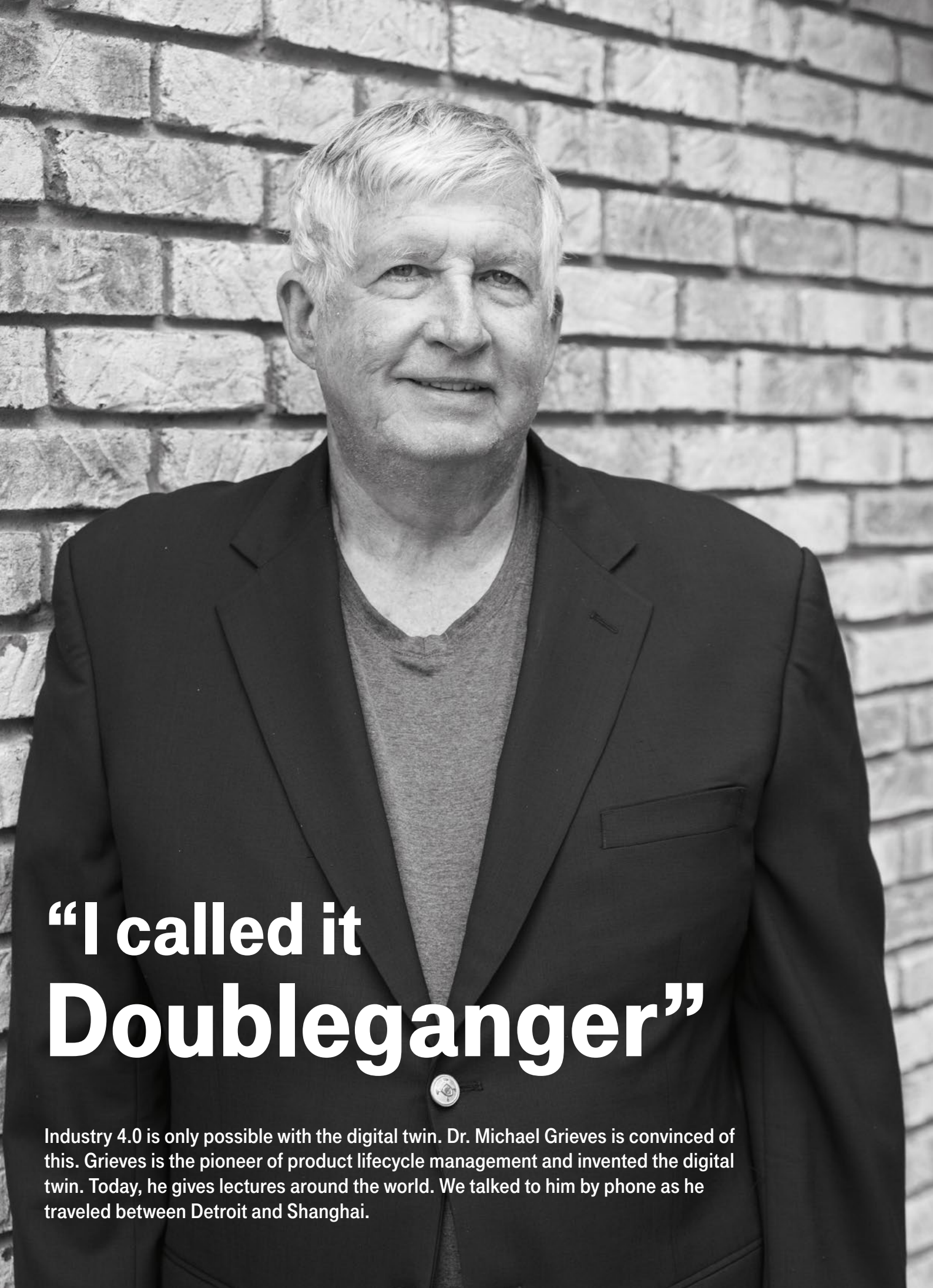

“I called it Doubleganger”

Industry 4.0 is only possible with the digital twin. Dr. Michael Grieves is convinced of this. Grieves is the pioneer of product lifecycle management and invented the digital twin. Today, he gives lectures around the world. We talked to him by phone as he traveled between Detroit and Shanghai.

