Photographer: TEMPELHOF URBAN IDEAS COMPETITION, CHORA architecture and urbanism, Buro Happold, GROSS.MAX, Joost Grootens

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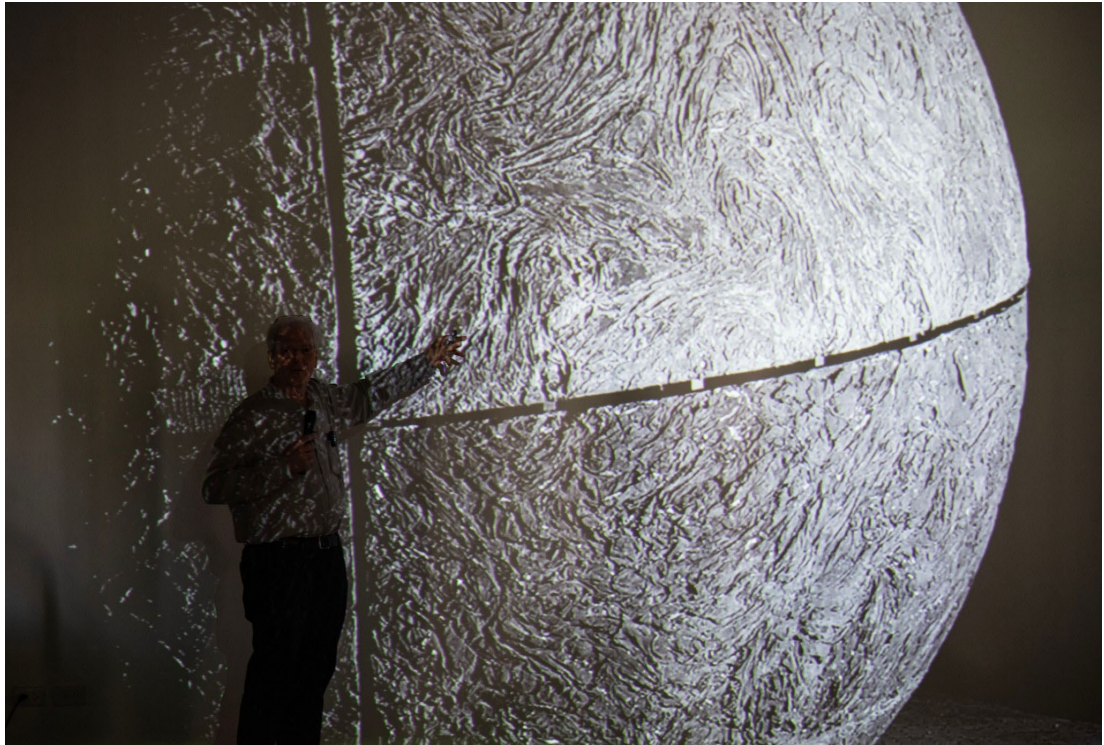Faculty of Architecture Chulalongkorn University

Seminar
SECOND SKIN: BUILDING WITH NATURE

07 JULY 2023

SECOND SKIN: BUILDING WITH NATURE

วันที่ 7 กรกฎาคม พ.ศ. 2566 ณ คณะสถาปัตยกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

โดย: PROF.AD.RAOUL BUNSCHOTEN (TU-BERLIN, CHORA CONCIOUS CITY)

      อุตสาหกรรมการก่อสร้างอันเนื่องมาจากสถาปัตยกรรมและการขยายตัวของเมือง ส่งผล
ต่อการปล่อยก๊าซคาร์บอนไดออกไซด์ทั่วโลกทั้งทางตรงและทางอ้อมถึงร้อยละ 40 จากรายงาน
ของคณะกรรมการระหว่างรัฐบาลว่าด้วยการเปลี่ยนแปลงสภาพภูมิอากาศ (IPCC) ชี้ให้เห็นว่า
ปัจจุบันอุณหภูมิของผิวโลกเฉลี่ยได้เพิ่มขึ้นเกินกว่า 1.5 องศาเซลเซียสเมื่อ เทียบกับอุณหภูมิ
ในช่วงก่อนยุคอุตสาหกรรม สถานการณ์ดังกล่าวนำไปสู่การสูญเสียสายพันธุ์ซึ่งเป็นภัยคุกคามต่อ
ความหลากหลายทางชีวภาพและความเป็นอยู่ของมนุษย์ ปัญหาเหล่านี้เน้นย้ำถึงความจำเป็น
เร่งด่วนในการจัดการกับการเปลี่ยนแปลงสภาพภูมิอากาศและผลกระทบต่อสิ่งแวดล้อม

เพื่อตอบสนองต่อปัญหาที่โลกกำลังเผชิญในฐานะสถาปนิกและนักออกแบบผังเมืองซึ่งมี
ส่วนร่วมโดยตรงต่ออุตสาหกรรมก่อสร้าง แนวคิดการออกแบบ second skin ผ่านการก่อสร้าง
ร่วมกับธรรมชาติ จึงได้ถูกหยิบยกขึ้นมาเพื่อเป็นแนวทางในการสำรวจสถาปัตยกรรมและเมืองทั้ง
ที่มีอยู่แล้วและกำลังจะเกิดขึ้นเพื่อความยั่งยืนในอนาคต first skin หมายถึงผิวของโลกที่มีโดย
ธรรมชาติ หรือ อาจเทียบได้กับเปลือกโลก ส่วน second skin คือส่วนที่ถูกสร้างขึ้นโดยมนุษย์ การ
บรรยายนี้มุ่งเน้นการออกแบบสถาปัตยกรรมและเมืองโดยใช้วัสดุหรือองค์ประกอบที่มาจาก
ชีวภาพ สร้างความกลมกลืนระหว่างผิวทั้งสอง เพื่อนำไปสู่การชะลอและลดผลกระทบจากการ
เปลี่ยนแปลงสภาพภูมิอากาศ แนวคิดนี้ช่วยให้เราสามารถสำรวจถึงการไหลเวียนของวัสดุและ
พลังงานผ่านขั้นตอนต่าง ๆ ตั้งแต่ที่มาของวัสดุ การใช้งาน และการรีไซเคิล ผ่านห่วงโซ่คุณค่า (a
value chain) เพื่อหาจุดสมดุลที่จะเกิดประสิทธิภาพสูงสุดภายใต้ข้อจำกัดทางด้านสิ่งแวดล้อม
การบรรยายได้รวบรวมตัวอย่างการใช้เทคโนโลยี เช่น AI และ machine learning ในการ
ออกแบบสถาปัตยกรรมซึ่งมีมิติความซับซ้อนที่มากขึ้นร่วมไปกับการเน้นย้ำถึงความสำคัญของมิติ
ทางสังคมที่เกี่ยวข้องกับกระบวนการมีส่วนร่วมและการเจรจาเพื่อแก้ไขปัญหาการขยายตัวของ
เมือง เพื่อนำไปสู่แนวทางใหม่ด้านสถาปัตยกรรมที่ผสมผสานธรรมชาติและคำนึงถึงผลกระทบต่อ
สิ่งแวดล้อมอย่างรอบด้าน
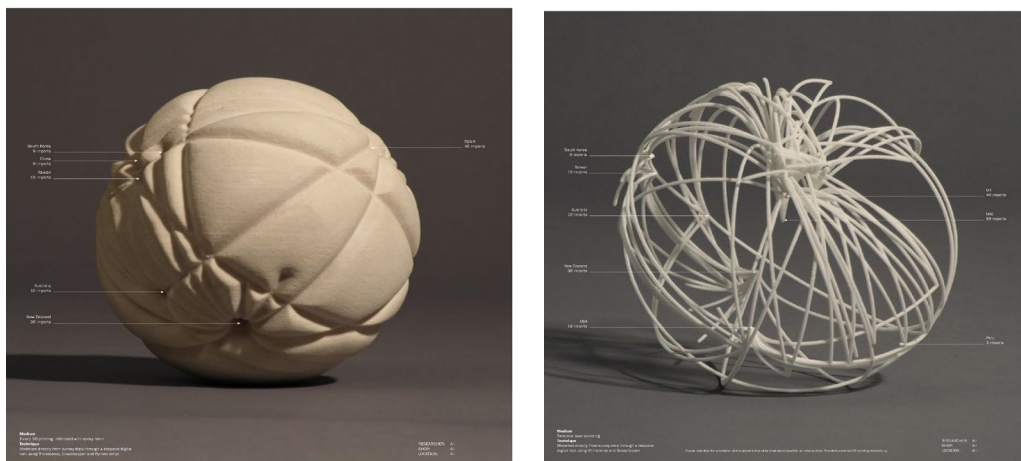
ภาพจาก Spherefolio 3D printed map, โดย Henry Jonas, SS2018, FG CHORA, TU Berlin.

