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INDUSTRY 4.0 – THE FUTURE IS NOW

↘ Marcus Fairs and Clemens Weisshaar at the ewoTALK at Vienna Design Week in October 2016

At the 2016 edition of Vienna Design Week, ewo hosted a discussion between designer Clemens Weisshaar and journalist Marcus Fairs, the founder of Dezeen, the influential online publication dedicated to design and architecture. The title of their talk "Industry 4.0 – The Future is Now" was the jumping off point to discuss the future direction of design and how advances in digital technology and robotics will alter the sector and society at large.

Fairs began the conversation by observing that today we are on the cusp of a third industrial revolution. He noted how we've come a long way from the first industrial revolution that took place in Britain's textile industry in the late 18th century. Jobs previously done by hand by hundreds of weavers were brought together in a single cotton mill. After the rise of factories, we then experienced the second industrial revolution in the early 20th century, when Henry Ford mastered the moving assembly line and ushered in the age of mass production. Now a third revolution is under way, one that has been nurtured thanks to the rise of Silicon Valley and the computer chip. Manufacturing is going digital.
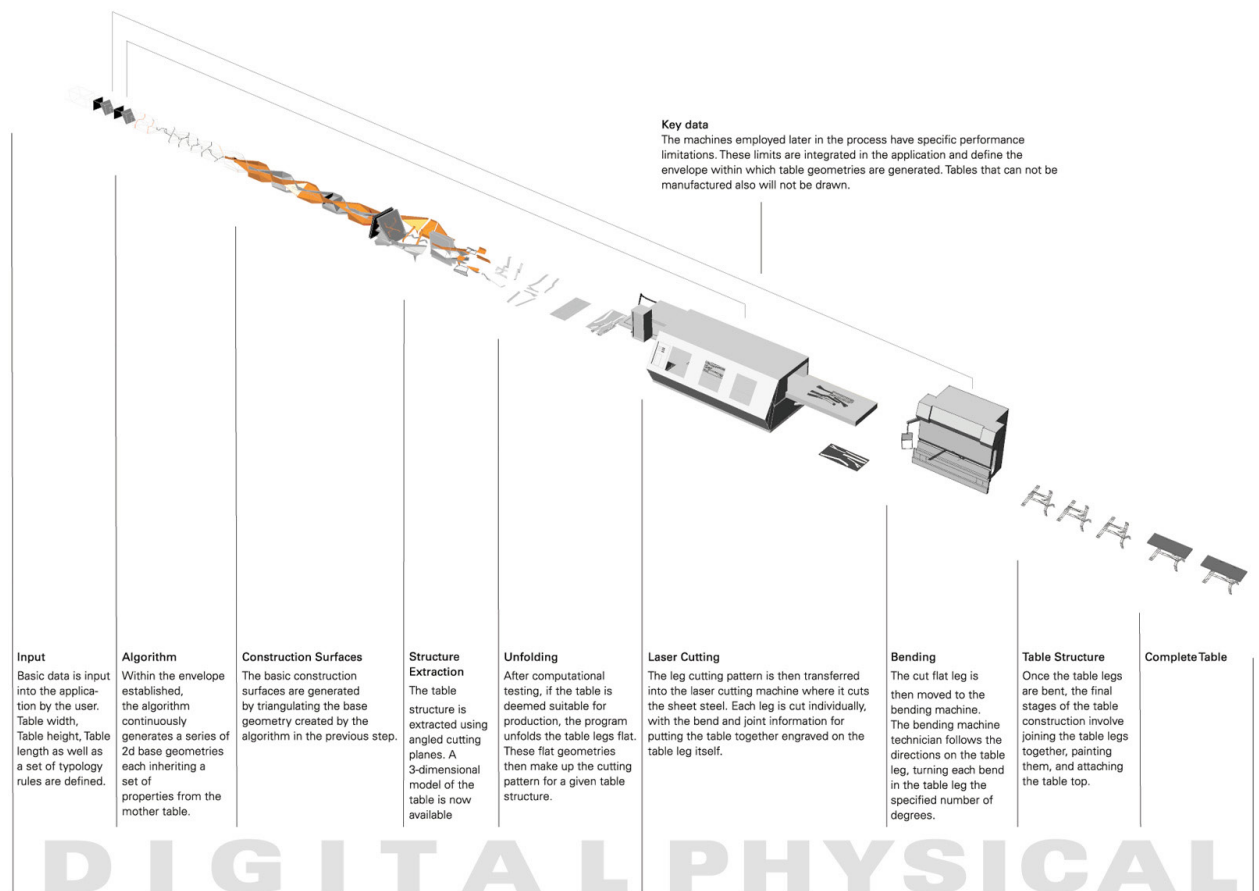
Weisshaar pointed out that this latest evolution could change not just how businesses operate but have wider ramifications for how we live. He explained that in 2014 German industry leaders came up with the term "Industry 4.0" to describe what happens when you connect networked machines to supply chains and they begin to talk to each other. It is the B2B side of what is now referred to as the Internet of Things (IoT), a phenomenon that has been fuelled by broadband internet becoming more widely available, technology costs falling, smartphone penetration skyrocketing and the rise of more devices created with Wi-Fi capabilities and sensors built into them.

