



Designing Sustainability Transitions

IO-MI-222

Minor Event
Wednesday March 31, 2021

*MSc David Klein
Acting minor coordinator
Masterclass coordinator*

*MSc Caroline Kroon
Design Challenge coach*



David Klein

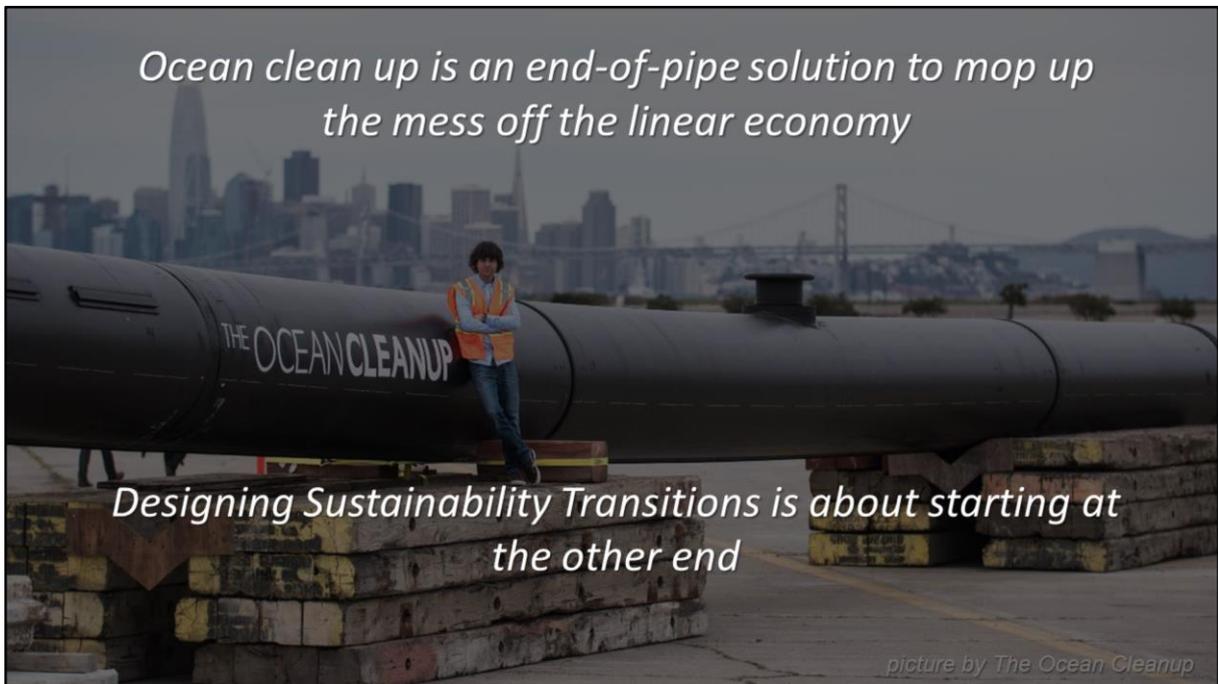


Caroline Kroon



Good morning everyone to this presentation of the minor Designing Sustainability Transitions.

The next 10 minutes I will explain what the minor is all about. If you have any questions, please put them in the chat. After these 10 minutes my colleague Caroline and I will have plenty of time to address them.



Most of the people in the field of sustainability know exactly who this guy is: Boyan Slats is developing solutions to clean up the ocean. In a way, this is what this minor is about. But in another way: it really is not. If we had enough people like Boyan Slats around, we wouldn't need to clean up the ocean. Because it would never have gotten that far in the first place. X So in short: this minor – Designing Sustainability Transitions – is about teaching engineers to think about the long-term effects of our products, services and systems from the start. It is about developing pathways to a desirable future.

		Course	Credits
Q1+2	IO3835	Design Challenge (DC)	11 ECTS
Q1	IO3830	Sustainability Issues and Social Change (SICS)	3 ECTS
	IO3834	Value Sensitive Design (VSD)	3 ECTS
	IO3832	Design Approaches (DA) a) Social Impact Design b) Circular Product Design	6 ECTS
Q2	IO3833	Masterclasses (MC)	4 ECTS
	IO3831	Demystify Green (DG)	3 ECTS

Credit (EC) = European Credits (credit points awarded to a course, one credit roughly equals 25 hours of study)

Just a quick peek at the setup of the minor. In Q1 and Q2 there are a number of courses that at first are quite focused on theory, but become ever more practical along the way.

All the courses are there to support you in carrying out a group design project – the design challenge - for an actual organisation with sustainability issues to solve.

