4TH INTERNATIONAL CONFERENCE ON COGNITIVE MOBILITY

BUDAPEST, HUNGARY | OCTOBER 2-3, 2025

CONFERENCE PROGRAM

Cognitive Mobility

TRA BUDAPEST
2026 | ReGeneration in transport
18-21 MAY

TRANSPORT RESEARCH ARENA

Európa legnagyobb tudományos– és innovációs közlekedési rendezvénye 2026-ban.

2026. május 18–21. között a Magyar Közút Zrt. főszervezésében, az Európai Unióval együttműködésben kerül megrendezésre Európa legnagyobb közlekedési, tudományos– és innovációs eseménye, a Transport Research Arena (TRA) Budapesten, a Hungexpo területén.

A TRA konferenciasorozat immár két évtizede ad találkozási lehetőséget minden második évben a kutatás, az ipar és a döntéshozatal vezető szereplőinek.

Több, mint 1 500 kutató adta le az absztraktját 69 országból, valamint a közlekedés, az intelligens mobilitás és a smart city megoldások területéről mintegy 150–200 kiállító részvételére számítunk. 4 000 látogatót várunk a világ minden tájáról, köztük az Európai Bizottság magas szintű képviselőit, európai és hazai iparági szervezeteket és döntéshozókat. A TRA 2026 különlegessége, hogy multimodális fórum, ahol a közút, a vasút, a vízi, a légi és az űrközlekedés szereplői együtt mutatják be legújabb fejlesztéseiket.

Meggyőződésünk, hogy a TRA 2026 egyedülálló lehetőséget kínál az Ön cége számára is, hiszen nemcsak gyártóként, hanem technológiai és innovációs vezetőként is pozícionálhatja magát.
A kiállítói jelenlét és a szponzoráció lehetőséget ad arra, hogy az Ön cége a közlekedés jövőjének formálójaként pozícionálja magát. A TRA aréna–jellegéből fakadóan – ahogy a név is utal rá – különböző nézőpontokat hoz egy platformra, amely nemcsak új ötleteket szül, hanem a legmerészebb technológiai megvalósítások előtt is megnyitja az utat.

Örömmel vennénk, ha egy személyes találkozó keretében részletesen bemutathatnánk az esemény kereteit, és egyeztethetnénk az Önök számára releváns kiállítói és szponzorációs lehetőségekről.

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WELCOME

We are delighted to welcome you to the Bosch Budapest Innovation Campus on behalf of the organizers of the 4th International Conference on Cognitive Mobility – CogMob 2025.

Cognitive Mobility (CogMob) explores the interplay between mobility, transportation, vehicle engineering, social sciences, artificial intelligence applications, and cognitive infocommunications. The central aim of CogMob is to provide a holistic perspective on how mobility can be understood, described, and optimized as a blend of artificial and human cognitive systems. By treating this integration as a single, inseparable CogMob system, we investigate the emergence of new cognitive capabilities within mobility. We believe that increasing cooperation between transportation-related domains and the integration of emerging cognitive technologies will lead to not only more efficient, but also more sustainable mobility systems.

This year, CogMob places special emphasis on smart rail systems, thinking infrastructure, and safe mobility—reflecting the evolving challenges and opportunities in the field. Engineering applications remain at the heart of our discussions, with a focus on how cognitive approaches can transform the future of transportation.

The conference brings together researchers and practitioners from diverse domains of science and industry to foster collaboration and innovation. We extend our gratitude to the session organizers and contributors for their dedication and for making the conference vibrant with their work. Our sincere thanks go to Robert Bosch Kft for their co-organization, hosting, and support. We especially acknowledge the devoted efforts of the CogMob Technical Program Committee and all members of the organizing team, whose commitment has made this event possible.

We hope all participants of CogMob 2025 will find the conference intellectually stimulating and rewarding.

