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■ **DATE IS A** leading international event providing unique networking opportunities. The conference brings together designers and design automation users, researchers, and vendors, as well as specialists in hardware and software design, testing, and manufacturing of electronic circuits and systems—from system-level hardware and software implementation down to integrated circuit design.

Almost four years had passed since we closed the doors on the last in-person edition of the DATE conference. With three online editions due to COVID-19 and in anticipation of a return to a full in-person format, the DATE Sponsors Committee felt that the conference needed to put interaction, as well as reinforcing and rebuilding links in the community, at the heart of the event. In this spirit, the postpandemic 2023 edition of DATE had a substantially reworked format intending for significant added value for in-person participation, with more focus on interaction and condensed down to three days. The intent was that, in this way, the community could actually do what DATE is for meeting, discussing, and exchanging the latest progress in design and design automation.

The 26th DATE conference was held at the Flanders Meeting and Convention Center in Antwerp, Belgium, from 17 to 19 April 2023 and offered an exciting, wide-ranging technical program.

New format

The biggest change implemented for DATE 2023 was the introduction of interactive technical sessions. With the duration of the conference being reduced from five to three days (in an effort to provide three fully packed days and make them count, rather than to stretch everything throughout an entire week), we could not accommodate "classical sessions" anymore, that is, sessions in which *each* paper is presented by a 30-minute slot. Instead, we introduced a renewed format of technical sessions focusing on live interactions (in addition to the common full-length presentations available before, during, and after the conference by video).

More precisely, the new sessions were structured as follows.

· Pitches of the regular papers with six pages in the proceedings (hard time limit of 3–minutes, max. 2–3 slides).
· A brief announcement of the presentations of extended abstracts (i.e., papers that were

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accepted for presentation with a two-page summary in the proceedings).

· The actual interactive technical presentations by the authors.

For the interactive presentations, we provided all presenters with dedicated stations where they were able to put up a poster, but also any further material, demonstrators, short videos, backup slides, or anything further which helped them to promote and/or trigger interest in their work.

Obviously, this required a new way of thinking for authors/presenters and session chairs. Authors/presenters had the most important role in making this new format a success. Hence, we particularly encouraged them to start planning their interactive presentation early and to think out of the box. The interactive technical presentations were intended to be much more than just a poster session and we explicitly pushed the authors/presenters to be creative. Similarly, being a session chair at DATE 2023 was substantially different than in previous years (or at other conferences). It involved more than reading author biographies and announcing the next speaker and was actually about making connections and getting the audience engaged. Accordingly, we held explicit preparation and kickoff meetings with the authors/presenters and session chairs, respectively.

Furthermore, it was crucial to properly communicate this new format to the community (and particularly emphasize the benefits). We pushed information out via the Call for Papers, the webpage, and many direct communications with the involved players. Also, physical attendance was key. Hence, we decided very early on that there would be *no* virtual option and no hybrid solution—every paper had to be presented physically! In a time in which COVID-19 restrictions were still in place in some countries/institutions, this was a risky move. However, thanks to clear and early communication, we managed (together with the authors) to find alternative presenters in most of the cases in which the originally planned speaker could not come—leading to a very low number of no-shows.

Through these efforts, we succeeded in creating an event that really brought the community together. Attendees did not only passively listen to talks, but engaged with the presenters. Session rooms turned from places in which a single speaker unidirectionally talks to the audience to lively and interactive exchange areas in which dozens of researchers discussed the presented approaches and created new ideas in a joint fashion (Figure 1). Still, it was important to understand whether the attendees really liked the new format. After all, the new format was a huge change compared to what the community was used to. Accordingly, we were very relieved to see the rather positive feedback obtained after the conference (see the summary of survey results later in this article). Even though some details probably still can be "fine-tuned," we consider the new format a success and plan to follow similar paths in future editions.

Program

With the opening ceremony (Figure 2), which was held on Monday morning, the 2023 edition of DATE officially opened its doors and kicked off with a plenary keynote lecture given by Edith Beigné, research director of AR/VR Silicon at Meta Reality Labs, U.S., who gave insights into "Building the Metaverse: Augmented reality applications and integrated circuit challenges." The second plenary keynote lecture, complementary to the first and also part of the autonomous systems design initiative, was given by Dirk Elias, senior vice president Robert Bosch GmbH, DE on "The Cyber-Physical Metaverse—Where digital twins and humans come together."