Last year's coaches:

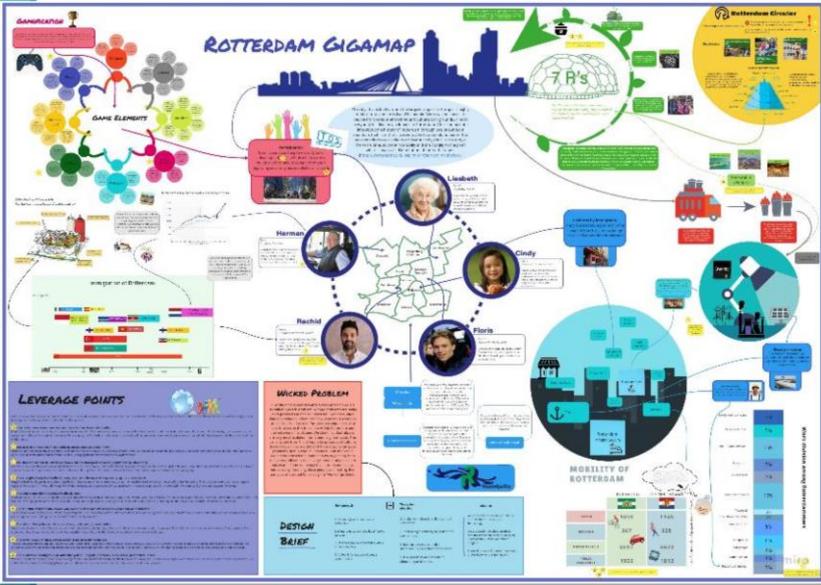


Caroline Kroon Joep Trappenburg

Martien Bakker

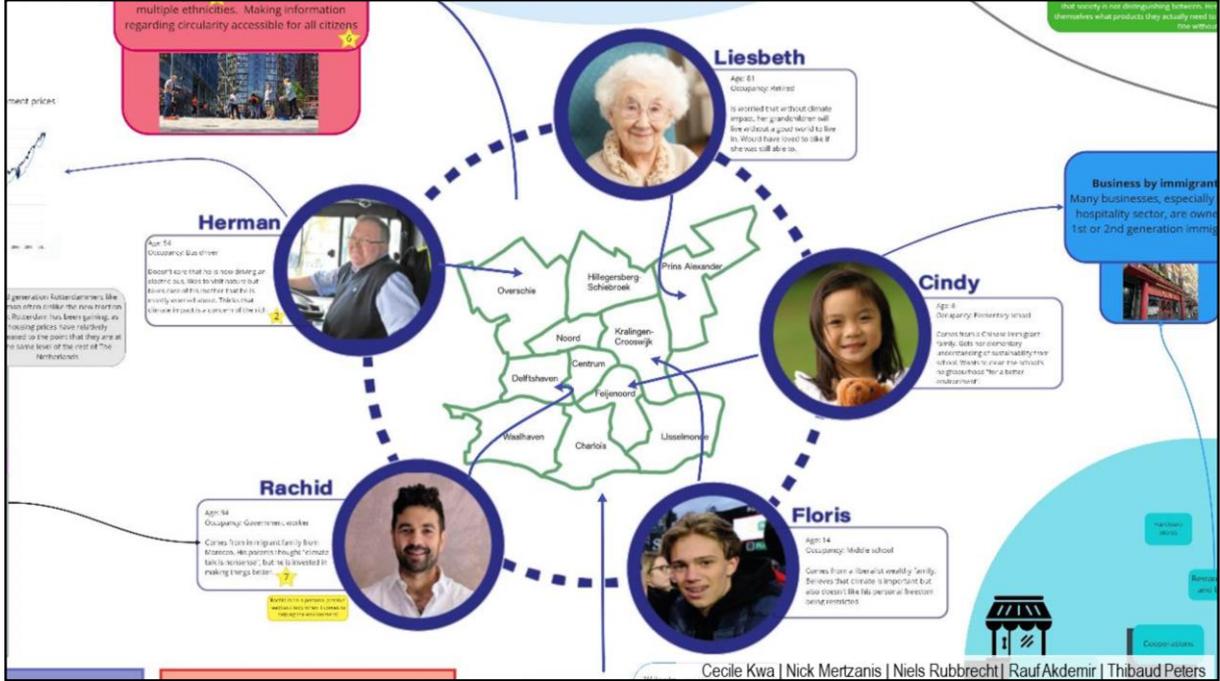
Design Challenge

Q1+2
IO3835 DC

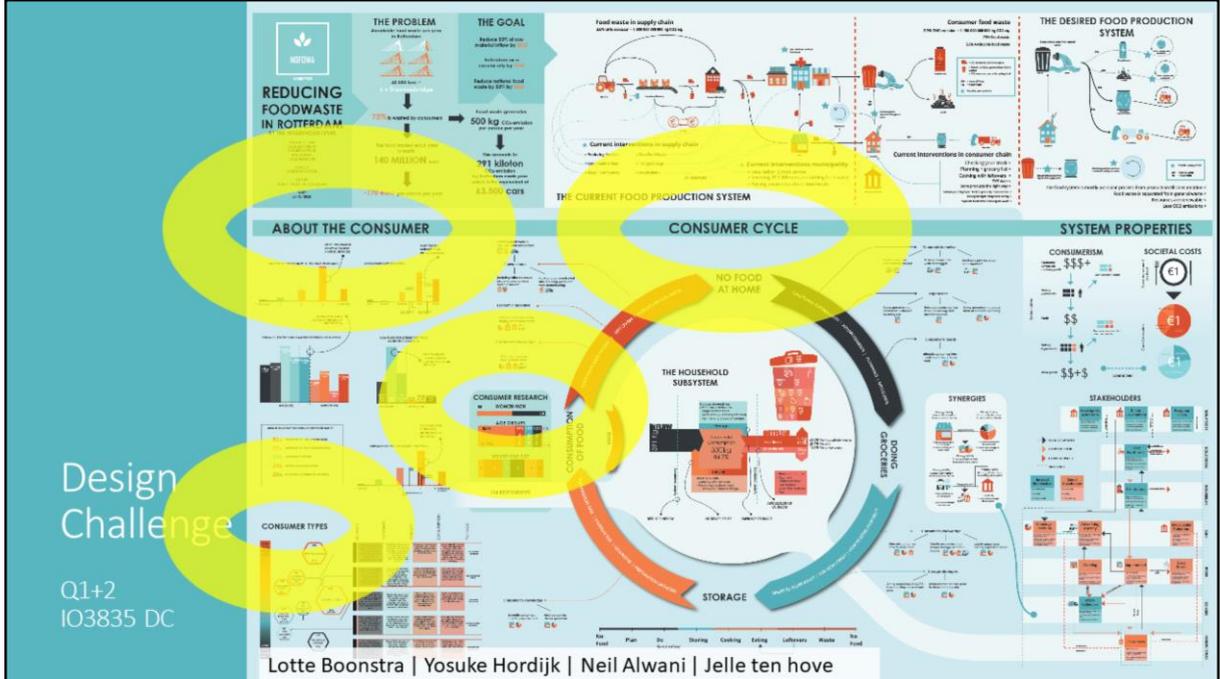


Cecile Kwa | Nick Mertzanis | Niels Rubbrecht | Rauf Akdemir | Thibaud Peters

The Design Challenge is a semester long design project carried out in a multi-disciplinary team of 4 to 5 students from various faculties. The first quarter of the design challenge focuses on understanding the problem.. In this case the client was the municipality of Rotterdam seeking ways to increase circularity. They were especially interested in solutions using gamification. A typical result of the analysis phase of the design challenge is the gigamap as depicted here, in which the issues the client faces are systematically organised.



Involving all stakeholders is an important topic throughout the minor. In this case, much attention is given to the diverse citizens of Rotterdam. They are in the center of the gigamap.



This second gigaposter – this time about food waste – at first glance is very different.

X But just like in the first gigaposter, the main stakeholders – the consumers – are given the attention they deserve.

Last year's clients:



Gemeente Rotterdam
Focus: food waste



Unilever
Focus: restaurants



Focus: spreading the message



Gemeente Rotterdam
Focus: energy

Design Challenge

Q1+2
IO3835 DC



Gemeente Rotterdam
Focus: gamification & circularity



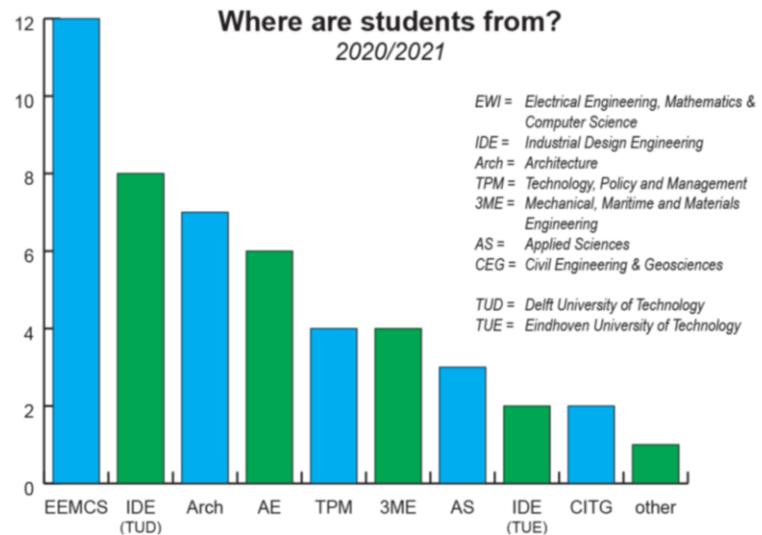
Unilever
Focus: Take away