Prof. Dr. Máté Zöldy DSc.
General Chair of CogMob2025 Conference

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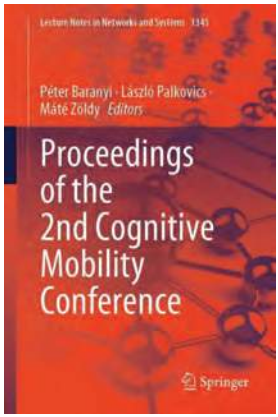
Péter Baranyi, László Palkovics, Máté Zöldy

Proceedings of the 2nd Cognitive Mobility Conference



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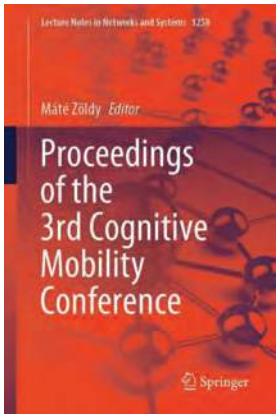

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GENERAL INFORMATION

DATE & VENUE

CogMob 2025 will take place between 2-3 October, 2025 at the Bosch Budapest Innovation Campus in Budapest, Hungary (H-1103 Budapest, Robert Bosch str. 14)

OFFICIAL LANGUAGE

The official language of the Conference is English. No translation will be provided. Free WIFI is available during the conference.

BADGES

Identification badges are provided along with other conference materials upon registration. The organisers kindly ask you to wear them all the time during the conference. Please also note that your conference badge assures your entrance to conference premises and catering. Persons without badges may be refused. The identification badges are also helpful when contacting the secretariat and other participants.

PARTICIPANT KIT

Conference kits are provided for all registered participants. Please do not put personal belongings (money, ID Cards, mobile phones) in the conference bags, since many of similar bags will be around the conference venue, and they could be easily confused.

PROCEEDINGS

Scientific papers associated with the presentations delivered at the conference will be published in the Lecture Notes in Networks and Systems series by Springer. (https://link.springer.com/series/15179)

GENERAL REGULATIONS

We kindly ask all participants to observe the regulations of the host institution. All participants are kindly asked to refrain from smoking outside of the designated smoking areas.

SOCIAL EVENTS

Welcome message of the Chairman Oct 2 (09:00)	Bosch Budapest Innovation Campus, Auditorium
Award Ceremony Oct 2 (14:50)	Bosch Budapest Innovation Campus, Auditorium
Banquet Oct 2 (19:30)	Mercure Korona Hotel (H-1053 Budapest, Kecskeméti str. 14.)

COGMOB2026 - SAVE THE DATE!

7-8 October, 2026
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The facility offers excellent opportunities not only for organizations in the surrounding regions but also for development teams across Europe and beyond. In addition to state-of-the-art testing infrastructure, the complex provides comprehensive services, including advanced engineering support, modern technical equipment, fully equipped workshops, skilled technicians, and an on-site fuel station. The testing process is further supported by office infrastructure, ADAS testing equipment, and experienced test drivers.

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OCTOBER 2, 2025

08:00-09:00 – REGISTRATION

09:00-10:00 – WELCOME & PLENARY SESSION I.

Welcome message of the Chairman (10')

Plenary session I.

AI transformation in the world of mobility and engineering (25')
Zoltán Karaffy

Ammonia as a prospective fuel for internal combustion engines (25')
Dr. Wojciech Tutak

10:00-10:20 – COFFEE BREAK

10:20-11:55 – PARALLEL SESSIONS I.

Auditorium	Session Chair: Dr. Csaba Tóth-Nagy (Szechenyi University)
Advanced fuels, drives and engines	
Aleksandr Sabanovic, Jonas Matijosius, Arturas Kilikevicius, Aleksandras Chlebnikovas and Tadas Zvirblis	Optimizing a Diesel Aftertreatment System Using Machine Learning and Simulation
Dragos Tutunea, Horia Beles, Florin Bogdan Scurt and Bogdan Adrian Tolea	Experimental Investigation Regarding the Use of EGR System in Internal Combustion Engine
Emese Lévai and Ákos Bereczky	Dynamic TREC system concentration tracking for efficient control
Thomas Kivevele and Henry Kahimbi	From Forest to Fuel: Exploring Uapaca kirkiana (wild loquat) Extracts to Enhance Biodiesel Life
Ádám Nyerges	In-Depth Analysis of External EGR in Diesel Engines