The main conference program (Figure 3) of the conference included 23 interactive technical sessions and 11 sessions covering Best Paper Award candidates. All sessions were organized in parallel tracks from the four areas (D—design methods and tools, A—application design, T—test and dependability, and E—embedded systems design).

As always, the presented papers were selected through a rigorous review procedure. Out of a total of 1,069 abstract submissions, 834 full research papers eventually went into review. With the help of the 356 members of the Technical Program Committee, who carried out 3,144 reviews (mostly four reviews per submission), 205 papers (25%) were finally selected for regular presentation, and 78 additional submissions (cumulatively 34%, including all papers) for presentation as an extended abstract. We would like to sincerely thank all members of the Technical Program Committee for their efforts on this demanding task!

Figure 1. DATE 2023: keynotes, PhD Forum, interactive technical sessions. All photographs: DATE 2023. Copyright: Cruz Garcia.

Our thanks also belong to all authors and presenters who provide the very foundation of DATE. Authors from all submitted papers covered representatives from the three main world regions: 36% from Europe—Middle East-Africa, 30% from the Americas, and 34% from Asia. Overall, all submissions involved more than 2,600 authors from 33 different countries—a distribution that clearly demonstrates DATE's international character, global reach, and impact.

In parallel with the technical program, several new or revised activities were scheduled. Two late breaking result sessions presented breakthrough approaches: novel orthogonal research directions and results on "Novel computing paradigms" and "New ideas for low power and reliable computing." There were also papers covering results and lessons learned from multipartner projects addressing the DATE 2023 topics. Two unplugged sessions around the "Digital-X" theme featured direct "electronics-free" exchanges to formulate timely challenges as problems and find inspiration for solution approaches. In addition to the plenary keynotes, the keynote speakers also engaged in in-depth discussion after the presentations with the audience in dedicated "Later … with the keynote speaker" sessions. This was perhaps best exemplified after the IEEE CEDA distinguished lecturer lunchtime keynote given by Jan Rabaey, professor at the University of California at Berkeley and Chief Technology Officer (CTO) of the System-Technology Co-Optimization (STCO) Division of IMEC, on "Restoring the magic in design" with an exciting discussion on the past, present, and future of EDA.