The Second Skin

แนวคิดของ second skin หมายถึงวิธีการมองการขยายตัวของเมืองที่กำลังสร้างและ
เปลี่ยนแปลงพื้นผิวโลก second skin เป็นคำที่ใช้อธิบายสภาพแวดล้อมที่มนุษย์สร้างขึ้น ซึ่ง
แตกต่างจากสภาพแวดล้อมทางธรรมชาติหรือ first skin ของโลก second skin ครอบคลุมถึง

สิ่งก่อสร้าง โครงสร้างพื้นฐาน และภูมิทัศน์เมืองที่ถูกสร้างขึ้นเป็นส่วนหนึ่งของอารยธรรม second skin อาจส่งผลเสียต่อสิ่งแวดล้อม โดยเฉพาะอย่างยิ่งในเรื่องการเปลี่ยนแปลงสภาพภูมิอากาศ ในการบรรยายได้พูดคุยถึงผลกระทบจากการเปลี่ยนของของพื้นผิวโลกผ่านการนำเสนอข้อมูลใน เทคนิคต่าง ๆ ทั้งจาก 3D printing และ อินโฟกราฟิก เพื่อแสดงให้เห็นว่าการบริโภคส่งผลเป็นวง กว้างไปทั่วโลก เป้าหมายของการแนะนำแนวคิด second skin คือความสำคัญของการบูรณาการ ธรรมชาติ การมองมนุษย์เป็นส่วนหนึ่งในระบบนิเวศ และ การสร้างความสัมพันธ์ทางชีวภาพ ระหว่างโครงสร้างที่มนุษย์สร้างขึ้นกับธรรมชาติ เพื่อช่วยลดผลกระทบด้านลบของการขยายตัว ของเมือง และสร้างสภาพแวดล้อมที่ยั่งยืนและกลมกลืนมากขึ้น โดยสรุปแนวทางนี้มุ่งเน้นถึงการ ที่มนุษย์เป็นส่วนหนึ่งของธรรมชาติ และความจำเป็นในการปรับพฤติกรรมของมนุษย์ให้ สอดคล้องกับความสมดุลของระบบนิเวศในโลกปัจจุบัน
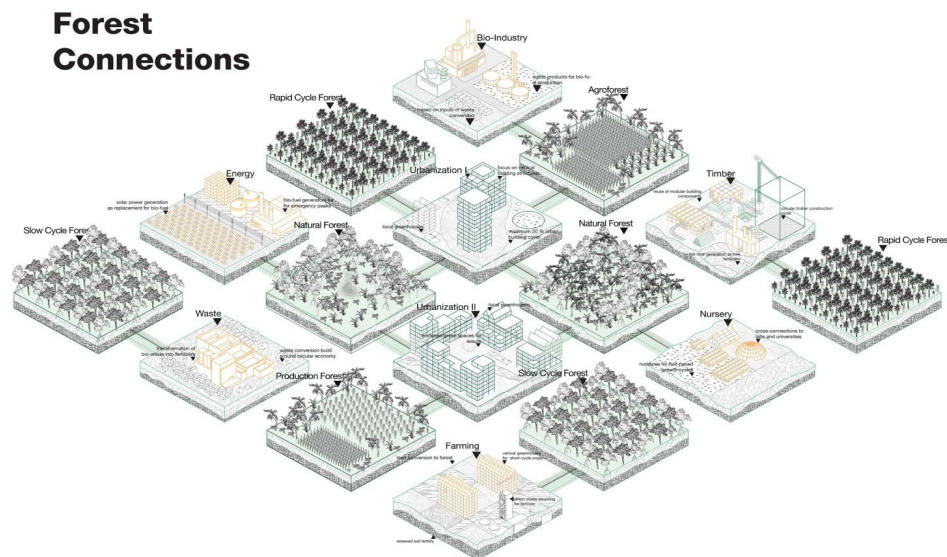
ภาพจาก A Path through the Forest, MA Supply Chain Urbanism WS 19/20 โดย Ann-Kathrin Salich, Daniel Dieren, Christina Krampokouki – FG CHORA, TU Berlin.

The Building with Nature

การสร้างเมืองที่ผสมผสานธรรมชาติจะช่วยผลักดันการพัฒนาสิ่งปลูกสร้างที่ถูกสร้างขึ้น ร่วมไปกับการเติบโตของสิ่งมีชีวิต ส่งเสริมความเป็นอยู่ที่ดีของมนุษย์ ความยั่งยืนด้านสิ่งแวดล้อม และความสามารถในการฟื้นคืนของเมืองเมื่อประสบกับภัยพิบัติ

การบรรยายในส่วนนี้แบ่งออกเป็น 5 ส่วน ได้แก่ ป่าไม้ การขนส่ง การผลิต การออกแบบ และเมือง เพื่อสำรวจวิธีการออกแบบสถาปัตยกรรมผ่านมุมมองของห่วงโซ่คุณค่า ผู้บรรยายได้ยกตัวอย่างผลงานทั้งด้านสถาปัตยกรรมและการวางผังเมือง ที่มาจากผลงานออกแบบส่วนตัวและผลงานนักศึกษา ซึ่งครอบคลุมองค์ประกอบและหลักการทางธรรมชาติตลอดวงจรชีวิตของอาคาร ตั้งแต่การจัดหาวัสดุไปจนถึงการจัดการของเสียส่วนต่างๆ เพื่อแสดงให้เห็นถึงความเป็นไปได้ในการปรับใช้แนวคิดเรื่องห่วงโซ่คุณค่าในการออกแบบการก่อสร้างร่วมกับธรรมชาติอย่างสมดุล โดยสามารถสรุปได้เป็น 3 ประเด็นหลักดังนี้

1. <u>บทบาทสำคัญของการก่อสร้างที่ยั่งยืนในการรับมือกับการเปลี่ยนแปลงสภาพภูมิอากาศ</u> แนวทางปฏิบัติในการก่อสร้าง ซึ่งเกี่ยวข้องกับการใช้แหล่งพลังงานหมุนเวียน การลดของเสีย และการส่งเสริมการใช้วัสดุธรรมชาติที่สามารถหมุนเวียนภายในห่วงโซ่คุณค่า มีความสำคัญอย่างยิ่งต่อการบรรเทาผลกระทบอันเป็นผลมาจากการเปลี่ยนแปลงสภาพภูมิอากาศ

