

Transcript Forming Plastic Futures
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Curator: Tal Erez (TE)

Participants Session 1: Raw plastic as consumer good
Peter Troxler (PT)
Gilbert Curtessi (GC)
Marcus Senicky (MS)

Participants Session 2: Rules and Regulations
Marcel de Zwaan (MZ)
Freyja van den Boom (FB)
Dries Verbruggen (DV)

Participants Session 3: Tools of Empowerment
Peter Troxler (PT)
Alexander Rulkens (AR)
Gaspard Bos (GB)

K: A very warm welcome to you all, good you are here on this afternoon. Welcome to the FPF debate. You are now at Het Nieuwe Instituut, which is the result of the merger of NAI Dutch Architecture Institute, Premisela for design and fashion and Virtueel Platform, sector institute for e-culture. Today's debate doesn't cover architecture but it does cover all the other disciplines. I'd like to give the microphone to Christine Vroom who is directing the thematic programme called Things and Materials of which this debate is a part.

CV: Hello welcome also. I would like to shortly introduce the programme of things and materials to you. As you know HNI looks at innovation and design and the implications of things that are going on in our world. We choose to do that from three different perspectives. One is Time, with year themes, one is Space and one is the Material world. Today we see a combination of the research of one of fellows, Tal Erez, which started more than a year ago in the area of 3D printing. From the Things and Materials programme, first of all we've looked at Biodesign, which showed us the democratization of science if you will, because we see the blurring of borders between science and design, great creativity taking over in these fields. What does it mean for that process. The wonderful thing about Plastic and the long-standing research that T has done is that it has taken us into the heart of this third industrial revolution. And there we see once this area have been mapped out by T actually these different arenas in which the conflict takes place. So he showed top down forces bottom up reactions and all these different stakeholders, so what does it mean when consumer becomes prosumer? It's a nice word but what does it actually entail? I think today the long awaited debate is going to take place in just a minute and of course tomorrow we see the opening of the Plastic exhibition and I'm very glad that today we have this debate with experts, specialists from these three arena's of materials, as a consumer good, of legislation and the empowerment of all of you but also all of us outside, the

consumer, the civilian, the designer is here present in the audience but also very active in the debate I hope. Lastly I'd like to invite you to follow this debate, to be active in it, to follow us as we trail this discussion along, also after this exhibition has gone. First of all on the 12th of March we have a Material Night on Plastic ethic, guided by Sophie Krier and also online we're building digital files on these discussion where you can find the research that T has been doing and others around it, many platforms. So you're very much invited to stay with us. But first of all, let's have the debate this afternoon.

KK: I'm K, your moderator today. Also the leader of one of the other thematic processes that we will not discuss today. T, please introduce us to the issue sphere of FPF.

TE: Also thank you for coming the speakers and the audience. I don't know if all of you got the chance to see the exhibition. I hope you go after this is ended. But I would say that it generally approaches the topic of plastic and later on 3d printing and tries to tackle it not from a design perspective and not from a material perspective but more from a cultural role of it in our lives and it tackles these 2 industries: one that seems to have run it's cultural course, plastic, at least in our lives we see it as this big promise, this man-made material that is endless and that could last forever, that could be anything we like. And of course the moment that we are reacting to it now, the fact that it seems like at least has been propagated as a material that is destructive, that represents all the evils of capitalism. So it's mass production, it's the use of third world countries, it's globalization, it's cheapness. And of course it has a very bad ecological footprint. Maybe. But this is at least how it is perceived. On the other hand, an industry that has just been birthed now, 3D printing, offers a new potential for plastic because it turns all of these ideas around. So it's suddenly not about mass-production but about custom production. It's not about global production but about local production. It's not about a blind consumer, but about an active user. But these are all in potential. It really offers a new consumption model in potential. That can maybe empower plastic to become something new and maybe not. And for us, and to frame this kind of the 4 walls of this debate, it's really about whose interest it is this industry will develop in one way or the other. So, one wall of this debate is big market forces. What is their interest in this technology? Where do they want it to go? And in the exhibition we try to frame it as the idea of capitalization. So the idea you can capitalize on this industry, you can traditionalize it and work with the structures we know from the past, structures that we use also propagate plastic as a material. And make it into something that is profitable. And on the other side social forces, bottom-up forces that try to democratize, try to open up, try to share knowledge, try to share knowledge, try to make the word 'free' relevant. If it's good or not we'll maybe know in three hours. The two other walls in this debate are the physical and the digital. Physical, from the materiality of plastic, but also from the idea that the 3D printer makes physical objects. So a 3D printer is maybe just marking this idea of digital production and manufacturing in general, but it is very good example. It makes physical objects from digital files. And for us this whole scope from materials, to online files, to software, to production, to production mechanisms is relevant in this debate. The last point I want to make in this debate before we start with the questions is the role of the Institute here. Because I think a cultural institute has values in the way that is a junction between business, academy, more radical artists and designers, other forces in society. This junction gives us the opportunity to make this debate from a cultural perspective and not necessarily

a business perspective, which is where we see most of the debate come now. These questions are mostly business questions. We want to ask them from a social point of view.

To start with the first debate is maybe framing kind of the big topic: because the idea of the debate is, the exhibition was a platform for us to generate new content, and to reframe these questions. Maybe if we don't have all the answers here, this could maybe be a base for future exploration. I think the first debates main question is one that deals with what it is, who is this new consumer, what are we selling? I think it's a question that frames on one hand the idea of open design. Which at least in theory, and that's my role here, is a capitalist question, the idea of open design. So it's an idea of how you can expand what you can offer a consumer. So you had the model T black, then you could buy a car any colour, and now you can change it any size, shape you like. And on the other hand open production. Which is in a essence socialist question, in the Marxist sense of the word. We distribute the means of production. So you own a factory at home and you own capital in a way. So between these two boundaries, whether we sell the opportunity to design or the opportunity to produce, to own and to know about production chains, is the topic of the first debate, and I took one example from the exhibition:

Video 3D systems.

I think this is a good example: it's 3D systems on the future of manufacturing. It really introduces the idea of a factory into 3D printing. 3D printing we have this image of the home desktop printer, we're producers at home. But on the other hand you see more and more of these images saying 3D printers in a factory can offer mass customization, mass production and the centralized perspective on this idea of production. It takes us away from the home again. Besides the very natural kind of dichotomy in the notion of the 3D printers as a tool to make yourself and the idea of the factory is exactly that. This is about open design.

KD: Thank you Tal. So we have here at the table Peter Troxler, we have Marcus Senicky and Gilbert Curtessi, who represent or embody different positions in the field, and maybe you can briefly say who you are so that we know how to read your expressions if you like. Peter Troxler.

PT: Right. Good afternoon. My name is Peter Troxler, I work as a research professor at the University of Applied Sciences here in Rotterdam on the topic of the revolution in manufacturing. So actually the guy in this panel who is probably thinking about what is happening, while my colleagues here are more doing what is happening, making it happen.

KK: did you bring an example of something that you wanted to view?

PT: I brought this excerpt from these 1950s or 1960s euphoric presentations of plastic where this idea was: Plastic is going to save the world. It's going to make the world a better world, and a cheaper world, a more affordable world and a better life for everyone. And what strikes me with the discussion about prosumer and 3D printing, and 3D printing at home, and all these changes in manufacturing, is that they in a way equal that same technological euphoria. It's going to make the world a better place, it's going to make everything cheaper

and affordable, more accessible. It's all nice and positive. But we know now that with plastic it was not all good and a better world but it lead actually to a horrible world you could argue.

KK: Thank you Peter. Interesting indeed that plastic has been the topic of a previous wave of utopias, like maybe we are in now. As you know in 3D printing is still at the high level of the Gardner hype cycle, the plane of heightened expectations. Already there for 4 years, so it's about to collapse. Maybe the collapse will happen after today, that's possible. Marcus, please.

MS: Hello, I'm Marcus Senicky. I'm a maker and creator of the project Filamaker. It's a desktop recycling machine for your printer. It's an open source machine which everybody who can build it can built at home. It got a grinder for plastic and an extruder for the filament. It's hand operated. I have my own company where everything I produce is open source. I actually produce those extruders and shredders, which sell pretty well. Actually it's one or two months waiting time. My philosophy is: don't buy what you can build. So I'm building every machine, nearly every machine in my workshop I've built by my own. This is a brand new plasma cutting machine. Behind is a milling machine. Don't buy what you can build. It's cheaper and better and you know what is inside.

KK: Not everybody.. the difference of course is what you can build, but this will also be the topic of today's discussion.

MS: You can ask everytime in a fablab for help. K: If there is one around.

KK: Gilbert Curtessi, who are you?

GC: I love plastic, because without plastic there would not be skateboarding for example and I'm a skateboarder. Polyurethane, you know the wheels from a skateboard are really good. And rollerskating as well. You know without Polyurethane there would be no rollerskating. If you wake up in the morning (I stole this one from a journalist in the New York times) there's a beautiful book: Plastic, a toxic love story. I really love it. Really good. Because plastic was not..

KK: Can you please tell us who you are?

GC: Really? I'll do it at the end.

Session 1: Raw plastic as consumer good

GC: So there are beautiful things coming out of plastic. it's the same with putting your eyes to another direction when you know something is happening there. That's what we do as a consumer. Constantly. I can compare it to political situations in the world. We tend to look this way. Even ecologically. My background, I studied environmental technology. My name is Gilbert Curtessi, I live in Rotterdam, I have two kids, I have a house, I was a shrimp farmer on the Maasvlakte and I'm an entrepreneur, but not that I'm a.. how can I say.. Everything I do

at home, I get problems with my wife. So, when I was 16 I started building a skateboard ramp.

KK: Can you please tell me what your company is about now?

GC: No. I'm telling my story, sorry. So when I started this skate park it was a hobby. But when a consumer starts a good hobby and it's succesful it becomes a business. And then suddenly things happen. I would love to talk about that. Sorry Klaas. I'm the director and partner at Transmare, a 60-year-old Rotterdam chemical and plastic company. It's a family business. We have a factory in Roermond. We produce 20 milion kilo's of polymers. We transform the company into a bio-based plastic company. Very difficult, very hard. There's a scheme there, which I can show you later on, there's some samples here as well. It's very hard to work with bio plastics and as a company to transform you and to define your perspective for the future is very difficult. Coming back to my wife, every time I start doing stuff in the kitchen she really hates me. Because it smells and it stinks and I'm not even talking about the carcinogenous gases and other stuff that's coming out of it, so when you are really serious about 3D printing, my main issue is that children will be happy standing there, fablab, breathing in, getting all these industrial fumes. Which in a company environment this is all licenced. In a consumer environment it's not licenced. I think that's an issue.

KK: Toxicity and security is what you're worried about.

GC: I would call it harmfulness and sustainability or ecology.

KK: Can I ask you to elaborate on the question: What from your perspective is the essential value of 3D printing? What is it you sell if you sell it, if you would like to sell it? What is it you sell if you would like to sell 3D printing? Peter? I know you're not a seller but your deep into the world of...

PT: If we look at the 3D printing at the moment and if we look at not the industrial side of 3D printing for a moment but at the consumer end, then what we're selling is a big dream. What we're selling is a gadget to spend your time on. And that's not only truthful of 3D printing but that's also truthful of a lot of practice that happens in the maker movement and in fablabs. It's a big huge pastime for rich guys, like me, white, male, between 40 and 50.