Session Room I.	Session Chair: Dr. Maria Szalmane Csete (BME)
Cognitive traffic management	
Bladimir Toaza and Domokos Esztergár-Kiss	Definition of a utility function for daily activity scheduling optimization in activity-based modelling contexts
Csanád Ferencz and Máté Zöldy	Scalable Implementation of Autonomous Vehicle Functions for Closed-Environment Sensing and Control
Vlad Imre Tent, Florin Bogdan Scurt, Tiberiu Vesselenyi, Horia Beles, Bogdan Adrian Tolea and Stefan Iuliu Halasz	Considerations regarding design and construction of the rear underrun protective devices of trailers intended for the transport of wood material
Richard Szaloki and Petra Szakonyi	Cognitive Mobility Hubs: Rethinking Sport Infrastructure for Sustainable Urban Development
Balázs Horváth	Do more people use public transport that is more understandable?

Session Room II.	Session Chair: Dr. András Nagy (Szechenyi University)
Advanced emobility I.	
Mihály Katona and Tamás Orosz	Effects of Feasibility Constraints on Optimisation of a Synchronous Reluctance Machine
Tibor Vajsz, Dániel Norbert Szántó, Vilmos Paiss, Csongor Horváth, Richárd Csaba Kovács and István Szászi	Comprehensive analysis of radial- and axial flux synchronous reluctance machines for electric vehicle applications
Ammar Al-Lami, Anas Alatawneh and Adam Torok	Drivers of CO_2 Emissions in Central European Transport: Intra and Inter-Country Spatial Analysis
Ábel Göntér, Tibor Sipos and Ábel Göntér	Determination of Battery Electric Motorcycle Energy Consumption Using a Virtual Vehicle Model and Measurements, and Optimization Possibilities
Peter Harth and Bence Major	Comparison of Driving Styles for Estimating the Range of Electric Vehicles

12:00-13:00 – LUNCH

13:00-14:00 – ROUNDTABLE DISCUSSION

Managing global automotive R&D challenges in local collaborations

Moderator
Enikő Gécsek Tóth

Roundtable members
Mr. András Kemler - *The Bosch Group in Hungary*
Dr. Barna Hanula - *Széchenyi István University*
Mr. Sven Richter - *Audi Hungária Zrt.*

14:00-14:50 – PLENARY SESSION II.

Plenary session II.

AI-Powered Mobility: Transforming the Landscape of Automotive Innovation (25')
Prof. Dr. László Palkovics

Electric Vehicles in the Era of Cognitive Mobility: Data, Energy and Smart Integration (25')
Prof. Dr. İlhami Çolak

14:50-16:05 – AWARD CEREMONY & DEMOS

Award Ceremony

Demos
Magyar Közút Zrt.
Simulator-Based Training Equipment for Advancing E-Mobility Education, Maróti Kft.
Traffic Light, Bosch-BME

16:05-16:25 – COFFEE BREAK

16:25-18:25 – PARALLEL SESSIONS II.

Auditorium	Session Chair: Dr. Tamás Lovas (BME)
Cognitive applications in smart infrastructure	
Mohammad Fahad and Nagy Richard	Polymer and Fiber Modification of Asphalt Mixtures
Amir Hajimirzajan, Milad Kazemian, Ghezelhesar Ahmad Davari and Szabolcs Fischer	An Agent-Based Modeling Approach for a Bi-Level Optimization and Simulation Framework in Road and Street Maintenance Planning
Ziyad N. Aldoski and Csaba Koren	Traffic Sign Detection Related to Weather Variations
Éva Lublóy and Judit Koltai	New challenges for tunnel structure design
Tamás Attila Tomaschek	Towards Cognitive Mobility: Data-Driven Road Management through Digital Twins and BIM-GIS Integration
Viktor Horvath and Arpad Barsi	The effect of transformer neural network compression on aerial photogrammetry
Hanna Csótár, Szabolcs Szalai, Gusztáv Baranyai and Szabolcs Fischer	Investigation of the size effect of concrete elements and surface optimization to enhance DIC measurements - (short presentation)