In addition, we offered several focus sessions on hot topics, including: embracing uncertainty and exploring nondeterminism for efficient implementations of machine-learning models; open-source hardware technologies; EDA for silicon photonics; the past, present, and future of chiplets; cross-layer design for the predictive assessment of technology-enabled architectures; new perspectives for neuromorphic cameras: algorithms, architectures, and circuits for event-based CMOS sensors; sustainable chip production; different ways to seek funding from European Chips Act;
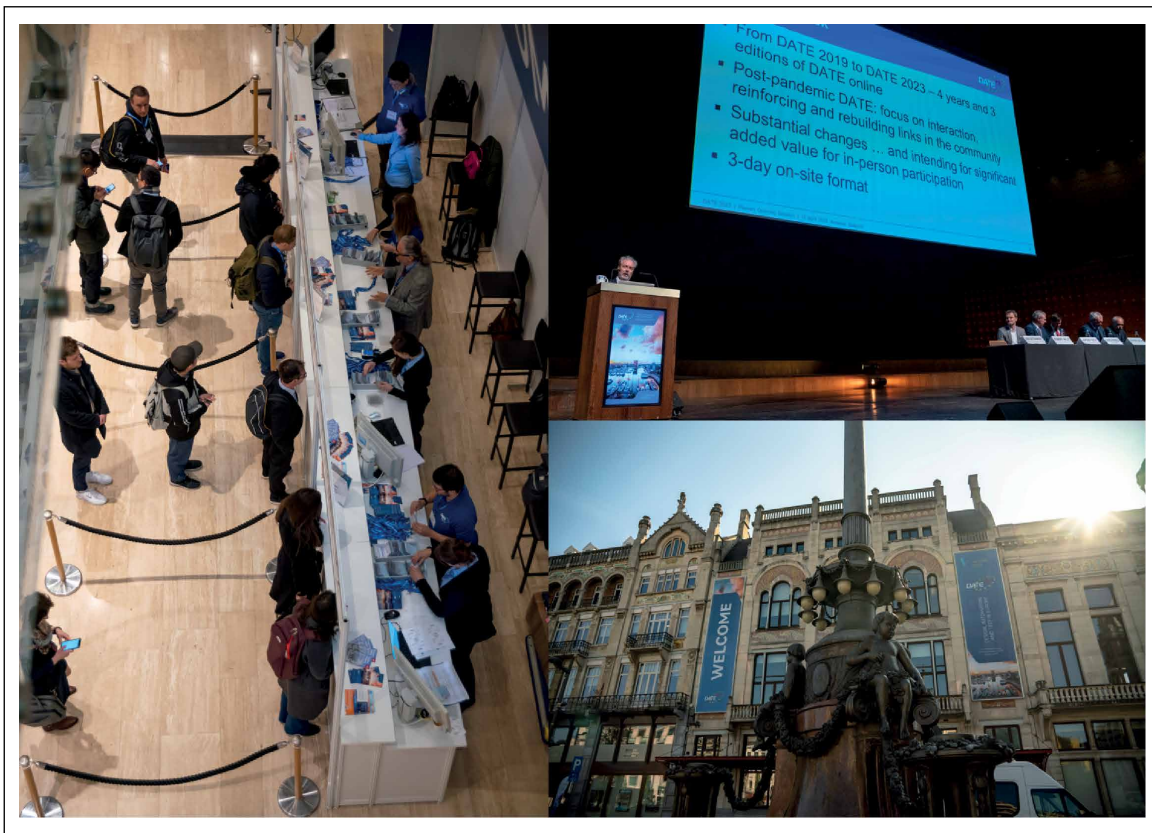
Figure 2. DATE 2023: registration, opening ceremony, and venue—Flanders Meeting and Convention Center in Antwerp, Belgium. All photographs: DATE 2023. Copyright: Cruz Garcia.

learning-oriented reliability improvement of computing systems from transistor to application level; and smart additive manufacturing: fabrication and design (automation).

Two special days in the program focused on areas bringing new challenges to the system design community: human–artificial intelligence (AI) interaction and personalized medicine. Each of the special days had a full program of keynotes and technical presentations.

The special day on human–AI interaction focused on how computing systems are becoming increasingly entangled with the physical world, such that keyboards and screens are no longer the only way to communicate between humans and computers. More "natural" ways to communicate such as voice commands, analysis of the environment, and imaging are increasingly widespread, thanks to the progress of AI. To further enhance communication and understanding between humans and machines, the next step for computing systems will be to enable

a more precise evaluation of all implicit communications, including emotions. In exchange, they should provide more natural, human-like responses, in a trustworthy way. The goal of this special day on human–AI interaction was to show the latest developments in this field, including "emotional systems," but also to present the corresponding ethical aspects. A particular highlight of the day was the lunchtime keynote given by Catherine Pelachaud of CNRS-ISIR/Sorbonne Université, who discussed "Interacting with Socially Interactive Agent."