KK: Marcus?

MS: I think we are selling independence and possibilities for people. Because you can buy a printer and you can produce. So you can be independent, you can produce in your own home and start your own company.

KK: And you don't think that's a dream, in your case it's a reality.

MS: It's reality, it's for a lot of people. Not only for me.

GC: That's the whole idea concept of a garage start-up. There are a couple of garage start-ups here in Rotterdam. Gaspard is one of them. He will become a really big company. And the ideas these guys have, they come from their consumer side, from their position in society, from their background, their inspirations, everything they do is expressing the way that when you started as a consumer, you'll end up as a producer.

KK: But what from your in your sphere in the business, in the whole industry, what is it you sell? Not the material, but what is the value, not so much the economic but more the social or cultural or ideological value of 3D printing?

GC: what do I sell? Raw materials are getting scarce. Cost price at the moment: oil is very cheap but cost price will become a big problem. You start an idea from a brainstorm or from some philosophy but if you want to run a company the main focus is profit. So when you sell something you sell, but of course with an added value, with a margin and you really try to keep it for yourself because you did a lot of investments. On the other hand, if you do not share, and if you don't transform like a traditional chemical company into a future perspective based company then things run differently. So we need to share much more. We want to cooperate much more. The whole Sugu idea was in fact from the strategy..

KK: What is the Sugu idea?

GC: The start-up and grown-up movement we kind of pitched a night somewhere and suddenly there were a lot of people around about this group, a lot of designers, plastic people, entrepreneurs, people from the government. You see the necessity of a workplace or a field lab or whatever you can call it, I just call it 'werkplaats', workshop. Where you can experiment, start production and become a company or grow into a company.

KK: This is oriented around 3D printing or additive manufacturing?

GC: I'd rather leave alone that whole term of 3D printing; I'd rather just call it engineering and design. You combine polymers, you combine natural fibres, and you combine all sorts of new ideas. 3D printing for me is a little bit too simple because 99.9% of the plastic market is not 3D printing.

KK: But it is the topic of today. Yes this is a very good addition, which in the whole sphere 3D printing takes up only a very small fraction of the whole.

GC: So how do we make it bigger?

KK: But why would you want to make it bigger? Can you answer that in one word please?

GC: I'm a businessman, I want to grow things. I love to see things grow because it's nice to see things grow.

PT: May I jump in here? On the industrial side of 3D printing. Because I've been taught that the home 3D printing in the first statement. The industrial side of 3D printing is really

interesting. And is totally revolutionary to industry. Industry is built around the idea of mass manufacturing and standardization. That's how we developed industry in the 20th century. The requirement of standardization and mass production comes from the production technologies. Mainly from injection moulding. You have very expensive tools, very expensive machines, it takes a long time to set up the machine, and then you need to produce hundreds of thousands of the same thing. If not, it's not economically viable. With 3D printing you're down to batch sizes of ideally one, or a couple of hundred. That means you don't need to produce millions of the same cup. For the same price you can produce two hundred of the same cup. Or even two hundred different cups in one go, for the same price, as you would produce in injection moulding. And why is that fundamentally revolutionary to industry? It allows factory to be small instead of huge. That means factories can be distributed everywhere, round the corner, instead of concentrated somewhere in China.

27:08 KK: How is the factory you describe now different from yours? Or is that your factory the kind of factory you describe now? Maybe you can answer that?

MS: I would say that my factory I'm not producing a lot of stuff for profit and that people come ask for special stuff that they cannot buy or it will be very expensive and they need just one piece.

27:37KK: So what you're saying is you're actually driven by not by the profit not by the private value sphere but more of a public sphere, public value.

MS: Yes.

KK: Because that's actually, I heard you saying in the introduction as well, you're in the middle of this big transitioning towards a circular economy and the raw materials you sell they are driven by an approach with very different values than traditional businesses were, or not? What's the value behind, or what's your orientation towards your transition? Is it also only profit?

GC: No, no, no. My partner is 64 and he's studied in Delft during the first energy crisis. Companies like DSM are aware of these problems. So it's not a financial thing, it's more like an integrated approach. As a company you don't have perspective if you don't put attention to these things.

KK: what things?

GC: Ok. Raw materials. Corporate social responsibility towards your employees, towards yourself, don't work yourself to death. Your environment. CSR aspects. But also processing, for example energy costs, you can try to bring them down, you can try to buy renewable energy because a plastic plant uses a lot. You can also try to produce your own energy and try to make it renewable. There are a lot of options in your company that are now technologically available. And it's more or less a long-term investment decision. We tend to do long term investment decisions.

KK: So the bottom line is always profit is what you're saying.

GC: But that's not the fun of the game. The fun of the game will end if you can't pay the bill. So the fun of the game is: of course throwing stuff in the extruder trying to test things and see that you're extruder head is completely fucked and you try to do it again, that's the fun.

KK: I'll frame this question differently. So what are the kinds of people that you sell to? You're selling to companies who ultimately?

GC: We sell to people that want to buy granulates for testing, and at the moment there's not a lot of clients in that world.

KK: Not yet.

GC: No, because, filament and granulates is a thing of course. All 3D printers have filaments. Except for the bigger printers. The Automotive or the 'portaalprinters'. Big extruder heads, and then you bring in granulates for example in a silo. Then the business of 3D printing is expanding and I think we don't have to be afraid to professionalize the sector. I mean why not? It's a lot of experience you can get in and you combine that experience into a...

KK: So you're actually looking for big customers?

GC: Yeah.

KK: But you said that's not the essential of 3D printing. The possibility of 3D printing for the industrial sphere is actually that the factory can be smaller. Are you? (All talking at the same time here for a moment)

PT: Factories can be much smaller and much more distributed. That doesn't take away that it could be one big company owning a lot of small factories. That is a possibility. The other point is, when factories can be smaller than the entry barrier to just open a factory is much smaller. So also Transmare will experience that they will have to deal smaller clients. That's a very interesting change in industry. Because many companies are not good at serving small clients if you talk business to business.

KK: What are the people that you work for?

MS: I'm selling practically for one thing to one customer. I'm dealing with universities or scientists, which are looking for special tools that they cannot buy somewhere else because it doesn't exist. They ask for it and I build it for them and it's one piece and there's not another one.

32:33 KK: But it's really small. Tal?

TE: If I may interfere with one question: I hear that you're talking about 3D printing as a sort of tool for experimenting to grow into a business. This is kind of what I got from you. So it's a machine that you use to eventually become a business. But I'm also curious if you look at it at the trajectory a bit into the future: is this the only end goal of 3D printing, or is owning a 3D printer is that you would want to be a business? Or that it can make a product for you to use. And that is also a difference in the perspective of saying, is it something that is worthwhile? You mentioned Gaspard in the beginning; it's a small business that's going to grow into a big business. But of course there's also the also trajectory, saying I have it at home and I make a thing for myself to use. So it's not about the profit. And I think a lot of these questions here are also trying to figure out what the profit is for a consumer. Why would a consumer, if and why, would want a machine at home, to make things for himself? And what is the value? Do you sell raw materials to these consumers? Do you sell software for them to design? Do you sell files? Do you sell knowledge about production mechanisms? What is the potential there?

33:58 GC: The necessity for harmless plastics that can be used by consumers that will be produced and developed at the labs of the big multinationals. If we can be the bridge between those companies and the consumer markets I would love to share that. That's one I think.

PT: To sell raw material that is safe to use at home.

TE: But you do see a value of production at home.

GC: Sure. But I do not agree. Because 3D printers, the small systems, you're representation does not elucidate the complete market. Shapeways and 3D Systems picked up about hundred and twenty million dollars last year. It 's a big market, and it's heavily invested in. It will become huge. So it's not that we are talking about a small perspective, it's a big perspective because for example, the family of Brenninkmeijer invested really a lot of money in a 3-D printing company. Why? Of course they are going to lose C&A, but they have to look for something else. And of course when you have a new perspective in the industry, bio-based chemicals for me are the basis for this discussion. Not the 3-D printer itself. Because when a consumer comes up with something that is completely different than a 3-D printer.. I've seen some really weird 3-D printers already, like a tripod printer from Eindhoven, you guys make weird printers, you know. I don't care as long as the base material is the foundation of a new market and we're talking about the same stuff.

35:38 MS: I experience it some consumers that purchase some printers to build stuff for their own use, and then later they found out the printer is working like just six hours in a whole month. And then they start to ask, what should we doing this machine I have just invested two thousand day euro inside and I have no use for it because I have just printed my small Yoda or something, and what should I do? And they start to look at what can they do and they possibly find that webpages like 3D hubs where they can register their printer and people are going to write them: can you print this for me? Then they will print more Yoda busts and maybe like I got lots of people who'll need spare parts, asking me for different spare parts that makers who want some special casings for electronics. Even a

prosthetic hand. So when they look what they should do with the printer, they may become in the start a small business. So is people buy printers to use the stuff for them, and they may be going in the way of starting a small business later.

37:09 KK: What you just said is the example of the rich guys who bought the dream but found out that beyond my three Yodas, hmmm... It is a bit of a disappointing notion of a social value if you want. We're looking for what could be, so at the current situation I hear both you saying, and then we have not even taken into account toxicity issues, the 3-D printing for consumer and the market is actually a bubble, or not?

37:46 PT: If we look at what is possible now, then yeah it's the Yoda's and it's the odd spare part and it's the guys by such a printer, go into such a 3-D Hubs network or start their own small company producing things, selling on Etsy or whatever, tonnes and tonnes of examples out there. But what I think is interesting to think through, if we imagine that this 3-D printing technology will evolve over the next twenty years. And where somewhere, twenty years further with manufacturing machines that probably combines various processes that are able to combine various materials in both the manufacturing. And then the scenario that I could imagine is sort of an analogy to the microwave. The appearance of the microwave in the home kitchen has fundamentally changed the whole food supply chain. You know pre-cooked, pre-prepared meals that you would put into the microwave and heat up in three minutes, was not an idea that was possible without the microwave. I can think off a whole product and material supply chain that is kind of let's say a Netflix for data or stuff and you buy your kits of material at Albert Heijn in the shelves. And you produce instead of buying the thing.

39:36 KK: That still tastes of the same consumerist dream, like lets buy more useless stuff. So what would be the use, what would be to value beyond what you can buy now stuff. What's the point of buying it through your printer?

PT: Absolutely. The added value of the 3-D printer is that step away from mass manufacturing, to individualist manufacturing.

KK: What is that step and who is waiting for it?

PT: I believe there are people out there who want that.

KK: Who want this; raise your hand if you want this.

PT: Who's waiting to design their own stuff at home?

Audience: You before said I'm going to Albert Heijn, I'm going to buy something for my kids. Now I can buy the file and print by myself the file. It's not almost the same things; it's not just mass production. I mean it's the mass production of a file.

PT: It's distributed production in the sense that manufacturing actually happens at your home and on top of that they file you download you can change it to sizes, dimensions, extra stuff on top of that.

KK: We were talking about exactly as you framed the question, about the difference between open design, which is like buy your file from Albert Heijn and change the colour maybe or blow it up a little bit. Or open production, which is the own of the whole means of production, including the whole set of materials and tools, which we will talk about later, design. The question then remains, who is actually, and how big is your group of people?