The student teams get to work with real clients. Last year, three assignments were for the municipality of Rotterdam; two for Unilever and one for Repair Café. Each assignment had two competing student teams working on it.

Last year's students:

Design Challenge

Q1+2
IO3835 DC



The students come from a variety of faculties. In the team-forming process, care is taken by the staff to spread background knowledge evenly. Working in multi-disciplinary teams will be increasingly important in your future careers.

SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION

7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

SUSTAINABLE DEVELOPMENT GOALS

Jotte de Koning

Sustainability Issues and Social Change

Q1
IO3830 SISC

The second course - Sustainability Issues and Social Change by the course coordinator Jotte – is heavily focused on theory. There’s a whole lot more to sustainability than just climate change.

Marit van 't Walderveen
Julian Biesheuvel
Quinta Bonekamp
Hein van der Helm

Fig. 4. AvareSquare retail concept poster

Lotte Boonstra Bram
Verbeek Qusay
Fantazia
Isa Ritfeld

Fig. 2. Pile of unused vegetables and fruit (Reuters, n.d.)

Design Approaches

a) Social Impact Design

Q1
IO3832 DC

Cilia Boot
Ruben Broek
Matéo Caruso
Omar Hussein

The third course - Design Approaches – is a mixture of theory and practice. One such design approach is Social Impact Design. The problem all student groups worked on was food waste. The groups were all assigned to a different actor in society and asked to come up with solutions to solve food waste from each perspective.