2. <u>การบูรณาการเทคโนโลยีในการออกแบบสถาปัตยกรรมและการผลิต</u> การใช้เทคโนโลยีที่เพิ่มขึ้น รวมถึง AI และ machine learning ในการออกแบบและการวางแผนสถาปัตยกรรม สามารถเพิ่มโอกาสในการเพิ่มประสิทธิภาพการไหลของวัสดุ ลดของเสีย และเพิ่มประสิทธิภาพของกระบวนการสร้าง เทคโนโลยีเหล่านี้ถูกใช้ในการผลิตภาคอุตสาหกรรม สามารถนำวิธีมาปรับใช้กับการก่อสร้างได้

3. <u>ความจำเป็นของกระบวนการมีส่วนร่วมเพื่อจัดการกับความท้าทายของปัญหาการขยายตัวของเมือง</u> นอกจากแง่มุมเทคโนโลยีที่เข้ามาช่วยแล้ว การจัดการกับปัญหาการขยายตัวของเมืองที่ซับซ้อนจำเป็นต้องให้ผู้มีส่วนได้ส่วนเสียทั้งหมด ไม่ว่าจะเป็นผู้อยู่อาศัย ผู้ออกแบบ และผู้กำหนดนโยบาย ได้มีส่วนในกระบวนการตัดสินใจร่วมกัน การออกแบบร่วมกันนี้มีความสำคัญอย่างยิ่งต่อการพัฒนาเมืองและการแก้ปัญหาอย่างมีประสิทธิผล

การทำความเข้าใจการไหลเวียนของวัสดุและการสร้างการหมุนเวียนในห่วงโซ่คุณค่านับเป็นสิ่งสำคัญสำหรับการพัฒนาที่ยั่งยืน ช่วยลดผลกระทบต่อสิ่งแวดล้อม อนุรักษ์ทรัพยากร และส่งเสริมความเป็นอยู่ที่ดีทางเศรษฐกิจและสังคม ผนวกกับมุมมองด้านสังคมที่ต้องพัฒนาควบคู่ไปกับความร่วมมือระหว่างบุคคลต่างๆ องค์กรภาคธุรกิจ รัฐบาล และผู้บริโภค เพื่อขับเคลื่อนการเปลี่ยนแปลงที่สู่อนาคตที่ยั่งยืนมากขึ้น
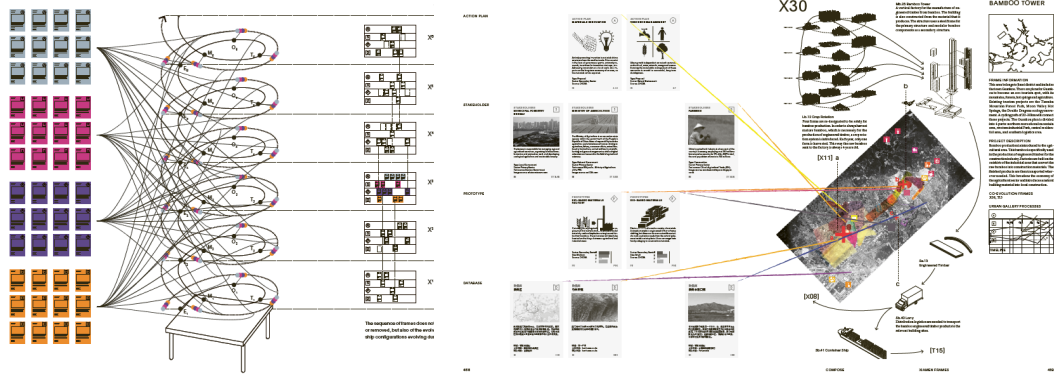
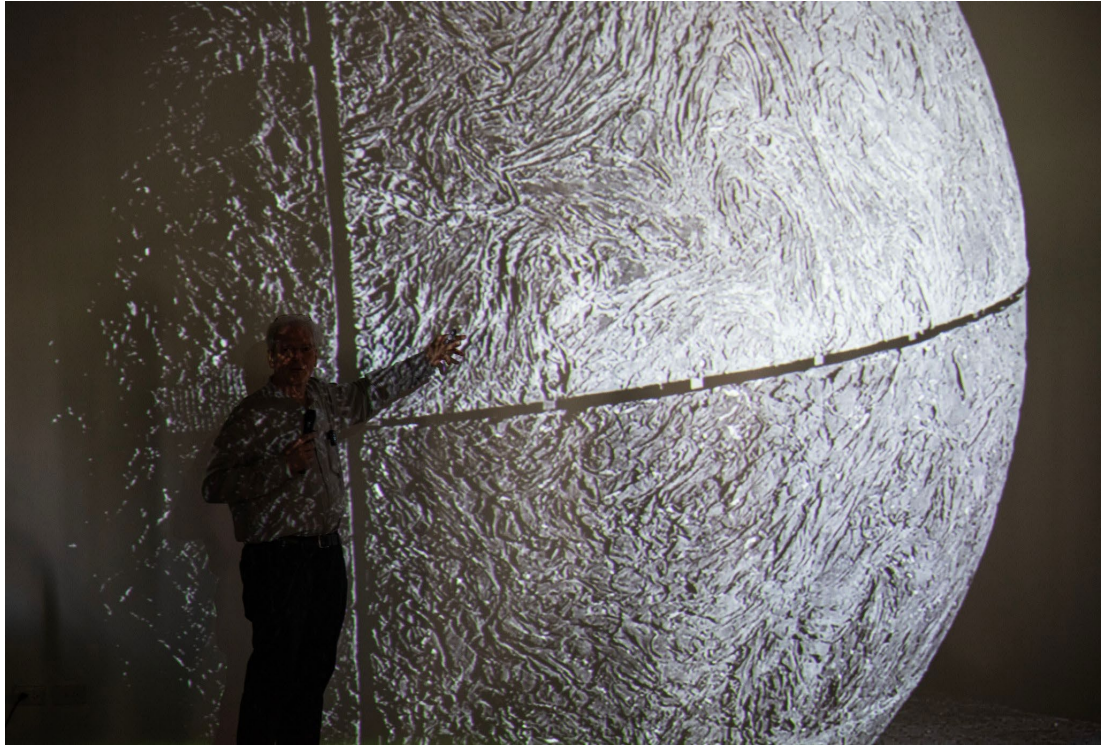ภาพจากการ Taiwan Strait Project โดย CHORA
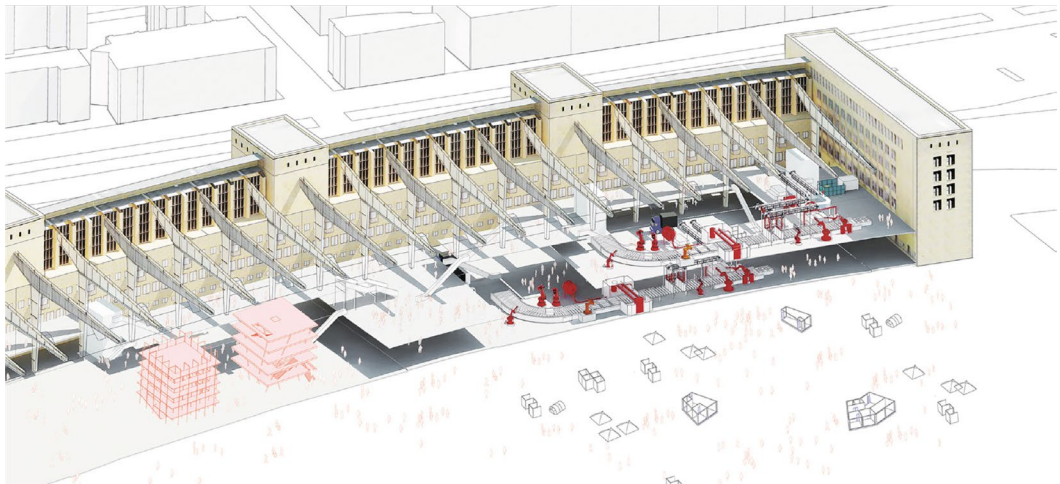
ภาพจาก Tempelhofer Project โดย Marta Lanfranco, Victor Li, Polina Sevostianova, Xianglin Zhang, FG CHORA, TU Berlin