PT: The interesting question there is, and that's what you just talked about before we started, and you might want to share that experience, you know what other people do with the design files of you machine. That's probably a good point there because.. Maybe you can tell that story.

42:06 MS Yes, of course, when you put something on the Internet and you make it free, then people will go and change it. They don't have the same machines, they don't have the same printer, and they are going to change it. And sometimes it's better than the original. Then it is best when they share it so practically you put something out and hundreds or thousands of people who will help you make this product better.

KK: Are these people rare? I mean this is a big difference, we were used to being consumers, we're treated as consumers, we go to Albert Heijn to buy stuff, we're not thinking about 'I would make it different if I would', so there would need to be some kind of transition in mentality to adopt the possibilities of 3-D printing. Which is the kind of people you work for, that's the people that find a way to your kind of products. But how should this happen? It is the difference between open design and open production. Can you explain the difference? Why is your proposition more radical than the open design proposition?

MS: Ok. Open production, the best thing to say is Linux. The operating system Linux. That was an open production. That means it's a community of people who are working from their homes or from their offices on one project and they all share the knowledge.

TE: I'll frame it a little wider. I think firstly consumerism was not birthed with man. So it's about 150 or 100-year-old concept. The mass consumerism, Industrial Revolution, of course expanded dramatically the idea of us being consumers. So I I'm trying maybe to ask you a question of what you think would be or hat could be, this 3-D printing at home market. But what do you think it should be. What value it should have because it's of course business, or a industry of technology that's not yet developed enough, the materials are not yet get developed enough, so you discuss the idea that materials should be...

CG: Everybody knows the word disruptive. Everybody? Do you know what disruptive means? Disruptive means you really shake up things. You really wake up. Digital photography did that. And it did exactly what is needed to be done with 3D printing. Everybody forgot about analogue photography. I was a photographer for a snowboarder

magazine at eighteen and also at gabber feestjes, really funny.. Really, I was in a darkroom, not on a party but at home, you know, making the photos. That was a lot of work. Doing it yourself with chemicals, and you know, when you're at the Willem de Kooning you probably learned it. But now: we can make the whole audio-visual industry change completely, in ten years, wait up. This will happen with 3-D printing. Only there are a couple of smart people that really comes up with good ideas that are disruptive. The 3D printer itself is a very old-school technology. It's nothing new. It's a couple of nuts and bolts combined in a sort of plastic chamber with here and there some server engines and electricity. You put a computer on to that and you hook up a designer you downloaded for 200 dollars from Shapeways. That's not like the same thing is happening with digital photography. You can now edit your movie at home. Ten years ago that was one million and now you can really do that. And you see people doing it because they like to do it. Really like to make a photo books on Internet with digital things. I question the fact if people really like to work with plastic. With a 3D printer. I think this is just a small group of crazy people that want that.

46:50 Audience: My name is Bas van Berk. And I'm going to interrupt a little bit and try to be the moderator. Gilbert please try to answer the question the moderator or Tal asked: what do you want this technology to be? Not what it is.

GC: I would like this to be really disruptive. How? Well, the point in being disruptive means you really shake up markets and things so big companies start thinking what is happening there? We really need to focus on that and maybe that would also be facilitating this development on one side, so the sector itself. But really if you empower yourself, to be able to make their own video, publish on the Internet, push a knob, to reach millions of people: this is in fact very new and very disruptive. If this is also the trajectory with 3D printing, then everybody will start doing printing himself or herself at home. That is the idea. Well, my question is...

KK: This is what you want it to be. That's what you think it should be.

GC: No. I think it will be that, that's what I said.

TE: Who will define it?

GC: the consumers and the users themselves will define it. If that group will really grow and grow and grow, it will prove itself.

KK: Marcus has a different take.

MS: I hope it will bring decentralization so that everybody can produce the stuff that they need; we don't need to produce in China like a million plastic things. But we produce then only when we need it.

KK; Right, that's a new take. So to only produce what is needed rather than what can be cheaply produced.

MS: Of course people are going to produce some stuff or they don't need like small Yoda's.. But it still better than let's say thousand people do it. Or it's better than when someone in China made one million pieces of it, because it's less plastic we choose.

KK: Then there is the whole promise of.. But we're going into that later, the possibility that plastic may become completely recyclable. Which if you don't like your Yoda anymore you can just put it in the grinder and then..

GC: Plastic is not endlessly recyclable people. I'm sorry, it's a fact and it will never be.

KK: So we have to get rid of plastic actually?

GC: No no, you can recycle best for about ten times, then you have to put in additives and then you can try to use it again and again but the quality will degrade. Eventually you have a thermo carrier that will only produce energy. It's also a difficult but issue.

KK: Can I first ask Peter this question? What do you think it should be?

50:03 PT: If we look at the media example, I think what YouTube really facilitated, is that people understand in a much more profound way how media has made. And that making media means taking points and make decisions and leaving stuff out and including other stuff. And what for me, this whole idea of open design an open production and 3D printing and using sustainable materials, should be, is that people start thinking about materiality, about the world of stuff that surrounds us, about the questions: who makes that stuff for us? Who decides what we need that stuff, and that stuff, and that stuff? And that it has to look like that? Who decides on that? And why is it yes to rounded corners and no sharp edges. For instance. Why is it yes to ABS, instead of some Transmire materials? Why is it stuff that is male rather than female? Why is it stuff that is white rather than black? In my view, if we use this technology the right way it's going to be a fucking eye opener.

TE: I just may want to elaborate on this. There is a good anecdote about the PC. They say, the PC was a hobbyist machine, then suddenly these guys in the university developed the spreadsheet and then it became a very useful machine. It's not just this kind of optimistic anecdote, but to contradict you. The users and consumers won't define it, but it will be defined by the uses. And the uses are not necessarily supplied by consumers. And I think you gave a good example with the digital photography because it's technology, but it's also the software that allows you to edit. The communication, the digitalization, the tools of distribution. YouTube, Flickr, iPhone, whatever. I mean, these are all still to be, could be made, and could be pushed in one way or the other and the people make these uses will define what it could be.

52:58 KK: So you are actually saying we don't have the killer app for 3-D printing yet, like the spreadsheet was for PC. You agree?

GC: It's Windows 95 maybe, maybe even Windows 3.1, we all get XP in a couple years now and Google is not erected yet in this world.

FB: I think a good example of the often disruptive effects of 3D printing writing is that for example Disney is going into, has a deal with I think Shapeways to print out toys. So in the world of plastic toys it is already a disruptive element, you already see that they are trying to avoid people to infringe on trademarks and copyrights by having these deals. You can go to Shapeways and print of your own Little Pony, while otherwise people would have done it themselves as you see on sites like Thingiverse and stuff. I think it is a good sign that it is definitely disruptive.

KK: It is at least disrupting the toy market.

GC: Would that be at home or in some kind of copy shop concept?

KK: That's the next round, we're nearly there.

Audience: I was wondering, isn't also the connection of plastics to 3D printing also limiting the discussion because I think 3-D printing is much more than just using plastics, and maybe it's also too utopian to think you can solve both a waste and resources issue and a consumer and capitalism issue in the same in one wave.

KK: What do you think Tal?

54:55 TE: I think 3D printing is an example, of course, it's the machine that today looks like something and does something, but it's basically the idea that you have a machine that can produce at home and the same goes for plastic. I mean plastic is a very strong example, especially 3D printing, especially in home 3D printing and what is necessary for it. But I think it's also a good example of how this machine could potentially change consumption models. So this idea that you can recycle ten times for example, means that use one tenth of the plastic you use today. The idea that you only make what you need means there is no excess production for example. The idea that you maybe only make things that are only valuable to you or contextualized to you maybe you keep things longer. So it's not necessarily this idea, here's this machine that will solve the plastic problem. But if we can change, if it will change consumption models it offers also new future for this material.

GC: I think it is part of the digitalization of the world. We really get this as a gift, part of that, not the other way around.

KK: Thank you very much. I would like the first panel to go and sit on the front row.

GC: people that are designing and are interested in Suguclub please go to the website or ask me or Peter or Gaspard. Especially for designers that like to be challenged are open to invitation.

KK: this is the end said, the last round might also be a good home to also discuss Sugu a bit. We go to the second round.

Session 2: Rules and Regulations

57:09 KK: Again I'm going to give the words to Tal first, he will introduce the topics of this round.

TE: Again through an example, I think that in this exhibition we tried to explore a bit what it means this idea of home production, or decentralized production. Also in terms of the legal questions that become about it. These questions deal with a few angles. One is dealing with danger. The sense of danger, the sense of what it means to.. distribution of production and anarchy. Can you regulate or can you enforce regulation on what happens in your own home? We know the example of the 3D printed gun, and maybe it's not a new legal question, but it's of course, gives us all this feeling of urgency in the world of 3D printing. The other one is also lets say a political question. A lobby question, a capitalist question, can you control it? We know it from the music industry for example. This idea of copyright, brand rights etc. so the idea that you can copy at home. So the second round deals with rules and regulations and maybe something that we didn't discuss but also enforcement. The ability to enforce the law. And the question is also again this idea: are we producing at home and what does this mean? And under these questions or are we producing in centralized facilities that can of course more easily be monitored, controlled, etc. So this is the introduction.

58:58 KK: Thank you very much Tal. Again from this perspective of the possibility that there is actually still a valid promising 3D printing but we haven't reached its potential yet, but how could we reach it? From that perspective, we also need to understand the whole legal sphere in the sphere of things. So I'm maybe you can first briefly introduce yourself; we have three people here, Freyja van den Boom, Marcel de Zwaan and Dries Verbruggen. Freyja, who are you? What's your position in this field?

FB: My name is Freyja van den Boom. I do artistic and academic research on law and technologies, so I'm also an artist working with 3D printing. But I'm also looking at intellectual property rights and privacy rights in design. That's why I'm here. I'm a big fan of 3D printing, I've been working with it for a couple of years already and to come back on the former session I think that it is really liberating for people who do not fit into the mold, so this is really giving you the opportunity to design new things which are really reflecting you. So if you can't find stuff that is made for the general public this is really the tool for you.

KK: Thank you. Marcel de Zwaan.

60:30 MZ: My name is Marcel de Zwaan, I'm a copyright lawyer already for 25 years now. I represent industrial designers amongst others, in the traditional world, like Piet Hein Eek and Joris Laarman and of course I also see the technological developments in my own practice. DUS architects who are trying to print the canal house. I heard architecture wasn't represented this afternoon but they are DUS architects are printing a whole house. If you would like to understand what my opinion is on the topic as such I must say that I was somewhat confused and also a bit skeptic when the invitation came to participate in this

session. Because indeed the question was that broad: the legal framework on 3D printing, it can be anything. For example of the gun was mentioned again. I would like to show my gun first; who recognizes this gun? You can't shoot with it. But it is a gun made of human skin by Janneke Meesters, and when the question came up legal framework on 3D printing and guns, that's like asking for regulations on hammers and nails, whatever. Everything could be relevant with what you do with a hammer and nail, with knives, whatever, with drones, or with 3D printing and I just follow thought of the example of the gun from the human skin, it somehow illustrates how broad the theme is. Therefore also how unanswerable the question actually is. But my point would be actually that technology won't change human nature. Consumers will not become designer because of the 3D printing possibility.