The special day on personalized medicine covered new trends in this new frontier for healthcare combining genomics, big data analytics, and population health. The field aims to improve diagnosis and tailor treatment to the individual patient's biological and clinical profile, as well as supporting individual preventive healthcare decisions to increase the quality of life. These profiles are obtained through biomarkers, which are objectively measured indicators of normal and pathogenic biological processes and
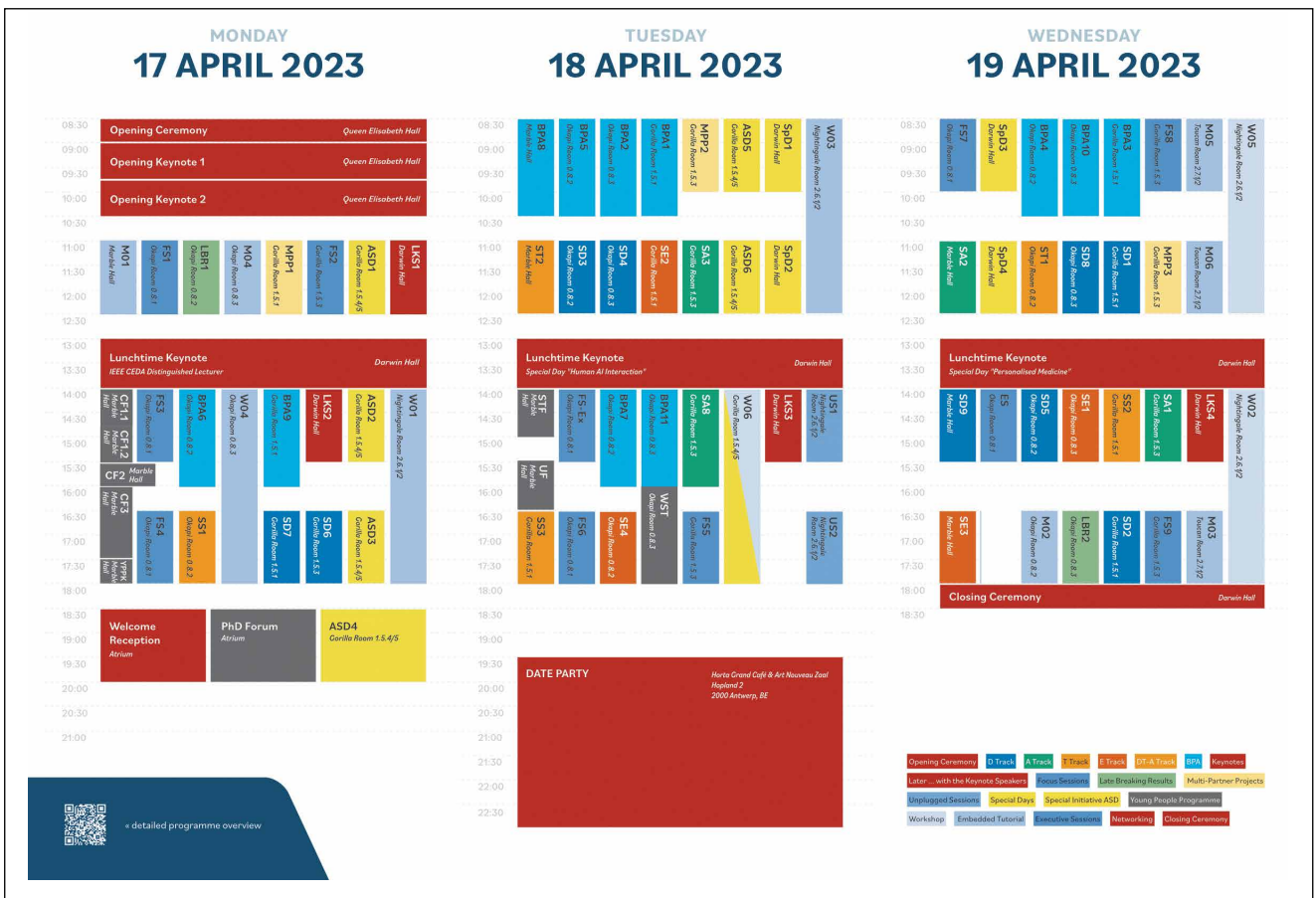
Figure 3. DATE 2023 program at a glance.

pharmacological responses to medical treatments. Biomarkers can be retrieved through intelligent wearable or insideable computing devices, continuously monitoring biosignals (electrical, temperature, pressure, and so on), behavioral patterns, and in-device processing of body fluids (biological samples). Together with biomarkers from genomic data, this can be used to get a much more finely grained picture of the health condition of an individual. The emergent field of personalized medicine covers novel approaches and challenges for designing silicon-based AI-equipped ultralow-power computing but has also given rise to a new field of biological computing, based on the ability to engineer biological circuits to monitor and react on biomarkers. As a highlight of the special day, Liesbet Lagae from IMEC talked about how to "Analyze the patient, engineer the therapy."

A new traditional special initiative on autonomous systems design was also held on Monday and Tuesday, consisting of reviewed and invited papers

as well as working sessions on self-governed and self-adaptive systems that are designed to operate in an open and evolving environment that has not been completely defined at design time. Monday's sessions included a special session on information processing factories, take two on self-aware systems of multiprocessor systems SoCs (MPSoCs) as well as two technical sessions on designing fault-tolerant and resilient autonomous systems, and autonomy for systems perception, control, and optimization. An evening panel session on autonomous systems design as a driver of innovation rounded off the first day of the special initiative. Tuesday kicked off with two focus sessions in the morning on autonomy-driven emerging directions in software-defined vehicles and SelPhys: self-awareness in cyber-physical systems, and an interactive workshop in the afternoon asked if autonomous systems can also be safe.