SECOND SKIN: BUILDING WITH NATURE
07 JULY 2023 AT THE FACULTY OF ARCHITECTURE CHULALONGKORN UNIVERSITY

PARTICIPANT: PROF.AD.RAOUL BUNSCHOTEN (TU-BERLIN, CHORA CONCIOUS CITY)

  The lecture stressed the significant role of architecture and urbanization in global CO_2 emissions, accounting for 40% of the total. It pointed out that global warming has already surpassed the critical 1.5-degree threshold outlined in the IPCC report, leading to species losses and threats to biodiversity and human well-being. These challenges underscored the pressing need to tackle climate change and its far-reaching impacts on the environment, human health, and food systems.

  In response to this urgency, the concept of the second skin and building with nature has been rising as an approach to investigating existing architecture and designing more sustainable urbanization for the future. The first skin refers to the skin of the Earth, while the second skin is created by human urbanization. The lecture explores the idea of turning urbanization effects into biogenic components to create harmony with nature. It also delves into the challenges of climate change and the need for sustainable construction. It highlights the importance of understanding material flows and creating circularity in the value chain. It demonstrates the use of technology, such as AI and machine learning, in architectural design and planning. Moreover, participatory processes and negotiations are required to resolve complex urbanization issues. It concludes by presenting a new approach to architecture that integrates nature and considers the environmental impact of buildings.
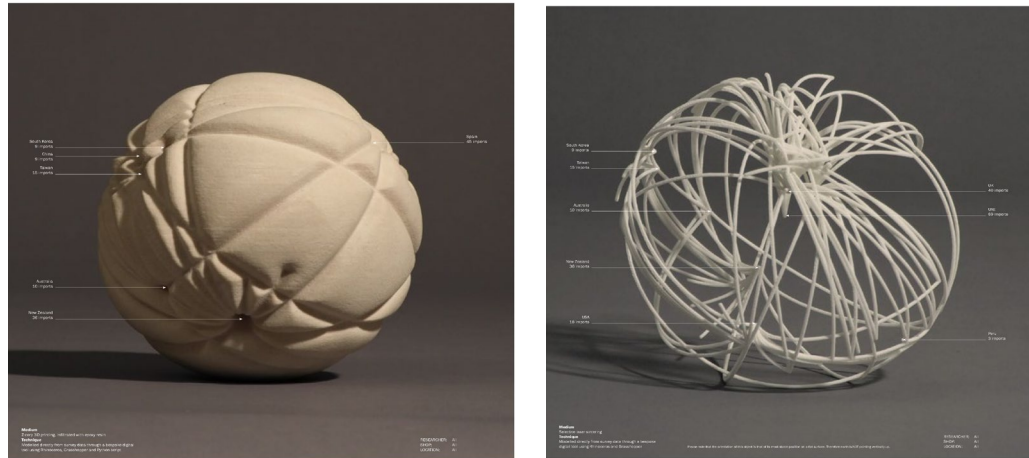
Image from Spherefolio 3D printed map, Henry Jonas, SS2018, FG CHORA, TU Berlin.

The Second Skin

The concept of the second skin refers to the way in which human urbanization is shaping and transforming the Earth's surface. It is a term used to describe the built environment that humans create, which is distinct from the natural environment or the "first skin" of the Earth. The second skin represents the structures, infrastructure, and urban landscapes we construct as parts of our civilization.

The second skin can have negative impacts on the environment, particularly in relation to climate change. The concept discusses the effects of climate change on the Earth and presents an infographic that demonstrates these effects using digital tools such as additive manufacturing and data visualization. The goal of introducing the second skin concept in this lecture is to stress these urbanization effects relating to biogenic components, meaning to integrate nature and create a symbiotic relationship between human-made structures and the natural world.

By incorporating nature into the second skin, it is possible to mitigate the negative impacts of urbanization and create a more sustainable and harmonious built environment. This approach recognizes that humans are parts of nature and seeks to align our actions with ecological balance and preservation principles. It highlights the importance of considering the environmental impact of buildings and promoting biogenic construction practices to achieve this goal.
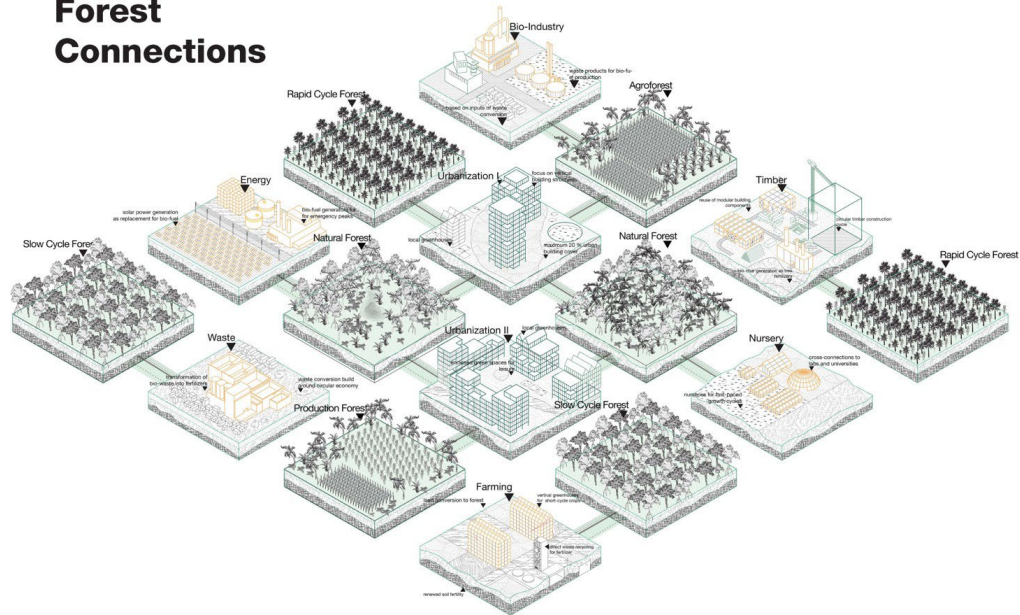
Image from A Path through the Forest, MA Supply Chain Urbanism WS 19/20
Ann-Kathrin Salich, Daniel Dieren, Christina Krampokouki – FG CHORA, TU Berlin.

The Building with Nature

The Building with Nature approach aims to harmonize built environments with the natural world, promoting human well-being, environmental sustainability, and resilience. It underscores the importance of integrating nature into the design and operation of buildings to create healthier, more sustainable, and aesthetically pleasing spaces. In this lecture, Building with Nature is examined through a value chain perspective, encompassing natural elements and principles throughout a building's lifecycle, from material sourcing to waste management. This section of the lecture is divided into five segments: forest, logistics, production, design, and city. These segments showcase state-of-the-art technology in architecture and urban planning, reflecting the accumulated expertise from Prof. Bunschoten's work and related projects. These advancements can be summarized into three main points:

1. The Crucial Role of Sustainable Construction in Combating Climate Change: Sustainable construction practices, which involve the use of renewable energy sources, waste reduction, and fostering circularity within the value chain, are essential in mitigating climate change's impacts.