X The group working for the Voedingscentrum tried to make consumers more aware of the different expiration dates by changing the shopping basket.

X The group of canned foods manufacturer Hak developed an app to promote recipes with ingredients that don't expire as fast.

X The group of Voedselbanken made it easier for ordinary citizens to donate food that is close to the expiration date.

The same problem tackled from very different viewpoints leading to very different solutions. That's Designing Sustainability Transitions for you.

Design Approaches
b) Circular Product Design
Q1
IO3832 DC

Proposed material	Reason (based on Ashby diagrams)	Supplier	Costs	Downside	Green score	Uncertainty	Final Choice Replacement
Bamboo	- Very light material with respect to its strength - Biodegradable - Takes CO ₂ from the air - Rapidly renewable resource - Good looking	Bamboo Import Europe BV (The Netherlands) https://www.bambooimport.com/en/bamboo-phywo?id=page=2	~ €230 per m ²	- Slightly flammable - Durability	3 or 4	High	Bamboo is the choice made to replace the frame of the fan
PP (polypropylene)	- Less embodied energy with respect to stainless steel - Lighter material with respect to stainless steel - No extreme hazard properties	S-Polytec (Germany) https://www.s-polytec.com/shetsid/html	~ €12 per m ² (variable)	- Fire hazard (LOI 19%) - Release toxic	2 or 3	High	
(Recycled) Aluminum 6061	- Infinitely recyclable - Lighter than stainless steel	Onlinek (USA) https://www.onlinek.com/shetsid/html					

Outer casing/Frame: Bamboo
Blades: Aluminium
Protection grids: Aluminium
Feet: Aluminium

<https://www.stadlerform.com/en-ch/products/fan/otto/information/>

Cilia Boot | Ruben Broek | Matéo Caruso | Omar Hussein

The second design approach is totally different. Like a true engineer, you are going to analyse a product and find ways to make it more circular. Like in the example of this simple fan, find out what materials it is made of. How circular is the product already?

X Are there hotspots to consider?

X What improvements could you make? And would that really be better?

X What could it look like?

No easy task.

Design Approaches

Q1
IO3832 DC



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 Room C-3-210

Areas of expertise

- Design for Behaviour Change
- Social Design
- Design Methodology
- Vision in Product design



Jeremy Faludi

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Present on: Mon-Tue-Wed-Thu-Fri

"To get the future you want, start building now."

[in](#)

Areas of expertise

- Sustainable Design Methods



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[in](#)

Areas of expertise

- Circular product design
- Design for Sustainability
- Life cycle management

For each course we have skilled and experienced lecturers guiding you through the process. Feel free to look them up.



'Envisioning Cards' developed by the University of Washington (vsdesign.org).

The next course – Value Sensitive Design – challenges you to think about the long term effects of any solution you come up with. Won't the cure be worse than the disease? Not if you do it right.

To challenge you to think way beyond the obvious, Envisioning Cards are used.

Value Sensitive Design

Q1
IO3834 VSD



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Room B-3-020

[in](#)

Areas of expertise

- Sustainable product development
- Cradle to Cradle
- Biomimicry
- Ecodesign
- Circular Product Design



Pieter Vermaas

Associate Professor

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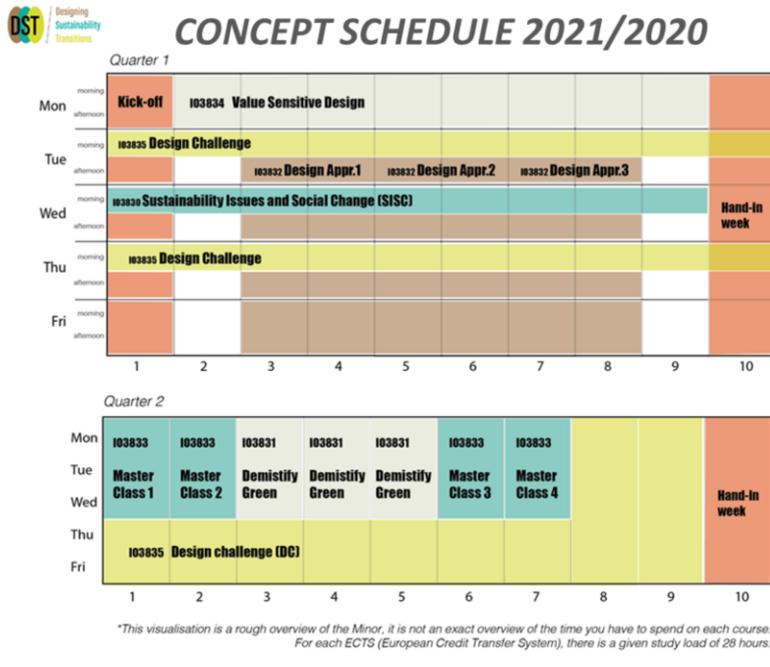
Department:
[Values, Technology and Innovation](#)

Section:
[Safety and Security Science](#)

Research interests:

And again, feel free to look up the lecturers that are involved.

DST Minor Overview



After all these course, we're halfway through the minor. As you can see here in yellow, in the first quarter there's not that much time for the main course: the Design Challenge. Much of the time you are being fed theory and inspirations from practice. The second quarter is quite different. The subcourses are fewer, more hands on and there's 3 times more time for the Design Challenge.

