigation system breaks down or produces untrustworthy results?

A: But of course, we have become very dependent on our ICT infrastructure. Dependability is king! If the system breaks down …

RLL: No, no, I am not talking about the *availability* of the electronic infrastructure. Building redundancy into the system is a solution to that. What I am more worried about is the quality of the information. Even if everything works fine, than I *still* might get useless results because the available information cannot be trusted.

A: Or you could be dealing with an untrustworthy avatar.

RLL: Right, and the problem is that I will not be aware of that.

A: I agree that the integrity of digital information and avatars seems very hard to verify. But there ***are*** ways to make virtual worlds such as SecondLife as trustworthy as reality.

RLL: Okay, let's hear an example…

A: Well, Wikipedia is a collaborative encyclopedia. Every one can be an author. And more importantly, everyone can be an editor to correct information, …

RLL: … and everyone can insert falsified information. Weren't there some recent cases where government agencies were 'adapting' certain descriptions?

A: Yeah, the fact that you know this, shows how powerful internet collaboration can be in revealing falsifications. Virtual communities or social networks, such as msn, friends, and Hyves, are definitively means to identify and filter out untrustworthy information and individuals.

RLL: Oh, but these collaborative techniques are far from perfect …

A: Sure, a lot of work still needs to be done. TU Delfts Tribler software is one such initiative that uses peer-to-peer technology to implement social media. And a lot more research and innovation in this direction is already emerging in Europe.

RLL: Mmm, that is true. But I am still worried. What about my privacy in such digital collaborations?

A: You have a good point there. Improving trustworthiness will require giving up the complete anonymity that we currently have on internet. For instance, your computer may have a biometric system based on facial features that always associates you with me, your avatar.

RLL: I see, so information and communication technology has a completely new role to play here. ICT-enabled trust in social networks: that is an important road forward for virtuality.

But I am wondering how we can guarantee the trustworthiness of more elusive types of information such as images and video? Everyone can photo-shop an image, often creating purposely distorted versions of reality. How do we re-create the trustworthy camera?

A: Digital watermarking offers part of the answer. A watermark is a secret and invisible pattern embedded into an image or video. Using this pattern, it is easy to check at any time if the data has been manipulated. This forensic technique works like a multimedia lie detector.

RLL: But lie detectors are notoriously unreliable!

A: Agreed! And therefore forensic techniques should be developed within the context of virtual communities. You see, I strongly believe in the combination of technology and the self-cleaning power of communities.

RLL: Right, and virtual communities and social network are on the rise in internet. Eventually, we will all live in virtual worlds.

A: Exactly! As a matter of fact, our university is researching advanced forms of man-computer interaction. These forms of interaction pave the way towards further removing the boundary between reality and virtuality. Interaction in virtual communities will be as natural as in reality.

RLL: This reminds me of a project some time ago in which we tried to augment reality with virtual *visual* information.

A: You see, even you yourself are thinning the line.

RLL: But we used the augmented reality scenario only as a technology driver for our proof of concept.

A: Technology driver? Proof of concept? That's pathetic. You bunch of techies simply did not have the *fantasy* to see beyond the technological challenges. I'll make my point by showing two clips. But let me first make some room here. Maybe it is a good idea if you explain what we see in the first clip.

< *Video clip is shown. See: http://www.youtube.com/watch?v=CEpA5gE_t_0* >

RLL: Okay, fine. The purpose of that project was to investigate technologies that can augment the real world with virtual objects such as signs and buildings. It works as follows.

First, we determine where a person is and what he or she is looking at in the real world. We do this using TomTom-like devices. Then, a virtual object – in this clip a ball – is shown to the person on a wearable display. Through a transparent display, not only the virtual object is seen, but also the real world. In other words, he sees the real world augmented with the artificially created object.

The clip shows you the view of the user though the wearable display. We see a virtual ball bouncing off the real floor and real walls in a real room. Hey! Pretty good merger of reality and virtuality, wasn't it?

A: Oh, this clip is such a piece of solid technology demonstration, so boring. The following clip shows how it should have been done. It is Hewlett Packard's vision of how, in just a few years time, games will be played in augmented reality

RLL: Okay, let *me* get out of the way.

< *Video clip is shown. See:* http://www.youtube.com/watch?v=BUOHfVXkUaI >

A: Isn't this a rather provoking glance into our future? Blending reality and virtuality?

RLL: Absolutely. I think we agree that virtuality must be taken seriously. But at the same time I believe that we do not yet sufficiently realize how rapidly we are becoming dependent on what goes on in virtuality.

A: And especially trustworthiness is an issue. Technology is needed to guarantee *trustworthy* virtuality.

RLL: Not just technology, I think. Yes, we need a generic and coherent technical approach to trustworthiness. But it must to take into account ethical, legal, social and usability aspects. Such ICT-enabled trust-technology is critical for the success of the virtualized knowledge-based economy that is going to emerge in the years to come.

A: So, what do you think are the requirements of this approach?

RLL: Clearly, it has to bring together the fragmented partial solutions and approaches that already exist, such as collaboration in social networks, watermarking, forensics, biometrics, and privacy protection technology.

A: And it should be applicable to a variety of environments in which virtuality plays a role, from personal information and identity, to that of companies, government and universities.

RLL: It should also work in networked environments that are several orders of magnitude more complex than today's solutions assume.

A: Very clear. And who will be the players?

RLL: Research and development of trustworthy ICT infrastructures is already on the European research agenda. The Netherlands, however, does not play a major role yet.

A: That's too bad. Because we have a good track record as a trustworthy partner in many ventures. I would think that we are in a unique position to take the lead in creating ICT-enabled trust-technology.

RLL: This could well start completely new businesses. And of course, I expect technical universities to play a leading role. The time is right to place this subject on the agenda of the 3TU federation and the NIRICT, Netherlands Institute for Research on ICT.

By the way, let's not forget education. Our university also has to define its own education position in virtuality.

A: And that is why the presence of TU Delft in SecondLife is more than a playful experiment. Virtuality does not have borders in space and time. In a few years time, students browse virtual worlds for what suits them best.

RLL: And students will follow lectures of the best and most trustworthy teachers worldwide.

A: Indeed, academic trustworthiness will largely determine the reputation of the completely virtualized university, with virtual classrooms, virtual students and virtual teachers.

RLL: I wonder. Will these students and teachers realize that they live in a *digital* version of Plato's cave.

A: Aren't we all living in such cave already?

RLL: Maybe you, but not me. I prefer to stay in trustworthy reality.

A: You'd better get real! As your immortal representation, I am your *future* reality.

Avatar of Plato (P):

As I debated before, I conceive *you* as being restrained from childhood, so that you remained in the same spot, able to look forward only. Consider, then, when *you* would be freed from your restraints, compelled to turn your *virtual* head around.

RLL: Then …. , then …… I would be speechless ….

The recorded version of this TU Delft Dies Natalis Lecture 2008 can be found on YouTube.Com:
Part 1: http://www.youtube.com/watch?v=ZAzzIZxSLtg
Part 2: http://www.youtube.com/watch?v=jvuWwtGGI74
Part 3: http://www.youtube.com/watch?v=Tv3oapiSg3Y