EINSTEIN CENTER
Digital Future

EINSTEIN CENTER DIGITAL FUTURE — ANNUAL REPORT 2021

ANNUAL REPORT 2021

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/ DIGITAL FUTURE BEGINS

FOREWORD

Dear readers,

2021 marked an important milestone for the Einstein Center Digital Future (ECDF). On November 30, we submitted our comprehensive evaluation report, including the application for an extension, to the Einstein Foundation Berlin. It is always impressive to see what our ECDF Professors have achieved since the interdisciplinary center of digitalization research was opened in 2017, and they continue to make remarkable contributions to the study of digital transformation.

We are particularly proud of the successful careers of our early career researchers. Prof. Dr. Dr. Felix Balzer started in 2018 as an assistant professor for E-Health and Shared Decision Allocation at the ECDF and Charité – Universitätsmedizin. Since January 2021 he has been a tenured full professor for Medical Data Science at Charité.

The ECDF has developed the panel discussion „One Room - Four Perspectives" as a new format that will be livestreamed from the Robert Koch Forum. Representatives from politics, science, business, and society take the opportunity to shed light on current developments in digitalization from various perspectives.

For our first issue on the topic of the digitalization of school education in times of the COVID-19pandemic, we were able to win over Britta Ernst, Minister of Education, Youth and Sports of the State of Brandenburg and President of the Standing Conference of the Ministers of Education and Cultural Affairs, among other participants.

The "Wissensstadt Berlin" (Berlin as a capital of science and knowledge) campaign offered us the opportunity to make the ECDF's research tangible for visitors on several action days. In front of the Red City Hall, our scholars presented projects on cycling safety, wearable computing, and cyber security, among other topics.

In this annual report, we would now like to take you through the year 2021 at the ECDF. We will give you insights into research projects, introduce you to new members, international cooperation projects, events, and initiatives. We look forward to many more years of developing ideas for a digital future together with you and hope you enjoy reading the report!

Chair of the ECDF Executive Board Odej Kao

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EINSTEIN CENTER DIGITAL FUTURE

The Einstein Center Digital Future (ECDF) is a significant and successful milestone in digitalization research for Berlin's Universities and the Charité – Universitätsmedizin Berlin.

Since its opening on April 03, 2017, excellent scholars have been conducting research in the core area of „Digital Infrastructures, Methods, and Algorithms" and in the innovation areas of „Digital Health," „Digital Society," and „Digital Industry and Services." Berlin universities have been able to position themselves at the forefront of digitization research nationwide with the ECDF and other successful initiatives from our network, such as the Weizenbaum Institute for the Networked Society – the German Internet Institute and BIFOLD – the Berlin Institute for the Foundations of Learning and Data.

The ECDF is based on a large public-private partnership (PPP) with partners from business, science, and politics. Under the leadership of Technische Universität Berlin (TU Berlin), the institutions that submitted the application are Charité – Universitätsmedizin Berlin, the Freie Universität Berlin, the Humboldt-Universität zu Berlin, and the Berlin University of the Arts. Numerous respected non-university research institutions (BIH, DLR, FOKUS, HHI, IZM, MDC, PTB, ZIB), the Berliner Hochschule für Technik, the University of Applied Sciences as well as the Federal Ministry of Education and Research and the Federal Ministry of Labour and Social Affairs are also involved in the Center. In addition, more than 30 companies participate in the initiative.

The Center for Digitalization Research has a planned duration of six years and was approved by the Einstein Foundation Berlin (ESB) in September 2016. The ECDF is endowed with more than 38.5 million Euros. Funding is provided by the private sector (approx. 1/3), the participating non-university research institutions (approx. 1/5), and the state of Berlin.

More than 40 additional ECDF Professors have now taken up their posts at Berlin's universities and Charité – Universitätsmedizin Berlin.

Since its founding, the ECDF has acted as an important

driver and impetus for digitalization research in Berlin. The professorships are deliberately designed to be interdisciplinary and involve research at the intersection of different fields. The ECDF is a cross-university nucleus for researching and promoting digital structures in science, business, and society.

Instead of new individual initiatives, the ECDF networks digitalization research in Berlin and tests new forms of collaboration while focusing on innovative interdisciplinary cutting-edge research and excellently trained young scientific talent. The professors play a significant role in strengthening digitalization research in Berlin and make an important contribution to innovative topics such as blockchain technologies, mobile cloud computing, cryptocurrencies, data and open science, and online platforms.

For the Einstein Foundation Berlin and the Senate Chancellery for Science and Research, it is important to ensure the ECDF is sustainably established in Berlin, a center of science. The Senate Chancellery therefore promised ten tenured ECDF Professor professorships at an early stage. The selection process for these positions was launched in 2020. Selection was made in two rounds due to the wide variation in appointment times. The first round was aimed at all ECDF Professors with a start date up to the winter semester (WS) of 2018/19.

The second selection round took place in 2021. Five professors were selected in each of the first and second rounds. More than 30 top-class international scientists had prepared comparative expert opinions for the candidates. The final ranking is made up of the assessments of the international reviewers as well as the members of the Scientific Advisory Board and the Executive Board.

In November 2021, the ECDF submitted the evaluation report to the Einstein Foundation Berlin (ESB) including the application for an extension of funding for a maximum of five years. This is possible under certain circumstances for Einstein centers that are funded by a public-private partnership in addition to those centers financed exclusively with public funding. The on-site review with international reviewers was planned for February 22, 2022.

/ PROFESSORSHIPS

/ URBAN RESILIENCE AND DIGITALIZATION / DISTRIBUTED SECURITY INFRASTRUCTURES FOR SECURITY / INTERNET OF THINGS FOR SMART BUILDINGS / CONTROL OF CONVERGENT ACCESS NETWORKS / DIGITAL TRANSFORMATION AND IT INFRASTRUCTURES / DIGITAL TRANSFORMATION AND STRATEGIC INFORMATION MANAGEMENT / DIGITALIZATION AND SUSTAINABILITY / MOBILE CLOUD COMPUTING / E-HEALTH AND SHARED DECISION ALLOCATION / SECURE AND TRUSTWORTHY NETWORK-ATTACHED SYSTEM ARCHITECTURES / SOCIOLOGY OF WORKING WORLDS' DIGITALIZATION / TRUST IN DIGITAL SERVICES / DATA SCIENCE AND ANALYTICS / DIGITAL SELF-DETERMINATION / WEARABLE COMPUTING / DIGITAL EDUCATION

RESEARCH AT THE ECDF

Whether you look at physics, economics, sociology, medicine, or design – ECDF scholars from a wide range of disciplines are united by the research field of digitalization. Since its opening in April 2017, the ECDF has been the center for digitalization research in Berlin, providing a holistic view of social change and the associated discourse. The year 2021 has once again brought digitalization more into focus and shown how diverse the opportunities and challenges are in this field of research.

In 2021, numerous new interdisciplinary projects started at the ECDF. Some research projects were completed in 2021 or are still ongoing: The app of the SimRa – Safety in Cycling project, led by Prof. Dr. David Bermbach, has been continuously developed and has significantly increased the visibility of the ECDF through numerous media mentions (p. 23).

In 2021, two new ECDF Professors accepted an appointment at their respective universities: Prof. Dr. Lydia Kaiser has been Professor of „Digital Engineering 4.0." at TU Berlin since March 01, 2021. On December 01, 2021, Prof. Dr. Andreas Schwitalla joined the Charité – Universitätsmedizin Berlin for Digital Implantology (p. 18).

ECDF Junior Professor Prof. Dr. Christian Meske has taken the next step in his career and accepted an appointment at the Ruhr-Universität Bochum (RUB) (p. 19). As of September 01, 2021, he has been Professor of Socio-Technical Systems Design and Artificial Intelligence. Christian Meske remains affiliated with the ECDF as an associate member. Thus, 37 professors are currently (as of December 31, 2021) conducting research at the ECDF, ten of them women and 27 men.

The following pages provide the status of the appointment procedures in the order the professors started their work until the end of 2021, portray the professors appointed in 2021, and provide an insight into joint projects.

LIST OF APPOINTMENTS

Appointed professors

Name	Specialism	Institution	Start Date
Prof. Jochen Rabe	Urban Resilience and Digitalization	TU Berlin, Faculty VI – Planning Building Environment	October 01, 2016
Prof. Dr. Florian Tschorsch	Distributed Security Infrastructures	TU Berlin, Faculty IV – Electrical Engineering and Computer Science	April 01, 2017
Prof. Dr. Tilman Santarius	Socio-Ecological Transformation and Sustainable Digitalization	TU Berlin, Faculty I – Humanities and Educational sciences	December 15, 2017
Prof. Dr. David Bermbach	Mobile Cloud Computing	TU Berlin, Faculty IV – Electrical Engineering and Computer Science	December 20, 2017
Prof. Dr. Stefan Kirchner	Sociology of Working Worlds' Digitalization	TU Berlin, Faculty VI – Planning Building Environment	April 01, 2018
Prof. Dr. Jan Christoph Nordholz	Secure and Trustworthy Network-Attached System Architectures	TU Berlin, Faculty IV – Electrical Engineering and Computer Science	April 01, 2018
Prof. Dr. Dr. Felix Balzer	E-Health and Shared Decision Allocation	Charité – Universitätsmedizin Berlin	April 01, 2018
Prof. Dr. Timm Teubner	Trust in Digital Services	TU Berlin, Faculty VII – Economics and Management	April 01, 2018
Prof. Dr. Helena Mihaljević	Data Science and Analytics	HTW Berlin	July 01, 2018
Prof. Dr. Max von Grafenstein, LLM	Digital Self-Determination	UdK Berlin	August 01, 2018
Prof. Dr. Berit Greinke	Wearable Computing	UdK Berlin, Institute of Product and Process Design	August 01, 2018

Name	Specialism	Institution	Start Date
Prof. Dr. Daniel D. Hromada	Digital Education	UdK Berlin, College of Architecture, Media and Design	August 01, 2018
Prof. Dr. Felix Biessmann	Data Science	Berliner Hochschule für Technik	September 17, 2018
Prof. Dr. Andrea Cominola	Smart Water Networks	TU Berlin, Faculty V – Mechanical Engineering and Transport Systems	October 01, 2018
Prof. Dr. Elisabeth Mayweg	Digital Knowledge Management in Higher Education	HU Berlin, Faculty of Humanities and Social Sciences	October 01, 2018
Prof. Dr. Tilo Schwalger	Data Assimilation in Neuroscience	TU Berlin, Faculty II – Mathematics and Natural Sciences	October 01, 2018
Prof. Dr. Sangyoung Park	Smart Mobility Systems	TU Berlin, Faculty V – Mechanical Engineering and Transport Systems	October 16, 2018
Prof. Dr. Michael Gensch	Terahertz and Laser Spectroscopy	TU Berlin, Faculty II – Mathematics and Natural sciences	January 01, 2019
Prof. Dr. Tobias Schaeffter	Biomedical Imaging	TU Berlin, Faculty IV – Mechanical Engineering and Transport Systems	January 01, 2019
Prof. Dr. Leonid Goubergrits	Cardiovascular Modelling and Simulation	Charité – Universitätsmedizin Berlin	February 01, 2019
Prof. Dr. Philipp Staab	Sociology of the Future of Work	HU Berlin, Faculty of Humanities and Social Sciences	February 01, 2019

Name	Specialism	Institution	Start Date
Prof. Dr. Anastasia Danilov	Organizational Economics – Future of Work	HU Berlin, Faculty of Economics and Business Administration	April 01, 2019
Prof. Dr. Janik Wolters	Physical Foundations of IT Security	TU Berlin, Faculty II – Mathematics and Natural sciences	July 01, 2019
Prof. Dr. Michelle Christensen	Open Science	TU Berlin, Faculty I – Humanities and Educational sciences	August 01, 2019
Prof. Dr. Florian Conradi	Open Science	TU Berlin, Faculty I – Humanities and Educational sciences	August 01, 2019
Prof. Dr. Emmanuel Baccelli	Open and Secure IoT Ecosystem	FU Berlin, Department of Mathematics and Computer Science	August 22, 2019
Prof. Dr. Guillermo Gallego	Robotic Interactive Perception	TU Berlin, Faculty IV – Electrical Engineering and Computer Science	September 01, 2019
Prof. Dr. Michael Ortgiese	Traffic and Mobility Management	TU Berlin, Faculty V – Mechanical Engineering and Transport Systems	September 01, 2019
Prof. Dr. Rebecca Frank	Information Management	HU Berlin, Faculty of Arts and Humanities	October 01, 2019
Prof. Dr. Björn Globisch	Terahertz Sensing	TU Berlin, Faculty II – Mathematics and Natural Sciences	October 01, 2019
Prof. Dr. Anna Almosova	Digital Currencies / Crypto Currencies	TU Berlin, Faculty VII – Economics and Management	October 16, 2019

Name	Specialism	Institution	Start Date
Prof. Dr. Adrian Paschke	Semantic Data Intelligence	FU Berlin, Department of Mathematics and Computer Science	October 17, 2019
Prof. Dr. Joachim Seifert	Digital Networking of Buildings, Energy Supply Systems and Users	TU Berlin, Faculty III - Process Sciences	December 18, 2019
Prof. Dr. Rita Streblow	Digital Networking of Buildings, Energy Supply Systems and Users	TU Berlin, Faculty III - Process Sciences	December 19, 2019
Prof. Dr. Tabea Viktoria Flügge	Digital Technologies for the Reconstruction of Complex Facial Defects	Charité – Universitätsmedizin Berlin	March 01, 2020
Prof. Jussi Ängeslevä	Societal Aspects and Challenges of Industrial Internet of Things	Berlin University of the Arts	April 01, 2020
Prof. Dr. Lydia Kaiser	Digital Engineering 4.0	TU Berlin, Faculty V of Mechanical Engineering and Transport Systems	March 01, 2021
Prof. Dr. Andreas Schwitalla	Digital Implantology	Charité – Universitätsmedizin Berlin	December 01, 2021

Alumni

Name	Denomination	Duration	New Position
Dr. Sebastian Köhler	Methods for Digital Phenotyping	June 01, 2018 – October 31, 2019	Information Architect, Ada Health
Prof. Dr. Daniel Fürstenau	Digital Transformation and IT Infrastructures	December 01, 2017 – September 30, 2020	Professor at Copenhagen Business School, Denmark
Prof. Sergio Lucia	Internet of Things for Smart Buildings	May 01, 2017 – September 30, 2020	W2 Professor for Process Automation Systems, TU Dortmund University
Prof. Dr. Setareh Maghsudi	Control of Convergent Access Networks (CCAN)	August 01, 2017 – September 30, 2020	Professor for Decision Making, University of Tübingen
Prof. Dr. Christian Meske	Digital Transformation and Strategic Information Management	October 16, 2017 – August 08, 2021	Professor of Socio-Technical System Design and Artificial Intelligence, Ruhr-Universität Bochum (RUB)

Pending appointments

Denomination	Institution	Expected start date
Digital Trial Outcomes	Charité – Universitätsmedizin Berlin	Winter Semester 2021/2022

50

45

42
*5 Alumni

41
*2 Alumni

32

18

2

2017 2018 2019 2020 2021 2022 2023
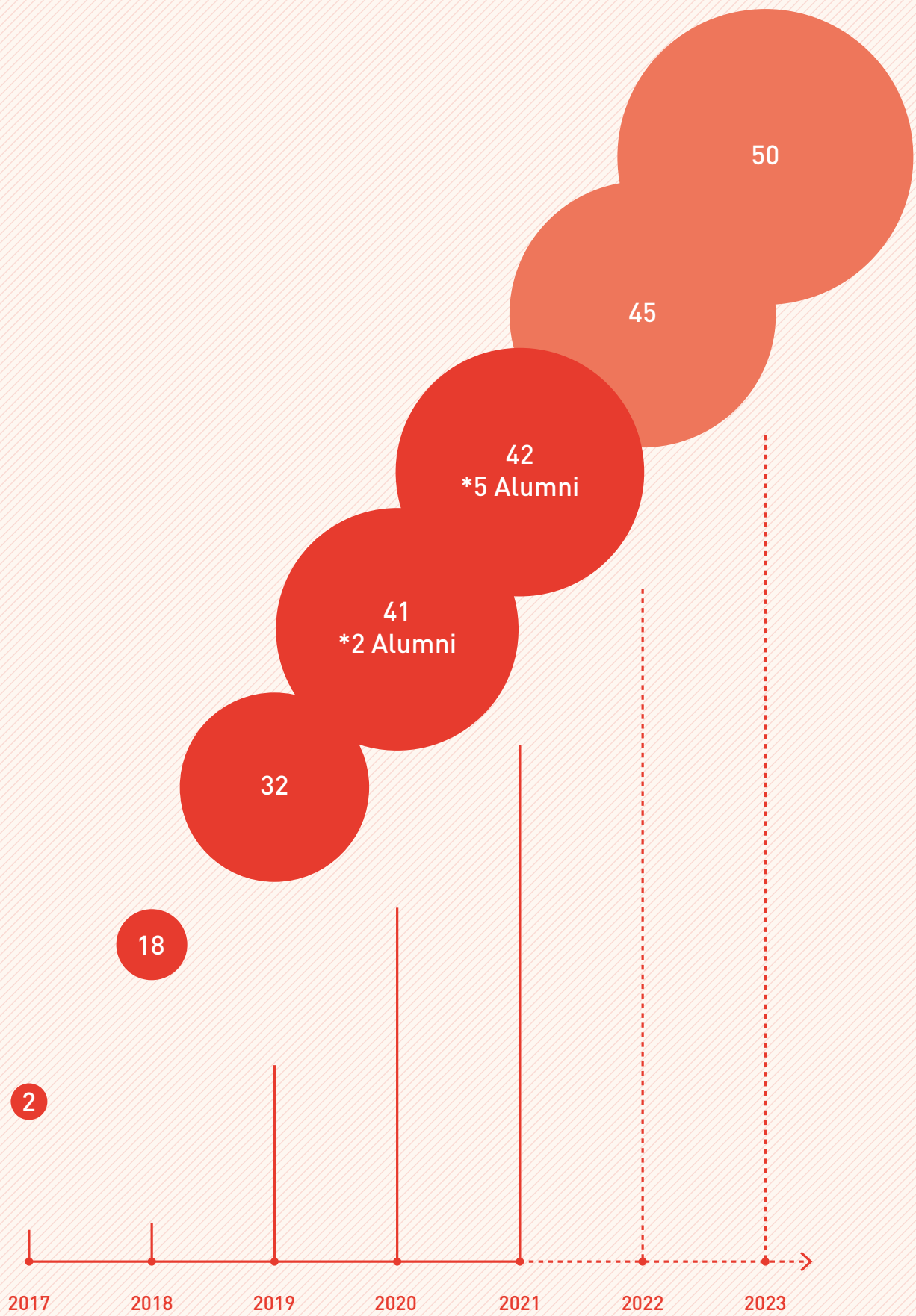
PROF. DR. DR. FELIX BALZER

Medical Data Science

At the beginning of 2021, ECDF Professor Dr. Dr. Felix Balzer accepted a tenured full professorship in Medical Data Science at Charité – Universitätsmedizin Berlin. He had previously been a junior professor at the ECDF. The specialist in anesthesiology is not only a medical doctor, but also a computer scientist. His work will continue to be characterized by interdisciplinarity: At Charité, Balzer's role will include mediating between medical and information technology needs in the capacity of Chief Medical Information Officer (CMIO). In the future, he will head the Institute of Medical Informatics, coordinate the digitalization process in health care at Charité, and teach and research in the field of data medicine.

As a physician and computer scientist, Prof. Balzer is familiar with both perspectives: The medical needs as well as the technological possibilities and hurdles in the implementation of digital solutions. „Technological advances have significantly changed the way we understand medicine in just a few years," said the new director of the Institute of Medical Informatics. „Large amounts of data are being generated at an unprecedented degree of granularity. These data are now becoming available, opening up whole new possibilities that can be used to characterize patients and diseases in novel ways." However, this also raises new questions about how to protect patients' sensitive data.

The research aims to find suitable IT solutions for medical problems and issues in order to better support doctors, nurses, and patients. New options for diagnostics and therapy, greater patient safety, improved treatment quality, and less bureaucracy for medical staff are the declared goals. „There is a lot of untapped potential in the digitalization of healthcare, something we have seen very clearly in the current pandemic. However, digitalization processes in medicine not only have to overcome technical hurdles, but also gain social acceptance and answer ethical questions," said Charité Dean Prof. Dr. Axel R. Pries, who is also a Board member of the ECDF.

At the ECDF, Prof. Balzer represents the field of Digital Health, and since 2018 he has held an endowed professorship in E-Health and Shared Decision Allocation here and at Charité. In his interdisciplinary research, he regularly collaborates with scholars from other disciplines such as business informatics, sociology, and design research. „We provide young professors with the platform and freedom to develop their research in innovative and creative ways. Prof. Balzer's excellent work has been recognized both nationally and internationally. I am therefore all the more pleased that he will remain associated with Berlin and will continue to make significant contributions to the sustainable development of the field of e-health," said Prof. Dr. Odej Kao, Chair of the ECDF Executive Board.

Privat

PROF. DR. LYDIA KAISER

Digital Engineering 4.0

Prof. Dr. Lydia Kaiser has been ECDF Professor for „Digital Engineering 4.0." at TU Berlin since March 2021. In her research, she focuses on the transformation that industry is undergoing through digitalization processes and the opportunities and challenges that companies are experiencing as a result.

"Technical systems are now networked, which in some cases results in new business models. How can we shape these processes? This question must be considered from socio-technical and interdiscipli-nary perspectives, not purely technically: Who needs this solution? Engineers, employees in purchasing or marketing? We need to understand the stakeholders and their needs in order to develop solutions," explained Lydia Kaiser. The first step is not to develop new soft-ware, but to bring together potential users with solu-tions that already exist. "In the second step, I would also like to help design solutions – this includes adapting existing software but also developing new concepts that integrate artificial intelligence processes."

Kaiser's research using systems engineering approa-ches fits very well with the ECDF's vision: Digitalization for everyone, digitalization beyond silos, human-centered digitalization. "In companies that implement technical systems, questions from software enginee-ring have to be answered more and more frequently. However, traditional mechanical engineers and software developers often take very different approaches to these issues. The goal is for them to be able to participate

in the process on an equal footing," is how Kaiser described her research project. What's more, industry boundaries are increasingly being lost and new types of collaboration are also emerging within the value chain. These developments must be addressed both system-ically and systematically to identify correct solutions. In the process, people are always at the center of product development: Technological progress should be used in such a way that it supports people in their work. This means that new solutions should be developed with users in mind. „The professorship at the ECDF is quite special for me: the topic is newly established and I can help shape it from the very beginning, and I can do all this in an interdisciplinary environment with colleagues from a wide range of disciplines," said Kaiser. After several years in applied research, she is looking forward to now going deeper into university research.

