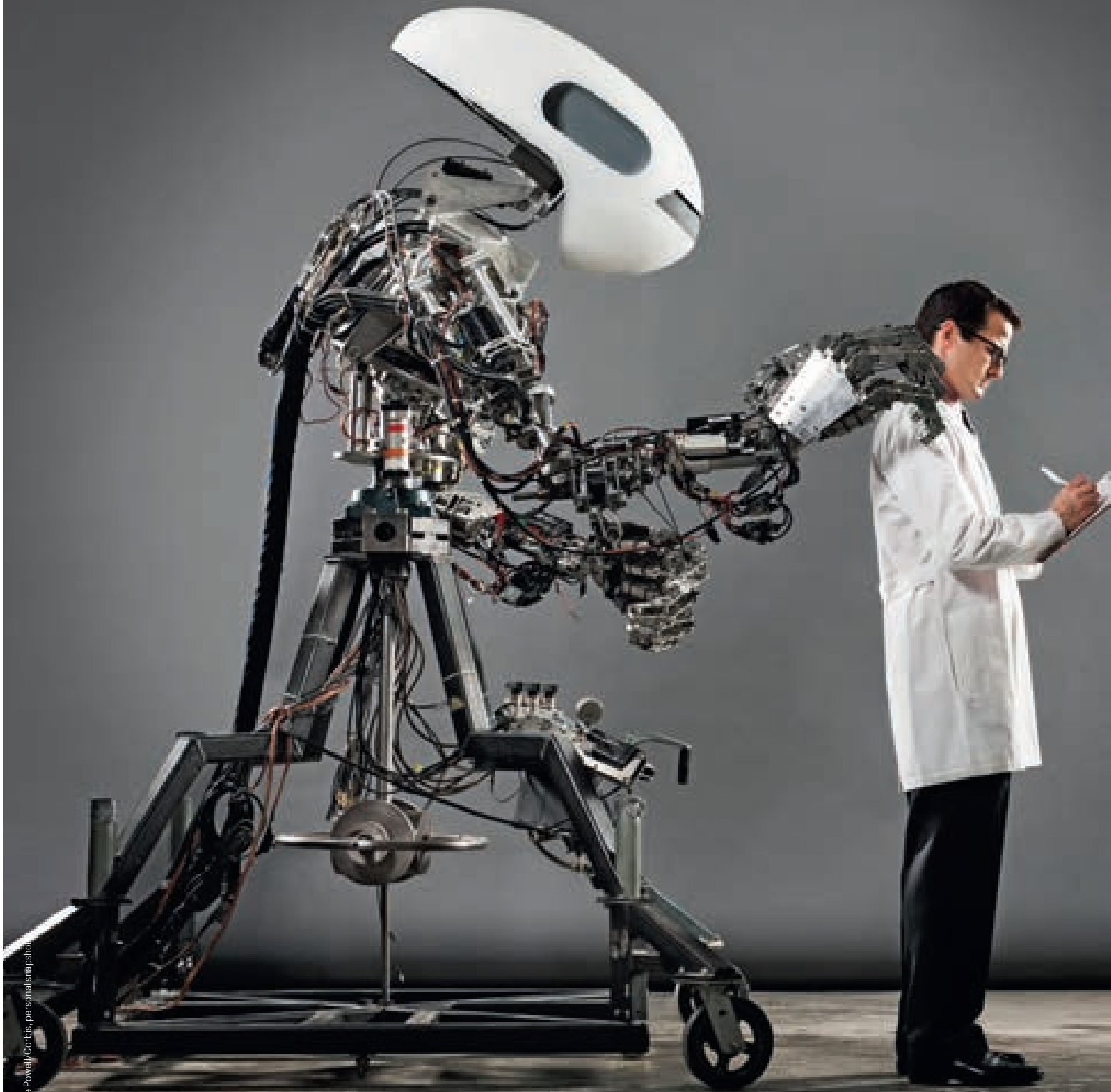# Who's the boss?