The image is a composite graphic. On the left, a teal vertical bar contains the text 'Masterclass 2.1 Sustainable Entrepreneurship' and 'Q2 IO3831 DG'. To the right of this bar is a portrait of Fatima Delgado Medina, a woman with blonde hair and glasses, wearing a black turtleneck and orange pants, with her arms crossed. To the right of the portrait is the Reefy logo, which consists of a stylized white fish-like shape inside a circle, with the word 'reefy' in lowercase and 'Innovation for nature' in smaller text below it. The background of the Reefy logo is an underwater scene with coral and rocks. Below the Reefy logo is a photograph of a large, black, cylindrical floating trash collector on the water. A person in an orange safety vest is standing on a concrete pier next to it. The San Francisco skyline is visible in the background. The text 'THE OCEAN CLEANUP' is written on the side of the collector. A small caption at the bottom right of the photograph reads 'picture by The Ocean Cleanup'.

Fatima Delgado Medina

Masterclass 2.1
Sustainable
Entrepreneurship

Q2
IO3831 DG

reefy
Innovation for nature

THE OCEAN CLEANUP

picture by The Ocean Cleanup

Alongside the design challenge, the second quarter starts off with a set of four masterclasses. The first one goes into depth concerning sustainable entrepreneurship. You can't run a business in sustainability if your business itself goes broke in record speed. Believe me: I know.

There will be real companies presenting their business cases and in teams you will try to come up with your own sustainable business plan.

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Lise Magnier · 2nd
Assistant Professor of Sustainable Consumer Behaviour
Delft, South Holland, Netherlands · 427 connections ·
[Contact info](#)

Masterclass 2.2
Behaviour Change

Q2
IO3831 DG

source: Teadofor2
<https://teadofor2.wordpress.com/2010/05/25/melbourne-part-one/p1040282/>

The second masterclass is about behaviour change. What if we could design our products, environments and our shops in such a way that doing the most sustainable thing is the natural choice? Like here, in the classic example of the piano stairs, in which people are playfully seduced to take the healthier stairs instead of the escalator running alongside.

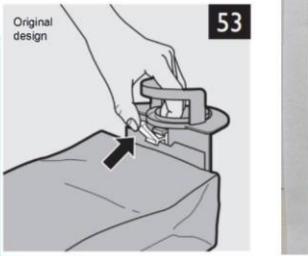
Part analysis



Important factors:

- impact resistant
- resistant to friction
- fits into the slot on the vacuum cleaner
- holds the dust bag in place

Redesign



Evaluation



Masterclass 2.3
Digital
Manufacturing &
Sustainability

Q2
IO3831 DG

The third masterclass is really hard core and classical engineering. In order to understand what on demand digital manufacturing could do to change the landscape of sustainability, you'll be challenged to find a broken product and repair it using 3D printing technique.

Like in this vacuum cleaner in which a small button was broken, forcing the user to improvise with a clothing hanger. That's the linear economy for you: a small part breaks and the product is near useless.

X In the original product, there was a much more practical way to hold the dust bag in place.

X The student in question reverse engineered the button back into the world. Of course, taking into account the strengths and weaknesses of 3D printing.

This is a simple example, but of course, the real potential of digital manufacturing for sustainability is much bigger than that. So maybe you can find applications in your design challenge.





Julieta Bolaños Arriola · 1st

Circular Product Design, Researcher at Industrial Design Engineering, TU Delft

Delft, South Holland, Netherlands · [500+ connections](#)

Masterclass 2.3

Digital Manufacturing & Sustainability

Q2
IO3831 DG



Alma van Oudheusden

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[📍 Room B-3-290](#)

Present on: Mon-Tue-Wed-Thu-Fri

Main areas of expertise

- Sustainability
- Circular Economy
- Refurbishment
- Transitions
- Designing Design
- Design Research Methods
- Technology
- 3D Printing & Scanning



Bas Flipsen

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Present on: Mon-Tue-Thu-Fri

"Get fired-up instead of burned-up."

And here are the lecturers.

1. Testing/findings



- When the leg is in a driver, the boards flexed at 45 degrees.
- Catches fire easily and will catch burning.
- Softer material for no. 4, but easily sandable with some sanding.
- Will be possible, should not take up water or small amounts of it.

Defne Eraksoy
Rykiel Fijn
Thibaud Peters
Timea Nagy
Tristan Vooren

Masterclass 2.7
Engineering in
Biobased &
Biodegradable
Materials

Q2
103831 DG

4. Ideas



The final masterclass is about the application of biobased and biodegradable materials. Samples of materials that have recently been developed are provided by NPSP and other organisations. It's your job to test them and find out the properties. X Next, based on the properties, you will need to come up with competitive and sustainable applications for the given materials.