62:42 KK: Thank you very much. This is important to know, at least from your perspective, there is nothing new to 3D printing.

MZ: Basically :-)

KK: But we'll cover it. That difference is also important. Dries Verbruggen: who are you and what's your position in this field?

DV: Hello from far away Antwerp. I'm co-founder of the Antwerp based design studio Unfold. Basically our work investigates the intersection between traditional physical making and kind of new digital creation. We are mostly known for our work on ceramic 3D printing but more related to the topic: in 2011 we created a mobile 3D copy-shop and presented this in the Salone del Mobile in Milan to kind of start a discussion about authorship and appropriation in an age where goods are manufactured and distributed digitally, and to get the conversation and a discourse going around that topic. Last year we edited a book on 3D printing within the creative industries and one of the key texts that we wrote was called 'The right to copy?'. Again, talking about authorship and appropriation in relation to 3D printing.

64:28 KK: Thank you Dries. So because we don't know. This is old in a way obvious for you, clearly, from the way you speak but for us maybe this isn't. So why is 3-D printing nothing new from the perspective of the law? Why doesn't there need to be anything specific about protecting either users or buyers or businesses from the possibilities of 3D printing?

64:55 MZ: Well the issue is of course first, that you have to define law. And law is very broad concept from public law to private law to whatever law, environment laws.. Surely there must be certain regulations for certain aspects maybe customized for 3D printing at home, or whatever aspects. You can imagine that if you are at home, turn it into a factory, that you have certain regulations also applied on your home victory of something like that.

KK: Because the home is a separate sphere. The private, already now you cross in my experience at least something rather crucial like you go from the public to the private. You extend certain principles. That's not a detail in my opinion.

65:46MZ: My first point is that we have to focus, focus. Because the topic is so broad and the law is such a broad concept. Of course there are all kinds of relevant issues but do they really need a new legal concepts, it may be an issue. But if we want to address it from existing law and existing concepts I can only talk with some authority on the field of intellectual property and then copyright law in specific. And in that respect, I would say that 3D printing as far as I understood it also here, although I heard two variations: one of the private, printing at home, and the manufacturers in the customized printing in their factories. As far as we concentrate on the number printing at home it's of course a matter of private copy; this is for years already in the copyright laws of exemption. That's on the one side. So it does it just qualify as a private copy and a private copy as you know is allowed without consent of the right holder. That's one thing. And on the other side there is the principle of law making on copyright that says 'we never want copyright law that is technology-based or technology driven'. We want rules that are future proof, that cover principles that we want to apply regardless of technology. That would certainly also cover 3D printing and the only thing which is very relevant and should be taken into account is that of course the impact private copying through 3D, if it will be this huge success, on the wave of the highest expectation, if that would be the case; personally I doubt that but I don't want to be too much of a skeptic. Then of course the impact is such that the lawyers will say, the lawmakers will say, 'hmmm, that goes beyond the limits we have thought of in this restriction. It becomes so important that we want to do something about that.' The impact on the establishment, on ownership, on the economy, that must be limited. We can't allow that to go on.

KK: Freyja, can you say from your perspective, how are regulations, certain rules applied in the sphere of 3-D printing? And do you think that's supportive of its developments?

68:54 FB: With respect to 3D printing I also look at the technology in general. So it's not just the 3D printing but also the scanning that I think is really important. So my idea is, 3D printing does have, or is going to have an effect on the copyright. Because of course it's not only the home printing exception, but it's also those people who are designing the things. In that sense if you just copy something which is already there you will infringe copyrights. So if you are a designer you will infringe copyright. With the sense of 3D printing you can also scan some things. So I can just scan an object which is copyright protected and then 3D print it out at home. So on the example of Philip Starck citrus press you can just go to the store and instead of paying 40 euros for it you just take a picture of it and 3D print it for maybe 1 or 2 euros. So that is going to have an effect. If I think about the law, I used to work in law, I know a little bit of the gray areas there. Law should be a reflection of society, or at least that's my ideal of what the law should be. So in society we accept that maybe copyright should not be all of these products and that we should just be free to make our own stuff. Then maybe the law should change and we shouldn't be upholding copyright the way it is.

70:46 KK: Is copyright law used to prevent.. maybe I should ask this to Dries: In your experience, is the law used to prevent user empowered developments in 3D printing?

71:05 DV: Well definitely the impression is being made that the law does apply on certain cases. But maybe I want to start with reacting to Freyja because copyright doesn't apply to every physical thing that exists. Copyright applies to creative expressions so a lot of

utilitarian objects and things are not protected by copyrights. So with physical goods it's a lot more complicated. Whether it's copyright also depends on the region, like in the UK it needs to be sculpture, in the US it's a bit more complicated in physical goods probably then in media. But a lot of smaller creators are being threatened or copyright as a big word being used to take down things that might actually not be infringing on people's intellectual property. It's being used but if it's valid is still quite a question that's not being.. there's no court case so far that I know of.

72:37 KK: So it's mostly threatening, like cease-and-desist.

DV: I know so far is 3D printing it's only been cease-and-desist and so nothing has been really brought in front of court to really validate whether those claims are valid or not.

KK: Can you give an example?

DV: For me the most striking or important example that we used in our book is the Joaquim Baldwin, an animator and he made 3D printed figurines of an old game called Final Fantasy. So what he did is he extracted 3D data from the DVD of the game and send that data to Shapeways, an online 3D print service, and materialize those. It's quite obvious that copying 3D data from the disk is really copyright infringement, because copying software is protected. But the interesting art was that what he offered online for sale was not a copy of an existing thing. There was no such thing. So they are low polygon game figurines. And the owner of the game, which is a company called xxx, they're offering figurines for sale but they are highly detailed. The ones that Baldwin made were really applied the kind of retro gaming aesthetics. So, nothing like that is actually on offer. So Shapeways received a cease-and-desist and these things were removed. But what I find important in this whole discussion is first of all, there was no original that has been copied. There was no physical figurine like this. And two is that Baldwin was one of Final Fantasies biggest fans. So basically this is fan art. And I think that is the problem that I see or issue is that I really believe what Marcel says: that the law is there, and nothing really new has to be invented. But the question is whether the law can still be enforced. 74:57 Basically what is and I'm quoting Adrian Boyer here, who was kind of the founder of RepRap, is suing one's customers is a crude and ineffective method of protecting one's business model. So basically what a lot of people, a lot of companies are doing is suing their own fans. That doesn't seem to be a business model. You see the examples, Freyja referred to it. It's not Disney it's Hasbro. Working with Shapeways to open at least part of their intellectual property for appropriation and teaming up with Shapeways to allow people to make their own interpretations of My Little Pony and offering that for sale and splitting the profit between the IP owner, the creator-fan and the production company. So I think those new models are super important.

75:55 KK: Thank you Dries. Freyja you wanted to react.

FB: There is also an interesting example of the Penrose triangle. I think that was one of the first, not lawsuits, but one of the first legal cases, claims. A designer made a file of the Penrose triangle, which is a quite old and mathematical figure, and then he sued somebody who also made the same file and who made it available on Thingiverse. You see a lot of

people are misusing copyright and other intellectual property rights that way. Another interesting example which I think is also good to mention here is the Game of Thrones iPhone stand. Somebody was also a fan of Game of Thrones so he designed the actual throne into an iPhone stand and he also showed these to other fans. It's a gorgeous thing. He also received a cease and desist letter. What is interesting here as well is that this thing also did not exist in the real world. But there was a market for it. So he also said 'ok, I understand that this is your copyright, I'm just a fan, but maybe I can licence this design and sell it. There are people wanting this. And you don't sell it so why not.' But they said no.

77:34 KK: To summarize the positions so far: the law is there but it actually is from your examples often misused in your perspective, to prevent interesting new developments from developing further.

MZ: That's right. And that's nothing new either. Mein Kampf has been prohibited by copyright to spread further by the state of Bavaria. So copyright being used as censorship to either protect material interests or political interests is nothing new. Copyright is being misused in that sense. Another issue is of course that copyright is not able to cover all new technological and developments in society. If we realize that 99% of all content that is being produced every day, all the images on the internet, in the social networks.. copyright shouldn't be there. Copyright is interesting for the professional industry, for professional makers. But copyright doesn't have an amateur exception or a social media exception. So 99% of everything that's being created everyday on the internet, in enormous amounts, copyright is totally irrelevant but nevertheless it exists and it creates a chilling effect, a threat of 'oooooh, maybe you're doing something illegal'. The issue is not 3D. 3D is nothing new. Identical to copyright: it's perfect and it works. Now it doesn't work in a lot of respects and it cannot be enforced. Internet eliminated geographical borders. You can't enforce your rights everywhere in the world and so on and so on.

79:12 KK: The difference in these notions, where does copyright apply and where does patent and brand apply? Because they're different fields, and some seem to hold and some don't.

MZ: Partially they have the same problems of course, but copyright basically protects the appearance, the outer, the outside, the form, the way you perceive things. Patent covers the idea, the inside, how it works. Trademarks they protect the possibility to discriminate the origin, or at least the product. From who is it, where does it come from. Then we have the design and drawings law, and that does the same with applied arts, with products. That's the same as copyright, regards those products. Copyright also protects the shape of the product.

KK: Would you say that this brand and patent varieties of the law are also misused in this concept or are they really valid?

MZ: No, no, they are also misused. They are tools in competition. The law is about competition basically. The law is about society saying what is mine and what is yours and

how we're going to organize that. And of course that's being misused. So you will sometimes use an IP right for a totally different means than what you got it for.

TE: Of course. And that may also be something that we may learn from history. Because in the field of product design of course production is traditionally centralized, easy to enforce, easy to understand, it's origins. If something is infringed we can easily track it. But of course as you say it's cyclical. It happened before. The music industry was centralized but not anymore. But of course we are designers so we don't know enough about.. then maybe you can teach us a bit about what are the transformations there. If you take this huge field of 3D products, which is quite a lot of our surroundings and you open it up to this notion?

81:43 MZ: The example in the past is of course that of sound and music carriers. If we wanted to stop the use of private copying on sound and music we had to enter into the private, the homes of people and we didn't want this. We solved it by putting a levy on the machines that allowed us to copy on these machines. The cd's and cdrom's and so on got a little bit more expensive; you paid your checks when you bought the carrier so the law wouldn't have to look in your home to see if you were actually copying. With 3d printers of course that would be identical. You could imagine an identical application and say 'ok, 3D printers are going to be a little bit more expensive with that copyright levy'.

82:54 Audience: How did they organise it?

GC: Collect the money and then bring it to the people that make the music, like BuMaStemra organisations?

MZ: A bit like that, collecting rights agency indeed. It negotiates with the industry for the price of the copyright levy, of the copyright tax, and then it's being collected by the industry and being divided over various copyright collecting agencies for various groups of rightholders like writers or actors of whatever and they spread it among their makers, their rightholders. That's how it works. And it doesn't work. I know some artists; why does Marco Borsato get much more than a producer from Rotterdam?

MZ: Well the basic idea is not so strange, that you collect a kind of copyright tax and you're going to pay it back to the rightholders.

KK: In Europe there is a study towards a general culture tax, to cover the whole torrent, peer-to-peer systems. Even applying it to 3D printing, also music, films and games, anything you can download.