Lydia Kaiser started her scientific career with bache-lor's and master's studies in physics at the University of Paderborn. In December 2013, she received her docto-rate there with the dissertation title „Framework for Modeling a Plausible System Structure of Mechatronic Systems" at the Faculty of Mechanical Engineering. After four years as a research assistant at the Chair of Product Creation at the University of Paderborn, she gained experience in applied research at the Fraun-hofer Institute for Mechatronic Systems Design. At the latter, she co-chaired the Systems Engineering depart-ment with a colleague from 2018 until her appointment at the ECDF.

PROF. DR. ANDREAS SCHWITALLA

Digital Implantology

Andreas Schwitalla has accepted the appointment as professor of Digital Implantology in the Department of Prosthodontics, Geriatric Dentistry and Craniomandibular Disorders at Charité – Universitätsmedizin Berlin. The Einstein Center Digital Future (ECDF) is thus expanding its research portfolio to include another important aspect of digitalization in medicine.

The digital transformation has long since arrived in medicine, and Andreas Schwitalla's research is on the cutting edge of this work: In the future, the specialist dentist for oral surgery will conduct research at the ECDF at the interface of digital planning, surgery, and subsequent prosthetic restoration. For Schwitalla, there is still a lot to do in this area: "Digitalized processes can enable better patient care, and at the same time they can also save materials through the use of additive manufacturing processes. There are many different areas with potential for optimization, and It's great that I can to work at the ECDF with colleagues who know about artificial intelligence or robotics, for example."

The native of Tübingen would like to use his time at the ECDF for the automation of implant planning and research into alternative, metal-free materials for implants, among other projects. In the future, artificial intelligence may take over implant planning and placement, and restorations with innovative metal-free materials may mean improved tissue compatibility. In addition to the fascination for his field, Schwitalla is also driven by the effect of a good result: „Toothless patients thus have a complete set of teeth again and regain a large part of their quality of life. That's a great incentive."

ALUMNI

Since its launch in 2017, the ECDF has aimed to support outstanding young scholars researching in the field of digitalization at the beginning of their academic career and in their professional development. The research center acts as a sponsor and door opener for „its" young researchers. These talented scholars inevitably arouse the interest of other institutions and organizations. Of course we regret their departure, but we are also pleased that no fewer than five ECDF Professors have already been able to use the research center as a career springboard. In 2021, Prof. Dr. Christian Meske accepted an appointment at the Ruhr-Universität Bochum (RUB).

//PROF. DR. CHRISTIAN MESKE

After four years as ECDF Professor for „Digital Transformation and Strategic Information Management" at the Einstein Center Digital Future and Freie Universität Berlin, Prof. Christian Meske has accepted an appointment to the Ruhr-Universität Bochum (RUB): As of September 01, 2021, he has been Professor of Socio-Technical Systems Design and Artificial Intelligence.

As at the ECDF, Meske's research has a strong interdisciplinary focus at RUB: The new professorship bridges the gap between the Institute of Work Science and the Faculty of Mechanical Engineering. Meske continues to research how artificial intelligence (AI) is impacting the world of work. In addition to AI-based decision support systems, his research group is also working on social bots and conversational agents, as well as on technologies that can help medical professionals with diagnoses.

Meske is leaving the ECDF with mixed feelings: „I am looking forward to the new opportunities that the tenured professorship at RUB will bring. The full professorship allows me to build up a large team of researchers and to conduct even more long-term research on specific topics, which I am particularly looking forward to. My time as a junior professor at the ECDF had a great impact on me and I was able to benefit from an excellent network of academia and practice, for which I am very grateful," stated Meske. In addition to his research on topics such as digital nudging and digital leadership, Meske was also involved in the ECDF Executive Board.

Meske studied business administration at the University of Potsdam and received his doctorate from the Department of Information Systems at the University of Münster. He then became a postdoctoral research associate and coordinator of the German Research Foundation's User-Centred Social Media graduate school at the University of Duisburg-Essen. Meske's career also includes periods as a visiting scholar at the University of Sydney Business School and Florida State University.

FIRST ECDF DOCTORATE: DOCTORAL CANDIDATE MAIK HESSE DEFENDS DISSERTATION

In March 2021, Maik Hesse successfully defended his doctoral thesis on the topic of trust, reputation, and data sovereignty in the digital platform economy. From January 2019 to March 2021, he worked on his doctorate with ECDF Professor Timm Teubner (TU Berlin), who heads the „Trust in Digital Services" research group. Hesse is thus the first doctoral candidate to complete his doctorate at the ECDF. In an interview with Samira Franzel, he talks about his time as a doctoral student at the ECDF.

You started your PhD at the end of 2018 and successfully defended it in March 2021. What do you think when you look back on that period?
Hesse: Of course it's great to be able to learn and research at a leading institution like the ECDF. At the ECDF, I particularly appreciate the dialogue with colleagues on site: A wide variety of disciplines come together here, but we are all united by our focus on digitalization. Especially before the COVID pandemic, I spent a lot of time in the Robert Koch Forum and exchanged ideas with colleagues, in the last few months of course that was mostly done digitally. The content-related supervision by Prof. Timm Teubner helped me a lot, so many joint projects with him also developed outside of my dissertation.

When and why did you decide to do a doctorate?
Hesse: I first studied mathematics in Cologne and the USA, with a minor in business administration. After that, I worked in consulting, in the area of digital transformation. The main focus was on how technologies can be used to design new business models, what

requirements and skills are needed in companies to do this, and what influence digital technologies have on the business world. In the back of my mind, I always knew that I might still want to do a doctorate. Then in September 2018, I read a little deeper into the topic of digital platforms. I was particularly interested in the fact that it is interdisciplinary – classic cross-sectional research in the field of digitalization that combines approaches from various disciplines of business informatics, economics, business administration, and sociology. The specific topic and design of the doctoral thesis were then developed with Timm Teubner.

Which topic did you deal with in your doctorate?
Hesse: I wrote my doctoral thesis in the area of digital platform ecosystems. This is mainly about how digital identity and sovereignty can be created and used on the Internet. The dissertation is titled „Trust and Reputation Portability in Digital Platform Ecosystems." On platforms such as Airbnb, eBay, Helpling, Uber, or (food) delivery services, virtually anyone can offer services and collect ratings today, thus establishing a digital identity. In the wake of the COVID pandemic, some of these platforms were recently even classified as essential. However, the rating system creates a dependency for the providers on the platform, since the ratings cannot be transported. One of the aims of my doctoral thesis was to explore how we can transfer this accumulated reputation to other services in the online and offline world, so that providers don't have to start over again and again. In the analog world, we are currently entitled to a reference letter when we change jobs; in the digital world, we should handle it similarly

„The content-related supervision by Prof. Timm Teubner helped me a lot, so many joint projects with him also developed outside of my dissertation." HESSE

What do you think we can expect in the future in the area of digitalization?
Hesse: One big topic that will be with us for a while is data and how we deal with them: How are data stored? How are they processed and what added value do they bring? I see a great need to train citizens in how to handle their own data so that they can become „masters of their data" and act in a self-determined manner. But it also includes the creation of independent digital infrastructures for the European economy, politics, and society. The whole thing runs under the big umbrella of „digital sovereignty."

It also remains exciting to see what influence technologies such as artificial intelligence or blockchain will have on our working world. What is certain is that completely new professions will emerge as a result and others will become obsolete. As a society, we have to find the right way to deal with this in the medium and long term.

What advice do you have for future doctoral candidates who are also thinking about doing a doctorate at the ECDF?
Hesse: The ECDF is a truly exciting research incubator – for me it was the right decision and a time with a lot of exchange and a great community right in the heart of the digital research metropolis Berlin. For a doctorate, however, you should realize that perseverance and optimism are required. And: Doing a doctorate in 2.5 years is like a marathon with many sprints in between - so it's best to allow yourself some time.

RESEARCH PROJECTS

Digitalization is everywhere – and has greatly changed the way we work and live. The research projects at the ECDF reflect the diverse opportunities and challenges that the digital transformation brings with it: In her subproject „Incentives, leadership, and work organization" in the Collaborative Research Center „Rationality and Competition," Dr. Anastasia Danilov is researching how certain aspects of employee leadership influence employee behavior and economic results (p. 25).

At oper. digital, three ECDF Professors are working on an interactive format that will equip the opera of the future with digital applause, crowd composing and fitness trackers (p. 27). In DIALLS, a project led by ECDF Professor Lisa Mayweg, researchers and teachers from nine European countries collaborated to design a program to promote cultural competence (p. 29).

 A real breakthrough was also achieved by our Professor of Physical Foundations of IT Security, Janik Wolters, and his team: To enable the quantum internet, the scientists propose quantum storage and quantum repeaters in a near-Earth orbit in space (p. 32).

In 2019, ECDF Professor Timm Teubner was appointed to the Expert Commission for the Third Equality Report of the German Federal Government, and in 2021 the Commission then submitted the report to the Federal Ministry for Family Affairs. Among other things, the report provides 101 recommendations for action to make the digital transformation gender equitable.

In addition to new projects, there were also some research projects that were further developed in 2021. The research project on Digital Economic Development in (North) Africa with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), in which Prof. Dr. Timm Teubner and Prof. Dr. Anastasia Danilov are investigating the local platform economy in Tunisia, published initial results in a white paper (p. 30); the app of the SimRa – Safety in Bicycle Traffic project, headed by Prof. Dr. David Bermbach, is now available in additional regions and cooperated with SWR, among others (p. 23).

Below we present a selection of research projects, collaboration projects, and initiatives that ECDF Professors worked on during 2021.
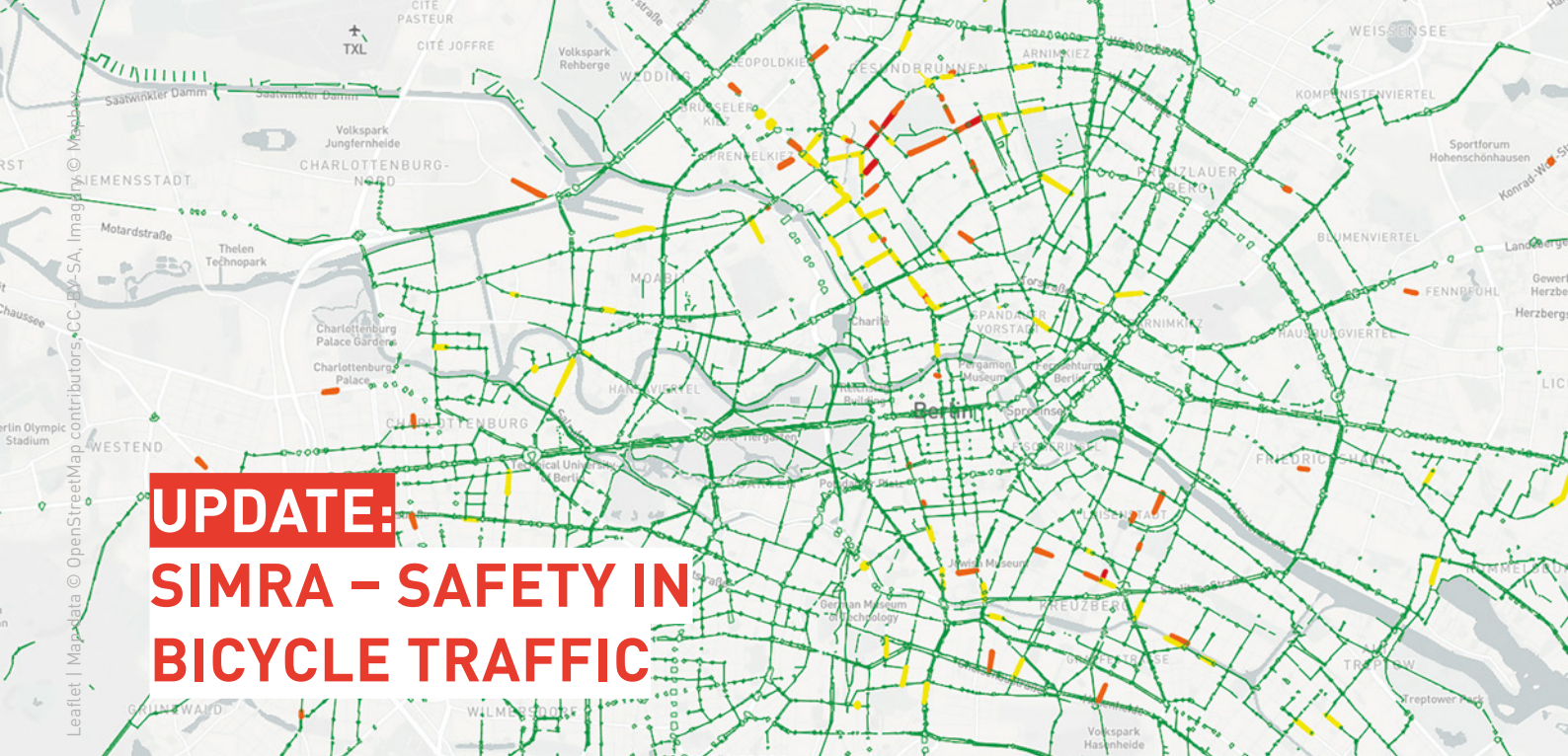
UPDATE:
SIMRA – SAFETY IN BICYCLE TRAFFIC

In the Berlin area, many cyclists have already registered with SimRa. In March 2021, Südwestdeutscher Rundfunk (SWR) launched a major campaign calling for active participation: Cyclists in the entire southwest of Germany were asked for their help in improving the traffic situation for cyclists. Citizens can use the SimRa app to document dangerous spots or exemplary traffic solutions or upload their findings to the SWR website. The data are then forwarded to Hochschule Karlsruhe – University of Applied Sciences and the Technische Universität Berlin for scientific evaluation. From March 22, the first of the two SWR theme days on cycling, the reports received were made publicly available.

„The app we developed, SimRa, collects data in a data-protection compatible way about where there are frequent hazards for cyclists in the city, what the nature of these hazards are, whether they are temporally or locally clustered, and where the main traffic flows are on bikes. We have already been able to win over numerous partners in the Berlin area," said Prof. Dr. David Bermbach, Professor of Mobile Cloud Computing at TU Berlin and the ECDF, and initiator of the app.

The app can be easily downloaded for all popular smartphones. GPS data is used to record driving routes and acceleration sensors are used to detect dangerous situations, such as sudden braking, swerving, or even a fall. After the ride, cyclists are asked to categorize and annotate the hazardous situations detected by the app and to add any undetected hazardous situations. Only then is each individual bike route uploaded and released on the project server.

As part of the cooperation project with SWR, the data collected from citizens, which can either be uploaded to SWR's websites or stored directly via SimRa, will be compiled and scientifically evaluated at both Hochschule Karlsruhe – University of Applied Sciences and TU Berlin.

„Of course, we hope that the cyclists in the south of Germany will participate actively. With the new data, we can continuously improve our app. This means that the campaign benefits all app users," said David Bermbach. For example, the data allow comparisons of which traffic problems in different cities have been regulated how well or where traffic policy can still be improved. „In addition, our incidence detection logic improves as more different events are captured. Last but not least, these data supplement the open data base that traffic research throughout Germany works with. Traffic models will be developed using this data base, among other sources, in the future," the scholar stated, expressing his pleasure about this participatory project.

EXPERT COMMISSION FOR THE THIRD EQUALITY REPORT OF THE GERMAN FEDERAL GOVERNMENT

Almost two years ago, ECDF Professor Timm Teubner was appointed by Federal Minister Franziska Giffey to the Expert Commission for the Third Equality Report of the German Federal Government. Since then, the Commission has been investigating what course needs to be set so that women and men have equal opportunities in the digital economy. On January 26, 2021, the Expert Commission submitted the completed report the Federal Ministry of Family Affairs.

„Shaping digitalisation in a gender-equitable way" is the title of the expert report for the Third Report on Gender Equality of the German Federal Government. It was drawn up by an eleven-member expert commission with specialists from various disciplines. ECDF Professor Timm Teubner represented information systems. "Digitalization opens up the opportunity to strengthen gender equality and thus democratic society," said Prof. Dr. Aysel Yollu-Tok, Chair of the Expert Commission. To do this, the Commission identified three main approaches:

// Gender-equitable access to relevant resources

// Gender-equitable use of digital technology

// Gender-equitable design of the digital transformation process and 101 hands-on recommendations to achieve these goals.

„The question requires a high degree of interdisciplinarity. Each and every one of us has a different research focus, which has resulted in exciting findings," explained Timm Teubner. In addition to information systems, experts from business administration, economics, law, sociology, computer science, and education were also represented. Unsurprisingly, the Commission then also advocated a socio-technical, i.e. interdisciplinary, approach to automated processes that takes the social context into account. This includes, for example, standardizing and systematically implementing existing methods for gender-equitable and non-discriminatory IT systems in practice. The Commission argued for a paradigm shift: „It is not women who have to adapt to the working norms of the digital industry (‚fix the women'), but the prevailing work and organizational culture that has to be made gender-equitable (‚fix the company')," the report stated. The stereotype of the male entrepreneur must be broken down.

ECDF Professor Timm Teubner's research includes trust in digital platforms, and there were some insights in this area as well from the Commission's work: „The fact that there is a pay gap between men and women is now well researched, and this trend continues on digital platforms. In the course of the report for the Equal Opportunities Report, however, we also found examples of positions where women earn higher salaries than men," said Teubner.

Teubner hopes that the report will bring a little more attention to the connections between digitalization and gender equality and address certain problems that the Commission has highlighted.

COLLABORATIVE RESEARCH CENTER / TRANSREGIO 190 "RATIONALITY AND COMPETITION"

The Collaborative Research Center / Transregio 190 (SFB/TRR 190) „Rationality and Competition" has received funding from the German Research Foundation for four more years of research starting in January 2021. The SFB/TRR 190 is a joint research project of HU Berlin, LMU Munich, TU Berlin, the DIW, the WZB, and the ifo Institute. The ECDF is represented by Prof. Anastasia Danilov. Together with Prof. Schöttner and Prof. Englmaier, she leads the subproject "Incentives, leadership, and work organization."

"I am very pleased that the German Research Foundation is funding our SFB/TRR 190. In our subproject we investigate the topic of leadership from the perspective of theoretical and experimental economics. This project is highly innovative: So far, there have only been studies on the topic of leadership from the perspective of psychology or management; there are hardly any economic findings on the subject," explained Anastasia Danilov. „With our team of 11, we hope to gain new insights into the causal effect of leadership on employee behavior. Our studies will build on a diverse portfolio of methods: econometric theories, economic laboratory experiments, randomized field studies with firms, representative surveys, and more."

In the SFB/TRR 190 she is Principal Investigator (PI) of the subproject B05 „Incentives, leadership, and work organization," which investigates how certain aspects of employee leadership influence employee behavior and economic outcomes (e.g. productivity). Economic models, laboratory experiments, and field studies will be used to clarify how characteristics, words, and actions of leaders influence personnel. The SFB/TRR 190 includes a total of 15 research projects led by renowned economists from the Berlin and Munich locations. The goal of SFB/TRR 190 is to produce reliable and meaningful research results on a variety of applied economic problems, on the basis of which, among other things, conclusions for economic policy can be formulated.

Since 2017, the German Research Foundation has been funding the Collaborative Research Center with 15 subprojects. Collaborative research centers enable innovative, ambitious, and long-term concerted research projects to be carried out in a network and are thus intended to serve the development of focal points and structures at the applicant universities.

DIGITALIZATION AND SUSTAINABILITY

A solution to pressing sustainability challenges? Or an obstacle to the socio-ecological transformation? It is still difficult to say what influence digitalization will have on sustainability. In the journal Oekologisches Wirtschaften, authors provide an insight into current issues and possible answers in 12 articles. The issue was published by the research group "Digitalization and Sustainability," a cooperative project between the ECDF, TU Berlin, and the Institute for Ecological Economy Research (IÖW). On the occasion of its 35th anniversary, the journal was published digitally and in open-access format for the first time.

ECDF Professor Tilman Santarius is part of the research group and again emphasizes the importance of the topic: „Especially in the COVID pandemic, we have seen that digitalization and sustainability are interrelated and can have a positive effect. Policies have resulted in more people working from home, traveling less, and using video conferencing instead; this has helped – at least temporarily – to consume less energy and fewer resources. The answers to the questions must be inter-disciplinary because digitalization and Sustainability affect so many different areas of our lives."

The current issue presents the topics of the research group's science policy workshop series „Forum Bits & Trees" (Forum Digitalization and Sustainability), which is funded by the German Federal Ministry of Education and Research (BMBF). How are the interdependency and co-evolution of human economies and natural ecosystems affected by increasing digitalization? How can comprehensive governance regulations and, in particular, policy steer digitalization toward sustaina-bility? On the one hand, digital tools and applications can serve as levers and trigger dynamic sustainability transformations in different sectors. On the other hand, digitalization can exacerbate existing trends of social exclusion and digital control as well as promote further economic growth, which in turn requires additional energy and resource consumption. The articles in the current issue address overarching issues that are of key importance to the ecological economy with a focus on policy measures for sustainable digitalization.

The authors of the research group, together with co-authors from academia and civil society, outline how governments can build a sovereign digital infrastructure and counter the centralizing tendencies of the platform economy. Two articles highlight the environmental and social impacts of the production, use, and disposal of ICT hardware and the design, use, and data traffic of software. The first article illustrates that an increasing number of digital devices not only entails a growing demand for energy and resources, but can also cause massive human rights violations. The second article argues from a civil society perspective that the poten-tials of open hardware and software can only be realized if competences go beyond the mere use of digital tech-nologies. The researchers from the IÖW and TU Berlin / the ECDF also highlight the diverse ecological, social, and economic challenges associated with the use of AI-based systems.

TEXTILES AND SOUND: THE FUTURE OF OPERA?

What could the opera of the future look like? What potential lies in digitalization? What role does artificial intelligence (AI) play? These are the questions addressed by the oper.digital project. And if those involved in oper.digital at the Neukölln Opera have their way, simple streaming will be a thing of the past: In a total of seven shows of The Dean of Germany, experiments were conducted at the interface between music and digitalization. The audience was always involved: Thanks to digital applause, crowd composing, and fitness trackers, they take an active part in the show from home.

Most of the shows also feature the Conductor Suit, a textile wearable developed by ECDF Professors Emmanuel Baccelli, Felix Biessmann, and Berit Greinke, among others, with Greinke leading the project. The sixth show on May 04, 2021, was followed by the first laboratory, in which the background to the technical innovations was explained. Over eight weeks, movement sequences of the conductor Claas Krause from the Verworner-Krause-Kammerorchester (VKKO) were analyzed in detail. The result is a custom interactive suit that is used as a performative musical tool in the show: „The suit recognizes Claas Krause's gestures and can thus generate sound effects – almost like a wearable instrument," explained Prof. Berit Greinke. „For this, an interdisciplinary team of costume designers, textile designers, computer scientists, electrical engineers, and experts other disciplines came together, all of them with very different research goals, which makes the work incredibly exciting." Thanks to AI, adjustments can also be

made - something which is necessary because electronic textiles are less reliable than standardized sensor technology: Textiles change by absorbing moisture or expanding, and each time the data received from the electronic textiles also changes. With the help of machine learning algorithms, new training data can also be imported again shortly before or during performance.