2. Integration of Technology in Architectural Design and Production:
The increasing use of technology, including AI and machine learning, in architectural design and planning presents an opportunity to optimize material flows, minimize wastes, and enhance the efficiency of building processes. This technology, already well-established in industrial production, can be adapted to the construction sector.

3. The Imperative of Participatory Processes for Addressing Urbanization Challenges: Addressing complex urbanization issues necessitates the engagement of all stakeholders, including residents, planners, and policymakers, in a collaborative decision-making process. This participatory approach is crucial for effective urban development and problem-solving.

Overall, understanding material flows and creating circularity in the value chain is essential for achieving sustainable development, minimizing environmental impacts, conserving resources, and promoting economic and social well-being. It requires collaboration among various stakeholders, including businesses, governments, and consumers, to drive the necessary changes towards a more circular and sustainable future.
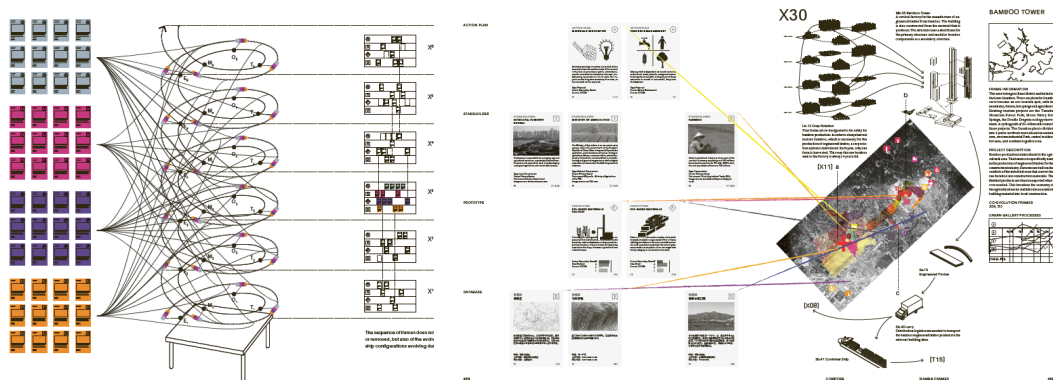

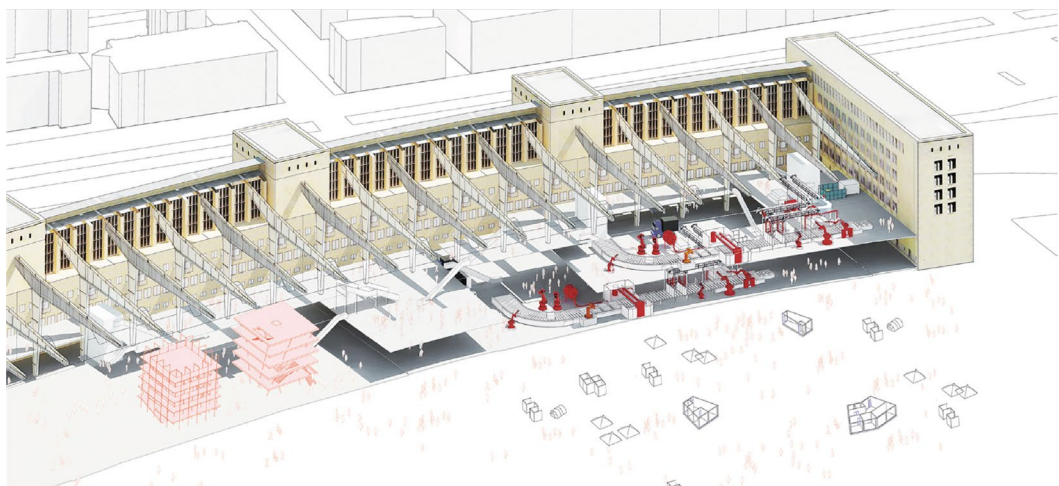Image from Taiwan Strait Project, CHORA

Image from Tempelhofer Project, Marta Lanfranco, Victor Li, Polina Sevostianova, Xianglin Zhang, FG CHORA, TU Berlin

Lecture Transcription.

Topic: Second Skin: Building with Nature

Speaker: Raoul Bunschoten

Records File: 2023-07-07 00020-00023.mts

Date transcribed: 06 August 2023

Time	Audio
V 00020 00:07:00	Today, I'm going to take you through a series of concepts. They start with the second skin and then move into this theme of building with nature. Second skin is something I've been working on since Chris (one of the lecture participants who studied with Bunschoten) knew me and even earlier. It has to do with the concept of the skin of the earth as we know it. It's our home, but the second skin, it's the way we are making it now as humanity. This is an infographic that we have been developing in TU Berlin with students. We show through 3D printing the effects of climate change on the sphere as a model. Here you see certain environmental effects printed on the picture of the earth. You can probably see here the first, and the second skin coming together what we're trying to do is, in a way, these effects that we show here, turning these urbanization effects of humanity into biogenic components.
	Basically, we are creating a pack with nature, not destroying nature and ourselves because we are part of nature. Since I'm Emeritus, I don't teach anymore, and I am now so pleased that students, ex or students, are here. I am leading the CHORA Conscious City Lab, and I founded the institute called Bauhütte, a German word for building plus the 4.0 that refers to the industry. It's an institution supporting biogenic construction in general. That's what I am doing right now. We're creating this Institute, and I am the president of it. I hope to work with that, so let's dive in.
V 00020 00:09:41	(Section A. The Skin) I will talk about two main components. I took components of the lecture one is the skin, and the other one is the building with nature. I'll talk a bit about the skin first.
	(Section A.1 The Skin of the Earth - The First Skin) The skin itself. This goes back to the theme of the skin of the earth. Chris and I just talked about it that was a theme 20 years ago when he was at the AA. The first skin, I will just say a few words about that. I trained as an architect in Switzerland and became more of a kind of urbanist later, so we're all amateurs in talking about kind of nature, yet we have to know something about it.
	I did these early years, probably before Chris came to the AA. I was involved in a lot of kinds of modeling myself. Not 3D printing exists yet, but handmade models of the earth. This is me with longer hair as usual and trying to create models of the earth, and then we try to start asking the question: What is the skin made of here? Is it an original primordial skin, or is it to spin that we are building like this model?
	We were creating these models like this in the Architectural Association and School of Architecture (London), and this Thursday, I'm leading an AA global forum, an alumni Forum in Bandung, Indonesia. I will go there, then I come back here. Here we were building the skin of the earth, literally right out of paper and every cast into a very architectural project, but it's a modeling project, then the question that came later, what is the skin of the earth?