MZ: There are a few big questions going on about copyright. Is it a still a 21st century thing? Of course there's a big crowd saying let's make it into a tax, a general thing, and not something you have to enforce. Just pay more and then we'll divide the money. Like an extra bonus on your income. How does it work? One of the problems is... the collecting agencies, one foundation 'thuisKopie' for sound and image carriers, that has this special status to be the one foundation negotiating with the industry on this copyright levy. Once it is collected it goes to these various collecting agencies like BumaStemra for music, Vevam for movie

directors, Lyra for the screenwriters and so on. The way they then have to pay what they get to their rightholders, they have of course their systems for it. One of the big complaints with regards to those collecting agencies is their system of payments and their calculation schemes were not transparent. So there have been big scandals and law cases also. Especially in that field, because they kept much too long much too much money on their bank accounts before paying it or not paying it to the right people.

86:04 But in this context now the internet now serves also as a nice tracker of any data that passes through any IP address, so the tracking system is already in place. In that sense the micropayments just need to follow. This is one example of how you might think of how you might think of the law, of how regulations can be shaped to account for, to not hinder this development. Are there other schemes?

FB: Maybe trademarks is also interesting regulation in this way. Trademarks protect the consumer so that the consumer knows that for example my phone comes from Apple or from Samsung or any other brand that you have.

KK: That's an interesting notion. It protects the consumer. This is the idea of trademark.

FB: Yes, so the consumer knows where the product comes from.

KK: So an accountability system.

FB: Yes exactly. Once we start 3D printing things you don't know if this is going to fit with your product that you wanted to fit into. Which of course is going to be problematic when you start 3D printing.. you mentioned something with aesthetics. What if your leg breaks in a place and you fall down and something bad happens to you. Who are you going to go to to complain? Yes, exactly. The whole liability issue is becoming problematic when we start 3D printing things and we don't know where these files come from. You just download a file from Thingiverse or from the Pirate Bay because they also have their own 3D model site as well.

87:56 KK: So how could you operate in the sphere? What do you think could or should happen? Is there a way to make certified design?

FB: There are already companies thinking about this and I think Makerbot already has their own certified files and then of course you pay a bit more for that. And also, they are coming up with to go back to copyright with DRM tools again. So they know exactly what you print out.

KK: DRM?

FB: Digital Right Management, which is known of course in the movie industry industry but also in the videogame industry. So they know exactly what you do at home on your computer. They track their file, so they know if you've downloaded something from the

Pirate Bay or something somewhere else. In this way, they are also coming into the private sphere again without you knowing it basically.

89:00 KK: Dries? Can you answer that question?

DV: I think we're focusing here maybe a bit on ways to protect things but I think that the best strategy and very unique to 3D printing or digital manufacturing is to remove the incentives to actually copy. It's a strategy that I would like to call 'no original'. Maybe an analogy, I can give an example: something like the Harlem Shake. It's this kind of meme that spread over Youtube. Nobody knows what the original of the Harlem Shake is. What it is, it's a set of rules in which people start to create the Harlem Shakes. So you cannot copy one of them because it's a whole system. So there's millions of variants of the Harlem Shake and none is the original one. So it's an ecosystem of Harlem Shakes. More specifically to 3D printing, to give an example of a group that already applies that: Nervous Systems Kinematics Project. It's a Boston-based design studio experimenting a lot with 3D printing. One of the recent projects was called kinematics and is actually a framework in which people can design jewelry and clothing themselves. So it's a design application in which you can customize these jewels or these accessories. So in the end, there is really no singular original design item. Like we're used to from mass manufacturing where you have one item that is then mass produced but you have a system that creates a family of shapes. So what they design is software, they design the language of aesthetic and they design limitations and possibilities.

91:24 KK: So Dries, just to frame this question: so this is from the possibility of the maker, from the designer, to kind of encourage reuse. This is not to protect your copyright, this is not to maximize your profit, this is a different kind of value you are embodying now.

DV: Of course, this is a way to protect, but it is an indirect way to protect. Because you're removing the incentive to copy. There's no original to copy anymore. You offer a service that allows people to create their own kind of copies or variants.

KK: But why do you call this a way to protect?

DV: Because it removes the incentive. If there is no singular iconic original, and you'll make it easy for people to interact with it and make it their own there will be less incentive to copy that one original.

KK: To get clear: to use the service you still need to pay?

DV: Not to use the service but to get the object you need to pay.

DV: And there's two other things: in short, what they also did which is pretty clever; so this you can customize, send to Shapeways, get a good produced product. But they have a second version for home manufacturing which is free, but which is way more limited because the machines at home are more limited. So it's two ways to kind of reduce or remove.. if you wanted to copy the design you would have to copy a whole ecosystem or the

whole system, the software, everything. Maybe a last small one: I would think that maybe in the future we would also... it's a hope that I have that there will be less reasons to actually materialize objects. That we might actually be going to enjoy objects or design in a digital way only. And that only a limited sense will actually be materialized. So this application they make is quite fun to already play with and to share with each other without the necessity to actually materialize it.

KK: This is very interesting but it is actually the topic of the next round. So I want to stay with the theoretical regulations framework, so how could you consider, and this is also a question for Marcus, how can you consider the legal implications of what you do from a social.. if you if you are driven by social, by public value, so if you're not... This is a very interesting example of how you can circumvent copyright. Still protected, but also open it up and still get a business out of it. That's what you just described Dries. But if you're not basically doing this for profit, if your goal is social values or empowerment, how would you go about it? You publish everything open source but are there also other strategies maybe? Marcus?

94:25 MS: Practically everything I make is open source but the people have the possibility to buy from me. If they cannot build it or they can buy just parts. Example is this compost shredder which is printed. If the if people don't have the possibility to buy the ball bearings for it or the screws they can still buy those parts from me. But they can print their own shredder, they can make it different and they can change it how they want it. So I give it all free but people who cannot do it can still buy from me.

KK: So open source is actually a legal construction, it's a license basically. Maybe one of you can elaborate on this whole stack of possible licenses, briefly as it's a very broad topic.

MZ: It's a very broad topic. As a model, as a basic model for innovation. It's a very understandable, very objective thought. But as I said in the beginning; technology doesn't change human nature and law does neither. It structures it's consequences maybe a little bit. The whole idea of sharing and synergy and whatever, which are very understandable good ideas for innovation. But at the same they violate the basic principle of the copyright law, and maybe of Western law, capitalist country law which is based on ownership. Everybody wants to get rich and everybody hopes that his idea or maybe the creative aspects of his idea will always be his own. So that he's in a position to give his consent or to refuse his consent. If that bridge isn't crossed nothing 's going to happen because the law is based on an your sovereign possibility to either prohibit or to give consent. As far as I know there was one of the founders of Creative Commons was speaking at the meeting last summer in Amsterdam and as I understood he said: ' Wikipedia is the only example of a really successful Creative Commons license application'. He acknowledged it doesn't work as a tool for general economy. People are not going to change economies. Whatever maker revolution, we're not really going to change of course.

KK: Now we have to define change of course.

TE: For me it's interesting, it seems like the law is a wall, a brick wall that's there. Not in a good way and not in a bad way. It's just there it's not going to change. But it seems

interesting. Also, your example from the music industry. This idea of collecting the taxes, etc. And the examples in 3D printing is how this technology, when it introduces products to these questions, it invites new business models or new structures. Because of it's tackling with the law. So understanding the law is quite important in a way in order to innovate around it, through it, above it.

98:18 MZ: I totally agree. And since copyright doesn't work anymore, it's so hard to enforce ownership and it doesn't apply in a lot of ways, especially in the the social media. We need to fix it. The most important suggestion is always the introduction of a fair use exemption. The general concept: as long as it's fair you may do it without the consent of the copyright owner. And that's not something to laugh about, it is really existing in all Anglo-American countries. The concept of fair use. That doesn't mean that everything is allowed over there. They have of course criteria. When is it allowed, when is it fair use. And it's never fair as soon as profit is involved. So again, you have this wall so you can get away from all kinds of wordings which restrict you but never skip profit.

PT: It really is a business decision to open source or not to open source. The very interesting developments last year in June and this year in January, when Tesla last year and Toyota this year in January going: 'Please, we're sitting on this pile of patents on hydrogen fuel cells, please use them.'

GC: Elon Musk made a very strategic choice. You just throw in the streets which he knew was not strategic for the development of his company. He did develop a lot of carrying capacity and of course Tesla is the most mediagenic, sexy.. He's really good in this. It's like someone selling their coal power plants. It's not happening for real, it's like a window dress action.

100:20 KK: Or it may be even a way to cripple the competitors. You can't use this. Ok, elaborating on this. Maybe if you're very purist Wikipedia seems to be the only public value driven company on that scale. On the other hand we all know that, we're not going into the big topic of sharing in general, but giving stuff away, giving design away for free, is not bad for your own business.

GC: Every market and every person is part of a value chain you create by making an object. There is a starting point. But the funny thing is what we really want is to become circular, to become empowered to do things yourself. But when you are in that circle in that ring, of course you come up suddenly in that value chain and you see other actors in that chain and you really need each other. I think it's also a good step of being able to open of your company and work together in that value chain.

KK: Gaspard?

GB: I want to react on that as well, from being in a startup but also from doing these startup programmes. I notice a lot that a lot of people that think they have a good idea they want to sit on it and develop it and then bring it to the market. And then develop it and don't tell it to everybody else. But actually the hardest thing for a startup is even getting noticed by

anyone, so you should in fact go out with your ideas, tell everybody about it, share it and other people give you great input.

102:06 KK: Sadly Maurits Kreijveld is not here but he has written a book called 'Platformen van Innovatie' which is actually about, he sketches from a very broad perspective the way current innovation dynamics work and a crucial phase is the moment where everybody shares everything they know so that you can develop a standardized technological platform on which you then again can build all kinds of things you want to add but that need to have a set of all other people there and all the other practices there to actually be of value. But then also at some point there comes this moment when this whole development is crystallized, and then monopolizing agents come in. Then people start to buy the smaller companies; now we know what we were dealing with, now we want to own the thing and close it off. Now it's ours. This is what Google does basically. Google is open-source basically, not entirely. Peter, I have a feeling this is your area of expertise as well. Can you elaborate on this dynamics between openness and closing off, maybe also from the perspective of public value which seems to resonate with openness, and then private value which is obviously the closed perspective.

103:22 PT: Allright. This opens a really huge field again but particularly with the topic of the public value. So I'd rather first address the business point of view, where you've been running around in startup fields and many of us as well. This idea is that you build your company around intellectual assets. You protect those intellectual assets and you then sell off your your company based on on profit projections and the value that is given to those intellectual assets. So protecting an intellectual asset is in that sense a business decision. And opening up is another business decision. And you know you can argue Tesla did it as window dressing. Window dressing is a business decision. Toyota did it legitly to speed up development of hydrogen fuel cells. This is a business decision. Because they know, if the market grows they're going to sell more of these cars. So at the end of the day it helps them to run their company. If GE does design contests on redesigning parts off an engine they're sort of inverting this whole idea of opening up by inviting outside people to think with them on issues of the company. Gilbert talked about this in the first panel. Yes as a company you're supposed to make money. As a company, but you're also supposed to be a good employer. You're also supposed to care for the environment, you're also supposed to care for the city where you are based.