Clemens Seemann, project manager of oper.digital, explains in an interview that digitalization and opera are currently still seen as opposites: „With oper.digital, we want to inspire the digital generation for opera. We are looking for new starting points for this. A first step is the use of textile wearables or digital applause, so that the audience and musicians are connected even though they are not in the same room," said Seemann.

What's next for the opera of the future? Berit Greinke still sees a lot of potential in applying research to the stage: „This is where different forms of communication and gestures come together, and I would love to explore it more. We are currently working with various musicians to record their instruments," said Greinke. In the opera of the future, textile wearables for trumpeters, cellists, and vibraphonists could conquer the stages.

DIGITAL TRANSFORMATION

More flexible working hours, work locations, working methods – for some, this has quickly become commonplace with the onset of the COVID pandemic. These developments have many advantages but also entail some risks: In a new research project, ECDF Professor Stefan Kirchner (TU Berlin) is examining the impact of the digital transformation on employment risks and the quality of work.

The digital transformation is increasingly linking physical and virtual worlds and establishing new communication channels that make new working models possible. Retirees, mothers, and parents, for example, benefit from new jobs that they can adapt to their time and family needs, whereas the usual forms of employment only allow them to do so to a fairly limited extent. „Of course, these opportunities go hand in hand with the risk that the boundaries between work and leisure will become increasingly blurred and a heavier workload will result," explained Stefan Kirchner, head of the project.

It is already being discussed more frequently that the digital transformation will lead to some activities being carried out automatically in the future by artificial intelligence – that is, by machines instead of people. This changes the demand for certain occupational groups and will force some people to have to look for other fields of work.

"On the theoretical and methodological basis of economics and sociology, our interdisciplinary project will provide new evidence on digital workplaces, platform work, and artificial intelligence, thus creating a sound basis for decision-makers to make evidence-based policy decisions in labor and social policy," said the sociologist. The project aims to identify negative effects so that politicians can take countermeasures while at the same time ensuring that as many population groups as possible benefit from technological progress.

Overall, it is so far only possible to roughly assess the extent to which digitalization is already determining everyday working life and which population groups, economic sectors, and qualification or occupational groups it actually affects. It is also often unclear which jobs will benefit from digitalization or who and to what extent will bear the associated costs. The consequences for private life have also not yet been sufficiently researched and quantified. "That's exactly where our research project picks up. With the help of an innovative questionnaire module, we want to record various aspects of digitalization at the same time. A survey of employees at home is particularly suitable for this, as it gives us insights that go beyond the direct consequences at the workplace," said Kirchner, describing the central points of the project.

The interdisciplinary research project, which directly combines economical and sociological perspectives, is funded for 36 months with almost 600,000 euro by the German Federal Ministry of Labour and Social Affairs (BMAS) and is being conducted jointly with Dr. Alexandra Fedorets of DIW.

DIALLS: STRENGTHENING THE CULTURAL COMPETENCE OF STUDENTS

Under the leadership of researchers from Humboldt-Universität zu Berlin, scholars and teachers from nine countries have developed and tested open access teaching materials to promote the cultural competence of students in Europe. ECDF Professor Elisabeth Mayweg, head of the Digital Knowledge Management in Higher Education working group at the Department of Education Studies, is responsible for the project at HU Berlin.

Many different cultures come together in Europe. But are children and young people already aware of this? How can they build intercultural skills while still in school? These are questions that European scientists are investigating together in the EU project "DIALLS," which stands for „DIalogue and Argumentation for cultural Literacy Learning in Schools."

After researchers and teachers in four different countries have worked together to design a „Program for the Promotion of Cultural Competence" since March 2018, psychologists from Humboldt-Universität zu Berlin developed the materials further in their subproject so that they can be used in the long term by teachers from all over Europe – the materials are freely accessible and can be used flexibly.

This phase of the project took place in four countries simultaneously – Portugal, Israel, the United Kingdom, and Germany. From September 2020 to February 2021, more than 100 teachers from primary and secondary schools tested the materials with their students and provided feedback. The teachers used the DIALLS materials under the difficult conditions of the pandemic and were even able to use them to design distance-learning lessons. „In addition to the scientifically sound development of an instructional program, it is also important that the materials created can be used in the long term by many teachers for meaningful instructional design. They must also be able to respond flexibly to new challenges," emphasized Dr. Maria Zimmermann, a psychologist at the ECDF and HU Berlin.

DIALLS also aims to be exciting for the students: Specially selected films tailored to each age group serve as digital teaching materials. Students are to develop the ability to consider different perspectives, empathize with others, and learn to argue. The program can also be used for cooperation with other schools (on a national and international level), for example using digital-based teaching units for school classes to collaborate. In addition to discussions, designing small art projects is also part of a DIALLS lesson. A selection of such artwork can be found on the DIALLS website.

The three-year DIALLS project was led by the University of Cambridge. Two universities from Germany were involved, Humboldt-Universität zu Berlin and the University of Münster. The „Horizon 2020" project was initiated and funded by the European Union. Experts were also involved from the fields of cultural studies, civic education, education, and psychology, as well as specialists in teacher training and literacy.

WHITE PAPER: DIGITAL SKILLS ON THE TUNISIAN LABOR MARKET

Tunisia wants to combat the country's high unemployment rate with a digital strategy. But what digital skills are actually in demand on the Tunisian labor market? Researchers in the team of ECDF Professors Anastasia Danilov (HU Berlin) and Timm Teubner (TU Berlin) investigated this question. On June 29, scholars Teo Firpo and Julia Baumann presented the latest white paper with research results on this topic.

In the joint research project of the ECDF and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), ECDF researchers looked into the local platform economy and opportunities for job creation in the Tunisian and North African industrial and administrative sectors. After a brief introduction to the project, Professor Anastasia Danilov elaborated on the goals of the project: „The aim is to provide GIZ with scientific data and evidence-based recommendations for action regarding the platform economy as well as the impact of digitalization in Tunisia."

„Tunisia has a high unemployment rate: even among college graduates it is 30 percent. The Tunisian government has therefore set up a digital strategy to create more jobs while improving Tunisians' digital skills. But what digital skills are actually in demand on the Tunisian labor market? That's what we wanted to find out in our project," explained Teo Firpo, head of the project. To answer this question, the researchers collected data from Tunisia's largest online job portal over the course of a year, obtaining almost 60,000 job ads, categorizing them according to the digital and social skills mentioned, and analyzing which skills are in demand. Machine learning was used for the categorization process. Forty-two percent of the ads asked for at least one digital skill, with „programming" the most common at 16 percent, followed by data science and data engineering skills.

Furthermore, the researchers found that job advertisements requiring digital skills were mainly posted in the Tunis region. Of these, 52 percent of digital ads were posted in the capital itself, but surrounding areas also showed higher demand. In addition to digital skills, however, non-digital competencies such as experience in customer service were also in demand in the same ads. „Two concrete recommendations for action can be derived from our data set: The most sought-after digital skill – programming – should be actively promoted, and the same applies to soft skills, since both are often in demand together," explained Julia Baumann.

SURVEY: IMPACT OF COVID-19 ON HIGHER EDU-CATION TEACHING IN EUROPE

The COVID-19 pandemic has forced universities, still largely analog, to rethink their teaching methods: „The COVID situation was definitely a challenge that forced us to reorganize our lives and teaching habits. At the same time, we had the opportunity to test new teaching formats that we can use in the future," stated ECDF Professor Andrea Cominola, Principal Investigator (PI) of the ide3a project.

ECDF Professors and PIs Andrea Cominola, Sangyoung Park, Jochen Rabe, Paul Uwe Thamsen, and ECDF Executive Board member and Speaker Odej Kao, along with their respective research groups, developed a Europe-wide survey in 2021 to assess the impact of COVID-19 on teaching in higher education in Europe.

„With this survey we want to get an overview of which teaching formats students and teachers in Europe prefer or want to keep after the pandemic and which circumstances influence these attitudes and prefe-rences," explained Margaux Huth, research assistant with the ide3a project.

The results of the survey will serve as the basis for various teaching formats in the ide3a project and will support the accompanying research, which is intended, among other things, to promote the international mobi-lity of students.

STUDY: QUANTUM MEMORIES IN ORBIT

To enable the quantum internet, researchers at the Einstein Center Digital Future (ECDF), the DLR Institute for Optical Sensor Systems (DLR-OS), Humboldt-Universität zu Berlin (HU), and the University of Strathclyde (UoS) have proposed the installation of quantum memories and „quantum repeater" stations in low-Earth orbit in space. This new technology potentially enables an entanglement rate three orders of magnitude faster than quantum communication via satellites without quantum memory, and can also be used to bridge longer distances.

To enable the use of quantum internet, researchers from the Einstein Center Digital Future (ECDF), the DLR Institute for Optical Sensor Systems (DLR-OS), the Humboldt-Universität zu Berlin (HU), and the University of Strathclyde (UoS) have suggested installing quantum memories and repeater stations in space. The study suggests that quantum memories (in which information is secured) could enable the use of highly secure communication technology. This is done through the spread of quantum entanglement, a phenomenon in which two particles are connected to each other, even over long distances. Quantum memories are a key technology for realizing quantum repeaters, with which quantum entanglement can be efficiently generated over long distances. The collaborative project's research has shown that satellites equipped with quantum memories deliver entanglement rates that are three orders of magnitude higher than those of fiber-based quantum repeaters or space systems without quantum memories. The study was published in the journal npj Quantum Information. Technische Universität Berlin, the Institute of Optical Sensor Systems of the German Aerospace Center (DLR-OS) and NASA's Jet Propulsion Laboratory (JPL) were also involved.

„With our work, we show that the method we propose is much more powerful than previously discussed methods of direct signal transmission via satellites, and we identify promising physical systems with which it can be implemented. Quantum communication links will form the basis of the quantum internet – thanks to quantum repeaters and space-based systems, the technology will then also be globally applicable," said Prof. Dr. Janik Wolters, ECDF Professor for Physical Foundations of IT Security at DLR-OS, explaining the research results. This is a decisive advantage over glass fibers, which cannot realistically be used beyond a few hundred kilometers due to exponential signal losses.

This restriction would then be obsolete thanks to the new technology. Specifically, the researchers propose the use of satellites equipped with quantum storage devices in low-Earth orbit. Quantum memory focuses on the distribution and synchronization of data transmission that would otherwise occur randomly. „This allows our system to better compensate for atmospheric losses in optical signal transmission and thus improve secret-key rates. This applies not only to quantum communication via satellites, but also to quantum key distribution (QKD) protocols in general," said Wolters.

NEW RESEARCH PROJECT: ROBOTS IN EVERYDAY LIFE

Robotic vacuum cleaners and mowing robots – the first automated helpers have long since arrived in German households. With the increasing digitalization of the economy and society, the areas of application for service and assistance robots will also grow steadily outside industry. The transfer center RimA (Robotics in Everyday Life), with the participation of ECDF Principal Investigator Prof. Martin Gersch, is investigating the use of robots in everyday life and with funds from the German Federal Ministry of Education and Research (BMBF) with a total of 2.25 million Euros.

The team of scientists under Prof. Gersch will be working on business models for service and assistance robotics as a subproject until May 2025. The transfer center is intended to support partners and other institutions in transferring new robotics technologies and solutions into everyday life. „Our focus in the subproject is primarily on economic use scenarios for service and assistance robotics and the development of a knowledge platform. In this way, we want to ensure that the results also reach society and provide concrete benefits,“ explained Gersch, Professor of Business Administration at the Department of Information Systems at Freie Universität Berlin. Gersch sees the potential of robots in areas such as nursing care – both inside and outside the home – and in difficult and dangerous work in public spaces. New fields of application and business models are to be developed through competitions and an open knowledge platform.

In addition to Freie Universität Berlin, other institutions that support the transfer center's work include the FZI Forschungszentrum Informatik with the participation of the University of Bonn and TÜV SÜD AG. In total, the BMBF is funding three competence centers with different specific application domains of assistive robots; the RimA competence center is to serve as a link between the individual centers and promote efficient, scientific, but also technical exchange of ideas.

FREEMOVE
TRANSDISCIPLINARY PROJECT FOR RESEARCH ON MOBILITY DATA

ECDF Professor Max von Grafenstein is a scientific supervisor at freemove, a transdisciplinary project for researching mobility data. The Technologiestiftung Berlin spoke with him about data protection and his role in digital projects. Frauke Nippel conducted the interview.

Data protection issues are considered by many to be so complicated that they are almost incomprehensible. Can you relate to that?

Grafenstein: It's true that some things were conceptually unclear in data protection for quite a long time. What exactly is data protection law supposed to protect? Normally, there is an asset that is intrinsically worth protecting; property, for example, is an asset that needs to be protected from theft - but data? Data in itself is not a protected good, but the autonomy of the individual is, and it can be endangered by the information power asymmetry that can follow from data processing: Based on the information that can be generated relatively easily from the data and used for a wide variety of purposes, it is possible to invade people's private lives, to discriminate against them, to undermine their rights of freedom or participation, etc., that is, their autonomous exercise of fundamental rights.

Legally, it makes a big difference whether I define the data as a protected good or whether I protect it from the threat that can arise for the fundamental rights. If fundamental rights and the threat to them are the focus of attention, I have to ask myself next: How plausible is this threat? Does every use of data really aim to impair all fundamental rights in the same way? Is it

a problem if the master craftsman stores a customer address in order to send an invoice for his service later, or the school collects data of the children in order to better organize the school day? When it comes to handling data, can I really make no distinction between a company focused on data and the school or the craft business?

This legal clarification will make things easier for practitioners because it will make it possible to examine the practical handling of data in a more differentiated way.

In what way?

Grafenstein: Data protection remains a complicated area of law, no question about it. And it is clear that many companies cannot employ in-house lawyers or, if they do have such a person, that person does not necessarily specialize in data protection issues.

But now that fundamental matters have been clarified, future work can focus on methodological issues. I expect that certain standardized practices will develop, that practitioners will work with data protection authorities, and that over time certain practices will become best practices that will be set down in statements, codes of conduct, certification programs, and the like.

In practice, one will then be able to choose a certification process for dealing with the collected data: Data protection according to a recipe, so to speak. Our freemove project on mobility data also has such a goal: Ideally, the end result should be a certificate that enables users to handle mobility data in a privacy-

„When designing a project, data protection forces us to carefully consider how data is handled so that the risks for those affected are kept to a minimum." GRAFENSTEIN

compliant manner for defined issues. I think this is very realistic given the possibilities offered by the GDPR and current developments. The way we deal with data will change.

However, it still needs time. The first certification programs are not expected to be approved by the authorities until next year, four years after the GDPR came into force. There were simply a lot of conceptual questions to be clarified.

In the workshop, you told practitioners that data protection should be seen as an aid in the conceptual work for digital projects. What do you mean?
Grafenstein: When designing a project, data protection forces us to carefully consider how data is handled so that the risks for those affected are kept to a minimum. These are not only legal, but also technical and organizational issues that must be clarified as early as the

planning phase. If you try to adapt a technical system to such design principles only after the fact, it can become quite expensive. In addition, data protection puts the data carriers, i.e., customers or users of digital projects, at the center of considerations. This is also a very positive effect.

Incidentally, data protection also favors many innovations, creates new services, etc. Its poor reputation in current practice stems primarily from its ill-conceived application, which makes compliance with regulations an end in itself and completely forgets the actual meaning and purpose of the regulations. Fortunately, this is something that companies are increasingly understanding, and more and more of them are putting good data protection practices into place as a quality feature and even a competitive advantage.

*General Data Protection Regulation

AWARDS

ECDF PROFESSORS RECEIVE RECOGNITION FOR RESEARCH

//Prof. Dr. Daniel Hromada has been awarded one of four Senior Fellowships for „Innovation in University Teaching" by the Stifterverband. The ECDF Professor received the 25,000-euro fellowship for his project „Teacher.solar: open source/hardware toolbox for CO_2-neutral online outdoor teaching."

How can teaching at universities be further developed and improved? 179 applications addressed this question, and in the end, 17 concepts were selected and awarded prizes. The goal of the fellowship program is to motivate teachers to develop innovative concepts that further develop their own teaching and at the same time send new impulses into the higher education landscape. This is intended to attract young people to universities and strengthen research and teaching.

In the „teacher.solar" project, Prof. Dr. Daniel Hromada will work with students at the Berlin University of the Arts to design and test a solar-powered, e-ink digital artifact and associated open-source suite for outdoor online learning (OOL). „I am very pleased to receive this award because it allows me to reconcile the classical Aristotelian concept of peripatetic teaching with state-of-the-art electrophoretic, portable, CO_2-neutral digital technologies," said Daniel Hromada. As part of the project, students will design their own copies of the OOL toolbox.

//Prof. Dr. Timm Teubner received good rankings twice in the business administration researcher ranking of WirtschaftsWoche (January 2021): Among researchers in business administration in Germany, Austria, and

Switzerland, he ranked 76th and thus belongs to the top 2.3 percent. In the ranking of young researchers, Teubner made it into the „Top 40 under 40."

Every two years, WirtschaftsWoche honors the scholars with the strongest reseatch in business administration and economics. „I am very happy about the two places in the ranking. My research focuses on trust in digital services and is quite practical. The ranking in Wirt-schaftsWoche will hopefully make it even more visible outside academia," said Timm Teubner.

The current ranking refers to publications of the past five years from German-language chairs and Fraunhofer and Max Planck Institutes. The ranking is compiled by the KOF Research Institute at ETH Zurich together with the Düsseldorf Institute for Competition Economics on behalf of WirtschaftsWoche, and the bibliometric web portal Forschungsmonitoring serves as the data source.

Teubner's current projects deal with practical issues on the web: One research project is investigating the trans-ferability of online ratings from platform to platform, for example. According to Teubner, this would increase competition between platforms and make consumers less dependent on individual platforms. In another project, Teubner and other ECDF scholars are rese-arching how trust in artificial intelligence (for medical applications, among others) can be improved.

//Prof. Dr. Andrea Cominola und Prof. Dr. Sangyoung Park vauthored the paper „When Privacy Protection Meets Non-Intrusive Load Monitoring: Trade-off Analysis

and Privacy Schemes via Residential Energy Storage." This was one of three papers awarded „Best Paper" at the 2021 International Conference on Smart Grids, Green Communications, and Energy-Aware IT Technologies (IARIA).

Non-invasive load monitoring (NILM) algorithms are being actively researched to break down the power consumption of an entire household into the contribution of individual appliances. While understanding the usage patterns of individual devices can be beneficial for flattening peak demand, reducing electricity bills, and improving energy use efficiency, NILM algorithms raise privacy concerns. Residential energy storage could address these concerns by modifying the electricity profile that is monitored. However, residential energy storage systems are still very costly, so it is important to evaluate the financial cost of privacy protection technology. In this paper, we present examples and preliminary results on how much residential energy storage would be required to outsmart a state-of-the-art NILM algorithm. Our preliminary results on the tradeoff between NILM accuracy and privacy protection suggest that some intuitive approaches that require a significant amount of battery capacity may not be the most effective at reducing disaggregation accuracy.

//Prof. Dr. Philipp Staab has been awarded the Hans Matthöfer Prize for Economic Journalism for his book „Digitaler Kapitalismus – Markt und Herrschaft in der Ökonomie der Unknappheit" (Digital Capitalism – Market and Power in the Economy of Scarcity). The prize is awarded annually by the Hans-und-Traute-Matthöfer-Stiftung and the Friedrich Ebert Foundation and is endowed with 10,000 Euros. „I am very pleased to receive this award and hope that I can contribute to the democratization of digital capitalism with my research," Staab stated. His book examines contemporary digital capitalism from a variety of perspectives: While banks as well as energy and industrial groups were still among the most valuable companies in the early 2000s, they have since been overtaken by companies such as Google

and Apple. Staab shows how the proliferation of digital surveillance and assessment practices is penetrating more and more sectors of the economy, exacerbating social inequality in the process.

Against this background, the jury also saw Staab's book as particularly relevant: „Philipp Staab's analysis of the strategies of the major players in the internet economy provides groundbreaking insights for understanding digital capitalism. Here, companies not only act as competitors in markets, but they themselves constitute these markets, in which they then simultaneously act as the sole shapers of supply and demand conditions. This means that economic policy directed at the internet must be radically rethought. The unabated triumph of internet companies in the pandemic underscores the great relevance of the The prize is awarded to economists and social scientists who go beyond standard economic theory or the macroeconomic mainstream in their search for new answers to the major economic and sociopolitical challenges. It is intended to promote diversity of theory, pluralism of methods, and interdisciplinarity. Scholars cannot apply for the award themselves, but must be nominated. The official award ceremony took place digitally on May 3, 2021.

//Prof. Dr. Guillermo Gallego was recognized by IEEE as an Outstanding Associate Editor in 2021. Each year, the IEEE Robotics & Automation Society (RAS) recognizes Outstanding Associate Editors and Reviewers for their contributions to the journal Robotics and Automation Letters. This year, ECDF Professor Guillermo Gallego (TU Berlin) is among the five winners in the Outstanding Associate Editors category. „I am honored to receive this recognition and look forward to contributing to the development of robotics from TU Berlin. I am grateful to the senior Editors of RA-L: I learn a lot from you, and to the reviewers who make my work easier with their entertaining and thoughtful reviews," stated the ECDF Professor.

INTERNATIONAL ACTIVITIES

For the ECDF, global networking and lively exchange with universities and companies is very important. The international activities range from conference participation and guest stays at universities to joint publications and research projects with partners from all over the world.

Contributions to international conferences, workshops, professional meetings, or symposia are an important aspect of the academic and scientific work of ECDF Professors. In 2021, however, the coronavirus pandemic also had a massive impact on international exchanges. Many trips to conferences, evaluations, and guest visits had to be cancelled due to travel restrictions. Therefore, the scholars developed new digital ways to hold conferences, develop research ideas, and write publications. Below we present a selection of the ECDF's activities:

//NETHERLANDS: EDGE COMPUTING
In June 2021, Prof. Dr. David Bermbach was invited to a renowned Lorentz workshop (similar to the Dagstuhl events of the German GI) on „Edge Computing," which took place virtually due to the pandemic. Together with about 30 very different researchers from all over the world, he discussed open research directions in this field and showed possibilities for collaboration. The participants are currently working on a joint position paper.

//DELEGATION FROM AUSTRIA AT THE ECDF
Organized by ADVANTAGE AUSTRIA, the foreign trade organization of the Austrian Federal Economic Chamber, a delegation from Lower Austria with a focus on „research/start-ups" visited the ECDF in November 2021. The group, consisting of high-level representatives of several universities of applied sciences, chambers of commerce, and start-ups, was impressed by the Micro Factory and the exhibits in the newly designed Demo Area.