For consumers, the new rule is going to be "anything that can be connected, will be connected." In future, you will be driving home from work and receive a notice from your network-enabled refrigerator that there is no milk. The IoT deals with B2C, while Industry 4.0 looks at businesses, including those operating in the field of product design, and how the digitization of manufacturing will transform the way goods are made.

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"What we are trying to do here is to understand the following: how do we design? How can we design tools that help us design in much closer contact with machinery? How can we document the knowledge that we gain during a process? How can we document it and ultimately make it available to others? We are much more focused on the process and much less on the look of things," explained Weisshaar.

During his remarks, Weisshaar presented several projects that he conceived with fellow designer Reed Kram as part of the pair's creative work for their design studio Kram/Weisshaar. At the 2010 London Design Festival, he and Kram unveiled their Outrace installation that involved installing eight industrial robots in Trafalgar Square that could be fed messages by the general public over the internet. The robots wrote the messages in the sky using laser light brushes, where they were filmed and returned in the form of video files to the senders.

In terms of product design, Weisshaar highlighted the Breeding Tables initiative, where he and Kram developed their very own design software that took into consideration constraints such as size, weight and height to let a computer imagine hundreds of configurations. In place of making one product to be mass manufactured as a reproduction of the original prototype, they created a process using algorithmic modeling sequences and CNC (computer numerically controlled) production that could realize an infinite number of table shapes.

Key data
The machines employed later in the process have specific performance limitations. These limits are integrated in the application and define the envelope within which table geometries are generated. Tables that can not be manufactured also will not be drawn.

Input
Basic data is input into the application by the user. Table width, Table height, Table length as well as a set of typology rules are defined.

Algorithm
Within the envelope established, the algorithm continuously generates a series of 2d base geometries each inheriting a set of properties from the mother table.

Construction Surfaces
The basic construction surfaces are generated by triangulating the base geometry created by the algorithm in the previous step.

Structure Extraction
The table structure is extracted using angled cutting planes. A 3-dimensional model of the table is now available

Unfolding
After computational testing, if the table is deemed suitable for production, the program unfolds the table legs flat. These flat geometries then make up the cutting pattern for a given table structure.

Laser Cutting
The leg cutting pattern is then transferred into the laser cutting machine where it cuts the sheet steel. Each leg is cut individually, with the bend and joint information for putting the table together engraved on the table leg itself.

Bending
The cut flat leg is then moved to the bending machine. The bending machine technician follows the directions on the table leg, turning each bend in the table leg the specified number of degrees.

Table Structure
Once the table legs are bent, the final stages of the table construction involve joining the table legs together, painting them, and attaching the table top.

Complete Table

DIGITAL PHYSICAL

↘ Breeding Tables marks a departure from established methods of mass reproduction using original prototypes, and instead explores the possibilities of what happens when you apply the principles of biomimicry and articifical intelligence to product design.

Outrace empowered the general public by giving them the means to control the robotic arms. But the end result of Outrace was entertainment, while the duo's breakthrough Breeding Tables effort led to a physical table being produced in countless variants – and in a range of colors – that flew in the face of the traditional Ford assembly line model.

Also highlighted was the Robochop project from Kram/Weisshaar that pushed further the idea they had developed in London. Again, using a very simple interface would-be designers could remotely access – via smartphone or laptop – a robotic arm to carve a bespoke sculpture or piece of furniture out of a 50-square-centimeter cube of foam. These efforts show how the world of product design is changing. It is becoming more democratic. Designs can originate from anywhere by anyone so long as they have a networked device and are able to navigate the interface.

↘ Using ROBOCHOP internet users around the world as well as visitors on site during CeBit 2015 Hanover, Germany were able to design and fabricate a piece of furniture in real time using a web application

The creative projects from Kram/Weisshaar are the result of a convergence of a number of technologies: innovative software, novel materials like carbon fiber, more dexterous robots, new processes (notably three-dimensional printing) and a whole range of web-based services. The factory of the past focused on churning out millions of identical products: Henry Ford famously said that customers could have any color they liked, as long as it was black. Today, we see costs falling for those interested in producing much smaller batches of a wider variety, with each product tailored to fit a customer's specific needs. In future, the factory will focus on mass customization and may look more like those weavers' cottages in northern England than Ford's assembly line.