V 00020 00:11:26	The skin of the earth, scientifically, we know a lot about that. Here, you can see some of the earlier drawings in which we (humans) tried to understand what skin is made of. It's, of course, fish, plants, and humans. But then, bit by bit, you go deeper; it gets into a rock, melted lava becomes liquid, and volcanos, where the liquid comes out. Today, one of the big issues is: what is this first skin, and do we still have parts of the first skin? Yes, we do. This looks very abstract, like a painting, but it's actually an image that we have generated from satellite data. I'll show that later. From satellite data, it's looking at the heart of the island of Borneo or Kalimantan, if say this in Indonesia. To some degree, it's still more or less original in nature. It looks a bit like this if you know it. Of course, there are other of nature that we are exploring more and more, such as the root structures of trees, which creates a kind of intelligence, and these are the root structures of fungi that link global forest together. Bit by bit, we are beginning to understand the kind of intelligence that is formed by these roots, which are like neurological connections in the brain. We have to understand this intelligence better if not, we won't survive. This is a still of the mycelium network from fantastic fungi, and we're now also getting to see it as a building material. I am showing this image so we get a bit of a sense of this first skin, what I mean by that, and how much of that is still there. We are talking about the Anthropocene now, which is the last thing that influenced humanity, but we also more an understanding that we are changing nature to a very deep extent.
V 00020 00:13:39	(A.2 The Second Skin) The changing of this nature is caused by humanity spreading building the city, effectively creating the second skin. So, back to that model I made in the Architectural Association. I created a series of the black squares of these models, the spheres I made for a project in the Netherlands. This is really old work but for me very interesting. I showed this right now because we're working on books about six books first but about 12-15 in total. You will see them coming, and so we're looking at some really old work in terms of what is relevant to contemporary societies. What I was looking at these handmade models was how we sort out their Dynamics. Part of the Dynamics are first is original skin, the first skin, but what I was interested in is the kind of urban society and how we can see the footprint of the humans within the skin. I started to make these kinds of drawings out of these photographs by my wife, Helene Binet, the architectural photographer. We started to look at these fragments and gave them names for vanity. Those fragments are new cities, but they also tell you that these are traces of humanity. It is this burning forest in Indonesia, and I will show the worst part in a second. These are also the traces of humanity and are like my drawing if I go back for a moment. It was made without a background knowledge of these forestries. This is just like a game drawing. These things themselves have patterns. You don't see here there is a roadway related to the burning pattern. What concerns us, in general, is these things, where you are looking to the heart of the rainforest in Indonesia, and these are human patterns cutting through diversity, separated by diverse territory. That's a bit of what I wanted to show in the gamification. Here, you can see a bit better the difference between the original rain forest and the burned parts, which turned into whatever, like cows or palm oil. That's the kind of today's reality we live in. That's the way I meant with these kinds of things, although at that time, we were not thinking so much of forestry. We were thinking about the cities, and we were thinking of game technology to create layers of the city to understand the dynamics of the city better. This kind of gaming is one aspect of the workshop next week. It's a bit of gaming that will take place in the upcoming Workshop.

V 00021 00:00:00	Berlin, where I just flew in from yesterday. It looks a bit like that if you are far away. (Berlin) Looks very green. I mean, in fact, one-third of the landscape of Germany is covered by forest, so that's why the big drive is now towards using the wood of this forest in a better way. Using them, I am saying it very carefully because it's actually packed of people managing these forests and that don't say use, they say we have to replace part of it because part of it is really not so good and we'd like to have a higher degree of substitution. They were getting to tell us there was too much wood. We would like it to be used in the city we would be proud of. That is the message we get from the first owners Here looks very green, but of course, the reality you know here, or in Bangkok. If you zoom in, it's very much concrete, also. The concrete softwood inside all the buildings, steel, and other bottom materials, so this is, of course, an urbanization, ultimately it looks alike. The consequence of a lot of these urbanizations is the weather change that we now know as a climate change crisis. This is the house I live in. I just left here yesterday, but it's typical stone Berlin and some renovation on the top of the here and there. Inside, it would actually, historically, we are quite used to building with wood, but this is completely wood inside. But this is urbanization that's also constantly changing, and this kind of changing characters is the thing that now we need to work to understand better, and we have to be part of making more changes. This is a bit of my mission. I've increased sped up the change of urbanization, not stopping it. As a debate in Germany, should it be stopped building, no more building, some people say to stop any form of building. Yes, tell that to people in Southeast Asia or other places in the world. We have to deal with these dynamics of the second skin, which it could be seen as something like this. You can see it as climate change, but I can also say it's data or the internet. Like now, we're streaming to some students who are online watching this event we're in that set of lines in global datasets that create their own form of architecture. Sometimes, we started a bit of this architecture. These are studies within some institutions in London at some point that we're looking for example, just one example, right? This was a student of mine who asked some friends of his to have dinner. These seven friends lived in seven different places in the world, and he asked them to note the origin of the ingredients of what they were eating and then to map these on the world, and that let's do map so all of these lines were food transports. One point where they come together as the spider points you see the better here are the place of dinner itself so this the world of global logistics so it is we're cities where we have meals the come from the whole world. Materials flow across the world. 90% of the wood is harvested in the state department of Brandenburg, which is the province in which Berlin sits. This goes to China in the containers. Some also go to Canada, so we're asking why they say that there's not enough market in Germany. Build more wood than we supply you more; let's debate now. I'm getting involved to go back a little bit from this global madness.
V 00021 00:04:29	You can see the map here. You see some of the ingredients of just meals, but you can do that with any kind of product, clothing, housing, and things like that. This is the second skin that we are creating. For example, where we get energy, here is an extraction of a student's work. The extraction of natural gas and compressed CO_2 in the Arctic Ocean on the edge of Siberia. Here, you have an extraction point that leads to a new city because the ice is melting. A whole new set of cities are emerging in the Arctic, and they have their own data. Here are the effects on the Arctic and the places where it crosses (work done by students). The Arctic is on the top. These are measurement data of things influencing mostly CO_2 emissions influencing the melting of the Arctic because the Arctic is heating up six times faster than any other place on earth. It is the kind of reality that we're living in. It speeds up even quicker than you think. Even if you're not close to the Arctic, you're in it (in

	so we look at these kinds of data to understand better second skin and also amazing images. Of course, we are looking at some of the reports, for example, the Intergovernmental Panel on Climate Change (IPCC). We're trying to understand what the UN is looking at, what are these thousands of exports looking in that. You can find it yourself online. It's good to look at because it's it creates some of the scenarios of how it could possibly survive. It shows the trends that we are in now, not managing to change, and its basic sets out what we have to do to get the trend downward. These points we already have passed. You probably know that we have now reached occasionally the level of a 1.5-degree increase since the 19th. This one is basically over already. The question is, what can we do to bend these curves (down)? Since all of you are in the same game, the architecture and urbanization are responsible for 40% of global CO_2 emissions and other forms of changes. We are heavily responsible. We are part of this. The IPCC is looking at these global model pathways to limit global warming to 1.5 degrees, which has already passed the kind of steps we have to take. It is a lot of debates on that because we have all these SDGs, but they are not directly effective. We started to discuss what we have to do inside the simple categories of SDGs to handle these changes: the risk of species losses, heat, and humidity risk to human health, like when the temperature reaches 40-50 degrees. What will you do when you are outside? Or the food production impacts and so forth. These are now the contexts that we are now acting in.
V 00021	(B. Building with Nature)
00:08:34	We have been working on some Machine Learning. We were introducing AI (Artificial Intelligence) in a curriculum for architecture. These are some exercises that students did. It's very interesting. A person goes back from urbanization, like the city of Berlin, into some sort of natural state, as you can see here: the desert or forest. These are not just a pretty good exercise because we feel AI can be part of the architectural curriculum, but they're also interesting because they are kind of wishful thinking. In fact, what's happening is the opposite as we've come from the end of this exercise towards this urbanization of the skin. I believe that AI is capable of being part of the future of design simply because of its complexity. I'm showing a few examples. This is an artist who is beginning to work using not just AI but nature itself, like bees and so on, to create guides. She's an artist, so she's mainly concerned with the creation of pathways or gardens that use bees to make the pollination. This is something you can find online. You can create your garden by setting a series of algorithms that then our use to place seeds in this garden in corporate with bees and other insects. It's a beautiful project. It's now created as one example in Berlin at the Museum of Nature (The Natural History Museum, Berlin). When I saw this, I was suddenly inspired. We have to think of this in terms of urbanization and its link to nature, like in forestry. We are going to use this way to fill in these gaps that have been created in forests or to deal with dead spots in oceans and things like that. It is just one example of linking the latest technologies we have with nature.
V 00021 00:11:01	"Urban to Rural Landscapes and Actors Gradient", was a project of some students of mine. Where we have started to link urbanization to natural processes in gamification. We do a lot of gamification because gamification leads to negotiation. Since the city is so complex, it needs to negotiate. I have a colleague in Indonesia who just texted me before this lecture. She was just in a meeting in Sumatra with this farmer organization, the big companies trying to sell their stuff, and the local NGOs trying to protect the forest with so many conflicts. So, we have to learn forms of gamification to negotiate this process. We also have to learn the complete value chain. This is a standard diagram of a value chain. Value Chain means inbound logistics, operations, outbound logistics, marketing and sales, and services. And then you have firm infrastructure, HR management, technology development, and procurement. This stuff, we usually don't look at. This is an industry, but we've been working on it. This is a diagram made by Wasita (a Ph.D. candidate who working on the bamboo project). We are looking at the Bamboo to City Value Chain. This is a new thing that we're trying to work on in biogenic materials. Wood in Europe, Bamboo