Session Room I.	Session Chair: Dr. Éva Lublóy Dr. Majorosné
New aspects of cyber security and safety	
Viktoria Ötvös and Róbert Major	Cognitive Mobility and Road Safety: Insights into Children's Knowledge and Awareness
Madalin-Florin Popa, Florin Bogdan Scurt, Horia Beles and Bogdan Adrian Tolea	Analysis of defects and wear in the braking system of trucks and their influence on road safety
Kumaresan T, Raja Guru Ramaraj, Rajeshwari Ramaiah Murugesan, Sasikumar A N and Manjunathan Alagarsamy	Swarm-Synapse Hybrid IDS for Cognitive and Mobile Cybersecurity: Integrating Starling Flock Optimization with Spiking Neural Networks for Resilient Threat Detection
Nithyadevi Shanmugam, Manjunathan Alagarsamy, Ranjidha Periyasamy, Vairaprakash Selvaraj and Raja Guru Ramaraj	Mobility-Centric Cognitive Cybersecurity in IoT: Quantum-Inspired Transformer with ZOO-Seasons Hybrid Feature Selection
İlhami Çolak, Utku Kale, Erdal Irmak and İsmail Erkek	Integrating Digital Twin and Explainable AI for Cyber Resilience in Critical Infrastructures
Ai Juan Li, Qiang Zheng and Jia Qi Chen	Deep Learning-based Tire Defect Recognition and Classification Technology

Session Room II.	Session Chair: Ákos Bereczky (BME)
Advanced emobility II.	
Omar Alharasees, Artūras Kilikevičius and Utku Kale	Strategic Evaluation of Urban Electric Vehicles Charging Infrastructure in Budapest Using Integrated Multi-Criteria Methods
István Lerchner and Zöldy Máté	How to fulfil environmental aspects of individual car purchasing preferences
Tibor Vajsz, Vilmos Paiss, Richard Csaba Kovács, Csongor Horváth, Dániel Norbert Szántó and István Szászi	An investigation of axial flux synchronous reluctance machines with aluminum- and copper windings for electric vehicle applications
Adrienn Boldizsár and Beatrix Kiss-Béres	Analysis of the impact of OBOR on European countries

19:30-21:30 – BANQUET

Mercure Korona Hotel (H-1053 Budapest, Kecskeméti str. 14.)

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OCTOBER 3, 2025

08:00-08:30 – REGISTRATION

08:30-10:15 – OPENING & PLENARY LECTURES

Opening speech

Prof. Dr. Máté Zöldy (5')

Plenary lectures

Recent Advancements in EO Based Monitoring of Railway Infrastructure (25')
Prof. Dr. Milan Banić

Lecture title: AI on Track: Trends, Strategy, and Innovation (25')
László Reich

Future-Proof Tracks: Building Railway Resilience through Digital Innovation (25')
Dr. Hana Dellemann

Lecture title: Innovating Toll Systems: Hungarian Expertise in Indonesia's Mobility Transformation (25')
Balázs Varró

10:15-10:35 – COFFEE BREAK

10:35-11:35 – DEMOS

Demos
1. AllTerra Hungary Kft.
2. MOME – Mobility Design Lab
3. MOME – ixD – Interaction Design

11:35-12:50 – PARALLEL SESSIONS III.

Auditorium	Session Chair: Dr. Richárd Nagy (Szechenyi University)
Smart railways	
Zoltán Major, Attila Németh, Vivien Jóvér and Szabolcs Fischer	Numerical determination of contact radii in rail-wheel contact
Alyona Lovska, Ján Dižo, Miroslav Blatnický and Martin Bučko	Analysis of running properties of a rail motor unit
Ján Dižo, Alyona Lovska, Miroslav Blatnický, Martin Bučko and Oksana Kryshtopa	A modification of a locomotive gearbox lubrication system
Abdaljbbar Dawod and György Terdik	Railway Track Quality Inspection via GLasso with Zero-crossing Segmentation
Peter Palotas and Attila Domotor	Scanning and measuring the railway track and its environment with developed LiDAR measuring systems
Michal Przybylowicz, Olga Nabochenko, Mykola Sysyn and Szabolcs Fischer	LCC estimation of ballasted track superstructure with wide sleepers and the universal side-tamping technology