//USA: INTERNATIONAL VISITING SCHOLAR
Professor Alexander Glaser from Princeton University, USA, was a visiting scientist at the ECDF from July 2020 to July 2021. His research includes technical and policy analysis in the context of international security, particularly in relation to nuclear disarmament and non-proliferation. Alexander Glaser describes his research as „science-oriented peace research." He was pleased to be able to conduct research as a visiting scholar at the ECDF, as he believes interdisciplinary work is the „gold standard."

„The different perspectives of the various disciplines often result in unexpected opportunities that would not have arisen on their own.
That's exactly what's happening at the ECDF: different disciplines with different perspectives on the big topic of digitalization." He continues to work with ECDF Professors such as Rebecca Frank after his time as an ECDF visiting scholar.

SCIENTIFIC EXPERTISE
discourse of politics, science, and public

The professors at the ECDF are considered important contacts for governments, associations, and non-governmental organizations at the federal and state levels on topics related to digital transformation. For example, Prof. Dr. Odej Kao a member of the State Advisory Board for Digitization of the State of Berlin and Prof. Jochen Rabe is a member of the Smart City Strategy Advisory Board.

In 2021, the following activities were added:

//DIGITAL COUNCIL OF THE FEDERAL MINISTRY OF DEFENSE (BMVG)

Prof. Dr. Lydia Kaiser has been a member of the Digital Council of the German Federal Ministry of Defense (BMVg) since June 2021. The committee, which was established in 2019, accompanies the ministry in its digital transformation. The Digital Council's second term of office began in June 2021. The council consists of eight selected individuals from academia, business, civilians, and the Bundeswehr (German armed forces) and is constituted for a two-year term. In June of this year, the Digital Council was partially reconstituted. In addition to the scientific expertise of the universities of the Bundeswehr that has been present in the Digital Council to date, expertise from the scientific community outside the Bundeswehr will also be represented in the future. This role has been fulfilled since the middle of the year by Lydia Kaiser, ECDF Professor of Digital Engi-

neering 4.0. „I'm looking forward to my new role. The Digital Council brings together diverse views and expertise, which are the best prerequisites for the holistic digitalization of the Bundeswehr," Kaiser said.

Digitalization opens up new opportunities and challenges for the Bundeswehr, and the Digital Council, as an independent body, meets as needed and provides advice. The aim is to have an outside view of the strategic level of the Bundeswehr and to shape the digital transformation. In addition to topics such as digital culture after COVID-19, digital sovereignty, and data-oriented action, this term will focus on the link between digitalization and sustainability.

//GOETHE INSTITUT BOARD OF TRUSTEES

ECDF Executive Board member Gesche Joost was elected as a member of the Goethe Institute's Board of Trustees at the end of November 2021. The term of office of the new Board of Trustees is four years and began on January 01, 2022. Joost has been an honorary member of the Goethe Institut since 2014. The tasks of the Board of Trustees include decision-making on the guidelines for the Institute's work as well as long-term conceptual planning. „I am very much looking forward to working with the Board of Trustees and would particularly like to promote the topics of sustainability and digitalization in international cultural dialogue," stated the professor of Design Research.

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/ ASSOCIATED MEMBERS AND VISITING SCHOLARS

OVERVIEW OF ASSOCIATED MEMBERS

Since its foundation, the ECDF has been very interested in looking beyond its own scientific horizons and bringing valuable external know-how to the center for digitalization research in Berlin. Therefore, it is an important concern of the ECDF to gain highly respected scholars and researchers from all over the world as associate members. The associate members are in scientific discourse ECDF Professors and PIs and initiate joint research projects. They provide new ideas and contribute their experience to identify research topics that can be taken up and addressed by the ECDF.

Name	Research area	Institution	Associated since
Prof. Dr. Peter Hildebrand	Biophysical spectroscopy, imaging, computer simulation	Leipzig University	May 2018
Prof. Brian Kobilka	G protein coupled receptors	Stanford University, USA	May 2018
Prof. Dr. Dr. Ayad Al-Ani	Change management and consulting	Stellenbosch University, School of Public Leadership, South Africa	February 2019
Dr. Julius Emmrich	Neurology and neuroscience	Charité – Universitätsmedizin Berlin	August 2019
Dr. Samuel Knauss	Neurology and neuroscience	Charité – Universitätsmedizin Berlin	August 2019
Prof.in Dr. Janina Sundermeier	Business administration, especially digital entrepreneurship and diversity	Freie Universität Berlin	November 2019
Prof.in Dr. Meike Hopp	Digital provenance research	Technische Universität Berlin	December 2019
Prof.in Dr.Silvia Polla	Archeoinformatics	Freie Universität Berlin	June 2020
Prof.in Dr. Juliane Siegeris	Software engineering	HTW Berlin	July 2021

PRINCIPAL INVESTIGATORS

The Principal Investigators (PIs) of the four Berlin universities and Charité - Universitätsmedizin are the backbone of the ECDF. They are not funded, but are intrinsically motivated and support the ECDF through various formats and roles such as mentoring, organizing joint workshops and events, supporting teaching and research, and finding and approaching sponsors and donors. In 2021, Prof. Dr. Tom Brown (TU Berlin), Prof. Dr. Lars Gerhold (FU Berlin), Prof. Dr. Lars Grunske (HU Berlin), and Prof. Dr. Matthias Weidlich (HU Berlin) joined the ECDF as PIs.

//Prof. Dr. Tom Brown was unanimously accepted as PI by the ECDF Executive Board on May 07, 2021. Brown has held the „Digital Transformation in Energy Systems" (EnSys) chair at TU Berlin since April 2021. The chair is part of the Institute for Energy Engineering and is dedicated to the complex interactions among technology, politics, society, and energy markets. The chair combines two of the greatest societal challenges of our time: digitalization and the climate crisis. „Without an energy turnaround, the sustainable digitalization of our society cannot succeed, and without digitalization, the coordination of fluctuating renewable energy sources or millions of electric cars and heat pumps is hardly conceivable. My research has been interdisciplinary for many years. I'm excited to now be able to bring my experience to the ECDF as a PI," Brown stated.

Brown and his team model the coordination between generation, flexibility, and infrastructure such as electricity and gas grids with a high level of detail, so that the course for the energy transition is set in a direction that is not only optimal from a techno-economic point of view, but also gains the approval of industry, politics, and civil society. Using open source software and open data models, the team shows how to bring together techno-economical issues related to the design of our energy systems with broader issues of societal acceptance of large-scale infrastructure.

Brown studied at the University of Cambridge and Queen Mary University London, earning a PhD in theoretical physics from the latter. Before his appointment at the TU Berlin, he was, among other things, research group leader for energy system modeling at the Karlsruhe Institute of Technology.

//Prof. Dr. Lars Gerhold was unanimously accepted as PI by the ECDF Executive Board on March 10, 2021. He is head of the working group on Interdisciplinary Security Research at Freie Universität Berlin. As PI, Lars Gerhold intends to actively shape and further develop the research activities in the ECDF. The Future Security Lab, led by Gerhold, has been based at the ECDF Premises since 2018. There, political decision-makers and representatives from organizations and government agencies learn about new findings in security research. The Lab is unique in Germany: Its proximity to the government district, its practical design, and its function of promoting the increasingly important transfer of knowledge from science to politics cannot be found anywhere else in the country. „I am very much looking forward to serving as PI and helping to shape the scientific and strategic direction of the ECDF," Gerhold stated.

//Prof. Dr. Lars Grunske was unanimously accepted as PI of the ECDF by the Executive Board in October 2021. The computer scientist is Professor of Software Engineering at HU Berlin. His research interests are in the areas of software engineering, research software engineering, data science, reliable software, search-based software engineering, software fault localization, and software testing.

//Prof. Dr. Matthias Weidlich was also appointed as a Principal Investigator by the ECDF Executive Board in October 2021. He is Professor of Databases and Information System at HU Berlin. His research interests include behavioral modeling and analysis, formal methods, data stream processing, complex event detection, data integration, and uncertainty management.

/ TEACHING AND YOUNG SCHOLAR DEVELOPMENT

/ JOINT TEACHING / IDE3A / HEIBRIDS

JOINT TEACHING AND YOUNG SCHOLAR DEVELOPMENT

Due to the COVID-19 pandemic, teaching in 2021 was dominated by online courses. In 2020, face-to-face teaching at the universities and colleges participating in the ECDF abruptly led to significant limitations and challenges in the spring, but by the following year, procedures were more streamlined. In 2021, the ECDF Professors' great personal commitment was clear. Through the development of joint teaching formats, both virtual, hybrid events as well as courses and examinations could be conducted partially in person.

In November 2018, the Graduate School HEIBRiDS' lecture series (p. 56) started as a common platform for exchange between PhD students and local, national, and international researchers. Lectures are held at the ECDF every two weeks during the lecture period and cover various HEIBRiDS research topics, with a focus on interdisciplinary research and current trends in Data science lies, often inviting ECDF Professor as Guest lecturers. The lectures are intended both for the doctoral students of the Graduate School and for the interested public. HEIBRiDS hosted the lecture series in 2021 completely virtually. Once again, various ECDF Professor and ECDF Partners were invited to provide insights into their research. During the summer semester, Prof. Dr. Guillermo Gallego spoke on the topic „Space-Time Measurement of Ocean Waves Using Stereo Vision Systems." Kashif Rasul and Julia Lasserre from Zalando spoke on „Neural Time Series Forecasting & Algorithmic Size Advice at Zalando."

The „ide3a" research project also provided important ideas in teaching in 2021. In the joint project, professors from the ECDF Pool their expertise. The German Academic Exchange Service (DAAD) is funding the research project of Prof. Dr. Andrea Cominola (ECDF/TU Berlin) and Prof. Paul Uwe Thamsen (TU Berlin/

ECDF Principal Investigator) within the framework of the program on international mobility and cooperation (Internationale Mobilität und Kooperation digital, IMKD). The focus is on the "student journey," i.e. the cycle that students go through during their studies. In terms of content, the project focuses primarily on the interdisciplinary, innovative topic of "Critical Infrastructure and Digitalization" and offers four teaching modules per year in blended learning and blended mobility format.

Thus, three courses on „Smart Sensing," „Smart Cities," and „Critical Infrastructures and Digitalization" were developed in collaboration between ECDF Professors, staff, and PIs (Andrea Cominola, Sangyoung Park, Lauritz Thamsen, Jochen Rabe, and Paul Uwe Thamsen) as part of the ide3a project. These courses focus mainly on the digitalization of critical urban infrastructure systems on different spatial and temporal scales. They are also structured in a mixed format to allow access to several international students from the ide3a university network. On a smaller scale, joint seminars have been and continue to be held. For example, the seminar „Advanced Topics in IoT" is led by ECDF Professors David Bermbach (Mobile Cloud Computing), Sergio Lucia (Internet of Things for Smart Buildings), Timm Teubner (Trust in Digital Services), and Florian Tschorsch (Distributed Secure Infrastructures) to bring together different perspectives on IoT. Students receive learning content on algorithms as well as platform economics, communication networks, privacy aspects, and data distribution and processing systems in applications related to the Internet of Things.

The module is one of the semi-elective modules in the master's programs in Computer Science, Information Systems, and Computer Engineering at TU Berlin.

HEIBRiDS

HELMHOLTZ EINSTEIN INTERNATIONAL
BERLIN RESEARCH SCHOOL IN DATA SCIENCE

Founded in 2018, the Helmholtz Einstein International Berlin Research School in Data Science – HEIBRiDS for short – is an interdisciplinary program that trains young scholars at the interface of data science and the domain sciences.

HEIBRiDS brings together four university partners from the ECDF (FU Berlin, HU Berlin, TU Berlin, and Charité) and six Helmholtz centers from the Berlin metropolitan region. The cooperating Helmholtz centers include the Alfred Wegener Institute for Polar and Marine Research (AWI), the German Electron Synchrotron (DESY), the German Aerospace Center (DLR), the German Research Center for Geosciences (GFZ), the Helmholtz-Zentrum Berlin für Materialien und Energie (HZB), and the Max Delbrück Center for Molecular Medicine (MDC).

The HEIBRiDS partners pursue the common goal of training PhD students in the various fields of data science and giving them a deeper scientific understanding of the complex interrelationships between domain-specific expertise, algorithmic skills, and application-oriented methods. The implemented program for PhD students aims to equip computer scientists with domain knowledge and to provide domain specialists with a deeper understanding of algorithms and programming. Together they develop language and are able to understand the specific needs and requirements of both sides.

HEIBRiDS PhD students are all working on doctoral projects at the intersection of databases and data mining, machine learning, statistics and statistical physics, information retrieval, applied mathematics, and the analysis of complex networks.

These projects open up numerous opportunities for interdisciplinary exchange. The training program applies the cotutelle training principle, in which both a supervisor from a Helmholtz partner and one of the ECDF Partners are involved. Annual meetings with the doctoral advisory committee and a combination of a core research program and individual training sessions are the basis of the training program. Doctoral students develop advanced programming skills and experience with data management systems that complement applied knowledge in their field.

In the first round of recruitment, which took place in spring 2018, 13 doctoral candidates were selected to start their projects in fall 2018. In the spring of 2019, a second, much smaller selection round successfully recruited three prospective doctoral candidates. The last recruitment round in early 2020 resulted in another ten outstanding candidates for the HEIBRiDS program. Eight more positions for doctoral candidates were to be advertised in early 2022.
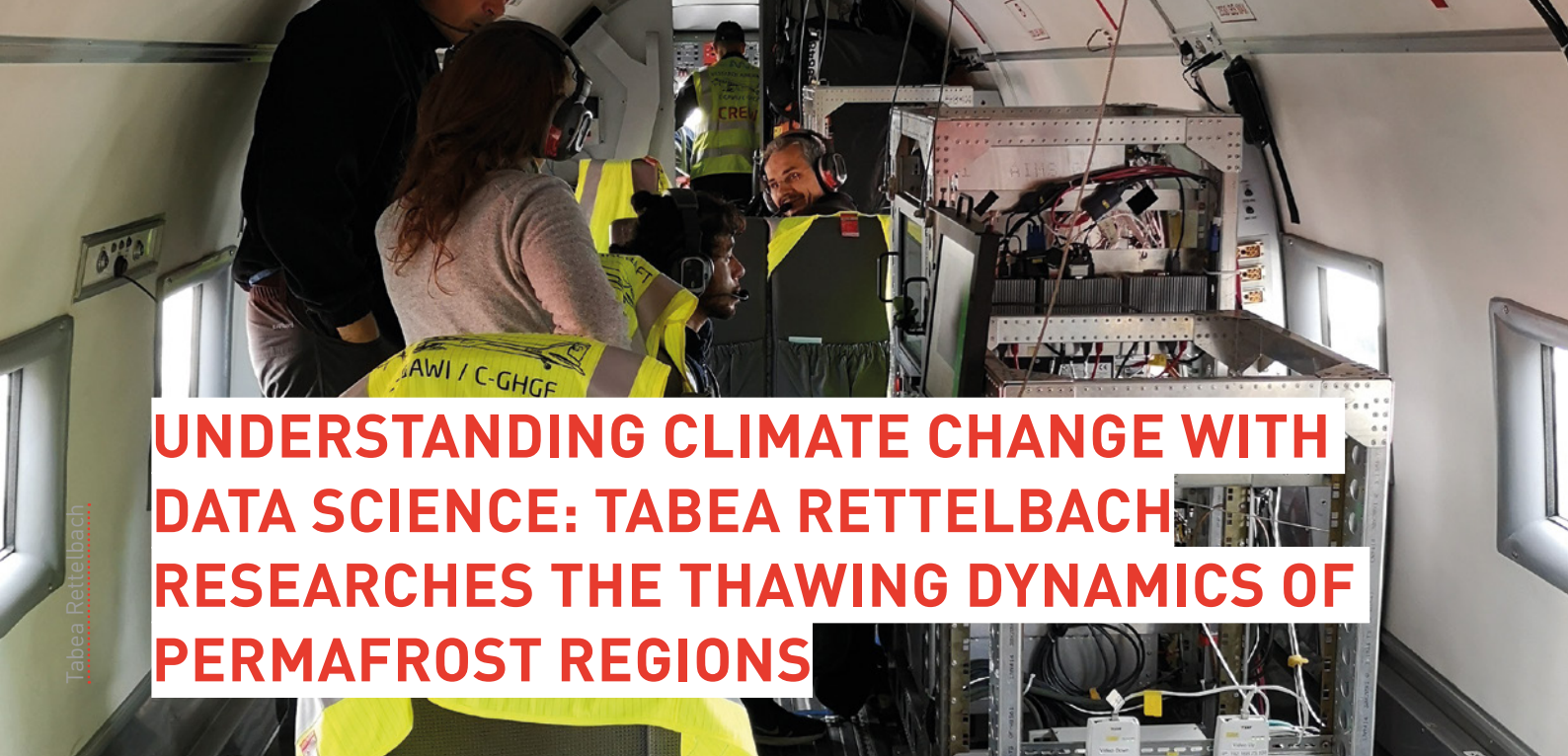
UNDERSTANDING CLIMATE CHANGE WITH DATA SCIENCE: TABEA RETTELBACH RESEARCHES THE THAWING DYNAMICS OF PERMAFROST REGIONS

Tabea Rettelbach has been a HEIBRiDS PhD student since 2019 working on the topic „Facilitating Machine Learning on Super-High-Resolution Earth Observation Data for Detecting and Quantifying Arctic Permafrost Thaw Dynamics." Rettelbach's supervisors are Prof. Dr. Guido Grosse, geoscientist at the Alfred Wegener Institute (AWI), Helmholtz Centre for Polar and Marine Research, and Prof. Johann-Christoph Freytag, PhD, Professor of Computer Science at Humboldt-Universität zu Berlin. The interview was conducted by Samira Franzel, Press and Public Relations Officer at the ECDF.

Melting polar ice caps, rising sea levels, higher ozone levels – since 2019, you have been doing a PhD on the thawing of permafrost at HEIBRiDS. Why is it important that we know more about dwindling permafrost, Ms. Rettelbach?

Rettelbach: Permafrost is what scientists call any soil that has two or more years below zero degrees, but the oldest permafrost discovered so far is much older at 650,000 years old. Much of it is over 100,000 years old. In some places, the ground is frozen several hundred meters deep. Permafrost is a very large CO_2 and methane reservoir; permafrost regions contain about as much CO_2 as we already have in the atmosphere. Science already knows that our climate is warming due to more and more CO_2 in the atmosphere, so it would be catastrophic for our climate if this additional CO_2 were released. The problem is that as the air warms, so does the soil. Microbes become active and decompose the CO_2 in the soil, which then enters the atmosphere and warms it further. This causes the permafrost to thaw even faster. It's a vicious cycle. However, the current

IPCC (Intergovernmental Panel on Climate Change) climate reports do not yet take into account the full extent of permafrost thaw, so the magnitude of climate change is potentially even worse than previously thought.

Why are these thawing processes not yet sufficiently taken into account in the forecasts?

Rettelbach: There is one big unknown, and that is processes of abrupt thawing, which are different from gradual thawing. Abrupt thawing is triggered, for example, by fire ignited by a lightning strike. The fire then wears away the top layer of the soil because it burns. However, this layer isolates the permafrost that lies beneath it. If this layer is suddenly lost due to a fire, the permafrost will then thaw suddenly and not gradually, as current calculations take into account. Especially in Siberia, Alaska, and Canada, there are many individual fires, the number of which has also increased significantly in recent years; taken together, however, these areas then make a big difference. Comprehensive aerial photographs are very important for research precisely because the area is so large – currently 15% of the northern hemisphere is made up of permafrost – and not all scientists can be on site. But here, too, a problem remains: We can only scan the surface, nothing underneath. This is where my research on ice wedge polygonal landforms comes in.

Ice wedge polygon landscapes – what exactly are they and what do these landscapes tell us about the state of permafrost?

Rettelbach: Ice wedge polygon landscapes are special landscapes created by permafrost that are visible on

the surface. Due the soil's coldness and dryness, polygonal cracks appear in the ground. Around here you can see this phenomenon when mud puddles dry out, for example. In permafrost regions, for example Alaska, ice wedges form in these cracks – sometimes up to ten meters wide and several tens of meters deep. We are looking at the ice wedges: The lower they are compared to the edges of the earth, the more advanced the thaw. How fast the ice melts is already well researched, but this has been done with soil samples. My focus is therefore on developing an image processing algorithm that allows evaluation on a large scale and can therefore efficiently quantify permafrost thawing over large areas.

Where do the data come from?
Rettelbach: That's almost the best part of my research: We are recording the data ourselves! Last year, with a team of five people and a small plane, I flew a camera over the permafrost landscape in Alaska to record data and then analyze it. Of course, I also use aerial photographs taken by other scientists, or even satellite images if they have a sufficiently high resolution.

Why did you want to do your doctorate at the HEIBRiDS graduate school and what do you think are the advantages of an interdisciplinary graduate school?
Rettelbach: First and foremost, it's absolutely key to me that my topic suits me perfectly: It is exactly the mixture of geoscience and data science that interests me. I studied physical geography in my bachelor's degree and geoinformatics in my master's degree and subsequently wrote my master's thesis on image data/telescope imagery, deep learning, and astrophysics in Perth, Australia. In the course of this, I realized that I wanted to combine data science and my interest in climate research because there is a research gap here. At AWI, Guido Grosse supports me in all aspects of geoscience, and Johann-Christoph Freytag assists me in the field of information technology. Everyone is always talking about how important interdisciplinarity is. HEIBRiDS creates the necessary visibility for this and young scientists are given the opportunity to actively implement this type of research. In addition, you naturally benefit from a large network through the various players involved. For me, HEIBRiDS is the perfect combination of methodology and application.

What impact did the COVID-19 pandemic have on your doctorate?
Rettelbach: Unfortunately, many conferences in my first year of doctoral studies could only take place digitally. This year, however, I have high hopes that I will be able to go to Alaska for a conference, this time actually on site. I am very much looking forward to that. Although I would have liked to attend more conferences on site, participating in many online conferences has allowed me to improve my presentation skills and build a large network.

