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universität wien

NEMO SUMMER SCHOOL SERIES

Learn *Conceptual Modelling*
to innovate, design and engineer
Digital Ecosystems

Become a digital leader!

BUILD DIGITAL TWINS OF THE FUTURE

NEMO SUMMER SCHOOL SERIES

DIGITALISATION NEEDS HIGH POTENTIALS,
THAT'S WHAT THE NEMO SUMMER SCHOOL PRODUCES.

INITIATORS OF THE **NEMO SUMMER SCHOOL**

Prof. Dr. Dimitris Karagiannis

Prof. Dr. Heinrich C. Mayr

At the NEMO Summer School you:

create with the help of "Design Thinking"
design with the help of "Conceptual Modelling"
engineer with the help of "Digital Twin"

your disruptive Ecosystem.

The BENEFITS

WHO?

NEMO graduates represent a large international network striving towards academic and professional excellence, who are connected by a common experience and cooperation platform.

WHY?

NEMO enables participants to meet a large number of internationally renowned academics, discuss current research topics with them and actively participate in an international community of peers.

The FOCUS

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Conceptual Modelling in the Digital Age

Tomorrow's students will work in and for digitized organizations where smart devices, digital artefacts, intelligent machines and robots, data streams, and connectivity are ubiquitous. In their work, they will face human challenges (e.g. human-machine/system interaction), lifecycle challenges (e.g. ICT embedded in the lifecycle of consumer products like cars, industrial machinery, and energy provision systems, etc.), business challenges (e.g. new business models to exploit value from new applications and domains), and regulatory challenges (e.g. privacy, security, etc.). Additionally, a higher level of automated processing of digital information as well as the "end-to-end" integration of processes across multiple organizations and customers will be required by users. NEMO provides a vertical overview across different application domains in preparation for all dimensions of digital transformation.

One way to manage such complex ecosystems is through conceptual modelling, both in the form of theory and practice. How to define and combine modelling methods with an adequate level of abstraction and how to engineer corresponding modelling tools is at the center of conceptual modelling education.

The NEMO Summer School Series brings renowned researchers and academics together with students to explore current research challenges and future development of conceptual modelling with a focus on the design and implementation of Enterprise Digital Twins and Ecosystems.

NEMO exposes students to a wide diversity of lectures, covering manifold aspects of conceptual modelling, "Smart Models", Digital Ecosystems, Design Thinking, Digital Twins, as well as various cross-cutting issues. Besides, it supports networking in an international environment with colleagues and professors. Last but not least it encourages participants to enjoy the culture and the beautiful city of Vienna.

HOW?

The NEMO Summer School provides a highly-interactive experimental environment where students and teachers focus on conceptual modelling for digital innovation ecosystems.

WHAT?

Students work in multicultural teams to create practical solutions to real-world problems. They use the Digital Innovation Environment *(DiEn)* powered by OMiLAB to access open community artefacts and co-design their solutions.

NEMO SUMMER SCHOOL SERIES

The CONTENT

WE USE ABSTRACTION TO REDUCE COMPLEXITY OF A DOMAIN FOR A SPECIFIC PURPOSE

Foundations of Conceptual Modelling

Abstraction is used to represent the real world in models for a specific purpose. This is necessary to reduce and manage complexity. Models incorporate, beyond syntax and notation, also the semantics of the domain they address. This stream deals with scientific and philosophical principles for modelling, fundamental notions of conceptual models, goals, as well as scoping of design methodologies for modelling languages and methods. In addition, it presents formal methods that are necessary for method engineering frameworks. Lastly, the fundamentals of the creative conceptualization process are dealt with by applying the AMME Conceptualization Lifecycle.

"Smart Models" for Humans and Machines

Agile Modelling Method Engineering (AMME) is used to develop model-based domain-specific applications as well as to derive increased value from such domain-specific models. This stream presents modelling languages for specific domains, like capability management, enterprise information systems, health care management, immigration management, industrial management, model-driven software engineering, product-service-systems, production management, requirements engineering, service management, transportation as well as energy management, and, more generally, semantic-driven applications.