KK: Can you go to the decision-making process into closedness and openness? At what time do these issues come into play? Given the fact that openness seems a valid strategy right now, to grow, to develop a whole innovation sphere.

105:47 PT: Opening, open source is a is a very valid strategy. If you want to be quick and if you want to integrate multiple players without big contractual issues.

FB: Some of the first 3D printers were open source. The RepRap.

PT: The RepRap was designed as a very funny experiment on how technology could spread in society. A very thoughtful thing. And it did. And it generated a lot of companies that were

actually building these printers. And some of them, and the big devilish example here is Makerbot, who started off as an open sourced thing in hacker spaces, and developed shitty printers, got better, got money. Then money got involved and this whole play of investors getting involved, wanting to cash in on the investment, on the money they gave the company to develop. And at that point apparently closing down and then selling off to the big devil, one of the two big devils, that was actually business strategy for xxx to get rich. And now he's been put somewhere aside.

107:33 KK: There is a question from the audience. We have another round, we don't have to close off entirely, but we do need to close this round at some point. Last question.

Audience: About RepRap it only became available after the big patents from the sixties and seventies expired. So, the open source community is constantly fighting with the big companies like Stratasys. As an open source company with a heated chamber for instance because Stratasys has...

DV: Well it's true that any company who has based it's products on RepRap it's struggling with those patents, but RepRap already started 3 years before patents expired. So it's not keeping any open source at home developments etc from kicking off, but it is indeed withholding companies to jump on that ship and start producing things.

KK: We have to close off this one, but we still have left in the middle of it this question of when the public moves into the private, so what about the households? What can we actually do there still without.. You can make your own copy, actually patent doesn't apply there, you are allowed to make your own copy of an object. But on the other hand, the household is now the site of these new developments. And this is in a way, to summarize, quite a grey area. Maybe this goes back to what you said at the very beginning.

MZ: What's the grey area?

KK: it goes back to what you said at the beginning: If this thing, this promise, actually becomes reality, the household -based private prosumer, actually disrupts the whole economic system; then the laws as we know them may not be applicable anymore. But this is pure speculation.

MZ: No, no, this not how it will work. There are these kind of basic economic rules and they function that way. One is the thing which was mentioned by the googles that buy up startups that are appeared to be successful, speculate on their future succes. The other thing is if the impact on the establishment, on the economy as it works, is getting bigger, then resistance is getting bigger and new rules will be introduced. That's the way it works. The ideological background, that's the way it works.

KK: Thank you very much. We have a short break now.

Session 3: Tools of empowerment

112:02 KK: Are we all here? Then there's the closing round of this debate. You might say we're kind of anticipating the moment where the big dream of 3D printing collapses. But then something remains, something useful and interesting. And were trying to look at how we can get something useful, interesting from a social perspective. We're trying to look at, maybe we're trying to draw the lines of what that could be, and also how we could make it real. So we don't all buy this, we don't buy the big dream: everybody will be able to make everything and will do that. It's not going to happen. But still something is interesting. In order for that to become real; first we need to know what would be interesting, but also we would like to wrap our heads around the idea how that could become real. So what tools do we need to bring out the potential, let's say real or social or cultural value of 3D printing. From the individual households perspective. How this can become real. I'm going to give the word to Tal first.

113:15 Two points maybe about the last debate. This is I think a nice example by Makerbot. There is a material called high impact polystyrene. It is dissolvable with limonene, which is kind of an easily attainable liquid that you can melt this and you can use it to make undercuts with 3D printing of it. But it has been rebranded as Makerbot dissolvable filament. And Makerbot dissolvable filament is of course, you can know less about it's constructs, what it is, how it works, etc. because it is the area of branded material. And this notion of knowledge is important especially when we talk about empowered consumer. What do we know, what should we know, if we want to be these active users. And in that sense, and I think you come up very soon, so I'm going to say it very quickly and then we can develop it; there's also the question of spectrum. So not all of us want to make everything and know everything and build everything by ourselves. But we see a lot of examples online. From the ages we could've been either journalists or readers of journalism to everything that came inbetween. So we can all be journalists, but we can also only comment, make a blog, whatever. So this whole spectrum that opens also needs the tools, also needs the understanding of what kind of knowledge do we need, what kind of tools do we need to have different levels of empowerment and to be active in some level. So this is why we have these people here that will introduce themselves to try and think more practically even, on how this could work.

114:59 KK: Thank you Tal. Maurits Kreijveld sadly is not here, he's taken ill. Peter Troxler is taking his place. He doesn't need to introduce himself again. Alexander Rulkens, can you tell us who you are, what your position is in this a field?

AR: My name is Alexander. I started a company called Studio Ludens about eight years ago, together with a friend and colleague of mine Wouter Walmink. Our goal was and still is to give people the opportunity to design their own products, by making design tools that help them to translate their ideas into actual physical products. So we would create online tools, and we created about ten to fifteen different types of tools, that people could use to create their own product and we would link it to production techniques such as 3D printing, laser cutting, printing on textile all that kind of things. So we started out with the idea that everybody could be creative. We had this dream in our heads that everybody could and wanted also to be creative. Then we realized after a while, that actually to get people to think creatively is quite hard. A lot of people are fine just choosing stuff. But there is a group

of people that unlike you guys that have the design education never got that opportunity, but still want to be creative but never got the specific tools for that. So that's the group that we we aim for at empowering with our tools.

KK: We leave it here for now. Gaspard?

GB: My name is Gaspard. I'm from the design company Better Future Factory. We've existed for only a little less than two years now, we're here in Rotterdam. We have actually one of our projects is the Perpetual Plastic Project. If you're into 3D printing and recycling might have heard of this. And we have in installation. If you are not here in the new beasties and this actually lead to are links to environments right here in Het Nieuwe Instituut and that's actually the link to empowerment initially. It started out as this thing on Lowlands where we want to stimulate people to not throw their plastic waste on the floor anymore, but to hand it in. So this is a group of drunk people that are just consuming, so how are you going to convince them to do so? We thought, okay, what if we give them back stuff that is made from the plastic cup. So that's why started initially on the machine that could do that. And that's the shredders and extruders that Marcus also built, that allow you to make the filament for the printer. That was the first step for our company. We also found out you know once we are further along the line.. initially we were very idealistic so we thought ok we're going to start this.. the reason we made this machine is we had this idea of a local economy. You know local ways to make products for local use. But as you also said, people just want stuff. The things we were making were these rings with hearts. And I noticed at some point, people just said 'give me the ring' and they didn't even get the message about about recycling. So that also opened up my eyes.

119:06 KK: What's that thing you brought?

GB: Yeah okay, so I keep talking... so after that we got questions like, okay, but now you are opening people 's eyes but what good is it, because you're still not recycling a lot of plastic. You're still not doing anything for the environment. So then we were like, okay, fuck you, we're going to do something for it. This is one of our latest latest initiatives. It's called re-3D. And we're making now these filaments not only with our installation but also on a larger scale by talking to municipalities and saying ok there's a lot of waste streams; why don't we pick out the ones that are good to use for printers. Because by experimenting we find out which ones are good. And that are safe to use. And why don't we supply that to people with printers? So that they don't use again and again only virgin materials. For printing prototypes. That's what most people with 3D printers are printing, they are only printing of prototypes. And half of the time the print fails. So why not print with recycled material, right?

KK: And the other thing?

GB: And the other thing, so, that's not about 3D printing, I'll pass it around; we were asked by a Dutch company, Heerma Marine contractors, who saw our installation and they have shipping yards all over the world, amongst others in Angola, Africa. Can you bring this to Africa because we have a lot of waste over there, and can you teach people how to use

it. So then we said.. it doesn't really work that way. You really have to take into account the context. You cannot send a machine that was made for drunk partygoers to people in Angola, where they're living in low income communities and they only struggle to make a living. Either way there is no 3D printing industry in Angola yet. So we told them this and they said what do you propose? So we said ok we're going to do research like a real design company. How does the waste problem manifest itself? What is the capacity over there of the people and the industry? And how can we then effectively use waste to make stuff? So what I'm just passing around right now is made from PET bottles. Just by cutting them. The result that we wanted to have in the end is that local entrepreneurs in Angola can use the machines that we supply them. So this is the thing you use to cut the bottles, and start making products for local markets. Another thing we discovered by doing this initial research is that import tax is very high in this country. So all products are really expensive. So if you can make stuff locally from materials that are just lying around in nature, doing damage to nature, then there's a big win-win there.

122:38 KK: Basically you both introduced in different ways, and it's been coming up before already, to make what you need. To not look at what's possible, which is the thing that has been driving the dream in a way but to look at it from the other way around. To look at what do you need. What does a designer need versus what is a complete layperson, who's not that interested in being creative, need. To what do people in Angola need? Maybe a rope or maybe a way to translate waste into something useful. So I'm going to ask this question to all three of you. We're looking for ideas about the tools for empowerment. So we need to know who needs this empowerment; so from their perspective. And then what would be the tools in order to achieve that. Peter?

PT: Okay, maybe you can google something for us and that that would be *Petitie Makersonderwijs*. In The Netherlands we have probably globally the highest density of Fablabs and Makerspaces. And people from these Fablabs and educators have come together last year to discuss what these Fablabs, which are spaces where you can use machinery such as 3D printers, what this could mean for education.

124:50 KK: That's again the possibility sphere.

PT: That's what's happening now. This is a fundamental shift in education that we have been talking about since the 1970's. The fundamental shift is the insight that it's not sufficient to instruct people, to instruct knowledge. But that actually to learn means to construct knowledge. And using technology is one way to construct your own knowledge about technology, which then eventually empowers you to make use of that technology.

AR: For that it needs to be in context of actual values because the question was like, what do we need? And if you look at us, like what we have here. We don't *need* that much anymore.

KK: You're right, but before that, this, the fact that education is the key, the first frame you put here. Education is the key to empowerment.

PT: Reading is important, maths is important, Dutch is important, natural sciences is important, history is important, religion might be important... and: we're surrounded by technology, which is not considered important to understand.

KK: Which is considered important but maybe later in life. And so the move is actually to put that earlier into education, because it becomes a basic literacy.

PT: Exactly. Because that is my core take on the issue of empowerment. Empowerment means also to take the power away from somebody who has it now, and give it in other people's hands to be distributed at least.

KK: Maybe not take away, but at least to spread it more.

126:47 PT: To spread it, to give more people access to that power. Which then finds its reflection in how laws are created.

KK: So the need identified here is the need for technological literacy. So it's not to the needs of a particular thing, but more the general...

AR: But why do we need technological literacy? Why is that good?

KK: Anybody?

TE: I just want to narrow it down a bit. I think we had two debates before and this is the last debate for a purpose. Where we we try to say, and I urge again the kind of the social perspective, and saying, okay, if 3D printing is empowering to individuals, if that offers a new consumption chain. If the idea of home production is valuable, rather than centralized production etc. Then today at least I know that the 3D printer is not the most appealing kind of apparatus for someone to buy, operate, understand, use materials, shred and reprint etc. Maybe getting better with Perpetual Plastic, but still. And I'm saying, if we see a certain future that is positive and that is saying we should produce at home for example. How can we develop this future? What kind of things need to happen so that his future would be viable.

GB: I was also triggered by what Alexander said. Do we need more stuff? Because I think we keep seeing everything in context of the West here right now and have relatively few people with access to this technology to Fablabs. And of course there is also Fablabs in Africa, there is one in Nairobi that I know of..