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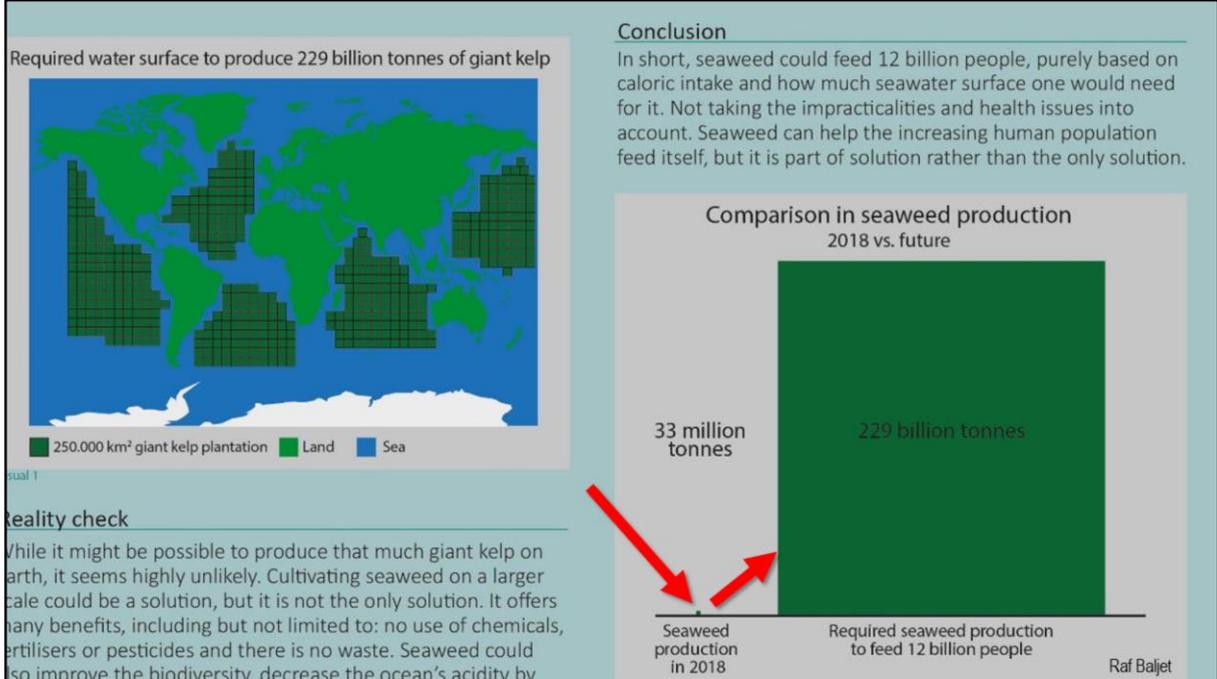
Masterclass 2.7
Engineering in
Biobased &
Biodegradable
Materials

Q2
103831 DG

Mark Lepelaar · 1st
Specialist and adventurer in biobased
and materials
Amsterdam, North Holland, Netherlands

Foto: <https://www>

NPSP, a frontrunner in the field of biobased materials, is involved in this masterclass.



The smart visualisation on the left shows that maybe in theory seaweed could feed 12 billion people, but it will require planet sized application.

The picture on the right shows the scale of current operations:

X the little square here

X compared to what is being proposed.

As you can see, feeding 12 billion people with seaweed is questionable at the very least.

Demystify
Green

Q2
IO3831 DG



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[Publications](#)
 Room B-3-060

Present on: Mon-Tue-Thu-Fri

"Get fired-up instead of burned-up."



Joris Melkert verkozen tot Beste Docent van de TU Delft

Joris Melkert, universitair docent bij de faculteit Luchtvaart- en Ruimtevaarttechnologie (LR), is verkozen tot Beste Docent van de TU Delft 2019. De bekendmaking vond plaats tijdens de Education Day op 7 november.

Zeer gecommiteerd

De faculteit Luchtvaart- en Ruimtevaarttechnologie (LR) zou gewoon niet zonder Joris kunnen. Dat stelt Studievereniging VSV 'Leonardo da Vinci' in haar nominatie van Joris Melkert voor Beste Docent van het Jaar aan de TU Delft. "Joris is zeer gecommiteerd aan de faculteit. Het aantal vakken en projecten waar hij aan is verbonden, is fenomenaal."

Melkert, altijd bereikbaar en open voor feedback, is continue op zoek naar onderwijsverbetering. Zo herontwerpt hij samen met een collega het vak 'Structural Analysis & Design'. Het vak werd altijd gezien als een groot potentieel struikelblok voor studenten maar door een andere aanpak in het lesgeven, is dat inmiddels verleden tijd.

Studievereniging VSV 'Leonardo da Vinci'

Patrick van Delft
Expert writing & communication

The lecturers have a background in aerospace engineering, sustainability, writing and communication.

Concept Poster | Repair Toolkits

Design Challenge

Q1+2
I03835 DC

Concept Summary

Repair Café is a place where people can bring their broken items to be repaired. It is a place where people can learn how to repair their own items and help others. The Repair Café is a place where people can learn how to repair their own items and help others. The Repair Café is a place where people can learn how to repair their own items and help others.

Learning Goals & Leverage Points

Children will learn how to identify and name different tools and materials. They will learn how to use tools safely and effectively. They will learn how to identify and name different parts of a machine. They will learn how to identify and name different materials. They will learn how to identify and name different colors and shapes.

Target Group

Children aged 4-6 years old. Children with special needs. Children who are interested in learning about repair. Children who are interested in learning about tools and materials. Children who are interested in learning about colors and shapes.

Design Process

Masterclasses Learning Experiences

Children will learn how to identify and name different tools and materials. They will learn how to use tools safely and effectively. They will learn how to identify and name different parts of a machine. They will learn how to identify and name different materials. They will learn how to identify and name different colors and shapes.