OVERVIEW OF DOCTORAL PROJECTS

Name of the doctoral candidate	Working title of the doctorate	Supervisors	Cohort
Thorren Gimm	Data-Driven Time-Dependent Multiphysics Simulation and Optimization of Electron Solvation from Nanodiamonds	Joachim Dzubiella (HZB) and Frank Noé (ECDF FU)	2020
Brian Groenke	A Data-Centric Workflow for Autonomous Monitoring of Arctic Land Surface Parameters	Julia Boike (AWI) and Guillermo Gallego (ECDF TU)	2020
Oleksii Martynchuk	Identification of Rock Falls in Mars Reconnaissance Orbiter Images Using Machine Learning	Jürgen Oberst (DLR) and Odej Kao (ECDF TU)	2020
Lusine Nazaretyan	Identification of Disease Causing Genetic Variants by Genome-Wide Predictions of Human Variant Effects	Martin Kircher (Charité) and Dieter Beule (MDC)	2020
Elizabeth Robertson	Building a Photonic Processor for Energy-Efficient AI	Janik Wolters (DLR) and Guillermo Gallego (ECDF TU)	2020
Hermann Julius Stolte	Dynamic Scheduling of Gamma-Ray Source Observations	Matthias Weidlich (HU) and Elisa Pueschel (DESY)	2020
Kevin Styp-Rekowski	Multi-Satellite Approach of Monitoring Atmosphere/Magnetosphere Space Weather Interactions	Odej Kao (ECDF TU) and Claudia Stolle (GFZ)	2020
Christian Utama	Explainable Artificial Intelligence and Trust in the Energy Sector	Christian Meske (ECDF FU) and Rutger Schlatmann (HZB)	2020
Nadja Veigel	Data Mining Dynamic Human Behaviours for Flood Risk Assessment in Coupled Human-Environment Systems	Andrea Cominola (ECDF TU) and Heidi Kreibich (GFZ)	2020
Xiaoyan Yu	Deep Learning with Sparse Annotations for the Analysis of Lung Tissue Microscopy Images	Dagmar Kainmüller (MDC) and Andreas Hocke (Charité)	2020

/ NETWORK

/ WEIZENBAUM INSTITUTE / ALEXANDER VON HUMBOLDT INSTITUTE FOR INTERNET AND SOCIETY (HIIG) / BERLIN CENTER FOR DIGITAL TRANSFORMATION / BERLIN PARTNER / CITY LAB BERLIN / BIH CHARITÉ CLINICIAN SCIENTIST PROGRAM / BERLIN INSTITUTE FOR THE FOUNDATIONS OF LEARNING AND DATA (BIFOLD) / ASSOCIATED MEMBERS / FUTURE SECURITY LAB / BERLIN OPEN LAB

THE ECDF'S SCIENTIFIC NETWORK

The founding of the ECDF was also linked to the idea that a critical mass of experts in the field of digital transformation would come together and, by linking up with the existing research centers, strengthen Berlin as a digital location – thus attracting further digitalization projects. This expectation has been fulfilled, as the national centers on key aspects – Big Data, machine learning and artificial intelligence, the impact of the Internet on society, and technology – have been assigned to Berlin.

The following list presents examples of highlight projects now established in Berlin with which the ECDF maintains close collaborations:

//**The Berlin Institute for the Foundations of Learning and Data (BIFOLD)** is one of five national centers for machine learning and data management that receive permanent federal funding to strengthen scientific and industrial competence and innovation in the field of artificial intelligence. It addresses the new challenges and requirements posed by the rapidly growing importance of data management and machine learning in virtually all fields, from medicine to industry, natural sciences, humanities, e-commerce, and media to government and society.

ECDF PI Volker Markl is the co-speaker of the center and several ECDF PIs (Kao, Hauswirth, Wiegand, etc.) are also BIFOLD PIs.

//**The Weizenbaum Institute** – The German Internet Institute is a social science institute that focuses on the societal impact of digital change rather than the underlying technologies, methods, and applications. The Weizenbaum Institute researches the ethical, legal, economic, and political aspects of the digital transformation. This creates an empirical basis for responsible digitalization. It is a joint project of Berlin and Brandenburg funded by the Federal Ministry of Education and Research (BMBF).

//**The Berlin Center for Digital Transformation** is a cooperative arrangement among four Fraunhofer Institutes – FOKUS, HHI, IPK, IZM – with the universities and the ECDF as associated partners. It focuses on the transfer of technologies and solutions of digitalization into industrial use.

//The Berlin Center for Machine Learning (BZML) advances the theoretical and algorithmic foundations of ML with an internationally competitive approach to opening up new scientific and technical ML applications. In particular, it aims to make new research contributions by jointly exploring new interdisciplinary research fields in the natural and medical sciences that present new challenges for ML.

//The Berlin Open Lab provides a shared infrastructure and open space for collaboration on the campus of the UdK Berlin and TU Berlin, creating an experimental research and development space for digital production, creative experimentation, and hybrid encounters.

//The BIH Digital Clinician Scientist Program is aimed at physicians who are already helping to shape the digital transformation through innovative research projects during their residency training. The participants deal with the technological challenges of data-driven medicine.

//Das Climate Change Center Berlin Brandenburg (CCC) sees itself as a transdisciplinary center for research and knowledge transfer. It follows a similar structure to the ECDF in that it forms a consortium of all universities in Berlin and in Potsdam to address the major challenges of climate change through coordinated action with policymakers, business, and civil society. There are also plans to solicit donations for professorships in the future.

//The Berlin Centre for Consumer Policies (BCCP) has a research agenda that covers questions such as „What characterizes Consumers and Market behavior?" or „How should policies be optimally designed to protect consumers?" The effects of digitalization on consumers and market participants are the common theme of the research agenda. ECDF Professors Timm Teubner and Anastasia Danilov are PIs at the center.

Based on this extensive network within the entire Berlin scientific community, the ECDF has established a variety of collaborative projects with different actors in the field of digitalization research.

This networking is particularly successful when it is supported and lived out by people. The ECDF benefits from the close interaction among academics, researchers, and scientists who serve as principal investigators, Board members, or directors at multiple centers. Several researchers are active at both the ECDF and the Weizenbaum Institute: Prof. Dr. Martin Emmer (FU Berlin), Prof. Dr. Manfred Hauswirth (TU Berlin), Prof. Dr. Gesche Joost (UdK Berlin), Prof. Dr. Klaus-Robert Müller (TU Berlin) and Prof. Dr. Dr. Thomas Schildhauer (UdK Berlin). Prof. Dr. Dr. Schildhauer is also Research Director at the Alexander von Humboldt Institute for Internet and Society (HIIG). In particular, the ECDF is closely connected with the Weizenbaum Institute and the HIIG on several levels, which is reflected, for example, in the organization and implementation of joint events at the Berlin Science Week 2021 on the topic „AirBNB, Uber, Lieferando: The Future of Work?", which looked at platform companies and their impact on the global economy. This cooperation has proved highly beneficial.
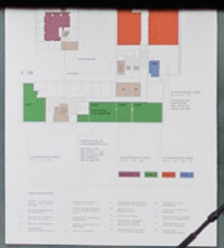
/ ROBERT KOCH FORUM

/ HOUSE OF DIGITALIZATION / FUTURE SECURITY LAB / MICRO FACTORY / DEMO AREA / EVENT SPACES

ROBERT KOCH FORUM
An interdisciplinary research and meeting place

//ECDF MICRO FACTORY

The Micro Factory plays an important role in developing ideas and solutions outside of traditional research structures. Here, scholars find support when they want to try out ideas and concepts and test their potential and risks. The prototyping method has exciting approaches for this purpose – whether with paper, cardboard, digital mock-ups, or 3D printing. Prototyping provides researchers with early visual and haptic models from which initial results, challenges, or change requests can be derived. Physical computing is also used in the Micro Factory. Sensors and microcontrollers like „Arduino" are used to control electromechanical devices such as LEDs, motors, or other hardware. These systems are interesting for research projects in the fields of design, medicine, and architecture.

The Micro Factory is headed by industrial designer Friedrich Schmidgall, who supports and advises scientists and students – from the initial idea to conception and implementation. He offers workshops on „3D Printing," „Basics of Electronics," and „Arduino Microcontroller." The target audience is ECDF Professors, research assistants, doctoral candidates, and students.

In 2021, Friedrich Schmidgall organized online workshops to introduce the new 3D printed circuit board (PCB) printer. While the first workshop focused on the printer itself, the second workshop offered step-by-step instructions on how to use the open program KiCad to design circuit boards and prepare files for printing.

//DEMO AREA

The Demo Area was set up at the ECDF to allow visitors to experience the latest technology trends and research approaches. In this ever-changing space, prototypes and research results from various ECDF members (research institutions, industrial partners involved in joint projects, start-ups) are presented. The diversity of the exhibits illustrates the ECDF's interdisciplinary approach. The Demo Area functions as an exhibition space that simultaneously provides a constant source of new questions on the most diverse aspects of society, co-existence, culture, health as well as new forms of knowledge generation in a digital future. The Demo Area regularly attracts student groups, delegations, and international visitors. It is also a permanent fixture for guests at ECDF events.

Current exhibits include:

SIMRA – SAFETY IN BICYCLE TRAFFIC – A Citizen Science project by Prof. Dr. David Bermbach that collects and analyzes cycling data to identify locations where cyclists are often at risk. In the Demo Area, the data recorded by an app are visualized. Visitors can see the first results on an animated 3D city model.

BBBLOCKCHAIN – An online participation platform based on blockchain technology. The project of Prof. Dr. Florian Tschorsch and Prof. Jochen Rabe explores new possibilities for digital citizen participation in urban development.

CONDUCTOR SUIT AND ELECTRONIC TEXTILES PROTOTYPES – With interactive prototypes, ECDF Professors Berit Greinke, Emmanuel Baccelli, and Felix Biessmann explore the possibilities of electronic textiles and textile sensors. The prototypes were made using traditional textile production methods such as sewing, weaving, and knitting as well as conductive fabrics and threads. They allow the wearer to control electronic music through body movements and gestures.

DIGITAL TECHNOLOGIES FOR THE RECONSTRUCTION OF COMPLEX FACIAL DEFECTS – How are digital technologies used in medical practice? This exhibit demonstrates the process of obtaining and processing patient data, which is then used to 3D print anatomical models. A project by Prof. Dr. Tabea Flügge.

Roman Peperhove

FUTURE SECURITY LAB

Innovations and findings from civil security research

Civil security research attempts to identify risks and to develop innovative technologies and ways of minimizing or avoiding risks through solution-oriented research.

What seems abstract at first glance is very concrete at second glance. How can police forces, for example, assess the explosive power of a suspicious package in a public space? How can firefighters find each other more easily in smoke-filled rooms and save lives in the future? How can the police be helped to better recognize and evaluate extremist content?

Such very concrete challenges of the daily work of authorities and organizations in the security sector can not only be seen but also tried out in the Future Security Lab. A simulator is available to help assess the impact of explosives in cities. In the future, firefighters could be better able to find each other during operations thanks to direction and distance recognition – which visitors to the Future Security Lab can try out in a virtual reality environment. The approach of being able to evaluate foreign-language symbols and signs of extremist groups faster and more robustly is demonstrated in a multiple-choice quiz.

These and many other interactive elements and research results can be found in the rooms of the ECDF. The Public Safety Research Forum is responsible for the concept and content. As part of Freie Universität Berlin, the Public Safety Research Forum has been cooperating with the ECDF for many years.

The rooms can still be visited virtually, but now visitors can also come on site again. The primary target group are experts from politics, public agencies, organizations dealing with security issues as well as colleagues from science and research.

One focus of last year's activities was the increasing risks to the population stemming from the growing climate crisis. A digital workshop was held with experts to discuss foreseeable risks. On the other hand, existing innovations and analysis possibilities from civil security research were presented. The workshop also included a virtual tour of the Future Security Lab.

The Future Security Lab is funded by the German Federal Ministry of Education and Research (BMBF) and is part of the Interdisciplinary Security Research Group of Prof. Dr. Lars Gerhold, who is also a Principal Investigator at the ECDF.

/ EVENTS

/ HACKATHONS / WORKSHOPS / CONFERENCES / SEMINARS / KICK-OFF / SUMMER SCHOOLS / PRESENTATIONS / PROTOTYPING / DESIGN THINKING / BOOK LAUNCHES / RECEPTIONS / SCIENCE MATCHES / PAIRING RESEARCH TALKS / INDUSTRY FORUM / SHORT TALKS / GET TOGETHER / FILM SHOOTS / LECTURES / MEETING POINT / FINAL PRESENTATIONS

EVENTS

Event organization has been a key part of the ECDF right from the start. Our spectrum includes workshops, conferences, hackathons, seminars, talks, and exhibitions – and our location in the very heart of Berlin in combination with our attractive event spaces allow us to offer a large number of exciting events on the topic of digitalization. These events are initiated by ECDF Professors and also by our partners. As a result of that the ECDF develops formats itself which have turned into a successful tool to network with our partners and interested members of the public. Events which are already firmly established, have been supplemented with new formats, such as the "Forum Bits & Bäume" or the "One Room – Four Perspectives" panel discussion.

The coronavirus pandemic has meant that almost no events could take place in person in our event spaces in Berlin-Mitte until July 2021. The experiences we gained with online events in 2020 made it easy for us to move our own innovative formats as well as the numerous contributions made by our researchers at events organized by collaboration partners into the digital space in 2021. Since the pandemic meant that our events also had to deal with tangible restrictions, we expanded our event portfolio to include the option of hybrid formats. One innovation was to establish a mobile TV studio in the ECDF's large event hall.

We are also using every opportunity to present our research at external events, such as "Wissensstadt Berlin 2021" (p. 80), which was initiated by Berlin's Governing Mayor, Michael Müller, or "Einstein meets school" (p. 79), conceived and organized by the Einstein Foundation Berlin. Overall, the ECDF has found a good way of holding events that both provides an appropriate response to the coronavirus situation and also puts the research center in an optimum position for the (digital) future.

Below is a selection of event highlights from 2021.

Berlin Water Hackathon

January 25 and 26, 2021
Einstein Center Digital Future/Online

Heat, drought, then more extreme rainfall – Berlin has been faced with several water-related challenges in recent years. At the "Berlin Water Hackathon" on January 25 and 26, 2021, students and experts from various disciplines worked together to develop creative solutions. The hackathon was organized by ECDF Professors Jochen Rabe and Andrea Cominola in cooperation with ide3a and the Berlin Senate Department for Economics, Energy, and Public Enterprises.

Not one but two teams presented convincing projects: Team 3, comprising Philipp Grimm, Lennart Schmidt, Julian Feinauer, and Sarah Eisenkolb, wants to use some of the 102,000,000 m2 of roof space in Berlin to stop the sewer system overflowing after heavy downpours. The team of expert's idea: 60% of Berlin's roofs are flat and would have space for a 1,000 liter rainwater tank in which water can be collected. Depending on the weather forecast, the water collected is either used for domestic purposes or – if capacity is available in the sewers – fed into the wastewater system at a later point in time to prevent flooding.

Team 5 has set itself the goal of keeping various groups informed about the status of the Berlin Water system on a daily basis. The idea is that public authorities, private companies in the water services sector, and civil society organizations meet up in the Aquapolis app. The team, made up of the students John Tu, Wanda Krauss, Mikolaj Szwaja, and Samar Adel Mohamed Mohamed Alarif, plans that the app can assist in the decision-making on water-related issues, and can also warn about polluted bathing water, for example.

Team 1 proposes that the already successful app "Gieß den Kiez" (water your neighborhood) be expanded to motivate more residents to water the trees in their neighborhood. This is to be achieved with the aid of gamification and financial incentives in particular. A further idea for surplus rainwater came from Team 4: Green roofs and permeable road surfaces could be supplied with surplus water to prevent flooding and reduce the expanse of sealed surfaces at the same time.

At the end of the event, which was held over several days, jury member Prof. Jochen Rabe again stressed the urgent need for concepts for solutions and the quality of the ideas presented: "It is really remarkable how detailed the ideas of the participants were, although so little time was available. I can't wait to see how the ideas develop from here." In the coming weeks, the winning student team will develop its idea further and present it again for a second time.

ECDF Industry Forum:
Opportunities & risks for the future of work

February 01, 2021
Einstein Center Digital Future/Online

Will artificial intelligence (AI) completely revolutionize the working world as we currently know it? This was one of the questions addressed at the sixth ECDF Industry Forum, which took place on February 01, 2021, in a digital format again because of the coronavirus pandemic. This time, the 70 or so participants examined the impact of AI on the working world of tomorrow, and discussed new opportunities and conceivable problems.

After the welcome by Prof. Dr. Odej Kao, speaker of the Einstein Center Digital Future (ECDF), and organizational information from host Tim Kawalun, Professors Philipp Staab and Janina Sundermeier immediately embarked on the topic: "There is already considerable public debate about artificial intelligence and it taking over human tasks, but we still know very little about the impact of AI on the working world," explained Philipp Staab, Professor of Sociology at the ECDF and Humboldt-Universität Berlin. While some already believed that AI was a new basic technology – comparable with the invention of electric power – which made other innovations possible in the first place, Staab argued more for understanding AI applications as "isolated solutions", which would lead only to the partial automation of work: "AI means in many cases simply just "machine learning" and this is already used very frequently, without that companies perceiving it as Artificial Intelligence." Janina Sundermeier, ECDF Associate Professor, emphasized that diversity was already important at the implementation stage so that processes which later ran automatically did not discriminate. The use of AI in companies generally provided the opportunity to achieve a deeper level of diversity, far exceeding the equality of men and women.

The pitches which followed explored further advantages of artificial intelligence. Oliver Giering kicked off by presenting a joint research project with ECDF Professor Stefan Kirchner. Their research here focused on weak AI, or systems which solved specific application problems, such as the widely used speech recognition,

which was already part of our everyday life. With this form of artificial intelligence, the issue was more to recognize patterns and rules and use them to derive actions rather than to replace human work completely. Anastasia Danilov, ECDF Professor for Organizational Economics of the Future of Work, discussed advantages and challenges associated with the use of AI-based tools for human resource management. Although the data set was often good, AI-based tools often failed when the question was what makes a good employee. The quality of AI-based human resource decisions moreover depended to a great extent on the training data, explained Anastasia Danilov: "It may be the case that AI only selects candidates who are very similar to existing employees – but this would not always be in the interests of the company. It is also possible that AI is better at identifying candidates who do not fit into the usual scheme, however." Anastasia Danilov concluded by providing some insights into her current study on the use of AI in companies.

ECDF Professor Helena Mihaljević's research relates to a slightly earlier stage in the process and investigates the effect of non-inclusive language in job advertisements. This also involved detecting certain patterns, explained Mihaljević, since jobseekers read the online advertisements and evaluated whether their own profile was a match. "When certain words are used, whole sections of our population do not feel they are being addressed: When a company advertises a position for a programmer and mentions coding ninjas, women will more likely not be able to identify with this." AI could analyze the job adverts in advance and help to phrase texts in a more neutral way to produce greater diversity among the applicants. ECDF Professor Max von Grafenstein rounded off the academic short talks with ethical and legal issues relating to indirect discrimination in hiring processes.

While direct discrimination based on skin color, gender, or religion was meanwhile a concept with which many

were familiar, people were often less familiar with indirect discrimination, although it also had far-reaching consequences. Max von Grafenstein is Professor of Digital Self-Determination at the ECDF and used a familiar example to illustrate indirect discrimination: When an employer decides to initially not hire applicants from the Bronx, a borough of New York City, there does not seem to be any discrimination at first sight," explained von Grafenstein. On closer examination, however, it became clear that the Bronx was a part of New York City in which most of the people were black before gentrification took hold some years ago: "Excluding candidates from the Bronx is therefore discrimination by the backdoor – this is what indirect discrimination means."

Professors and participants used the breakout sessions which followed to discuss more specific questions and talk about further joint projects. To conclude the event, host Tim Kawalun presented a new facility at the ECDF, the TV studio: "We hope of course that our Industry Forum can take place as a face-to-face event again in the future. Our next Industry Forum on April 26, 2021, on the topic of Digital Health will again be digital and take place in our new TV Studio, which we are glad to make available to our professors and partners as well," emphasized Kawalun in conclusion.

AI Camp 2021

April 27, 2021
Online

Neutral data and objective information will allow us to understand the past and shape the future. But can data and information really be objective and unbiased? In her workshop at the AI Camp 2021, ECDF Professor Rebecca D. Frank argued for an intersectional, feminist view of information and data: "Information and data often reflect the views and prejudices of their creators. Artificial intelligence uses precisely these data. Power systems can thus be reproduced and data can contribute to furthering the inequality and oppression of marginalized groups," explained Frank. The workshop participants likewise described AI as a "double-edged sword" and a possible starting point into a future which was utopian, yet also dystopian.

Frank provided a brief introduction to the relationship between data and feminism and the basic principles of a feminist approach for data science. This was developed by Catherine D'Ignazio and Lauren Klein, the authors of the book DataFeminism, on which the workshop was based. The main issue was to recognize and fight the distribution of power and sovereignty of interpretation, and also to take account of the fact that knowledge could only be complete when all perspectives – not only the most dominant ones – were heard. The data collated here were never neutral, but always dependent on their context: Twitter data was often used as the basis for sentiment analyses, but only a very small, privileged part of the global population was on Twitter. In digitalization, it was therefore important to ask who actually designed the apps we use day-in and day-out and for what purposes, for example.

What was deemed to be relevant and important often had a hegemonic stamp. It was often the case that the privileged groups did not perceive their sovereignty of interpretation as such, however: This was not ill intent, but simply based on the fact that they themselves had not experienced injustice and oppression on a large scale. "In science, we call this the privilege hazard, which is why today we want to consider where the blind spots of our research are or could be," explained Frank.

In the working groups, the participants discussed their own privileges within their research and within the science and university system: Who profits from the research, which voices are suppressed, whose goals are prioritized? It became clear right at the start that the academic system was only open to people with a good school education and often higher socio-economic status as well, since people had to be able to afford enrollment and tuition fees, and sometimes a high cost of living as well. In addition, there was the geographic flexibility needed to be able to study, do a doctorate, or undertake research,and further obstacles as well. Selected professors decided on research topics and methods; consent forms for test subjects were often phrased in very complicated language and thus did not afford participants genuine sovereignty. "As researchers, we have to be aware of these power structures and actively question them in order to include all perspectives," explained Frank in conclusion.

The ECDF was a cooperation partner of the AI Camp 2021. – in dialogue. With algorithms. For the society. German Federal Ministry of Education and Research (BMBF) and the German Informatics Society (GI). Prof. Rebecca D. Frank, PhD represents the ECDF at the AI Camp.

At the event on April 27, 2021, AI talents aged 35 and under met renowned AI experts from all over the world – in Berlin and virtually. In interactive fishbowl discussions, debating sessions, and hands-on workshops, the free science convention concerned itself with transdisciplinary questions of key importance for the future in seven thematic tracks: society, sustainability, production, science, health and life science, mobility and smart spaces, as well as art and media.

DIGITAL HEALTH IN THE AGING SOCIETY – ARE WE READY?

April 26, 2021
Online

In the health system as well, digital applications and technology are already an integral part of diagnostics, therapy, and communication between doctors and patients. How can we make headway with the digitalization of our health system and at the same time keep an eye on the challenges and needs of our aging society? At the seventh ECDF Industry Forum on April 26, 2021, which was again a digital meeting because of the coronavirus pandemic, the 60 or so participants from the worlds of business, politics, and academia concerned themselves with this question.

"If the coronavirus pandemic has shown us one thing, then it is how urgently we need digital solutions and that we still have some catching up to do," were the words with which Prof. Dr. Odej Kao, ECDF speaker, opened the event. After some organizational information, host Tim Kawalun again emphasized that the topic of "digital health" had become more topical in the course of recent months and welcomed Prof. Dr. Dr. Thomas Schild-hauer and Prof. Dr. Dr. Felix Balzer, initiators of the Digital Urban Center for Aging & Health (DUCAH). "With the DUCAH we want to establish a people-centered research center. A particularly important aspect for us is that the developments actually reach the people and that we accompany the transition," explained Balzer. The two professors used the fictitious story of patient Ms Müller to illustrate the opportunities which digital applications can offer for older people.