Session Room I.	Session Chair: Dr. Utku Kale (BME)
Special applications I.	
Petra Szakonyi and Agoston Winkler	E-scooters and Public Transport: Competition or Multimodal Synergy in Sustainable Urban Mobility?
Emese Makó, Miklós Ittzés, Viktória Kálmán, Csaba Borbola and Erzsébet Hóz	Lighting and Cognitive Safety Evaluation of Designated Pedestrian Crossings: A Case Study from Hungary
Maria Papanikou, Farzad Zolfaghari, Arturas Kilikevicius and Utku Kale	Leveraging Eye-Tracking Biometrics for Predictive Analytics in Aviation Landing Performance
Farzad Zolfaghari, Maria Papanikou, Arturas Kilikevicius and Utku Kale	Deep Learning-Based Classification of Expert and Novice Pilot Performance During Simulated Flight
Dániel László Hegedűs, Dániel Harrach, Dávid Bozsaky, Gusztáv Baranyai, Attila Németh, András Pollák and Szabolcs Fischer	Changes in the properties of thermal insulation materials due to environmental and exposure factors: Examination of autoclaved aerated concrete thermal insulation mineral boards – (short presentation)
Raja Guru R, Ramana M, Parthiban S and Antony Nithin A	Cognitive Audio Fault Detection in Railway Switching Systems Using Spectrogram-Based Transfer Learning

Session Room II.	Session Chair: Prof. Ilhan Colak (Istinye University)
Special applications II.	
Petra Szakonyi and Emese Mako	School Streets: Transforming Urban Spaces for Safer Student Commuting
Aswin Kumaran Mahesh Kannan, Raja Guru R and Jaya Swaruba Lakshmi Mahesh Kannan	Fed-AI: Explainable Federated Learning for Sustainable Crop Forecasting and Agro-Logistics
Souvanthone Phetoudom and Emese Mako	Quantifying Capacity Reductions from Pedestrian Activity at Unsignalized Crosswalks: A Queuing-Based Assessment Across 24 Hungarian Sites
Vetrivel Pandian, Raja Guru R and Prabhu Radhakrishnan	Secure and distributed automotive logistics systems integrating federated learning and blockchain for cognitive vehicle networks
Omar Alharasees, Artūras Kilikevičius and Utku Kale	Real-Flight Monitoring of Vital Physiological Parameters in Pilots: Implications for Performance, Training, and Safety in Aviation

12:50-14:00 – CLOSING LUNCH

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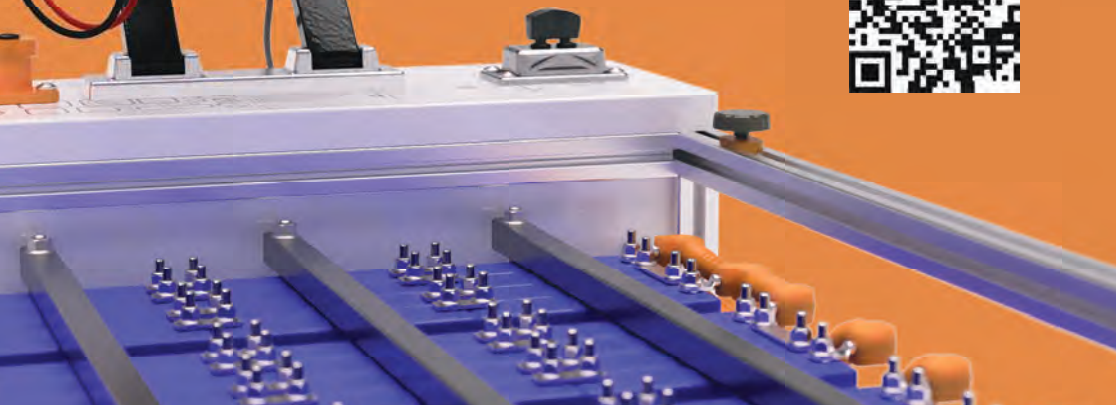