PROF. DETLEF ZÜHLKE FROM THE GERMAN RESEARCH CENTER FOR ARTIFICIAL INTELLIGENCE ON HUMAN-TO-MACHINE INTERACTION IN THE AGE OF INDUSTRY 4.0.

SMART TECHNOLOGIES HAVE PERMEATED almost every aspect of our daily lives. Anytime, anywhere web surfing on our cell phones has long been second nature to us. But now this Internet of People is being superseded by the Internet of Things and Services. And this development will bring about far-reaching changes in manufacturing. The pivotal premise of the evolution toward Industry 4.0 and a digital revolution is that every single element of a factory – from simple tools, through products, to entire systems – has built-in connectivity. As a result, all of these components can capture large volumes of data from their surroundings, process and forward it. To a certain extent, this enables them to organize themselves autonomously within networks of smart, decentrally distributed objects. Thanks to integrated communication capabilities, items in factories can 'talk' to their environment. For example, semi-finished goods can tell the production line on the fly what tasks need to be performed next. This growing self-organization of machines and parts paves the way for complex production scenarios that would have been unthinkable just a short time ago. For example, individual products can be flexibly manufactured in the same way as mass-produced items, without the need for human intervention. Retooling machines is also much simpler: in our Smart Factory in Kaiserslautern, we have put user-friendly plug-and-play concepts for fast, hassle-free retooling through their paces and successfully demonstrated their potential.

HUMANS ARE STILL IN CONTROL

In contrast to the CIM (computer integrated manufacturing) era of the late 80s, the goal of Industry 4.0 is not to banish people entirely from the factory floor. On the contrary, humans have an important role to play in overseeing the entire production system and as creative problem solvers. Industry 4.0 is designed to bring people and advanced machinery together. At the same time, it raises socio-technological questions with regard to autonomy and decision making.

The Law of Requisite Variety from the field of cybernetics offers an interesting perspective. According to this principle, a controlling system needs at least as much variety in state as the system being controlled, simply to balance out and respond to disruptions and discrepancies. And precisely this role as a flexible, creative troubleshooter for production systems is reserved for human beings – if you like, as managers overseeing the entire process.

GREATER RESPONSIBILITY FOR EMPLOYEES

So machines will not usurp humans, rather Industry 4.0 will change employees' requirements and the tasks they perform in the factory. In the future, the primary job of staff will be to develop production strategies and monitor their implementation within self-organized processes. Consequently, as comprehensive integration and the idea of always-on availability take off, traditional roles such as those in the control center and back office will lose their importance. However, to support this development, we need new assistance solutions that provide relevant information on products, processes and systems to the right employee at the right time. This will enable people to make decisions and monitor processes remotely and for a large number of production systems simultaneously. If something fails, or when it comes to optimizing processes and exploiting potential, it is still the human that is called upon, not the machine.

INDUSTRY 4.0 NEEDS AN INTERDISCIPLINARY APPROACH

But how can we respond to these changing roles and demands, and the challenges they bring from an organizational and technology perspective? Firstly, through modified certification strategies that reflect the cross-disciplinary interplay between IT and engineering that Industry 4.0 requires. This calls for a deep understanding of the Industry 4.0 paradigm and its potential for streamlining manufacturing based on increased transparency and flexibility in production. And it also requires knowledge about the methodologies and technologies that are essential for the successful implementation of Industry 4.0, for example network protocol.

Secondly, we need the right human-to-technology interfaces and solutions – ones which afford people a transparent view of integrated, decentrally distributed production systems, empowering them to do a better job based on real-time information. Recent trends in human-to-machine interaction such as the 'iPhonization' we're seeing in the consumer sphere are promising developments that deliver a host of opportunities. However, there is still some way to go in terms of research and solution maturity before they can be implemented in an industrial context.

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Résumé

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