On Monday and Tuesday, the Young People Program, an initiative targeting PhD students with the

Figure 4. DATE 2023: party—Grand Café Horta & Art Nouveau Hall. All photographs: DATE 2023. Copyright: Cruz Garcia.

goal of supporting their career development, was held. The program kicked off on Monday afternoon with the careers fair—industry, during which participating companies introduced themselves and explained their business and working environment. These presentations were followed by a panel, during which young professionals from companies and startups discussed their experience changing from academia to industry or founding a startup. PhD students had the opportunity to present themselves to potential employers from the EDA and microelectronics industries and arrange interviews during the speed dating session and the conference. During the careers fair—academia session, researchers from academia with open positions met enthusiastic students looking for a position in academia, and a panel tackled questions about various academic career paths across Europe: the opportunities, challenges, similarities, and differences. The PhD Forum closed on the first day of the conference and enabled 50 selected students who had completed or were about to complete, their PhD thesis to showcase their work to the academic and industrial community.

On Tuesday, the Young People Program continued with the student teams fair, which brought together university student teams participating in international competitions such as RoboCup, CaroloCup, HyperLoop, Formula SAE, and so on, with

EDA and microelectronic companies. Academic prototypes and practical activities were shown at the university fair, where universities and public research institutes presented software and hardware solutions in various topics like electronic design automation, hardware design and testing, and embedded AI. The workshop for student teams focused on system design and analysis for student teams and other interested attendees and work on how to use EDA tools to improve their systems. These initiatives all contributed to targeting PhD students with the goal of raising their profile, establishing contacts, and encouraging discussions about their future perspectives with experts in the field.

Over the course of the conference, five half-day workshops covered several hot topics from areas such as Eco-ES: eco-design and circular economy of electronic systems, 3-D integration: heterogeneous 3-D architectures and sensors, nanosecurity: from nanoelectronics to secure systems, open-source design automation, and hyperdimensional computing and vector symbolic architectures for automation and design in technology and systems.