For ewo, the projects discussed by Weisshaar are helpful indicators of where industry and design are headed. They are examples to study in order to meet the coming challenges that businesses running manufacturing facilities will face as digital technology and automation gear up to play a bigger role. Hannes Wohlgemuth, ewo Marketing and Sales director, noted that ewo has been making investments in technology to assure its clients will have greater flexibility when it comes to ordering ewo products. "Through our online configurator, customers are guided through a variety of options. It's not just an off-the-shelf product that comes in a few different variants. Today, someone in

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London can go online and configure our luminaire in such a way that it will truly serve their needs." Since 2010, when ewo introduced its patented rectangular lighting unit with its innovative modular system, Wohlgemuth said that it's very rare to find two product orders that are alike. It reflects the same approach that Kram/Weisshaar laid out with their Robochop project: to create a flexible system that leads to a highly personalized design.

Adds Wohlgemuth: "The idea is not to design the product but to design a system that has a logic behind it that helps to automate the production process and at the same time offer a mass customized product. Right now our small luminaire is the backbone of this concept. We have modules that act like building blocks. Think of the Google Ara modular smartphone project where they wanted to make modifying your phone as easy as rearranging Lego blocks so one could upgrade, repair and customize. With our ewo luminaires you can add more of them if you need more lighting power to illuminate a large airport apron or you can order just a single one to fit into a bollard to be used at street level in a residential neighborhood. The modules in future may offer more than just a LED-lighting unit. They could include modules that have sensors for monitoring traffic or the weather. In the end, it is about making a highly configurable product that can be mass produced."
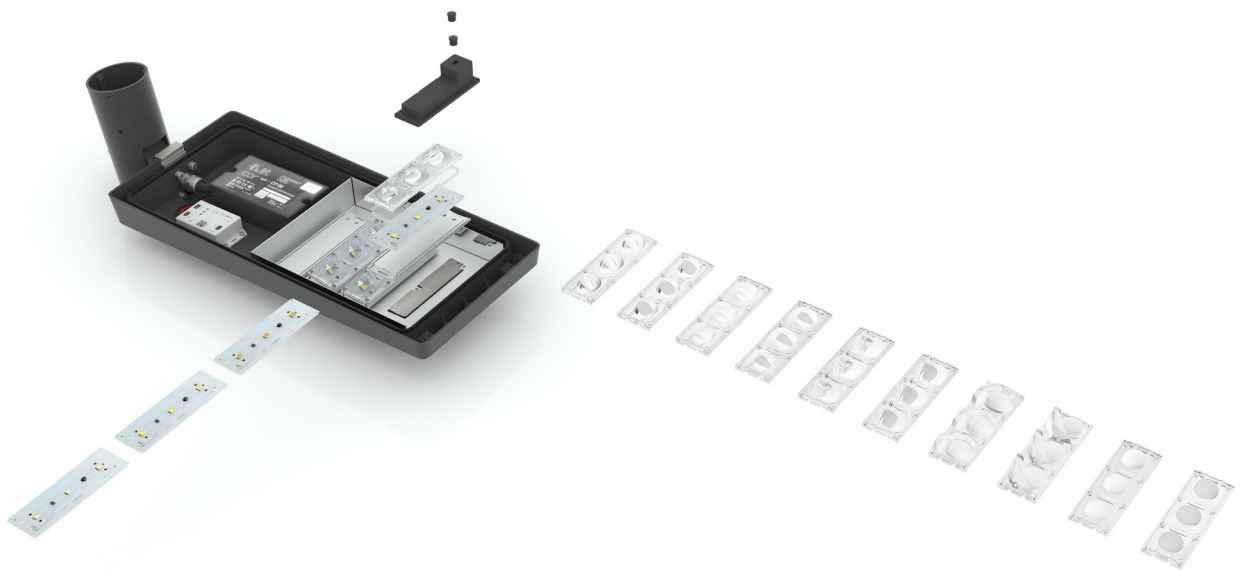
↘ The modular and highly variable LED lighting unit serves as the basis of ewo's lighting systems. As a basic building block its geometric dimensions remain the same in every possible configuration and can be implemented in systems of any size

↘ Text: Ivan Carvalho, Photos: Vienna Design Week, Kram/Weisshaar