	in Africa, or Asia has the possibility of being used as a smart material in the future. I'm not talking about traditional bamboo architecture. We talked about engineered products. This is something you'll see here in the upcoming workshop. So here, this is our own form of value chain. We look at the raw material supplied, first manufacturing processes, the building assembly, building maintenance or renovation, disassembly, and then waste processing disposal recycling. It does not stop at the building, it goes on. In Germany, you have to prove that the materials can be recycled. This is what we feel is a core part of architecture and construction now.
V 00021 00:13:36	(B.1 Forest) We're looking now at how to apply that to what we can do as an architect. I'm going to go now through these (VC) steps. I'll take you through these colors to show you a little bit of work that is going on, and again link to this image here. We've created several tools, and there are tools for observing what or where is raw materials and, second of all, how they flow. If you build a building with concrete, the sand increasingly comes from Saudi Arabia because the sand is becoming rare in Europe, for example. Other products come from somewhere else. As lithium in your telephones comes from South America and Africa, where is that stuff? Now, you would be looking at Indonesia some early versions of the tool. You see some tests we've been doing about the availability of bamboo lands in Indonesia. I will be there on Thursday and will have talks with these people in Bandung. Here is a statistic on bamboo farming in Indonesia, Thailand, Myanmar, Cambodia, and so forth. These are satellite data that we work with open-source data but then several pieces of these students are connecting these to regional data or local government data. Maybe increasingly data held by companies or the current land owners. We have to go top down and bottom up with that. Back to this picture again before I showed you a picture from this area here. Now you see the complete image. This is the picture of the current state of forest in Borneo. All of these colors mean burned forest, cut forest, and replaced forest. All the colors mean it's lost forest effectively. What I talked about before is these patterns, which my colleagues in Germany, in other places, and I are looking at very closely. These are the areas of the orangutan. I was asking some experts recently if they met these corridors (the forest lost pattern) because once they meet, it's over, which means the biodiversity collapses effectively. This area of the new capital in Indonesia, which Architects will be speaking on Thursday in that conference I'm leading, and we've been doing some tests. Can you replace some parts of this forest here? Some of this is also my mining, and the big debate is between the biosphere of the forest and the biosphere of the ocean. If you build capital here create more organization or begin to create some sort of restorative action between the biosphere of the ocean and the biosphere of the forest you can see that the task is incredibly difficult.
V 00022 00:00:00	Only last year, in one year, we lost 10% of all rainforests in the world. 10% in one year. Just imagine or calculate this is what's happening right now. You can see it changed, and these are the oil palm areas in both countries. Here's one glimpse of the work of Wasita you can ask her for the lecture herself. This is the Ph.D. work that she is doing. These are the software that she has been developing herself. It's an analytical project at the moment. This is Thailand's area through the data, and she's looking at suitable areas for growing bamboo and it's a result of combining several ecological and human settlements. Basically, she's looking at its creating a graphic structure. It's a tool based on open-source data, whereas what are or where are the production sites? Where is the need for new construction, like housing? We will visit some bamboo growers' production sites in Thailand for the next few days. This is highly data-driven. I don't think building with nature is like naturally growing, no. We have to know where and when.

	These things are partly available and partly not, so we have to learn how through the data. For example, logistics is a key point. The emission is created through logistics themselves in the value chain, and that is the issue.

On a slightly larger scale, I'm sure you have seen some images of the studies of logistics. For example, when we'd be looking at global logistics, whether they can help our process in raw materials from nature for urbanization. This is a student project in Africa trying to create forest connections to shift urbanization towards nature-based urbanization. But when we look at African cities, we're only looking at 10% of what will be built into the next 20 years, so if you calculated in terms of the mission, it's kind of catastrophe. What are the other possibilities to build nature-based cities in Africa? |
| V 00022

00:02:53 | (B.2 Logistic)

Now, touching on logistics, you see this. This is actually a model analysis of the Belt Road Initiatives (BRI). Since 1913, China has created the world's largest logistics system. Thailand is also part of it. What really matters is what happens to facilities and ports everywhere, and this is a major factor in urbanization. We shifted them from the analysis of developing BRI to a more general program of supply chain urbanism. For example, it's happening in Indonesia, BRI goes through the hearts of the archipelago in Indonesia, creating an issue in Indonesia on how to handle this negotiation. These global logistics are a major part of thinking about how to build with nature. Another thing I'm working on with the Indonesian government is to work with the overall maritime strategy of Indonesia. It's called Maritime Highway to distributes engineered bamboo.

Here are some of the effects of this BRI on different cities worldwide, and we're about to publish a book in a few months. You will see about the Taiwan Strait. We started to work on this over 20 years ago, and now, when it comes out in a time that's completely changed. This will be a major site of conflict. I hope not, but there is a lot of stress and tension right now. It's about negotiating logistics across the east of mainland China and Taiwan, which is a part of this BRI. I wanted to put this in (this lecture) to also show sometimes the joy of making these maps and the beauty here sometimes gets through abstraction. Although this is still full of meaning, this is the city of Xiamen in China. These are different icons that denote productions, logistics, and so forth. We have done a lot of mapping. It's a big, beautiful book about negotiations.

The negotiation itself is something we've developed over the years. We've developed a conscious city game box. In the workshop, there will be one day of gaming. It's very simple, but we do it a lot. For example, these are students from Taiwan and mainland China playing years ago in negotiation processes to create a map in this book, so this was quite a rare thing to have them together. We have to do all kinds of stuff to make that possible.

There is a lot of theory behind this game. It's actually creating DNA structures for the decision-making process. On this table, we did it with experts in Germany. It creates scenarios in order to decide at what point the card representing your prototype can be introduced, what point you build a factory, what kind of factory, or what design you make. That's the theoretical background of this simple-looking gaming.