Smart Watches, for instance, could help detect a fall during the night much earlier. The project put its faith in interdisciplinarity: In addition to research institutes and disciplines such as informatics, medicine, and engineering, other participants included social enterprises, hospitals, and housebuilding companies as well as various professional groups from the health sector. "With DUCAH, we want to ensure that research and teaching are transferred into society. We want to create a network to bring together the various players in the health sector," said Thomas Schildhauer.

Jörg Michael Huber from Roche Pharma AG kicked off the short talks given by the network partners with an insight into the care of those with Alzheimer's with the aid of digital solutions. Huber stressed that the employment biographies of women in particular were frequently interrupted since they frequently took on the nursing care of family members with Alzheimer's. "At the moment, the focus is more on coping with the nursing situation than prevention. The issue is simply to use the opportunities in the early phase of the illness, to postpone a later need for nursing care as long as possible. Initial indications for a later illness can often be recognized in advance many years earlier," explained Huber. Thanks to an app for early diagnosis, early and low threshold cognitive tests could be carried out, and this could open up completely new ways of preventing and treating the illness.

"With the Digital Urban Center for Aging & Health (DUCAH), we want to create a network to bring together the various players in the health sector." SCHILDHAUER

Staying with this theme, Dr. Anna Trukenbrod from UseTree then provided some insight into the issue of User Experience using the example of Health Games: "This type of game is fun and keeps people mentally fit. It is particularly important here that the users have a pleasant experience, want to use the games again, and are not overtaxed by technical problems or complicated operation. The games also have to be suitable for the age group, of course; bowling is really enjoyed by older people as well," explained the Senior Adviser for User Experience. In the last Short Talk, Torsten Knieps from medentis medical GmbH provided an insight into the opportunities and risks of digitalization in dentistry. Digital solutions such as the intraoral scanner were now replacing the analog mold, and changes could be measured and evaluated digitally. Torsten Knieps saw opportunities here because cloud-based solutions facilitated location-independent working and made consultations and teamwork easier, for example. Artificial intelligence could also provide crucial assistance in the planning of implants and improve the prognosis of patients. He likewise saw the handling and the protec-

tion of sensitive patient data as one of the greatest challenges.

In the breakout sessions, the participants then had the opportunity to discuss selected topics again in more detail. Referring to DUCAH, Thomas Schildhauer explained that it was to be a supraregional project in the long term; the discussion in the breakout session on Alzheimer's particularly centered around moral issues which early detection of the illness would involve. "We are united on the issue of how we can handle the large amounts of data and the challenges which result from the – justified – high demands placed on data protection, however," summarized Felix Balzer at the end. Host Tim Kawalun said farewell to the participants and at the same time told them about the next Industry Forum: "For the next Industry Forum in July, we are all naturally hoping that the situation is slightly more relaxed, and we would be delighted if we are then able to welcome some of you again in person in the Robert Koch Forum."

International symposium "European approaches towards a Sustainable Digitalization"

May 6, 2021
Online

How can digitalization be shaped so that it promotes common goods and respects the planetary boundaries? At the "European approaches towards a Sustainable Digitalization" international symposium on May 6, 2021, representatives of civil society organizations and academia, and political decision-makers met to develop a European approach. The digital event was organized by the TU Berlin, the ECDF, the Institute for Ecological Economy Research (IÖW), and Leuphana University Lüneburg.

The urgent need for sustainable digitalization had again been emphasized by the EU Council which passed conclusions on the design of "Digitalization for the benefit of the environment" in December 2020. Analyses showed that current forms of digitalization increase the demand for resources and aggravate social disparities. Concerted action at EU level was needed to change this: "We hope that this symposium speeds up the debate, triggers ambition, and leads to ideas for a collaboration across national borders. We believe that this is essential to achieve a far-reaching transition to sustainability," explained Tilman Santarius, professor at the TU Berlin and the ECDF during the opening panel discussion. Tilman Santarius, Daniel Lang from Leuphana University Lüneburg, and Friederike Rohde from the IÖW opened the event by emphasizing the significance of a specific European approach for a sustainable digitalization: Although the need for a digital transformation directed toward sustainability was increasingly being recognized in Germany, individual activities as part of the Green Deal had so far not been sufficient. The three panel members agreed that a targeted approach and political measures were required.

In three parallel workshops, the participants were able to delve deeper into specific issues. In the first workshop — "A three-tiered approach for a sustainable digital transformation" — the participants stressed the need for regulation and a vision: "How can we make Europe both digital and green?" asked Kim van Spar-

rentak, Member of the European Parliament (Greens/EFA). To achieve this, the individual had to be strengthened, a new perspective on Commons developed, and the ethics in a digital environment had to play a bigger role. Marc Schattenmann from the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety, and Consumer Protection emphasized the double burden of this project: "It is a challenge to master two big transformations at the same time, but absolutely necessary. Although digital technologies have great potential to help us solve our environmental problems, they also have a huge ecological footprint. The political decision-makers have to be made aware of this." Moreover, civil society had to be provided with data which was correct and accessible to bring about an attitude change.

The participants of the second workshop — "Forging a European interdisciplinary science network on digitalization and sustainability" — discussed a solution for the knowledge transfer between different disciplines which was lacking despite the current dynamics. Tilman Santarius presented the Digitalization for Sustainability (D4S) project of the TU Berlin, which aims to create a solution for this: A European research network which provided a comprehensive analysis of opportunities, risks, and governance options in relation to digitalization and sustainability, developed guidelines, policies, and new institutions, and outlined an interdisciplinary and transdisciplinary research agenda. The first panel members, Angelika Hilbeck (ETH Zurich) and Mattias Höjer (KTH Stockholm), provided an overview of the challenges in the agrifood, transport, and construction sectors, and emphasized the need for a common agenda: "We have to be very clear about what we want and where we want to go. Technology is going full speed ahead, and the sectors are being left far behind. We have to unite behind the transformation agenda and ensure that the technological development really is compatible with the sustainable transformation," said Hilbeck. Höjer also

drew attention to the responsibility of research to point out the potentials as well as the overall consequences of digitalization, and criticized the current practice of providing support which favored the former. Éliane Ubalijoro (Executive Director of Sustainability in the Digital Age) and Tim Unwin (UNESCO chair for ICT4D) subsequently agreed that the discourse required more collaboration, especially inter-sectoral and with political decision-makers, more reliable data on the effects of digital tools, and most importantly the fast implementation of the knowledge and the ideas into actual practice. To make an impact, researchers had to ensure that sustainability was introduced into existing and future EU policies, and there was no time left for discussion, said the researchers.

The third workshop — "The 'Bits & Bäume Movement' goes Europe" — discussed how civil society could become part of the process of sustainable digitalization on the EU level. "Reading and writing skills and social power dynamics shape who is allowed to speak and is listened to in a discussion on sustainable digitalization – we must make an effort to go beyond this," stressed Vivian Frick from the IÖW, one of the organizers of the "Bits & Bäume" conference and the 'Forum Bits & Bäume' series of events: "It is not enough to talk about technical details — we also need to introduce the link between social justice and sustainability into the discussion." Marie-Kathrin Siemer from Liquid Demo-cracy pointed out that digital participation could be part of the solution: "It is independent of time and space, it

is scalable, and shows the degree of participation: Were people only being consulted or were they part of the decision-making process?" The panel members also discussed the need for concerted action: There were many similar processes within national borders, but the players did not communicate sufficiently with each other, as Gauthier Roussilhe, designer and researcher at ENS Saclay, stressed.

The members of the final panel, Michelle Thorne (Mozilla Foundation), David Jensen (UNEP Digital Transformation Task Force), and Kim van Sparrentak (MEP, Greens/EFA) then discussed the vision for future collaborations: Academies and the academic community had to put a focus on the collaboration with civil society and players such as the tech industry to achieve real changes. Jensen thought there was a central theme — the business model of the big tech companies: "How can we regulate them or motivate them to change their business models toward sustainability? There are currently hardly any inducements to do so." Michelle Thorne argued for a holistic approach to the use of digital tools: "The environmental effects of certain tools are not yet part of the equation, this has to change. Carbon accounting is the key to sustainability." All those taking part in the discussion agreed that a common assessment frame at EU level was required to achieve comprehensive sustainability. But what will the future look like? "We need rules and ambitious proposals for a sustainable digitalization which benefits companies and society," said Sparrentak in summary.

Crowdboost re:publica: A digital strategy for Berlin

May 25, 2021
Online

What could the digital strategy for Berlin look like? On May 25, 2021, the ECDF together with the Berlin Senate Department for Economics, Energy, and Public Enterprises, and (inter-) national experts gathered visions, methods, technologies, and best practices for the Berlin digital strategy.

After Dr. Michael Mischke, Officer of the Berlin Senate Department for Economics, Energy, and Public Enterprises, had welcomed everyone to the meeting, Aik van Eemeren started the ball rolling with impressions and findings of the implementation of the digital strategy in Amsterdam. Van Eemeren is head of Public Tech for the city of Amsterdam and explained that for Amsterdam, the focus was on the creation of open, democratic, and sustainable digital public spaces: "Municipal planning comes from an era of financially driven value creation. We wanted to move toward open technology and an open design process, where the focus is on public values and the people," explained van Eemeren. This new type of municipal planning was then implemented with the participation of the residents and with the support of data-controlled design. Paul Manwaring, founder of the City Innovation Exchange Lab Amsterdam, emphasized further how important data protection was in planning and how the Responsible Sensing Toolkit was created:

"The important issue is the difference between surveillance and service: How can we gather information and at the same time protect the digital rights of citizens? When I as a municipal innovator am thinking about using sensors for data acquisition, I need a simple online tool kit which tells me how to use the technology in an ethical way."

The city of Hamburg had already implemented its digital strategy. Matthias Wieckmann, head of digital strategies at the Department of IT and Digitalization Hamburg, provided some brief insights into the Hamburg solution, a combination of top-down and bottom-up methods: "For us, digitalization means that we have to cooperate: with residents, companies, start-ups, and universities, and also with associations, societies, foundations, and other cities and countries, to ultimately have a strategy which is useful for everyone."

After further experts had given their input, the almost 60 participants took all the information which had been presented in the breakout sessions and jointly worked out further ideas for the creation and implementation of the digital strategy for Berlin. Over the next two years, the strategy will be in the participation phase and is open to contributions from all residents of Berlin.

Einstein meets school

Workshop IEEE Conference

June 18, 2021
Hybrid

On June 18, 2021, researchers invited school students to take a direct look at their research fields. Together with others, the young people explored a wide variety of scientific topics and discussed exciting research questions. In 2021, two ECDF scholars took part in the activity day organized by the Einstein Foundation Berlin: Prof. Dr. Berit Greinke (UdK) and Prof. Dr. Tabea Flügge (Charité) provided insights into their own particular research and their day-to-day work as scientists.

Berit Greinke has been junior professor of "Wearable Computing" at Berlin University of the Arts (UdK) and the ECDF since August 2018. One of Greinke's research fields is connected textiles, how technology is integrated into textiles and whether these textiles can be manufactured industrially. At "Einstein meets school", she gave a workshop on "Textile design: Textile Wearable Interactions – Programming with and for the body". Tabea Flügge has been a professor at the Charité – Universitätsmedizin Berlin and the ECDF since March 2020. Her research focuses on digital technologies for the reconstruction of complex facial defects in oral and maxillofacial surgery. In her workshop "Oral surgery: 3D scanners – Digital tools to examine the skull," she explained how medicine and digital technologies come together in her research.

A total of seven workshops were spread over the whole day and took place at seven different locations in Berlin. School students could attend in person or take part online. The activity day afforded school students the opportunity to discover and explore possible careers which they were maybe not aware of before. The school students gained insights in the STEM subjects: science, technology, engineering, and mathematics. The activity day drew attention to vocational opportunities, illustrated fields of research and work, pointed out career prospects, and made an important contribution to ensuring there was a subsequent generation of scientists.

June 19, 2021
Online

ECDF Professor Guillermo Gallego (TU Berlin) was one of the organizers of the workshop on event-based vision, a technology which allows visual information to be recorded more rapidly and with less data redundancy. The virtual workshop was part of the IEEE Conference on Computer Vision and Pattern Recognition and took place on June 19, 2021.

The workshop concentrated on event-based cameras, smart cameras, and algorithms which process data from these sensors. "While regular cameras work with frames and clear images, event-based vision takes its inspiration from biology: like our eyes, event-based cameras collect the changes in brightness in the scene and not the whole scene again and again (full-frames). New sensors make this possible," explained Gallego. "In addition to advantages such as the temporal resolution in the microsecond range, the low latency, the extremely high dynamic range, and the low power consumption, this means less unnecessary data. They also make it possible to record images under difficult conditions, to follow a baseball in moonlight, for example."

The workshop is the third in a series which Prof. Gallego and colleagues organize every two years at large computer vision and robotics conferences such as the ICRA (2017) and the CVPR (2019, 2021). There were more than 20 events at which researchers from leading universities and companies working on this revolutionary technology gave presentations and discussed their work. "New types of vision sensors, such as event cameras and pixel processor arrays, carry out massive parallel processing close to the image plane. Early vision calculations are thus carried out on-sensor, which makes the resulting systems high speed with a low power consumption, and ultimately leads to new embedded vision applications in fields such as robotics, AR/VR, automotive, IoT, surveillance, and many more," explained Professor Gallego. "Event-based vision is an emergent field, and in this series of workshops we meet to discuss and examine novel types of camera technology (hardware) and methods of visual data processing (software)," said Gallego.

Wissensstadt Berlin

Science for everyone, to join in and get your hands dirty – This was the slogan under which the ECDF presented itself at Wissensstadt Berlin 2021. The ECDF scientists spent five days in front of Berlin's Red City Hall using a variety of formats to provide insights into their research fields and information on the latest approaches and innovations.

How safe and secure do we want our lives to be? Can digitalization make a contribution to climate protection and sustainability? What could new mobility concepts look like? The activity days and events focused on the three big topics of health, climate, and co-existence. The first activity day was July 02, when ECDF Professor David Bermbach (TU Berlin) represented the SimRa (Safety in Bicycle Traffic) project in front of Berlin's Red City Hall. Cyclists can use the SimRa App to collect data on hazardous locations and near accidents in a way which is compatible with data protection. The data obtained in the project are evaluated jointly with partners from other departments such as municipal and regional planning, and also by involving interested members of the public. The objective is to achieve sustainable changes with the help of the Berlin Senate Department for the Environment, Transport, and Climate Protection. At the ECDF stand, visitors were able to experience some initial results on an animated 3D model of the city.

One week later, everything revolved around textiles and sound. At the activity stand, visitors were able to see and touch electronic textiles, and learn more about where they can be used — in music, for instance. The team of ECDF Professors Felix Biessmann (Beuth), Berit Greinke (UdK), and Emmanuel Baccelli (FU) are undertaking joint research on the use of e-textile sensors and gesture recognition technologies. The result is a tailormade interactive suit with which the conductor can control electronic music via body movements and gestures. Visitors were able to experience a live performance on stage. For the performance of the Verworner-

Krause chamber orchestra and Soundfolds, the gestures of the conductor were translated into sound effects — almost like a wearable instrument.

VR goggles for security forces, flooding simulation, digital overalls for fire fighters: On the last activity day, the EDCF activity stand was dedicated to the future of public safety and security: Future Security Lab. Visitors could look through VR goggles and use tablets to immerse themselves in virtual, interactive scenarios and learn more about the topic of public safety and security. "The coronavirus pandemic and the flooding in Western Germany in particular have made the public even more aware of the safety and security aspects of daily life, this was also evident from the questions asked by the visitors. It is all the more important that we as the center for digitalization research involve people in the digital transformation and introduce contributions on questions which are important for the future into the public debate," said Simone Harr, Managing Director of the ECDF.

Even outside the activity days, ECDF scientists were making their contribution to Knowledge City Berlin 2021 with short talks and Science Slams: Professor Michael Ortgiese (TU Berlin) presented his research on new mobility concepts; Professor Tilman Santarius (TU Berlin) answered the question as to whether digitalization can make a contribution to climate protection and sustainability; while Professors Michelle Christensen and Florian Conradi presented the concept "Open Source" — the cultural transformation in academic working toward open, interdisciplinary research environments. At the Science Slam, Margaux Huth and Siling Chen from the ide3a project were very convincing: With their vivid representation of large quantities of rainwater which cannot seep through sealed surfaces and lead to flooding, they achieved first place in the Climate Science Slam.

Presentation on the occasion of the visit of the Dutch royal couple

July 07, 2021
Lichthof TU Berlin

On July 07, 2021, the Dutch royal couple learned about the field of "Photonics" at TU Berlin during their three-day state visit to Berlin. ECDF Professor Janik Wolters (DLR Institute of Optical Sensor Systems/TU Berlin) together with other scientists presented the BOS.QT Graduate School (Berlin School of Optical Sciences And Quantum Technologies).

In the Lichthof, or atrium, of the main TU building, the focus was on "Photonics", a novel key technology which uses the special properties of light: for displays or laser applications, for sensors in medicine, or the fast and intercept-proof transmission of data.

This latter topic is also the research subject of Janik Wolters. Together with doctoral student Laura Orphal-Kobin, he represented the BOS.QT Graduate School, where he represents the junior scientists on the steering committee. Photonics is a very broad research field with many, sometimes very different disciplines: "At BOS.QT and the ECDF, we benefit immensely from the interdisciplinary nature of the institutions and amazing ideas for future research projects emerge. "I am highly delighted of course when we can then present the results to such high-profile visitors as the Dutch royal couple," said Wolters.

The official occasion for the royal visit was the ceremonial signing of an agreement for the collaboration between the Dutch and Berlin-Brandenburg competence networks for photonics, "PhotonicsNL" and "OpTecBB", in the presence of the royal couple and the Governing Mayor of Berlin, Michael Müller. Benno Oderkerk, founder of the Dutch optics company Avantes and chairman of PhotonicsNL, therefore immediately translated the term "Lichthof" as "Photonics palace". In his earlier address, the President of the TU Berlin, Prof. Dr. Christian Thomsen, had already pointed out that this space, which had been inaugurated at the start of the industrial era in 1884, was a symbol for change, progress, and innovation.

# Politics of the Machines – Rogue Research

September 14, 2021
Hybrid

As part of the Politics of the Machines conference series – after Copenhagen (2018) and Beirut (2019) – the third POM conference took place as a hybrid event from September 14 to 17, 2021, at Berlin University of the Arts. The conference was organized by Michelle Christensen and Florian Conradi as part of their joint Professorship of Open Science at the Technische Universität Berlin/Einstein Center Digital Future and their joint leadership of the Critical Maker Culture research group at Berlin University of the Arts/Weizenbaum Institute. The conference was held in collaboration with Aalborg University, Aalto University, and the International University of Beirut.

Track Chairs, speakers, and participants from 31 countries in Europe, Asia, Africa, North and South America from a variety of very different disciplines discussed critical perspectives of the current developments in technology (decolonial, feminist, and sustainable approaches), and the positioning between art, design, science, and civil society.

In a state of ontological crisis, the boundaries between man and machine, nature and culture, the organic and the inorganic, had become very blurred. Novel inventions were being made, automation was inevitable, the human and non-human were merging into a new interplay. But which power structures were embedded implicitly and concealed in these technologies, from one-sided machine learning through to surveillance capitalism and digital colonization? These questions were examined at the conference.

Foto: ECDF/Simone Harr

NEW ECDF EVENT FORMAT:
ONE ROOM – FOUR PERSPECTIVES
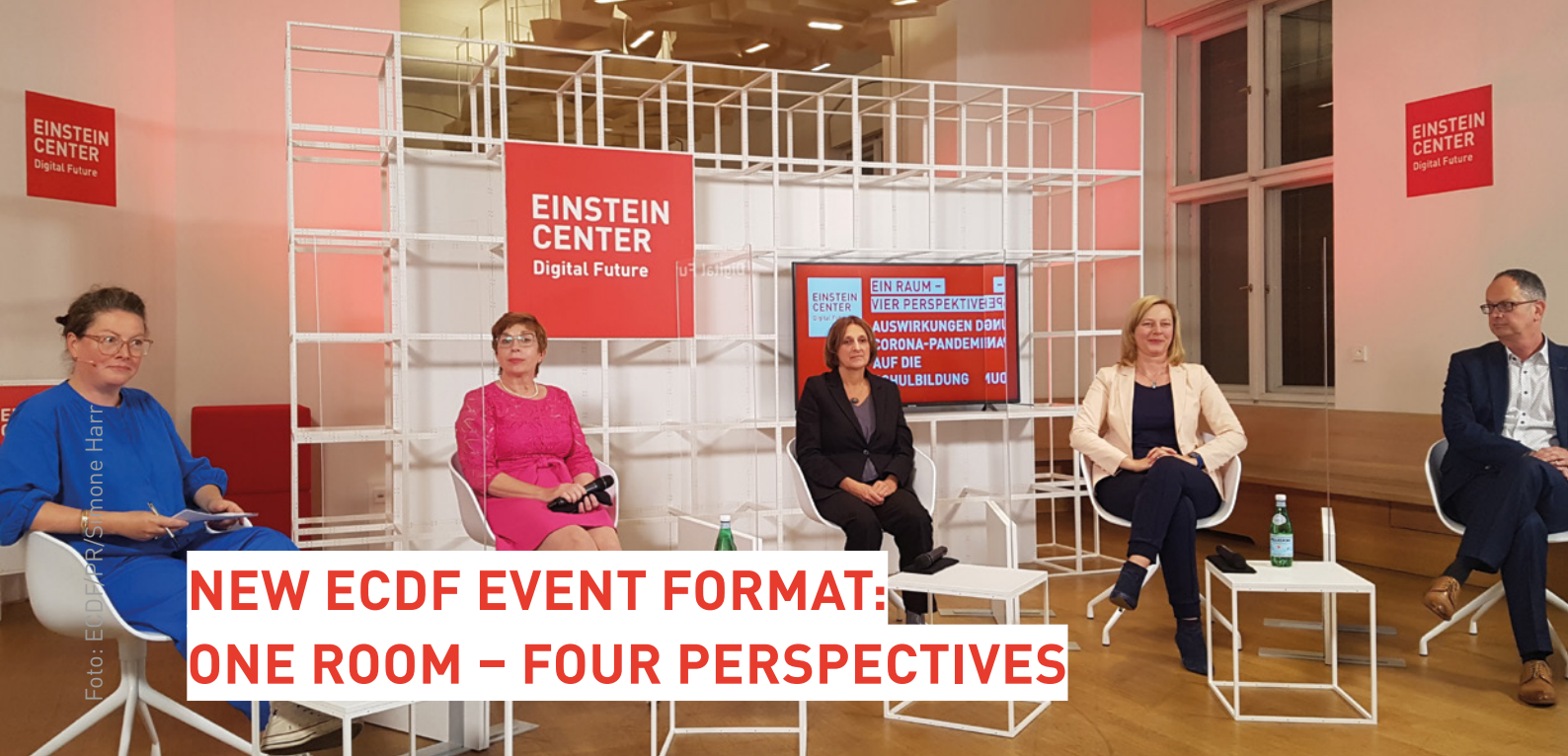
September 2, 2021
ECDF/Online

Current developments in digitalization from various perspectives — this is the theme of the new series of ECDF events "One Room – Four Perspectives". Players from research, business, politics, and civil society come together at regular intervals in a chaired panel discussion. To get things underway in September 2021, the panel guests discussed the effects of the COVID -19 pandemic on school education and the role played by digitalization.