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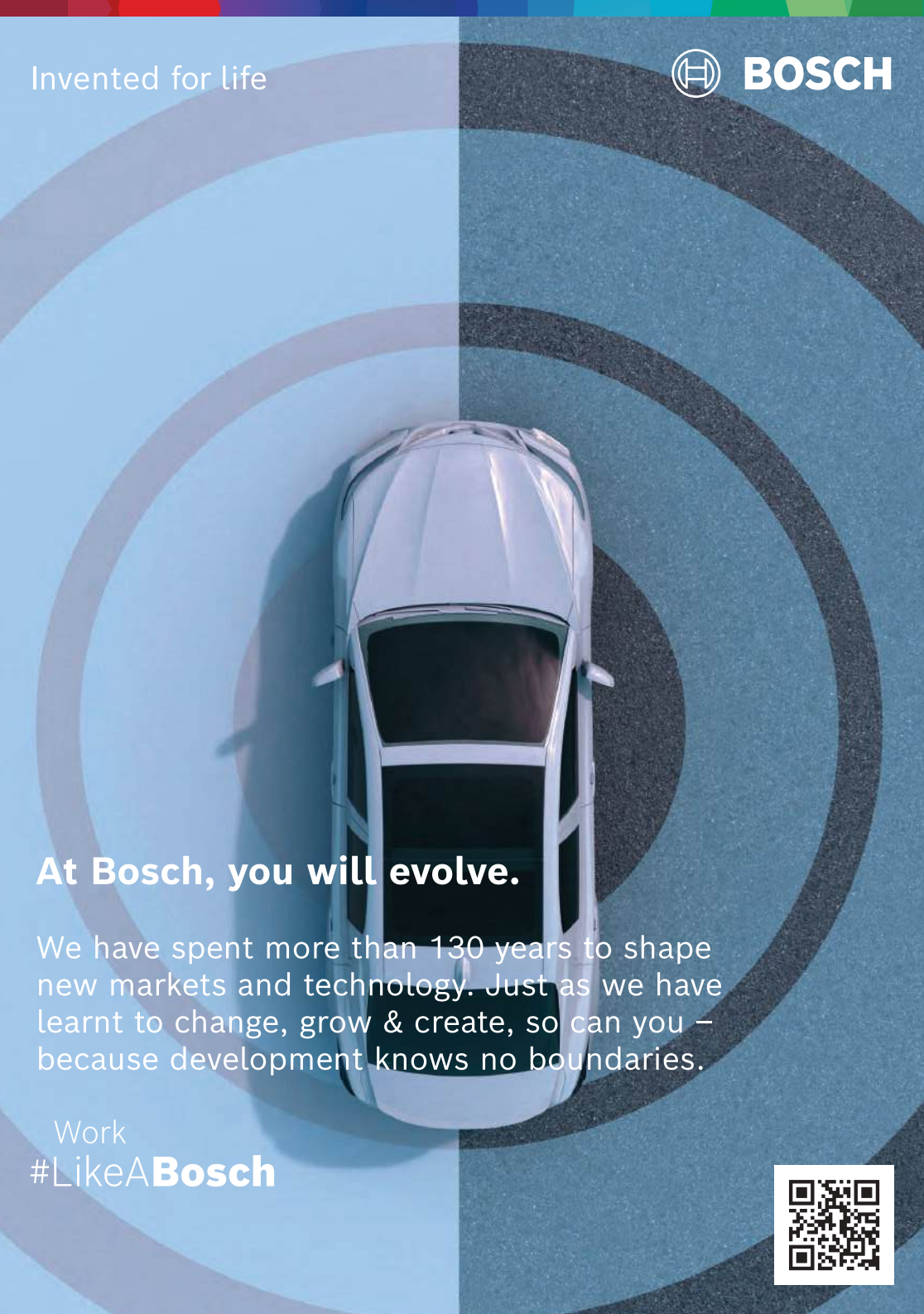

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