COPY —— Sabrina Waffenschmidt

"At first, I used the term Doubleganger," says Michael Grieves. The American began pondering the idea of the digital twin in the late 1990s during his executive management doctorate program at Case Western Reserve University in Cleveland, Ohio. A few years later, in 2002, he introduced the concept as part of his product lifecycle management (PLM) research at the University of Michigan, Ann Arbor. He had already rejected the English-German descriptor "Doubleganger" at that point; the slide that contained the revolutionary idea showed a simple graphic with the sober title "Conceptual Ideal for PLM".

While the term changed over and over again in the years to follow, this graphic already contained everything that still makes up the digital twin: a virtual image that contains all the information of a physical product and reflects it throughout the entire product lifecycle – an idea so visionary that it could not be achieved for many years. "At that time, we were not yet in a position to implement a comprehensive digital twin," recalls Grieves. "I had been in the IT industry for over 30 years at the time and was firmly convinced that computers would be powerful enough someday to bring my ideas to life."

ONLY ACHIEVABLE TODAY

His whole career, Michael Grieves has been switching between the academic and economic spheres. Today, he is a professor and the Executive Director of the Center for Advanced Manufacturing and Innovative Design (CAMID) at the Florida Institute of Technology, Melbourne, USA, as well as an advisor to leading global manufacturers. He is also a digital pioneer and in high demand as a lecturer around the world. Since developing the digital twin, Grieves has seen technological advances that have made his concept a reality. "Today, we have the ability to process huge amounts of data. Not only can we map the data, as we did in the past, but also analyze and use it for simulations and thus understand how the physical counterpart really works," says Grieves.

The digital twin reduces costs and increases efficiency – it always exists before the physical product. "No one walks into a factory, pounds on some metal, and hopes an airplane or an automobile will miraculously form. I would like to develop a product virtually, test it virtually, create it virtually, and support it virtually. And only if the virtual product is successful in these ways will I make the physical product and put it to work," says Grieves. Not only can products be steadily improved, they can also be continuously adapted to customer requirements. "Previously, a product left the factory as well as it could be made. And it stayed in that form for a long time. By putting products together virtually at the smallest level in the future, they will be able to constantly evolve, which in turn allows us to fine-tune the specifications even more." According to Grieves, serial made-to-measure manufacturing will be possible someday.

INCREMENTAL TRANSITION

The digital twin is not yet established on a broad front. "But I do not know any industry that is not at least talking about the concept," explains Grieves. In this sense, the twin can be introduced in the different increments. "It does not have to be an all-or-nothing project. There is a wide range of information that I can collect and process with the twin." Digital twins could also be used in very specific, very limited scenarios.

Currently, Grieves is working on several levels to improve product lifecycle management. This includes the development of a smart digital twin that, coupled with artificial intelligence, can predict what will happen in production over the next few hours, days, and even months. "It can be used to correct errors before they even occur." However, this would require even more information on the physical side and more applications to be implemented.

PLAN VIRTUALLY AND SIMPLY PRINT

Michael Grieves is also showing great interest in additive manufacturing processes like 3D printing. "When I plan, develop, and test a product virtually, I want to be able to just print it out right away. This is a logical step for me. Because this is exactly how I obtain the qualities – in terms of geometry as well as in behavior – that I want."

Grieves considers a future without a digital twin not only unlikely, but also irresponsible in the area of Industry 4.0. "The twin will be closely linked to networked production – this will even be necessary." The twin plays an important role in task monitoring when machines talk to each other, for example. "I'm concerned that without the digital twin in Industry 4.0, we will lose control and visibility, both in terms of efficiency and security."

Bio

In 2002, Dr. Michael Grieves first presented the digital twin concept at the University of Michigan at Ann Arbor. In addition to academic research, Grieves also consults for companies and government organizations such as NASA. He is currently a professor and Executive Director of the Center for Advanced Manufacturing and Innovative Design (CAMID) at the Florida Institute of Technology in Melbourne, Florida.

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