Semantics and technologies for Digital Ecosystems

Domain-specific tools support digitizing the relevant parts of the real world into conceptual models and applying processing mechanisms and algorithms on the models for problem resolution. Content discussed in this stream addresses advanced aspects of meta-modelling, ontologies, and generally semantic technologies focusing on domain-specific requirements. Technologies may range from lightweight modelling to formal algebra. Mechanisms and algorithms which enable the processing of models through e.g., assessment, evaluation, prediction, planning, analysis, and simulation are introduced. Advanced technologies increase model value and user interaction both, on the enterprise and individual level.

The CONTENT

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AN INTERACTIVE COMBINATION OF THEORY AND PRACTICE

Digital Design Thinking

Digital Design Thinking is a concept through which disruption of business models is achieved and its transformation is realized with technological and organizational changes. The content of this stream deals with Digital Design Thinking tools, which are employed for switching the working environment limitations into remote collaboration environments, which is especially useful when it comes to geographically diffused teams or sessions taking place at different times.

Enterprise Digital Twins

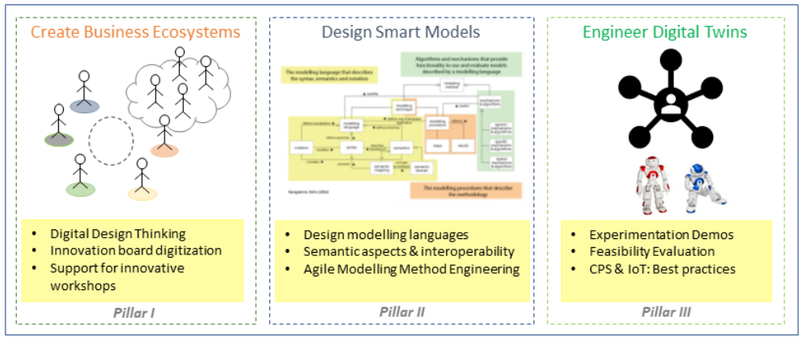
Enterprise Digital Twins present a virtual counterpart to an enterprise's assets and their static and dynamic features as the next step of digitalization. This stream addresses the concepts and technologies relevant for the realization of Enterprise Digital Twins, their data, and behavior along its lifecycle. The Digital Twins can be employed with their counter-part from the physical layer for activities like analysis, simulation, and feasibility verification among others.

Cross-Cutting Issues

A key challenge in conceptual modelling is the design process in which real-world artefacts are abstracted into concepts of a modelling language. This process is based on creativity, human interpretation of the real world, and the capability to transform this knowledge into a conceptual model representation. Content included in this stream deals with issues like interaction and abstraction required to create and manipulate models, to verify models, to incorporate possible processing of models in form of algorithms into modelling methods, to evolve and migrate models and modelling languages, to integrate model processing in service-oriented toolchains as well as to perform knowledge interpretation.

OMiLAB - a Digital Innovation Environment

The Digital Innovation Environment *(DiEn)* of OMiLAB enables experimentation, training, and engineering activities for organizations pursuing Digital Transformation initiatives. Stakeholders from a multi-disciplinary background are supported to develop innovative ideas as digital business models, to materialize them in proof-of-concept implementations, and to evaluate their feasibility in a laboratory setting, within a corporate or academic context focusing on Digital Innovation.



Approach

Business Ecosystems, Design Thinking, Digital Twins, Conceptual Modelling, Artificial Intelligence

Technology

ADOxx · bee-up · Olive · Scene2Model · Text2Model · Voice2Model · CoChaCo · ADOScript in Visual Studio

ROS Robot Operating System · Raspberry Pi · Semantic Web · Microservices

The Digital Innovation Environment *(DiEn)* of OMiLAB builds on the notion of digital business models. A digital business model uses a Digital Twin as a conceptual representation of an intelligent offering that:
a) must be co-designed by domain experts and innovators from different backgrounds,
b) must provide adequate virtualization of reality, considering domain-specificity and the value to be created, and
c) must enable experimentation and evaluation of the novel business model.