Kit 1 | The Happy Starfish

Kit 2 | The Bike

Kit 3 | The Pancake Mixer

Katharina Berger | Quinta Bonekamp | Matéo Caruso | Merlijn Mac Gillavry

Now let's go back to the main course: the Design Challenge. This is what one of the most important end results of your design challenge could look like. In this case, for Repair Café, three concept designs to stimulate children to be interested in and confident about repair from an early age.

Kit 1 | The Happy Starfish

Key Ingredients

Specific Learning Goals

Instructions

Story

Kit 2 | The Bike

Key Ingredients

Specific Learning Goals

Activity

Kit 3 | The Pancake Mixer

Key Ingredients

Specific Learning Goals

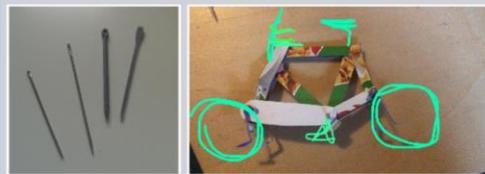
Activity

Katharina Berger | Quinta Bonekamp | Matéo Caruso | Merlijn Mac Gillavry

The design team focused on teaching young children the art of repair through a variety of toolkits they designed.

Design Challenge

Q1+2
IO3835 DC



Iterations | To evaluate the feasibility of our concept and improve it, we performed a field test on the first kit (i.e. the sewing kit) with children from 6-7 years old. This field test in an actual classroom provided us with interesting feedback from the children and the teacher, namely on some steps of the instruction and on the time required to perform the activity, but also on whether the fabric should be provided already cut. Overall, the children were truly enthusiastic about this kit and were willing to continue with creating their own stuffed smiley as soon as possible.

Katharina Berger | Quinta Bonekamp | Matéo Caruso | Merlijn Mac Gillavry

The design team used simple prototypes to test out their ideas with the target group: primary school children.



Those were small ideas for small people. But this project shows that the result can be very different as well. Like here in the presentation for the municipality of Rotterdam. Let's zoom in.

Desirée Bruning | Jay Husband | Julian Biesheuvel | Hein van der Helm

WE SUPPLY

SMARTGRID

GEOHERMAL HEAT

RENEWABLE ENERGY SOURCES

Preparation phase

WRIJ is developing smart solutions to help integrate data, as well as the smart meters needed to connect the existing network of pipes and to make it ready for the future.

Phase 1

HEAT FROM SEWAGE

- Heat is already there, you only need to extract the heat from the system
- Large upfront costs for installation needed

HEAT FROM DATA CENTERS

- Heat is already there, you only need to extract the heat from the system
- In the future more data centers will be built, it is expensive for the data demand
- It is expensive to modify the current data centers and to integrate them into the system

BIOMASS ENERGY/HEAT

- It is abundant, and can be used without extraction, cleaner than fossil fuel
- Can result in air pollution, takes a lot of energy to produce, can be unsustainable and competes with food production

SOLAR ENERGY

- Unlimited supply of sunlight and no pollution
- Travels on sunlight, so it doesn't generate electricity at night or when overcast
- Takes a large geographical footprint to generate a significant amount of energy

WIND ENERGY

- High pollution, social maintenance, relatively inexpensive to build
- No energy when the wind isn't blowing
- The turbines are usually designed to rotate around
- It creates noise, and can be harmful to birds and wildlife

TIDAL ENERGY

- Tidal energy is a renewable source of energy, which means the energy does not deplete as its used
- Tidal turbines will produce substantially more energy than a wind turbine of the same size
- While tidal power does have predictable power generation, it does not have constant power production

WAVE ENERGY

- Rather independent of weather conditions
- Lifespan of tidal energy devices is quite long
- Not mature yet
- Geographic limitations