KK: On the other hand, you might say that specifically in the West we're trained as consumers. This educational frame is a different one; you are not actually consuming knowledge but you're actually moving your position in the field from someone who eats what's offered to someone who can contribute to what's on offer.

AR: Can I say a couple of things on what we can learn from these tools of empowerment, linked to 3D printing? When you create something yourself is that the object you end up

with has a lot more value than something that you buy in a store. And I think all the makers and all the designers know that once you spend all their time and effort and energy in creating something yourself.. it's harder to part with and just throw away. If it breaks you want to fix it and you're going to take hopefully better care of it. And if you have tools that give people the opportunity to have what all you guys have, to see how that creative process goes.. they already have little bits, in their head that changes that says 'okay, I made something myself and now I have it here I'm going to hopefully take better care of it'. That's also what we see in the people that buy the products that they create ourselves. They're a lot happier with it, even years after it they still have it as something you have the story with it. They come back to us. They say I'm still happy with it. So, that's it like a little change.

130:42 KK: That is a sense of empowerment what you're talking about, a sense of empowerment which is valuable in our context, not only because you need that specific piece of rope if you don't have it, but because it changes your own being in the world in our context.

GB: Our problem is.. Our need is the one of self-actualization. Maslow, that's where we're at. And that's what he's talking about. The fact that you need to make something in order to feel a connection with the product that you have. This is not something that you need otherwise.

GC: See this ring. What happened is that my son printed that ring of course. And from that moment it's the wedding ring to my wife and my son. And from that point on, I told him about 3D printing, and now he's programming bits and bytes. He is seven years old. He doesn't need a teacher to do that. He uses his own computer to do that. And he's probably looking towards building his own 3D printer already, because he saw you doing that. I think that is empowerment, inspiration. And it's a good analogy with the positive deviants. The makers are positive deviants. Take that as an example.

KK: There are a couple of things. There's various groups here that have different needs for the different sensations of potentials for empowerment, and then there's the question of how do you support this empowerment development.

Audience: I have a question. Both of you said we need less stuff, and I'm a designer too so I have the same opinion. But then I have the opinion we need better stuff. So how can we make 3D printing to do that? How can we not only consumers but designers, how can we make it tool to make better stuff and not worse?

AR: What is better stuff?

Audience: That is difficult to define.

AR: That's the question that was asked in the last round. What do you want 3D printing to become? What should it become?

KK: But you make tools for designers that allow to make things that they.. what in your opinion is better stuff?

AR: I think better stuff... it sounds a bit strange.. but stuff that is not only stuff, but stuff that with it has stories. That is representing some values that we have as humans. Is helping you remember that beautiful moment that you had like twenty years ago, when you when you met your girlfriend who is now your wife for example. That stuff that we have is there to support things that are not physical but stories and ideas and memories. So, if stuff is there for that reason than its better stuff. If stuff is just here to satisfy my everyday desire.. yeah you can argue if it's...

134:07 KK: We're still discussing the sphere of possibility of 3D printing in general.

134:13 GB: I know of great research has been done at TU Delft, a programme called Products that Last, that actually handles these issues. They put a book out, called Circular Product Design, it deals with these issues, products that last.

TE: We already laid down this notion that if we are connected in some way then it's valuable for longer. It's a start. But I'm also curious on a more technical level. How do you achieve these, or how do you reach those people and provoke them to do this. What kind of tools and interfaces? How do you need to bound them, what do you need to limit.

AR: It's a good question because one of the hardest things is starting to create something. If you start with a blank sheet sheet of paper it's super hard to write the first line, but at the same time if you just get to choose out of three things it's not really creativity, it's just a choice. So somewhere in between there is a sweet spot for allowing people to create themselves. Designers have all these tools already that allow them to get to that sweet spot and create something themselves. What we find out is that if you give people an environment where they can play, so where they can express themselves without being put down, it's a first step. Secondly, people...

GB: Sorry to interrupt, but this is what is truly wrong with educational system. People are being completely put down.

AR: So, you have to re-educate people first. Then you have to give them the feeling that they can actually create something valuable themselves. Actually that is something that designers can do. People listen to authority, and if there is an authority on what is beautiful and what is worthy to have it's the designers. How stupid it sounds you know, and maybe you don't agree with this but a lot of people think like that.

KK: So you're saying the opening proposition is something in between the empty piece of paper and the drawing to which can only add two colours. That's one thing. Then you need an authority figure to say it's very good what you're doing.

AR: Well it helps a lot. We tried it without, and we tried it with and it's a lot of difference.

PT: I would sort of agree, but fundamentally contradict both statements. First, this idea of giving the tool.. I don't think it's a question of the tool. It's a question of not being afraid to use it. And that's what designers get trained in for years, to just draw, draw, draw. That's what writers do. They just write, write, write. Musicians make music, music, music. So to cross that barrier of 'oh gosh I'm not creative'.

KK: It's mentality.

PT: It's mentality and it's practice. And the second point is, yes, we believe that designers can are the authority on aesthetics. Designers believe that themselves and we make designers believe that. But in actual fact if I think that is beautiful or not, or it's rubbish or it's good, or it's funny... is a feeling I have towards a product. And again it comes down to 'am I allowed to make that statement?'

TE: But isn't that based on culture? Don't you think that certain music is beautiful because tens of generations before you have already agreed that a certain key is beautiful?

Audience: If you get back to 'what is a better product'; personally I think if a certain product fits me, it's a better product for me. My parents just bought a brand new car, and my dad showed it to me this morning, he said 'there are two cup holders but our cups don't fit'. It sounds perhaps really stupid but...

KK: No it's very straightforward. A better product is a shoe that fits better basically.

Audience: Well I have a couple of 3D printers at home and I immediately suggested well there's a ring around, why shouldn't I print an adapter for you, and for you your car works better just because two stupid cups fit. But I'm not a designer, I'm a technical engineer. Perhaps I think a little bit differently, but that's the way I look at it.

KK: But then how do you empower yourself or other people to allow them to say 'but that's actually better for me than something else'?

GB: I want to react to what you said about being a technical engineer and looking at the cup holder for your car, because that is essentially being a maker. Alexander and I were just talking about what's the difference between makers and designers. I was saying that I think makers often make things for themselves out of frustration for something that doesn't work or doesn't fit. But as a designer I think your role is to have empathy for other kinds of people that are not you, and learn what their needs are and design for them. I think that's what as a designer you should do. Maybe that was you for your father.

Audience: *inaudible question*

KK: That's too big a question for now. Why are we here? Freyja, please.

FB: Maybe one of the issues here was also how we phrase stuff. Because you call yourself a designer, he calls himself technical engineer, I think that's also limiting people. They're like:

'I'm not a designer, I don't know how to do this. I'm not an artist'. So just do stuff. And also something, I have a 3D printer, and a lot of people ask me, 'so what can you do with that?'. I don't know.. just fooling around with it, playing with it. But that's also a problem: what can you do with it, what's the purpose, what's this, what's that. No, just play with it.

TE: How do you get people to play?

KK. Exactly. But somehow it keeps coming back to your first point; How do you get this mentality started so that you're allowed to use stuff, which is another definition of this idea of empowerment, allowing people to change stuff in their surroundings.

AR: There is quite a big part of our society, of people that are allowed to play. The problem is that we think they have to be under twelve years old to be allowed to play.

KK: Wikipedia is not the best example, that's not a play sphere. But YouTube did this for instance for filmmaking. It changed everything. Everybody was and is allowed and is also using it as a playground. Some of them are some guys or girls are making their own YouTube channels and grow to be large media productions and have been hugely influential if they want to. But most people just play. How can we learn from YouTube? The tool does help. There is something about the tool that is easy enough to allow for playing. So maybe the 3D printer is not there, it's not easy enough yet.

TE: It's tools for making and also tools for distribution and I think both are relevant here.

KK: Any suggestions? We're talking a design question now.

GB: I'm thinking how I use Youtube, for learning piano, for learning snowboard tricks, for learning anything. If I want to learn anything I go to Youtube.

KK: But that's because everybody else posts their films on how to play the piano etc. So what can we learn from Youtube?

AR: Well, that it costs like zero cents.. nothing. It doesn't cost anything to put anything on there. It only costs you time to figure out how to record a video, edit it and upload it.

KK: So we're back in the add scheme of Google; that's the only way that.. so we have to sell the whole business to Google.

TE: *incomprehensible*... between separation between the cost of design and the cost of production. It's generally linked, today when we buy a product and buy the whole..

GB: ... I'm sure you're going to say ad scheme; because how do you think that it costs zero dollars to use it?

KK: It's paid for by advertisements for everybody.

GB: I reacted because sometimes people try to bash internet companies for using ads, but how would it otherwise be available?

PT: How could they.. what would be your business model?

KK: Its a very important discussion slightly out of the sphere of todays debate but is being free of cost the only solution to empowerment?

144:24 AR: It's not the only solution, but I think I talked with you yesterday, I said something like the difference between one and two cents, and between zero and one cents is completely different. It is so much bigger between one and two cent then between zero to one cent. Once you cross that threshold that you're not limited in that factor anymore, stuff will happen. You don't know what, like now also stuff happens like the amount of cat videos online is just so enormous...

KK: On the other hand, iTunes got successful because they stayed below one dollar in the beginning. Anything you could buy was less then one beer (not anymore).

AR: It would never have worked with Napster. Like before, trying out the zero one and getting everybody at least.

KK: That's true. First Napster, then iTunes. You're absolutely right.

AR: Not because... It was a business model, whatever. It was just to get people to understand that this is a possibility.

KK: And that's exactly what we're asking ourselves. So what is the tool or the technical environment or the mentality that belongs to it, that will free up the possibility of empowerment. Like YouTube did for film, for media, basically, for the visual media. Can we come up with conditions or quality of that environment? One of them is, it has to be free. The first one has to be free.

GB: You know the Fablab is supposed to be an environment like that. This is also a little bit, maybe directed at you Peter because you are involved with it a lot but I tend to the feeling.. I'm a little bit sceptical about how the consumer can answer and how this in serious is supposed to work, like people may go there, make stuff, may leave drawings for it and other people come there and build upon that. But I don't see that culture really being alive you know, I think a lot of what you said; the highest density of Fablabs in The Netherlands, yeah. Every local government was thinking 'oh we need a Fablab!' you know. We're just going to put a lot of printers in a room and people are going to get creative. That doesn't really work like that.

KK: So what's the problem with the Fablab?

GB: Well I think I think it's not a question of the tool. We were just talking about it. People have to cross this threshold and that is going to be empowering.

KK: It's also pretty hard to become literate in the Fablab environment. There's a lot of knowledge needed to create your first ring. So knowledge is another one. Back at education.

147:38 PT: The thing is, obviously, the huge difference between the Youtube story and making things... you as designers know that, the huge difference is that materiality. We deal with materiality and even if we can think of and imagine...

KK: Let's unpack that. Why is that a huge difference? Where is actually the difference, where does it reside?

PT: You always make the switch from bits to atoms, and back to bits, and back to atoms. And atoms are different kind of animal to bits.

KK: That's tautology.. so why aren't we saying that the 3D printing is actually extending the web to the materials sphere? Then suddenly it's continuous and now you're going the opposite direction again.