This is a theory. This is a management board, and here you see a page from the book about the Taiwan Strait. This is the Xiamen in China. Here are some prototypes and how to introduce the prototype in the city. Prototypes, for example, can be putting two ships together to turn into a logistics place in the middle of Indonesia. In order to get wood stored from one place in Indonesia, go to another place in Indonesia. |
| V 00022

00:07:45 | (B.3 Production)

Production: This is the key process. My partner in the Bauhütte 4.0 institution is a |

professor and leading Fraunhofer IPK, one of Europe's largest Research institutes. It deals with production, the production of materials. This is, again, some students were looking at flows of materials and production, for example, at the kind of what production can do in the gradual chains of a city, going from mineral-based to bio-based. We are once more in Indonesia. This is a city close to the new harbor that Indonesia is creating. It (the project) attempts to create a gamification planning process in order to use all the materials 100% oil palm for construction. It is accepting oil palm exists, but can we use it 100% for construction? At least to a concept of city

Whether you like it or not, it's a test that combines nurseries with more traditional types of housing, which effectively puts the industry inside the city where processes the waste of palm oil. Today, I believe we have to shift away from palm oil.

In order to do that, we've been looking at the possibility of creating an exhibition of production in Berlin. This is a famous ex-airport building (Tempelhof) where we were planning an exhibition of the production of wood, so this would include production components and some examples like prototypes and meeting places. This has not happened, but we, as Bauhütte 4.0 Institute, are going to produce something similar to this in another ex-airport (Tegel) together with Fraunhofer IPK and CHORA, which I am so happy about.

This short movie explains (the concept of) what we're doing right now. This is the largest wood-based district in Europe that will be used for production with the wood-based factory itself. Here are some examples of almost 100% wood-base buildings. I'll show you a few more. We were learning from historical joints, for example, from the temple.

When you look a bit closer at how we use AI to create a selection process of different types of housing plans, it's no longer easy to fill a city like this with many architects involved. Here is a quick glimpse of the different methods and technology that could be involved. You can see that the (material) percentage is changing. In this tool, you can see that as the percentage changes, the components need to be designed in a different way, and then the information goes back to the actual production phase. This is how we fill it in Berlin, with 100% wood staircases in student housing, and we have to do this with local sources. These are the local and regional partners that we are talking about, but they can scale up to the global project.

Here are a few glimpses of the type of productions that we are handling and the kind of factory that is emerging now. Architects don't love these things, but somehow, we have to learn to live with that and think of the mass production that creates the possibility of flexibility. Millions of housing units are needed in Indonesia, which requires fast production like this. I visited this factory, Nokera, to use it as the state of art in production. We have to work with them as an architect and design these things better.

Let's move to the last section. I am showing you the tool, which was first developed by the Ph.D. student Sebastian Munoz, from Costa Rica. Now, it's quite an advanced tool, and we are looking to work more with partners. This tool simulates the complete material flows along the VC from forestry to circularity.

V 00022 00:13:27	(B.4 Design) These bring back the questions of how we actually design with wood, where it is possible to make with regional wood, and possible to create multiple housing unit variations that citizens want. These are the complete building kits for the high-rise building made of wood. The wood panels can be lifted by robots or co-bots to put together because we believe this technology helps people to be more free and more creative. They're not a simple system, although it looks simply because you have different components like these panels. The construction system has to be simple so the robot can understand it. These are test

	projects done by students master students in my studio. Now, they're not possible yet as there are still too many regulations related to fire protection that this itself could be built, but we're not far away, and some very interesting results are coming.

For example, these interior plans are inspired by some great architects in Berlin. It has a very interesting fitting; then we take it over by robots. This is a pretty high building already for wood building. At the moment, the first wood building about this height is emerging, but the percentage of wood components is still below 50%. We have to understand how everything fits together and how we make it work for hybrid buildings.

We've been looking at a lot of Japanese wood architecture here. It's very traditional to create these kits by using the technology used in the car industry or other types of industry. The machines exist, but how do you put them in sequences? The tenancy is to go to this type of construction technology. These factory processes are not truly linear anymore but move around with the intelligent process. For 100% wood buildings; there are no existing ones yet. Most of the top engineers said we could, so in principle, we are there, and these things are possible. |
| V 00023

00:00:42 | (B.5 City)
On the city scale, if we want to do this in a city. Let's say all of what we see here in pink is wood-based. That is not happening yet, but we are trying to add more wood components. Here, we're putting two floors on top of the existing building, and this is what the city wants (to create more living space). But how to do that is not clear yet because we have to look very closely at how you can top this up, how you can extend the building, and how you can build a new building. These are the big discussions in Germany, and for that, you need the city vision. That is why I put the picture of the Tempelhof project in this lecture poster.

Once, we did a competition in Germany at the Tempelhof airport on the topic of Energy + District years ago. Now, this is an urgent topic and has to include biogenic production, but you need everything you can have. This is the calculation of the energy gain we could create by having new technology in this District. I would say we can do the same with biogenic materials or productions.

More than working on saving or generating (energy) programs, we have to create visions for the cities. We've done it in many places in the city in Italy. On the regional scale, you need to connect to organizations that represent people, so you need these diagrams to understand who is involved, who is there, and to what extent they can be part of the division. This is the start of cutting-edge planning.

For example, in order to create your local agriculture. This is a prototype developed for a city creating locally produced goods. The way to do that, as I said before, is the negotiation process. This is done by students in TU working in several city districts towards biogenic production. It's done by experts and representatives of organizations, so it had become a commissioned project. Our aim is also to do this with children; this was at the Contemporary Art Biennale in Chengdu, where we created a very complex smart city project for the city. However, in the exhibition, we had children and their parents playing games. We didn't really know what was going on, but we knew something could be done by them, so it was a participatory process that I'm very happy with. Contrary to reality, the fussiness that we also have to understand the city and all systems and the kind of data representation of the cities. This part here (in the middle), we normally called cities, but the communities, logistics, and data are layers making up the city. The last part is how do we create the circularity. We have to know where the material flows and where it goes. We have to create taxonomies of materials and the cascading of things so we can grasp and reuse materials. |
| | We created a simpler one for the use of bamboo, and eventually, the construction and the |

	mix of bamboo with a mix of materials to create a hybrid thing and how to digitize all of the materials before you can start working on the new material VC.
	The last few images I show are this model we're working on called the Value Chain Digital Model on a biogenic city maker incubator based on Bauhütte 4.0's diagram. We want to plan with forestry to the city. The reality includes the production process along with the digital connections. This is the picture of the tool in our laboratory that could go the full range from the forest viability kits to circularity. Now, we're in a new interpretation of this Value Chain. You can see the part of the dashboard that shows the total value chain or moves around to the forest. It is interactive, and we can take it to the whole chain.
	On the second page, you can navigate through the forest (in Berlin-Brandenburg). For example, you can reach the data on every forest patch here, and these numbers (forest areas, logistic emission, etc.) change according to where we move around.
	On the architectural scale, we can look at the particular type of apartments in the part of the city, what the components are made of, where they are, and how many of them. These are always coming back to the numbers of carbon balance. These are based on the existing wooden project from our partners in Berlin.
	We've been analyzing the project as part of the scenarios with different pathways on different typologies of wooden buildings. It shows again the carbon balance and the building volume. Each building is related to the new Berlin district (as mentioned before).
	The last panel is maybe the most important one as we go into the city scale. Still small, it has only 6,000 units, but the numbers shown here are very important. By using the slider (pointed at the slider) to select the different logistics, we will know the result of the energy use or carbon balance, which becomes the legal requirement in Germany. This is not just the guideline but the law coming into effect. Every investor has to look at these numbers, so this tool becomes an important tool for investors or planners to deal with climate change and measure the impact on the sea.
V 00023 00:07:42	That is the end. What I wanted to tell you is that the planning and architecture are moving into a new phase, which is extremely exciting. You have to look at a broad spectrum of technologies and participatory processes to design the building by nature. It's not a simple thing, but it's also a beautiful thing. It's amazing. I think we have to do it. This is the new approach to architecture (Showing the upcoming books)