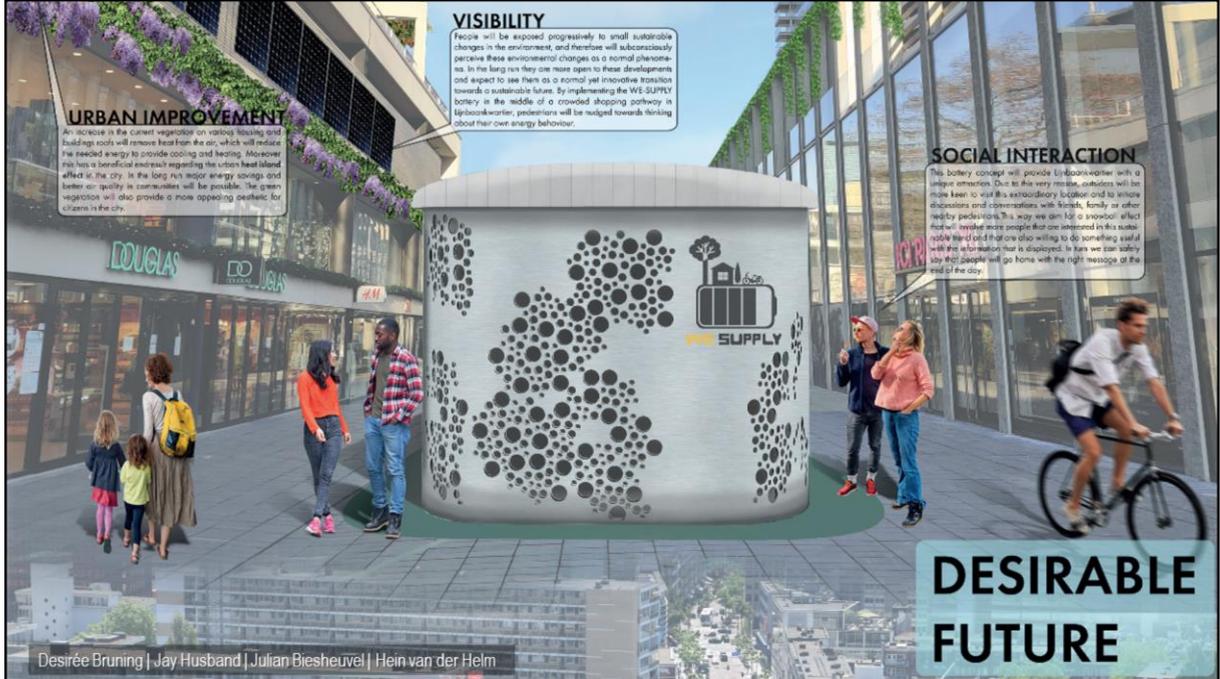
HYDROGEN

- Can use 20% of existing base load power
- Can be used to create the energy storage, producing hydrogen from electricity and water
- Infrastructure for hydrogen delivery is still underdeveloped
- Reliability, durability and robustness are still under research

GEOHERMAL HEAT

- Environmentally friendly compared to gas or oil furnaces (no combustion)
- Geothermal energy is a renewable resource as long as the Earth exists
- Geothermal heat pumps work year-round
- High upfront costs with implementing geothermal energy
- More suitable for new home builds as retrofitting involves large scale excavation

Here, they did a reality check on renewable energy possibilities within the city limits.



Here, a street view of that same desirable future. An important feature is the way energy storage capacity is integrated. In the vision of these students, batteries should be clearly visibly doing their useful work for society.



Designing
Sustainability
Transitions

Summary

IO-MI-222

This minor consists of:

- 30 ECTS
- 5 courses (including 4 masterclasses)
- 16 expert lecturers
- 6 assignments for real clients

This minor will teach you:

- Understanding of complex sustainable systems
- Meeting societal needs within planetary boundaries
- Evaluating processes on consumer to systems level
- Forming an opinion about transition pathways towards desirable futures
- Working in multi-disciplinary teams
- Communication and entrepreneurship
- Working with clients

So to summarise:

This minor consists of:

30 ECTS

5 courses

16 experts lecturers

6 assignments for real clients

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- Meeting societal needs within planetary boundaries
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- Working with clients

*Thank you for
your attention!*

Questions?

*Please put
them in the
chat.*



**Designing
Sustainability
Transitions**

Thank you for your attention.

Feel free to ask questions in the chat and we will try to answer them.

Contact

Minor coordinator: Jotte de Koning

Acting coordinators: Conny Bakker &
David Klein

Contact email: DST-IO@tudelft.nl

Frequently
asked questions
during the minor
event

Is this a selection minor?

This is NOT a selection minor. There are 60 spots available. The last two years, roughly 50 spots were taken.

When can we apply?

Other than mentioned during the minor event, from the 3rd until 31st of May for the first round. From July 1st to 15th for the second round.

How does the grading take place?

I've added a slide about last year's assessment at the end of this presentation.

Can you share the slides?

Done.

FOR WHOM?

Engineering, architecture, and design students from universities worldwide on a level comparable to that of the TUDelft.

Minors of the faculty of Industrial Design Engineering are open only for students from academic programmes in the third year of their Bachelor studies.

For information about enrolment, go to: tudelft.nl/minor.

5 RULES OF THE MINOR

1. Everyone is creative, but creativity feeds on interaction, so talk to each other.
2. Ask a lot of questions, a lot, to each other, to others, get a conversation going.
3. Much of the things we will discuss are complex, not complicated.
4. Try out, prototype, connect to the real-world (even more important in these times) .
5. Think in systems, think big, but make it small.

		Course	Assessment 2020/2021!	Credits
Q1	IO3830	Sustainability Issues & Societal Change (SISC)	Individual assignments + group Essay	3 ECTS
	IO3834	Value Sensitive Design (VSD)	1 Report (individual)	3 ECTS
	IO3832	Design Approaches (DA)	2 Reports	6 ECTS
Q2	IO3833	Masterclasses	Attendance	4 ECTS
	IO3831	Demystify Green (DG)	Reporting + presentation	3 ECTS
Q1+2	IO3835	Design Challenge (DC)	2 Posters 1 Design + presentations 1 Reflection Report	11 ECTS

Credit (EC) = European Credits (credit points awarded to a course, one credit roughly equals 28 hours of study)

Pass/Fail rules

Assessment rules

The student has passed the minor when the following requirements have been met:

1. The minor courses undertaken must add up to a minimum of 30 EC;
2. A result has been achieved for the minor courses: a mark, a pass (V or *voldoende*), or an exemption (VR or *vrijstelling*);
3. None of the marks for the six courses may be lower than a 6.0.
4. If a course consists of different main components, each main component has to result in a mark not lower than 5.0. Together, the main components must add up to a minimum of 6.0.