AR: It's actually if you compare software to hardware; it's actually a lot harder to build on the shoulder of giants with hardware. When you build something physical you have to figure out so many things for yourself.

KK: So it's knowledge again.

AR: It's already a bit easier but..

PT: When we say knowledge we think of books, but it's not the knowledge that's in books. It's being handy with stuff. Using that hammer the right way.

KK: So what happened to YouTube that it became handy to make films?

GC: Well easy question.. that's exactly an analogy to the low cost margin industry, or even zero costs margin production system. I don't think it's a toy. I mean, I would not give a fifteen hundred toy to somebody and say, okay, let's play with it. It is much more than that. I think it's too expensive, really, to be empowered from a position in Africa. It's very hard. If you empower yourself by building a printer, and really, the philosophy of BBF, to really empower the people that really need it.. I can buy a 3D printer. I didn't buy one, because, you know.. Like the digital camera that became cheaper and cheaper and cheaper. At the moment empowering people with a machine that costs 2000 euro.

KK: 200 euro, Ultimaker.

GC: If you can't spend money to buy the bolts and nuts, well, if you can't even bolts and nuts, you can't buy a printer.

TE: I think a couple of years from now it will cost 200 euros.

GC: Are we talking about empowerment? So if you want to empower people, the model, because you're all talking business models now. Where to make money, advertising, fine.

KK: We're talking mentality actually. We're talking education is key to..

TE: That's another thing, I think it's interface, which is your all talking about. I think it's all about.. you're saying software is easier than hardware. But of course software is completely not easy if you're standing in front of Basic or something, but it's easy when there is a good interface that says put your text here and it will appear there, for example. There is also interface to reality. Like Lego with an easy interface. A hammer is quite an easy interface to put a nail into a wall, better than a brick.

Audience: Yes, thank you. Let me make it a little bit smaller. I did a workshop for The New Institute in Cologne, during the fair, and I was given the assignment to think of a workshop to have the audience work with 3D pens. The 3D pen is an analogue 3D printer. You don't steer it with software, you steer it yourself. And of course all those questions arise. Are you empowered if you have a 3D pen? And what are you actually making and what is the value of what you are making without that pen. At first you will start to play around with it yourself, and think, well, I'm making crap, I'm making more waste. That waste needs to be recycled. The more you do it the more guilty you feel. More, more plastic waste, it's fun but it's more plastic waste. So what we try to do together with Helmut Smit is simply to come up with rules and design rules and what you can do as a collective, or what you can work on together. Then still the question remains, what is the value of what you are making and are you really being empowered? One of the rules was, I really had to tell people: 'don't make hearts. No ponies. No figurines. Don't do it. If you want to do it that's fine but not here.' You could say the same for the 3D printer but Tal you probably have the answer, you're questioning them if they have the answer but you probably thoughts about this particular kind of empowerment yourself and what conditions need to change.

TE: No, I don't have the answer. That's why we're having the debate. Otherwise I would be in my garage.

Audience: Is it about the empowerment of the consumer versus the industry? Is that's what's in the background?

TE: I try to underline this all the time; the question is, is there a social potential is here? Is there a social empowerment potential here? I don't know, it's a big question. Some people say: 'it's going to be a business thing'. Some people say it's a completely democratic opportunity, it's somewhere in between those two boundaries. But if there is a social potential here, how do we utilize it? And utilizing it I think revolves around laws, tools and semantics.

GB: Because if we also consider the installation, the exhibition here, Plastic Promises of a Homemade Future, plastic is a material that people don't even recognize most of the times, if it's plastic at all. They don't even know that you can sometimes melt it, how is it processed, all that kind of stuff. And I was also talking about it with people from bit plastic processing companies and recycling companies. Actually the debate was more about municipalities. Municipalities, they want to encourage people to throw their plastic in the plastic bin. It depends a little bit on how they organize their own waste streams because every municipality does it differently. That's why do the campaigns, right. Plastic euros, 'een beter milieu begint bij jezelf', if you throw it in the plastic bin. But, that's just people trying to do a good thing. But they're not aware of the whole system, in first instance, and they don't know where their plastic waste ends up. This is the 'it all ends on the big heap' syndrome. So in that sense, how far do you want to take the empowerment. That's the question the man from the recycling company asked me, and that's something that we're dealing with as well. We try to teach people with our installation, ok, this is this kind of plastic, you can process it this way..

TE: That's a good point. Maybe people should know this. So that is a starting point. That's why you are here, so you say 'I think people should know this'

GB: Actually I think it's nice we can, for example your kids; if we can show this process, and that they feel and see and be inspired by it. But in the big scheme of things it doesn't really matter if you teach people the numbers one to seven for recycling as long as you can motivate them for good behaviour.

TE: But that's also tools of empowerment

Audience: I have a question about plastic because, in 3D printing, I mean, before we also had ceramics, clay, anybody could take it. I think we should focus on the tool; what can the tool do as opposed to clay. 3D printing is exact, you can draw exact forms and complicated forms that you cannot do with your hands in the same way it and duplicate it. I think we're losing the focus on what we have here and what we can use it for.

AR: It's only useful when you actually have a goal, right? So I think firstly, okay, now it's really nice for educating everybody, 3D printing exists, we're teaching them stuff about plastics and about waste, how to recycle stuff. And I think the next step is to take it on the society level, and okay, then all of us are going to tackle the hard questions like how are we going to solve this energy crisis, how are we going to solve this waste crisis? And just say, these are the big problems that we have as a society and we know that all of you guys and girls want to help, but before nobody knew how, and that's a big problem. You don't know how you can help so you feel powerless. Okay, we slowly started to give you the power to actually know what you're doing, start helping us with this problem. Because we need to solve it, all of us.

GB: I want to say something about 3D printers and laser cutters. The past year I've been teaching at TU Delft as an external teacher for the sustainability minor, and I've noticed that during my studies, they've removed a lot of machines; the workshop has gotten smaller and

smaller. No millings, no lays, no wood working machines anymore. The hall of the university used to be the place where you would do things with your hands. Now there's like 9 3D printers, a bunch of laser cutters, one at Industrial Design and one at Architecture. And what I notice with my students is that they are getting less creative than the students that used to study there. Because they just think 'oh we've got printers here, now we're going to just print something it will come out of the printer like that anyway'. They don't think about other ways of production anymore.

KK: this raises questions whether 3D printing as a technology actually is the tool to achieve a more democratic technological empowerment.

GB: Students are less empowered. Because they think just everything is just going to roll out of the printer.

KK: So there's a double face. There's a democratization of the possibilities of making, anybody can make anything. On the other hand, it removes the process of making. So are they necessarily combined? The interface is the computer and it's no longer that the hammer or the saw or the screw or whatever. Like actually the interface for YouTube is actually the computer. So even in making a cup or a film is more or less the same process. Only the result is different. So there is the double face of the web, it democratizes the availability of all those tools; but on the other hand it removes them in a similar way. So, is this the face of empowerment? Or do we really need to take it in a very different direction? Let's say go back to the educational perspective. Is 3D printing then the thing that you should teach? Constructing knowledge is a valid thing, but is 3D printing the tool to achieve that?

PT: I would say totally agree with Gaspard about removing all those machines and reducing the contact with materiality and working with materials to this kind of remote-controlled print thing. This is exactly not what I mean.

KK: This is not what you mean with this constructing knowledge notion.

PT: It can be part of it, your 3D model stuff and instead of just looking at it on a screen you can go and cut it out on a laser cutter and disassemble it, which I still prefer to 3D print because it's a different interaction with materiality. It's a different interaction with space. It's a different way to go from material to shape. So the tools that we use and that we offer need to be tools that open up some space for intelligence, for play, for failure. Which luckily 3D printers do. *laughing* In terms of failure those machines are really great. Then you get, and that's a funny thing, then you get at it through a different angle. Because then you think 'why did it fail'. And what are the parameters of the manufacturing process that are not working?

GB: Flora, you're empowered, right? Because we put the printers up there, they need to be running the whole time, which they don't do, and you fix them. I'm a couple of times, I showed you, and now you fix them yourself. You are empowered.

FB: To get back to the empowerment moment, for me the empowerment in 3D printing is exactly the fact that I have an old ultimaker and most of the time it doesn't work so I get frustrated. I start to learn. I start to learn, how, what does that thing do? You go online, we have Youtube for 3D printing, we have Thingiverse, we have Instructables I think where you can learn everything about 3D printing there is to know. So in that sense it is empowering to me about software. To learn about how to weld stuff together. So that's empowering me personally. Does this empower my neighbour? No definitely not. But you get empowered by 3d printing. Because you start to think about 'ok I want drunken guys to recycle their bottles'. Then somebody came to you and said 'but what about the people in Africa'. Did you know there were Fablabs in Africa like before you even started the 3D printing? Knowing is empowering you to learn about this technology. You are then bringing it on to somebody else who also find his own thing with 3D printing. It's not in general, it's everybody themselves, as long as the product fails because that's what we need. We need crappy stuff.

AR: So a 3D printer that in the end you never get to the printing stage but that just allows you to learn a lot. Without you actually having to spend plastic.

TE: To sum it up a bit.. I think it's not empowerment.. there's also jokes.. but it's not a cynical concept, it's a political concept, empowerment. It is the idea that you as a user, as a citizen, as a human being, for some perspectives, have more possibilities to fulfill yourself. So democratization, or democracy, is a tool of empowerment. Maybe it doesn't always work, there's failure also there and it drives us forward etc. but it is a political concept. I think we should also consider that, yes, failure is the driver to move us forward, to get us more knowledgeable etc, or the possibility of failure. But there is, of course, it's more nuanced than that. When we go deeper down the rabbit hole and the printers work perfectly there is still a lot of opportunities for failure there. And I think, I mean, there's some notion that's kind of wrapping it up. Some fact that we cannot argue: home 3D printers are becoming better quality, they're becoming cheaper, and they're becoming more available. There is no golden app yet, probably one day someone will find it and make a lot of money, maybe not, but I think even then, there is a lot of nuances that can work either way. The argument about empowerment is a political one. It's not a cynical one.

KK: Also to summarize the other parts: we did establish a couple of qualities of the environment that would empower. So one of them is a low-cost availability massively distributed, like YouTube. The other one is it needs to allow for failure. And the other thing that came up in the end a bit is that maybe 3D printing is not that platform itself, but is part of a stack of platforms which includes other ways to deal with materiality and they all base on the sensation of being allowed to play, to being allowed to touch, to being allowed to break, being allowed to reconstruct. Which is something that belongs to the educational sphere. So in that sense it's interesting to see what happens in 5 years.

PT: Through Makerspace, Makerfares and Fablabs this space is also available to grow ups luckily.

KK: And that's the point that got the discussion started. Shouldn't we include this in our more basic education?

AR: And maybe something to take home for the designers here. For everyone here! You as a designer are in a position of power. We are in position of power. You can decide quite a lot. And you know that people look at you as someone who knows it all, and who has the authority. But as we see, what people actually need is the education perspective to learn to be allowed to play so that is actually a beautiful place to go to as a designer to see 'okay, maybe I can be a teacher instead of an authority figure'. So think about what you could do with it.

KK: Or both a teacher and an authority figure. One last question? I think this was also beautiful final statement. Thank you very much for being here.