The outbreak of the COVID -19 pandemic at the beginning of 2020 meant large sections of society were at a standstill. This particularly affected the school education of children, who suddenly found themselves doing distance learning and home schooling. In the first round of "One Room – Four Perspectives," we therefore wanted to get together with representatives from research, business, politics, and civil society to discuss the opportunities and obstacles which resulted from the coronavirus pandemic in respect of the digitalization of school education: What effect had (digital) distance learning had on the learning outcome and the development of social skills of the school students? What lessons could be learned from this? What does the digital classroom currently look like? What are the plans for the new school year in respect of the digital infrastructure and digital skills of school students and teachers?

"The ECDF is striving to be a pioneer in the field of digitalization, but also to provide guidance and promote the exchange of ideas. Digital transformation concerns all members of our society, which is why it is important to keep on talking to each other," said Odej Kao, ECDF speaker, on the new format. To reach as many people as possible and facilitate the exchange of ideas beyond the boundaries of the ECDF, the event was streamed live.

The panel members were:

// **Britta Ernst,** Minister for Education, Youth, and Sport of the Federal State of Brandenburg, and President of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany
// **Frank Thalhofer**, Managing Director of Cornelsen Verlag and Chief Didactic Officer Cornelsen Group
// **Prof. Dr. Gesche Joost**, Professor of Design Research and member of the ECDF Executive Board
// **Prof. Susanne Lin-Klitzing**, (National Chair of the Deutscher Philologenverband)

The event was chaired by Katja Weber, journalist and presenter at Rundfunk Berlin-Brandenburg (rbb) and Deutschlandfunk Nova.

One Room – Four Perspectives #2

October 28, 2021
ECDF/Online

Sustainable, digital transformation – can this be done successfully? In the second round of the new ECDF format "One Room – Four Perspectives" on October 28, 2021, four guests again examined their different perspectives on the topic and what they thought was needed for the digital transformation to take place in a sustainable and socially minded way.

The climate crisis was in full swing, the United Nations Climate Change Conference was taking place against a backdrop of protests in Glasgow. Technical innovation and digitalization were often seen as the key to achieving more sustainability and the urgently necessary climate goals — but how were digitalization and sustainability related? This was discussed by ECDF Professor Tilman Santarius, Professor of Socio-ecological Transformation and Sustainable Digitalization at the ECDF and Technische Universität Berlin; Ann Cathrin Riedel, Theme Manager for Digitalization and Innovation at the Friedrich Naumann Foundation; Rainer Karcher, Global Director IT Sustainability at Siemens AG; and Line Niedeggen, speaker of Fridays for Future Heidelberg.

Ann Cathrin Riedel from the Friedrich Naumann Foundation argued for a broader definition of sustainability right at the start of the panel discussion: "We give a lot of thought to climate and resources, but I always try to make clear that we have to shape digitalization so that it protects citizens and human rights in the future as well and facilitates freedoms"; Line Niedeggen, activist at Fridays for Future (FFF), and Rainer Karcher, Head of Global Sustainability at Siemens AG, also agreed that the term was meanwhile being used in a more inflationary way. ECDF Professor Tilman Santarius therefore felt that a new term made more sense: "I prefer to use the term socio-ecological transformation — it is not so catchy, but better emphasizes what this is about: It is not only important to make things so that they are still around in 10, 20, 30 years time, in other words, they are sustainable, or to simply do things a bit better or differently, in the sense of ecological modernization;

the issue is that we really must fundamentally change, transform, do things differently when we produce and consume things," said Santarius.

In the 21st century, civil society organizations such as FFF were organizing themselves via platforms such as Instagram, Twitter, and Facebook, to give their protests on the streets the necessary coverage. "All this needs electricity," explained chair Katja Weber, "is that a contradiction, Ms Niedeggen?" Niedeggen firmly pointed out that although the actions of each individual were important, "it makes no sense for me to do without things, but not generate any political pressure — this is not the way to defeat fossil capitalism, nor to contain the climate crisis. 71% of the emissions are produced by 100 companies, so the amount of electricity I consume in my shared apartment has very little impact," explained the student. And she went even further: "We have to use the structural situations to have a voice in this system in the first place, this system in which we all grew up. Shutting yourself away will not achieve anything!" Niedeggen criticized the fact that the FFF activists and demonstrators were confronted at every demonstration with the demand that they themselves should switch off their cell phones: "If I switch off my cell phone and lock myself away at home, the climate crisis will come nevertheless," said Niedeggen. For her it was important that we learned as a society how this technology could be put to good use.

Tilman Santarius likewise saw the debate as being completely misguided, he thought that two points were particularly urgent: "We should use the digitalization we already have in society as sustainably as possible. This requires us to look at hardware production, which is currently far from being socially or ecologically sustainable; and services as well, for instance apps, also have to become more sustainable. The other question is: What additional digitalization do we need to achieve sustainability goals?"

Rainer Karcher considered that companies had significant opportunities to make an impact here and significant responsibility. Siemens was already sending old hardware such as laptops and smartphones for refurbishment so that the devices could still be used elsewhere – in schools, for instance. He saw this as an example for lived sustainability, with no green-washing. Siemens was involved, among other things, in the resource- and energy-intensive areas of infrastructure, mobility, and medical engineering, and was putting its faith in renewable energies wherever possible. "Siemens wants to be climate neutral by 2030, and we are also working on making the supply chains more transparent," said Karcher. At the same time, decisions for end customers about their consumption had to become simpler and more transparent, Santarius was certain. With his interdisciplinary team of economists, psychologists, sociologists, and staff from other specialist disciplines, he was already investigating a digital solution, the Green Consumption Assistant, which automatically proposed sustainable alternatives when online shopping.

The panel particularly questioned the concept of economic growth and simultaneous compatibility with the climate goals: "We need more digital solutions which free our companies and whole societies from the pressure to achieve growth. This means a good life, good income, good jobs without having always to grow," said Santarius. For Karcher, the rethinking process had already started, even if companies such as Siemens had not completely said goodbye to the idea of growth. While some companies thought they were making good progress, it was clear to Niedeggen what the problem was there: "Ultimately, we will come up against physical limits, no matter whether I personally think that we have already made a lot of progress. We are in the middle of the climate crisis and are not able to have an open and honest discussion about what is really necessary," said the activist in the live stream. Rainer Karcher thought responsibility lay with the companies, but also believed that the transformation had also to take hold in people's minds, and in all social classes, but this had not yet taken place in his view. "Most people do not feel affected by the climate crisis, the political and

business communication here has failed completely," said Line Niedeggen. Tilman Santarius believed that although the transformation was already taking place in people's minds, "It is not enough!". "It is not yet possible to detect a reversal in the trend – structures need to change." Rainer Karcher saw this reversal in trend at Siemens already in the fact that the company was moving away from the concept of intellectual property when the sharing of experiences and data served sustainability.

The participants agreed that the right to repair could make an important contribution to the socio-ecological transformation. Santarius also saw the extension of the warranty, and a modular approach to devices and equipment to make repairs easier to carry out as important steps toward a more sustainable digitalization. For him, it was important to have local contact points near to where people lived which repaired electrical equipment and thus extended the service life.

Although Line Niedeggen thought it was important to keep on talking about little things and the contribution of each and every individual, she felt that "As long as the structural question is not posed and we do not talk about the massive destruction and the massive exploitation, I am not optimistic that we will change much in the short term." Ann Cathrin Riedel stressed at the end that the politicians had to create laws: "We can and must change the system from the political side. Provisions have to be made that I can have equipment repaired, that I can replace my battery, that I have to have modular equipment," explained the Free Democrat. In addition to focusing on the human exploitation which took place when our devices were being manufactured, Riedel again directed the focus onto the exploitation of user data: "One thing is often afforded too little discussion in my view, and this is how human rights are abused when the issue is the generation of data, for instance the use of data from surveillance cameras to improve facial recognition – urgent consideration is needed here. In this case, regulation facilitates freedom." Companies, governments, and civil society had to get round a table and create these standards, said Santarius in conclusion.

ECDF Industry Forum:
Systems Engineering

December 9, 2021
Online

Our everyday life is increasingly characterized by intelligent technical systems and products. These complex systems are developed as a collaborative project involving different disciplines. Systems Engineering (SE) is becoming increasingly relevant as part of the digitalization of various industrial sectors and utilized more and more. What does systems engineering in the digital age look like in concrete terms? At the eighth ECDF Industry Forum on December 09, 2021 – again held online – almost 50 participants discussed the use of systems engineering.

The event started with the welcoming address by Prof. Dr. Odej Kao, speaker of the Einstein Center Digital Future (ECDF), and host Tim Kawalun. Prof. Dr.-Ing. Lydia Kaiser, ECDF Professor of Digital Engineering 4.0 at the ECDF and TU Berlin, then introduced the participants to the topic. Engineering in this context did not mean engineering in the classical sense; in systems engineering it meant all activities which arose from the successful realization and the operation through to the subsequent disposal of systems. This holistic approach used systemic principles, scientific findings, technologies, as well as the associated management methods.

SE was not new, but had been used for decades in major projects in aerospace engineering, for example. Aerospace engineering projects were characterized by great uncertainty, transdisciplinarity, and complexity. Industrial companies now saw themselves confronted with the same or similar factors through the advances in digitalization. "While products used to be mainly mechanical in nature — for instance the automobile or also artificial limbs — today's functions are increasingly being realized with software. The use of artificial intelligence will make the systems even more powerful and complex. This means that development is no longer possible from the point of view of one single discipline. Neither are the methods from individual specialist disciplines sufficient, since they do not take account of the interplay — this is where SE comes in: "When the arms race was focusing on the conquest of space, the application of systems engineering gained momentum," explained Lydia Kaiser. The trigger for this novel collaboration was a problem which was then systemically and systematically solved with a combination of system design and project management. "What people like to describe as Rocket Science is so important for today's companies because they basically want to conquer their own 'space' through digitalization. This differs depending on the problem, of course, with different participants, such as customers, sales, design, software development, or IT security. Thinking in systems is very important when designing the solution, a skill we use to understand complex phenomena as a whole, as a system," said Kaiser.

For companies, this meant that internal transformation was undertaken holistically, and the interplay of organization, people, and technology had to be understood as a system. Fresenius Medical Care had started this process many years ago. In the Industry Forum, Nico Michels, Senior Vice President Engineering Systems at Fresenius Medical Care, reported on his experiences. "With such a process, the emphasis is on collaboration and the subsequent implementation. At Fresenius Medical Care, we have a concept which envisages various digital tools, among them a Digital Twin, the use of a Digital Thread, and Engineering Intelligence, sort of a mixture of model-based systems engineering and artificial intelligence," explained Michels, "and this particularly requires structures without large hierarchies as well as a certain mindset, which results in the work being practical, staff are empowered and feel secure enough to be able to work transparently. It is also important to change oneself and develop the system further." Fabian Ahrendts, Head of Group Systems Engineering at the Volkswagen Group, likewise emphasized that we had to rethink: "We are talking about a mega-transformation here — the organization of new automotive projects looks completely different nowadays than in the past. For this alone we move tens of thousands of developers." Carolin Rubner from

Siemens AG saw a successful transformation primarily in the agile working of all development departments. The experience with this in the software departments had been positive.

In the discussion which followed, experts again emphasized that specific specialist skills were always important, but should always be combined with thinking in systems. Prof. Dr. Rainer Stark, departmental head of Industrial Information Technology at the Technische Universität Berlin, saw a need to catch up particularly in the training of a new generation of engineers: "Many tools are available for the individual digital modelling aspects of systems engineering. But the methodological crux of systems engineering first has to be placed on a more stable footing at the scientific institutions of the universities. This in conjunction with agile procedures and holistic processes will then lead to the emergence of a robust systems engineering competence. Even then, the holistic implementation in industrial practice will still be demanding enough!"

The participants from industry and research made the potential of SE very clear. In the digital era, SE was going to help us bring players from different disciplines together and work out solutions in a holistic and trans-disciplinary way. Not only products could be seen as a system, but the value creation itself as well. The Faculty of Digital Engineering 4.0 was currently exploring how SE approaches could assist in shaping engineering within the companies. If you are interested in this issue, we will be pleased to put you in touch.

EVENTS AT A GLANCE

Datum	Veranstaltung	Art	Ort	Beteiligte Prof.
January 20-26, 2021	Berlin Water Hackathon 2021	Hackathon	Online	Andrea Cominola, Jochen Rabe
January 21, 2021	3# Data Feminism Workshop	Workshop/ Seminar	Online	Rebecca Frank
January 25, 2021	Schaubühne: Prof. Staab in conversation with Heinz Bude	Discussion	Online	Phillipp Staab
January 27, 2021	ECDF Lecture Series ("Digital Future" 2020/2021): Medical Data Science	Lecture	Online	Various
January 28, 2021	Networking Event: Digital innovation in the health sector	Panel Discussion	Online	Various
January 28, 2021	CPDP 2021: Enforcing rights in a changing World	Conference	Online	Max von Grafenstein
January 29, 2021	Tagesspiegel Series: "Play it Safe Digitally!"	Panel Discussion	Online	Max von Grafenstein
February 1, 2021	ECDF Industry Forum #6: Use of AI – Opportunities & Risks for the Future of Work"	Networking Event	Online	Various
February 16, 2021	Web seminar: Digital platforms in middle class	Workshop/ Seminar	Online	Phillipp Staab
February 18, 2021	Gender Data Gap	Workshop	Online	Helena Mihaljević
February 21, 2021	With the Energy Transition into Blackout?	Workshop	Online	Joachim Seifert
February 25, 2021	4# Data Feminism Workshop	Workshop/ Seminar	Online	Rebecca Frank
March 3, 2021	AGAINST//OVER – Debates on the Present	Debate	Online	Phillipp Staab
March 10, 2021	Lunch Session: How has our buying behavior changed in the pandemic?	Networking Event	Online	Tilman Santarius
March 14, 2021	Soup & Science: GenderGap, better traffic planning through movement data and ... Boxes	Workshop/ Seminar	Online	Helena Mihaljević
March 23, 2021	Symposium: Sustainability in Science (SISI)	Workshop/ Seminar	Online	Tilmann Santarius
March 31, 2021	Digital Salon: AI – The last one cleans up the Internet	Lecture	Online	Helena Mihaljević

Datum	Veranstaltung	Art	Ort	Beteiligte Prof.
March 24-26, 2021	DiGiTal: Interdisciplinary Digitization Research	Lecture / Workshops	Online	Helena Mihaljević, Berit Greinke, Michelle Christensen, Florian Conradi, Elisabeth Mayweg
April 12, 2021	TU Berlin for Future – lecture series on climate protection	Lecture / Workshops	Online	Tilman Santarius
April 14, 2021	Workshop: eduhacktory	Workshop/ Seminar	Online	Various
April 19, 2021	Lecture Series "Internet and Privacy"	Lecture	Online	Florian Tschorsch, Max von Grafenstein
April 19, 2021	Open auditorium for all: Thinking (IT) security holistically	Lecture / Workshops	Online	Lars Gerhold, Jochen Schiller
April 20, 2021	Lecture Series: Digitalisation of the working environment	Lecture	Online	Various
April 24, 2021	taz Lab: A change is gonna come	Panel Discussion	Online	Philipp Staab
April 26, 2021	ECDF Industry Forum #7: Digital Health in the Aging Society	Networking Event	Online	Various
April 26, 2021	TU Berlin for Future Lecture series – climate justice and digitalisation	Lecture	Online	Tilman Santarius,
April 27, 2021	KI-Camp: Feminist Approaches in Information Science	Workshop/ Seminar	Online	Rebecca Frank
May 3, 2021	Progressive Economic Policy Day 2021	Workshop	Online	Philipp Staab
May 4, 2021	Textiles and Sound: The Future of Opera?	Performance	Neuköllner Opera / Online	Emmanuel Baccelli, Felix Biessmann, Berit Greinke
May 6, 2021	Lecture series "Digital Education in Focus"	Lecture	Online	Ayad Al-Ani
May 6, 2021	Symposium: European approaches towards a Sustainable Digitalization	Panel Discussion	Online	Tilman Santarius
May 19, 2021	Storytelling in der (Digitalisierungs-)Forschung	Workshop/ Seminar	Online	Various
May 25, 2021	re:publica: Crowdboost Digitalstrategie Berlin	Workshop/ Seminar	Online	Tim Kawalun
June 1, 2021	Workshop: Digital Neighborhood Energy Management	Workshop/ Seminar	Online	Rita Streblow
June 10, 2021	WoWMoM: Prof. Wolisz gives keynote	Conference	Online	Adam Wolisz
June 14-15, 2021	Municipal climate protection: Climate-friendly, digital, future-proof: Conference for districts in climate protection	Conference	Online	Tilman Santarius
June 15, 2021	Workshop: Energy efficiency through digital building with BIM	Workshop/ Seminar	Online	Rita Streblow
June 15, 2021	We Need More: The Platform Economy in the Arab World	Workshop	Online	Ayad Al-Ani

Datum	Veranstaltung	Art	Ort	Beteiligte Prof.
June 16, 2021	The Role of Culture and Museums in the Digital Transformation of MENA Region	Discussion	Online	Ayad Al-Ani
June 17, 2021	Virtual workshop discussion: HR 4.0 and Diversity	Workshop/Seminar	Online	Helena Mihaljević
June 18, 2021	Einstein meets school	Workshop/Seminar	Online	Tabea Flügge, Berit Greinke
June 19, 2021	CVPR 2021: Event-based Vision Workshop	Workshop/Seminar	Online	Guillermo Gallego
June 29, 2021	Digital talent: Mapping the demand for digital skills in Tunisia	Presentation	Online	Timm Teubner, Anastasia Danilov
June 30, 2021	European Commission: Engaging citizens in green digital and fair transition	Presentation	Online	Philipp Staab
July 2, 2021	Actionday with SimRa – Wissensstadt Berlin 2021	Exhibition	Forecourt, Rotes Rathaus	David Bermbach
July 8, 2021	Education and Professional Development in Hydro-Environmental Engineering	Lecture	Online	Andrea Cominola
July 9, 2021	Textile Wearables – Wissensstadt Berlin 2021	Exhibition	Forecourt, Rotes Rathaus	Berit Greinke, Felix Biessmann, Emmanuel Baccelli
July 9, 2021	Science Slam "Climate" – Wissensstadt Berlin 2021	Exhibition	Forecourt, Rotes Rathaus	ECDF Project ide3a
July 15, 2021	People, Routes, Spaces: Who owns the city? – Wissensstadt Berlin 2021	Exhibition	Forecourt, Rotes Rathaus	Michael Ortgiese, Michelle Christensen, Florian Conradi
July 20, 2021	RBB Talking Science – Measurement data and AI for better medicine	Exhibition	Forecourt, Rotes Rathaus	Tobias Schäffter
July 27, 2021	Smarter, greener, more digital? – Wissensstadt Berlin 2021	Exhibition	Forecourt, Rotes Rathaus	Tilman Santarius
August 7, 2021	Future Security Lab – Wissensstadt Berlin 2021	Exhibition	Forecourt, Rotes Rathaus	Future Security Lab
August 18, 2021	Health in the City	Workshop	Online	Thomas Schildhauer
August 25, 2021	Berlin Open Data Day	Hackathon	Online	ECDF Project ide3a
September 2, 2021	One Room – Four Perspectives (1R4P): Covid-19, school education and the role of digitalization	Streaming Event	Hybrid event ECDF	Various
September 7, 2021	Human Rights 4.0? Artificial Intelligence and the Prohibition of Discrimination	Panel Discussion	Deutsches Hygiene-Museum, Dresden	Gesche Joost

Datum	Veranstaltung	Art	Ort	Beteiligte Prof.
September 11, 2021	Symposium: The civil society of the future	Conference	Online	Ayad Al-Ani
September 14-17, 2021	International Conference: Politics of the Machines	Conference	Online	Michelle Christensen, Florian Conradi
September 15, 2021	DataDay online: Data Protection & Digital Education	Streaming Event	ECDF	ECDF-Partners
September 23, 2021	DAAD election observer trip in ECDF	Discussion	ECDF	Tilman Santarius
September 26, 2021	TEDxTUBerlin: Switching Stances	Presentation	Spindler und Klatt, Berlin	Tilman Santarius
September 27, 2021	INFORMATIK 2021 – Computer Science & Sustainability	Conference	Online	Tilman Santarius
September 29, 2021	Presence, digital, blended, hybrid? University learning and teaching	Workshop/ Seminar	Online	Elisabeth Mayweg
October 3, 2021	Algorithms for the common good	Podcast	Online	Philipp Staab
October 6, 2021	AK Smart City / Smart Region: Der urbane Digitale Zwilling	Workshop	Online	Lydia Kaiser
October 6, 2021	FreeMove Workshop: Personal Mobility Data	Workshop/ Seminar	CityLab Berlin	Helena Mihaljević
October 14, 2021	Keynote: Digital Society – Between Utopia and Dictatorship	Conference	Online	Gesche Joost
October 18, 2021	Futuring the Liberal Script #4 Automatization and the Future of Work	Conversation	Online	Philipp Staab
October 19, 2021	Exhibition Berlin – Capital of Researchers	Exhibition	Rotes Rathaus, Berlin	Gesche Joost,
October 25, 2021	Semifinals: Global EdTech StartUp Awards	Ceremony	ECDF / Online	ECDF-Partners
October 27, 2021	Visions for a Digital Europe 2025	Conference	Online	Tilman Santarius
October 28, 2021	1R4P: Sustainable digital transformation? – Opportunities and risks for people and the climate	Streaming Event	Hybrid event ECDF	Various
October 28, 2021	Symposium: E-commerce Platforms and Trust Cues in the Maghreb	Symposium	Online	Timm Teubner, Anastasia Danilov
November 3, 2021	Airbnb, Uber, Lieferando: The Future of the Economy?	Panel Discussion	Hybrid event, Weizenbaum Institute	Philipp Staab
November 4, 2021	AckerKonferenz 2021	Conference	Online	Tilman Santarius
November 5-6, 2021	Cornelsen Impulses	Streaming Event	Hybrid event ECDF	ECDF-Partner
November 9, 2021	Hackathon: DigEduPrimer	Hackathon	Online	Daniel Hromada

Datum	Veranstaltung	Art	Ort	Beteiligte Prof.
November 9-11, 2021	Alumni Workshop "Tearing Down Walls in the Global South"	Workshop	Hybrid event ECDF	Simone Harr
November 11, 2021	Inaugral Workshop DIGIOP "Regulatory and technical requirements of patient-centered and digitally-supported medical care"	Workshop	Weizenbaum Institute	Daniel Fürstenau
November 15-17, 2021	EuroCities Conference "Social Affairs Forum"	Streaming Event	Hybrid event ECDF	Johann-Christoph Freytag
November 18, 2021	"Keynote: Crypto Currencies in the modern monetary system / 7. Werkstatttag des Netwerks Strategische Vorschau"	Workshop	Federal Agency for Security Policy	Anna Almosova
December 1, 2021	Workshop "Future of Work & Leadership"	Workshop	ECDF	Anastasia Danilov
December 9, 2021	ECDF Industry Forum #8: Systems Engineering in the Digital Age	Online	Online	Lydia Kaiser
December 13, 2021	Lecture series: Searching for traces	Lecture	Bibliotheca Albertina, Leipzig	Meike Hopp

/ SCIENCE COMMUNICATION

/ KNOWLEDGE TRANSFER / EXHIBITIONS / TOURS / WEBSITE / SOCIAL MEDIA / TRANSPARENCY / NEWSLETTER / MEDIA INFORMATION / #DIGITALFUTURE

ECDF/PR/Felix Noak

SCIENCE COMMUNICATION

The digital transformation affects all areas of our lives. The ECDF's goal is to involve all people in this digital transformation and to contribute to shaping a shared vision of society. We want to involve people from different backgrounds in discourse: about technologies, about the goals of digitalization, and about issues that affect the foundations of the principles of today's society. Science communication therefore has a high priority for the ECDF.