Six embedded technical tutorials on the main topics of DATE were also given by leading experts in their respective fields. The topics covered were: modern high-level synthesis for complex data science applications; nervous systems—from spiking
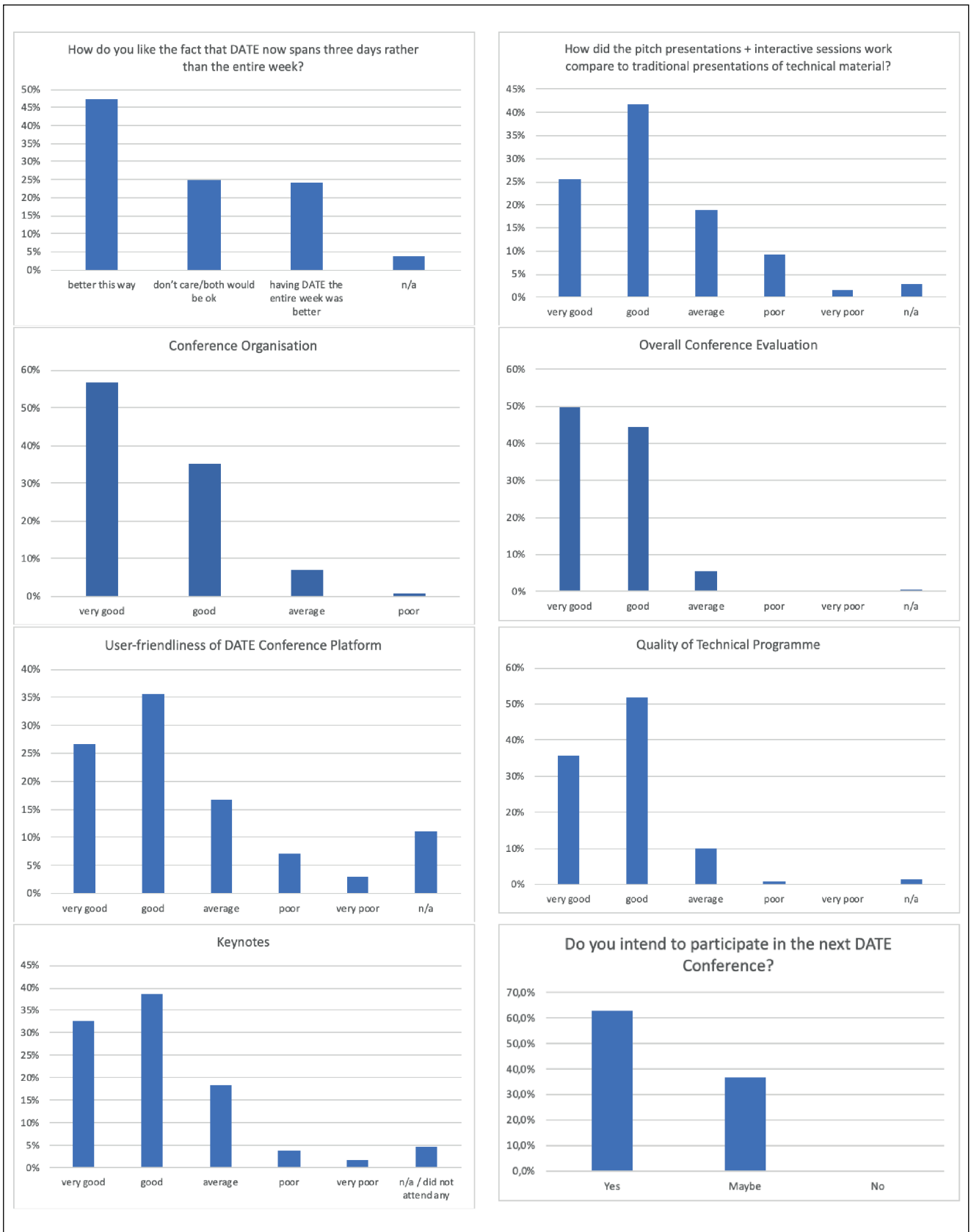
Figure 5. Selection of survey results.

neural networks and reservoir computing to neuromorphic fault-tolerant hardware; embedded FPGAs (eFPGA) and applications to IP protection via eFPGA redaction; remote side-channel and fault attacks in FPGAs; NVMExplorer: a framework for cross-stack comparisons of embedded, nonvolatile memory solutions, and design, programming, and partial reconfiguration of heterogeneous SoCs with the open-source research platform (ESP).

The conference was also complemented by several publicity stands from companies and a jobs wall for career opportunities, thus providing unique networking opportunities in the perfect venue for industries to meet university professors to foster university programs and especially for PhD students to meet future employers.

Moreover, many technicians and volunteer students continuously and invaluably supported the organizers during the conference week.

Attendance and feedback

The event attracted 920 attendees in total, with 806 full conference registrations and 114 day tickets. 550 people attended the very successful and enjoyable DATE party on Tuesday evening (Figure 4).

A SURVEY WAS held to gather feedback on the new format of the event, help to maintain future DATE conferences at the highest quality, and even increase the relevance of the event in the European Design and Test Community. A selection of the results is shown in Figure 5. These results show that, while the "rough diamond" of DATE 2023 in Antwerp can still be polished and improved, this experience with the new postpandemic format was overall very enthusiastically appreciated. Changing a format, the community got used to is a risky move. Accordingly, we were very relieved to see that, for example, almost two-thirds of the attendees liked the new format compared to the established procedure (with approx. 20% having no preference for either format and only 15% liking the old format better). ∎

Acknowledgments

Such a large event needed the contribution of many talented people from the community, and it has been a pleasure and a privilege to work with all the members of the DATE executive committee and the DATE sponsors committee. Acknowledgments also go, of course, to the members of the Technical Program Committee, the session chairs, KIT Dresden as conference secretariat, and, of course, all the authors, speakers, and panelists.

We all enjoyed DATE's return to an in-person format and meeting old and new friends and colleagues in a unique atmosphere; and we now look forward to another successful event at DATE 2024, to be held on 25–27 March 2024, in Valencia. See http://www.date-conference.com for more details.

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