//ONLINE

Online communication plays an important role in the ECDF's science communication portfolio. For this purpose, we use various channels to reach the specific target groups: All information about projects, events, publications, and other activities that are for partners and the public are published on our website www. digital-future.berlin and simultaneously posted via the social media platforms Twitter (@ECDigitalFuture) and LinkedIn. We use the hashtag #digitalfuture. More traditional communication channels include a newsletter, internal email distribution lists, and instant messaging via Slack.

//WEBSITE

The website was relaunched in 2019 with a bilingual version and has become a key element of communication. The website informs partners and interested citizens about our vision, goals, and current research and allows them to contact us. Current research projects are presented and professors comment on current developments in digitalization. The COVID -19 pandemic also had an impact on our professors' research projects. The website served as a venue to make this research available to the widest possible audience. Science communication was shown to be highly important during the pandemic. The ECDF has responded to this thirst for information by providing free scientific information. In the news section, users can find the latest developments about scholars and research projects.

Here users will also find a review of events and the scientific findings discussed at these events even for

those who were unable to attend. The event section is continuously updated. Here you can find information about events organized by and at the ECDF as well as external events involving professors, associated members, alumni, or Board members with keynotes, lectures, and similar activities. For reasons of transparency, the website also contains documents such as bylaws, rules, guidelines, and statements.

The latest Twitter posts from @ECDigitalFuture are automatically embedded in the homepage. Under the category „When I look into the digital future, …" players from science, society, business, and politics share their views on the digital transformation. All events, press materials, and press releases since the opening of the ECDF are available in an archive.

//SOCIAL MEDIA

Twitter is currently the most important social network in the field of science communication. On the ECDF Twitter channel, we present scientific content from our researchers and announce our own events as well as external events in which our professors are involved, such as conferences. In addition, media appearances by our professors are also announced here, such as interviews, commentaries interviews, comments, or references in newspapers, magazines, radio shows, and podcasts. We can also use Twitter to inform ourselves about and share the activities of our partners and other digitalization initiatives. As of November 24, 2021, we had 2,429 followers.

Twitter as a communication medium is very fast-paced and is therefore short-lived. It allows only very short posts, which is why we use it more often than other channels but do not provide in-depth analysis on current issues. To provide more in-depth analysis, we started using the LinkedIn networking platform in 2021. It allows us to share longer content while reaching a different audience: Industry partners and professionals.

The social network platform for maintaining existing business contacts and making new connections has a wide global reach – with a particular focus on the European regions. LinkedIn provides us with a great way to network with our donors from the private and public sectors. We publish events on the platform that are of particular interest to our partners – such as the ECDF Industry Forum or the „One Room, Four Perspectives"

format. In addition, the ECDF was able to establish various contacts for further collaborations – including with the Science and Start-ups initiative.

Thanks to the close exchange with the press offices of the Berlin universities, the Charité – Universitätsmedizin Berlin, and our partners, we can communicate on their channels as well as our own social media channels.

For example, TU Berlin publishes event announcements or new ECDF research projects via its Facebook account (44,181 followers, November 2021) and Instagram account (32,700 followers, November 2021). In this way, and through coordinated sharing and liking, we can significantly increase the reach of the ECDF through our partners.

//SLACK

Slack is a web-based instant messaging service for teams. The collaborative software provides fast and direct communication through open and closed channels. At the ECDF, we have extra channels for ECDF Professors, the Women* in STEAM Initiative, the Micro Factory, and the Management Office. We use the chat program as a tool for direct exchange between professors and with the Management Office. In addition, it offers the possibility to publish calls for project proposals, job postings, cooperation requests, and daily updated information.

//NEWSLETTER

The ECDF newsletter is published about six times a year and reaches about 1,000 interested citizens, industry partners, researchers, and journalists. It is an additional tool to provide our network with more detailed interviews with professors about their research as well as announcements about upcoming events. The newsletter is a great tool in addition to the website and our social media, as it allows us to send content to our network's email inboxes without them having to actively search for our content online. The distribution list contains almost exclusively people who have actively subscribed to our newsletter. In this way, we can ensure that only those people who are interested in the newsletter receive it. In addition to the reviews and event announcements, the newsletter has had a new section since the beginning of 2021: In the „ECDF@Home" section, we provide readers with a personal recommendation from one of our professors, such as a book, a program, or a podcast,

to bring professors closer to the recipients and provide readers with interesting and hopefully new ideas.

//MEDIA INFORMATION, IDW

The ECDF uses press releases to inform interested journalists about current developments in research and relevant events. This is done in close coordination with the press offices of the respective universities, which also distribute the press releases through their various channels. Besides contacting journalists individually, the ECDF also disseminates information via Informationsdienst Wissenschaft e.V. (idw), which offers an internet platform that bundles press releases and event announcements from around 1,000 scientific institutions: Universities, universities of applied sciences, governmental and non-governmental research institutes, research funding agencies, and science administration. It is accessible to journalists and offers the most comprehensive sources for science news in the German-speaking world.

//MEDIA MONITORING

To keep up to date with the current discourse on digitalization and media coverage about the ECDF and our professors, we use a media service provider that monitors print, radio, and TV publications for relevant information. We have been monitoring reporting on the ECDF with Cision since the spring of 2021. We use the results to internally evaluate the quality of our press relations.

In addition to traditional media monitoring, Cision's tool also allows us to identify suitable journalists for future press relations and events.

//ECDF TV-STUDIO

Since the onset of the COVID -19 pandemic, most events have moved to the internet, and the ECDF is no exception. In the fall of 2020, when it became clear that COVID -19 restrictions would continue to affect event operations for the foreseeable future, the ECDF developed a concept for creating a television studio in the Robert Koch Forum.

The studio ensures the implementation of high quality and professional online and hybrid events. It was important for us to stay within the corporate design of the ECDF and to give the participants and guests the feeling that they were in the ECDF's large event space. Professors and partners of the ECDF can use the TV studio for their own events. From recording a keynote to streaming digital events to moderating a discussion from a TV studio, there are many possible uses.

Various formats have already been streamed from the TV studio. These include the ECDF discussion format „One Room - Four Perspectives," the international conference „Social Affairs Forum 2021," and the Data Privacy Foundation's Data Dialogue.

/ COMMITTEES AND GOVERNANCE

/ EXECUTIVE BOARD / SCIENTIFIC ADVISORY BOARD / INDUSTRY PARTNERS / MANAGEMENT OFFICE / PUBLIC-PRIVATE PARTNERSHIP

ECDF/PR/Samira Franzel

EXECUTIVE BOARD

The ECDF Executive Board is responsible for the strategic development and scientific direction of the research areas, for the coordination and support of collaborative activities, for the allocation of resources within ECDF, and for the scientific research program, including decisions on changes to the overarching research agenda involving the addition or removal of research topics.

The committee also decides on the admission of further members such as Ambassadors, Fellows, Associated Members, Principal Investigators, or Visiting Scholars. The Board also reviews and makes decisions regarding the addition of new professorships and funders to ensure that additional research directions are consistent with the ECDF's overall vision. The members develop the ECDF's positions on various topics such as open access, digitalization in education, or guidelines for equal opportunities.

The Executive Board consists of a total of 11 members and is composed of:

// The speaker,
// Four Executive Board members who are professors at one of the managing institutions (TU Berlin, FU Berlin, HU Berlin, UdK Berlin, Charité) and are not funded by the ECDF ("Area Speakers"),
// Four Executive Board members who are ECDF Professors and are co-speakers of one of the areas,
// One Executive Board member who is a professor at a partner university,

// One Executive Board member who is appointed by the Landeskonferenz der Frauenbeauftragten an Berliner Hochschulen und Universitätsklinika des Landes Berlin (LaKoF),
// The Managing Director, who attends all meetings in an advisory capacity.

The Executive Board usually meets on a monthly basis. Due to the pandemic, the meetings have been held as an online video conference since April 2020, and this format continued in 2021. The closed meeting in October 2021 was held on site at a conference hotel in Potsdam. Together with the international Scientific Advisory Board (SAB), the Executive Board members implement the governance and quality assurance strategy and define KPIs and milestones to continuously review and manage the Center's vision and mission.

In 2021, the regular elections of the ECDF Executive Board took place. Newly elected as representatives of the ECDF Professors were: Prof. Dr. Tabea Flügge (Charité) and Prof. Dr. Anastasia Danilov (HU Berlin). Prof. Dr. Berit Greinke (UdK Berlin) and Prof. Dr. David Bermbach (TU Berlin) were re-elected.

The two long-standing members of the Board, Prof. Dr. Dr. Felix Balzer (Charité) and Prof. Dr. Christian Meske (FU Berlin), did not choose to stand again and left the Board.

The PIs elected Prof. Dr. Odej Kao (TU Berlin) as Speaker of the Executive Board. Re-elected as representatives of the PIs were: Prof. Dr. Gesche Joost (UdK

Berlin), Prof. Johann-Christoph Freytag, PhD (HU Berlin), Prof. Dr. Jochen Schiller (FU Berlin), and Prof. Dr. Axel Radlach Pries (Charité).

In the summer of 2021, there was also a rotation of the representative of the participating universities (HTW Berlin University of Applied Sciences and Berliner Hochschule für Technik). Prof. Dr. Juliane Siegeris (Professor of Software Engineering, HTW Berlin) was succeeded by Prof. Dr. Agathe Merceron (Berlin Hochschule für Technik) as a new member of the ECDF Board.

The members of the Executive Board are:

// Speaker:
   Prof. Dr. Odej Kao

// Digital Infrastructures, Methods, and Algorithms:
   Prof. Dr. David Bermbach

// Digital Industries and Services:
   Prof. Dr. Anastasia Danilov

// Digital Health:
   Prof. Dr. Tabea Flügge

// Digital Infrastructures, Methods, and Algorithms:
   Prof. Johann-Christoph Freytag, PhD

// Digital Humanities and Society:
   Prof. Dr. Gesche Joost

// Representative of the LaKoF:
   Dr. Christine Kurmeyer

// Representative from the universities of applied science:
   Prof. Dr. Agathe Merceron

// Digital Health:
   Prof. Dr. Axel Radlach Pries

// Industry and Services:
   Prof. Dr. Jochen Schiller

Privat

PROF. DR. AGATHE MERCERON

New member of the ECDF Executive Board

Prof. Dr. Agathe Merceron is a new member of the Einstein Center Digital Future's Executive Board. Since August 2021, the professor of computer science at the Berlin University of Applied Sciences (BHT) has represented the partner universities. Merceron succeeds Prof. Dr. Juliane Siegeris from the Berlin University of Applied Sciences in the rotation.

For over 20 years, Merceron has been conducting research in computer science with a focus on technology enhanced learning, educational data mining, and learning analytics. Her research focuses on figuring out how we can better understand and improve learning and teaching by analyzing digital data from education. In an interview, she talks about her new role:

What makes the ECDF special to you and what would you like to be involved with during your time on the Board?
Merceron: Digitalization and digitalization research are my world, and I find the ECDF's interdisciplinary approach particularly exciting. Since I'm only joining now, I don't know the ECDF inside and out, but have an external view and can bring my accumulated experience to bear when it comes to how things can continue for the ECDF and digitalization research in the coming years and decades. I am especially looking forward to that.

Interdisciplinary collaboration is at the core of the ECDF – where do you see the added value here in the area of digitalization and what experience have you yourself gained in interdisciplinary work?
Merceron: For me, the greatest advantage of interdisci-

plinary work is the creativity that unfolds. This creativity is urgently needed because no sector can do without digitalization. We need new solutions and new approaches to our life together.

I came to interdisciplinary research rather by chance: When I worked at the University of Sidney, I first came into contact with the combination of computer science and didactics: Colleagues had developed a completely new method for teaching programming and published about it. A little later I got into the field of data mining, also rather accidentally. The combination of all three areas suited me and shaped my research afterwards.

Of course, interdisciplinary work also brings challenges and often you first have to agree on the same vocabulary. Scholars from different disciplines often use the same words, but mean different things, so you have to work your way into the topic.

In 2015, you were presented with the Teacher of the Year award. What do you find most important in teaching and how has COVID-19 changed the way you teach?
Merceron: For me, one thing is particularly important: I want the students to understand what I say. If I'm talking and the students can't follow me, then I'm missing the purpose. As a professor, you teach and learn with students. They often ask things you're not prepared for – that's the best part of teaching.

My favorite is actually the concept of the flipped classroom: Instead of receiving teacher-centered lessons

from me, the students learn the content at home. The class time is then more focused on application, transfer, and collaborative learning. I use breakout rooms for this when teaching online. This kind of teaching is of course more time-consuming – materials have to be prepared and compiled in advance so that the students are able to acquire knowledge themselves – in addition, the pace and content of the seminar have to be adjusted depending on what was understood at home and what was not understood. In my eyes, however, it has the decisive advantage in that much more knowledge actually sticks.

Because of COVID-19, much of teaching is purely digital, and I'll be honest, human interaction comes up short:

Simply talking to the person sitting next to you during the break is no longer necessary, you no longer know each other – that is an element that is also important, though. I therefore hope that we as a society will agree on a mix between digital and analog formats.

I want to support digital scientists and artists on their way to a professorship. I see synergies above all in the stronger networking of the participants, since joint research can improve individual career paths as well as the visibility of research results.

Members of the Scientific Advisory Board

The members of the Scientific Advisory Board (SAB) are internationally recognized experts who conduct research in the field of digitalization and have a focus on one or more ECDF research areas. Since October 2021, the SAB has consisted of eight members who meet at least once a year to review progress, advise the ECDF on its future development, and guide the professional and scientific development of ECDF professors. SAB members also help to foster collaboration with other research institutions and organizations and develop the formulation of medium- and long-term goals related to the global development of digital transformation.

The members of the SAB are:

// Chair:
Kristina Höök, KTH, Stockholm, Sweden
// Co-Chair:
Wolfgang Wahlster, DFKI, Germany
// Members:
Peter Apers, University of Twente, Netherlands Søren Brunak, University of Copenhagen, Denmark Juliane Fluck, University of Bonn & ZB MED Informa- tion Center for Life Sciences, Germany Hans Hansson, University of Mälardalen, Sweden Iwona Miliszewska, University of Technology Sydney, Australia

MANAGEMENT OFFICE

The ECDF Management Office is located in the Robert Koch Forum. She supports the Executive Board and the ECDF Professors and is responsible for the operational and strategic development of the ECDF. It not only acts as the administrative backbone, but is also responsible for internal and external communications. The members of the office continuously develop the ECDF further – be it through the establishment of the Micro Factory, the development of new event formats, or the redesign of the co-working spaces. The office works closely with TU Berlin as the head university in administrative matters.

Die Geschäftsstelle setzt sich aus den folgenden Positionen und Personen zusammen:

// Managing Director:
Simone Harr

// Press & Public Relations:
Samira Franzel

// Events and Cooperations:
Tim Kawalun

// Interdisciplinarity and Open Labs:
Friedrich Schmidgall

// Graduate program and teaching:
Nina Reinecke

// Finance:
Anja Hertel
Jennifer Friese

// Secretary:
Ursula Menzel

// Student assistant:
Romina Artero

PUBLIC-PRIVATE PARTNERSHIP

The ECDF is financed by industry, non-university research institutions, and the state of Berlin. This is made possible by the public-private partnership model, which is unique in Germany.
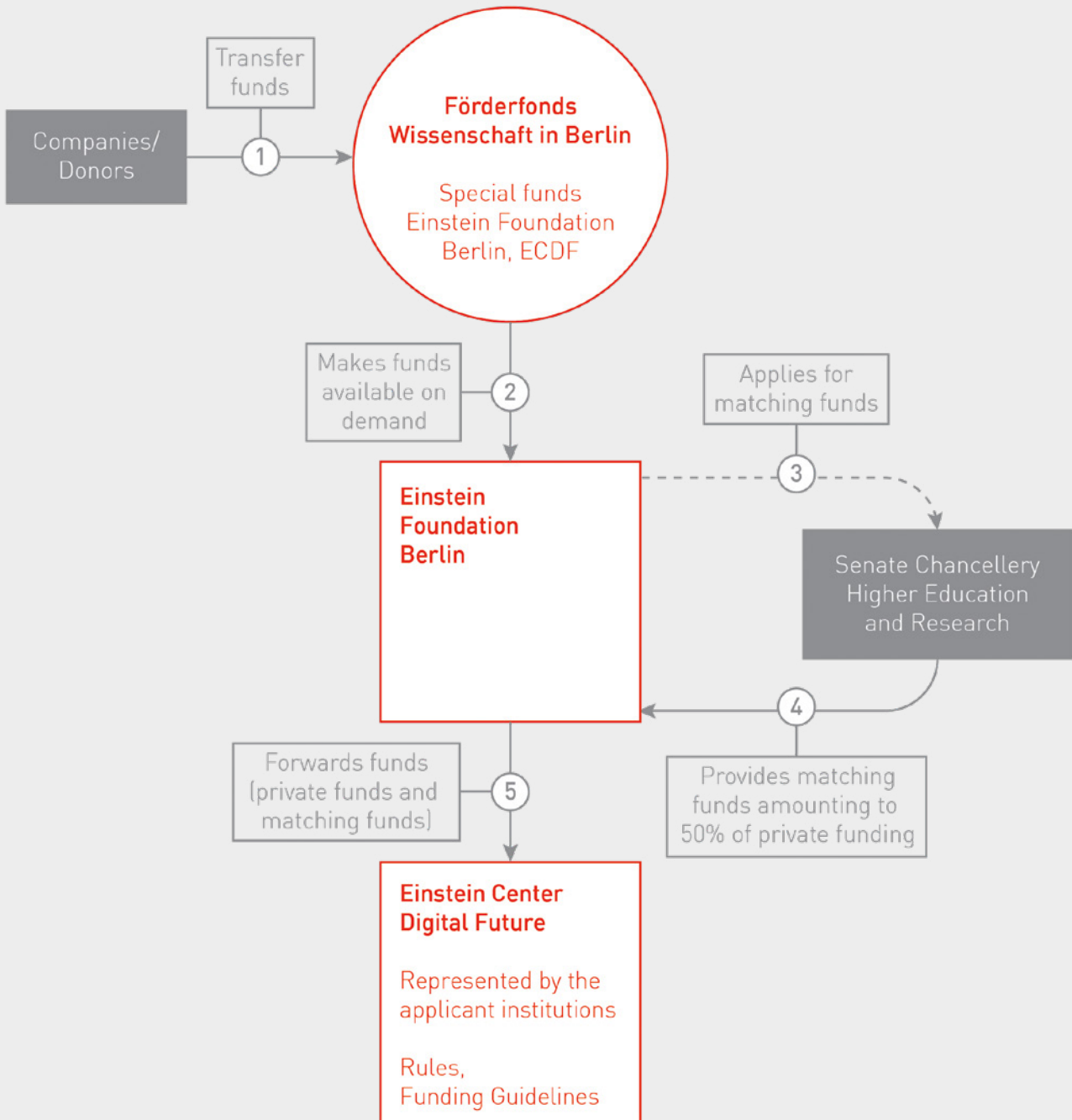
In addition, more than 20 companies participate in the initiative. From them, more than 12 million euros flow into financing the professors during the project period. The companies include Amazon, Berliner Sparkasse, Berliner Verkehrsbetriebe, Berliner Wasserbetriebe, Bundesdruckerei GmbH, Commerzbank-Stiftung, Cornelsen Verlag, Daimler Fonds im Stifterverband, Deutsche Kreditbank AG, Deutsche Telekom AG, Elsevier B.V., GESOBAU AG, HOWOGE Wohnbaugesellschaft mbH, Roche Pharma, Santander Consumer Bank AG, Siemens AG, Viessmann Werke GmbH & CO KG, and Zalando SE.

The state of Berlin adds 50 cents for every euro raised from privately financed companies – these are the „matching funds." In addition, the Federal Ministry of Labour and Social Affairs and the Federal Ministry of Education and Research each contribute funding for one professorship.

Further partners are the Berlin Institute of Health (BIH), the German Research Center for Artificial Intelligence (DFKI), Fraunhofer FOKUS, the Fraunhofer Heinrich Hertz Institute (HHI), the Fraunhofer Institute for Reliability and Microintegration (IZM), the German Aerospace Center Berlin (DLR), and the Physikalisch-Technische Bundesanstalt – Institut Berlin (PTB).

Funding is provided by the Einstein Foundation Berlin. It receives the corporate donations via the Stifterverband and applies for the corresponding matching funds from the state of Berlin. TU Berlin as contractual partner of the Einstein Foundation Berlin receives all private and public funds and forwards them to the other partners involved in the Center.

Transfer
funds

1

Companies/
Donors

**Förderfonds
Wissenschaft in Berlin**

Special funds
Einstein Foundation
Berlin, ECDF

Makes funds
available on
demand

2

Applies for
matching funds

3

**Einstein
Foundation
Berlin**

Senate Chancellery
Higher Education
and Research

4

Forwards funds
(private funds and
matching funds)

5

Provides matching
funds amounting to
50% of private funding

**Einstein Center
Digital Future**

Represented by the
applicant institutions

Rules,
Funding Guidelines

/ IMPRINT AND LEGAL NOTICE

IMPRINT