VISIT: WWW.OMILAB.ORG

OMiLAB is a space to:

Collaborate – with peers, academics, and experts from all over the world on topics related to conceptual modelling and modelling tool engineering.

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Innovate – ideas, extend existing concepts, methods and tools, apply modelling knowledge to new domains and innovative designs or technologies.

©Universität Wien/ Barbara Mair

Engineer – modelling methods, tools, and design models using the OMiLAB technological environment. An industry-grade meta-modelling platform, i.e. ADOxx, is available as well as a wide variety of open-source services.

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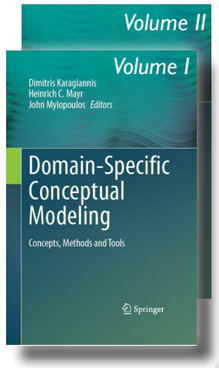
Domain-Specific Conceptual Modelling

Concepts, Methods and Tools

Volume I
Volume II

The OMiLAB Book Series draws attention to domain-specific conceptual modelling by presenting the work of thought leaders who have designed and deployed specific modelling methods. All domain-specific methods described in this series have also a tool implementation available on OMiLAB, making these usable and accessible to a wide community of developers and users.



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NEMO Summer School Series

... From Conceptual Modelling ... ... to Digital Environments and back ...

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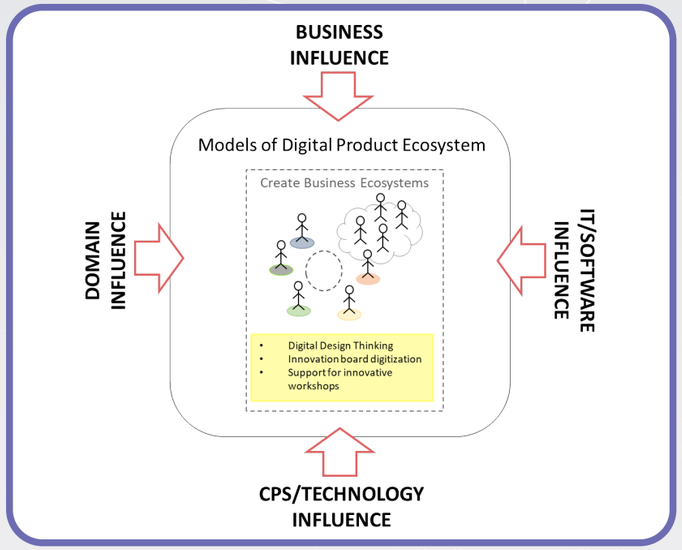
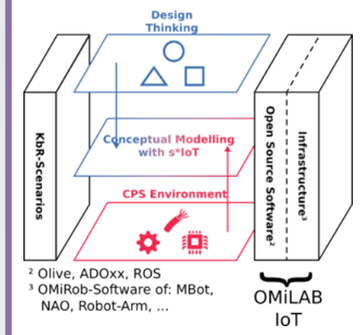
Digital Innovator

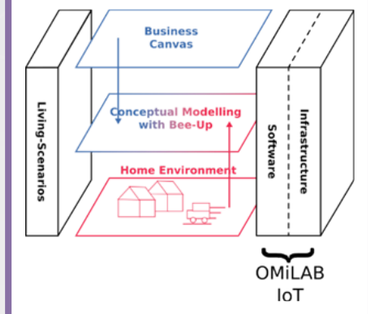
Creates new disruptive Business Ecosystems.



Knowledge-based Robotics



Smart Environment



Digital Engineer[1]

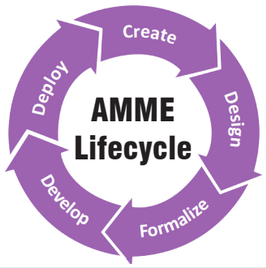
Experiences the Digital Twin in the lab environment.

Digital Laboratory: Materialization

Modelling Method Engineer

Uses AMME to build method artefacts and design Digital Twins.

AMME - Agile Modelling Method Engineering

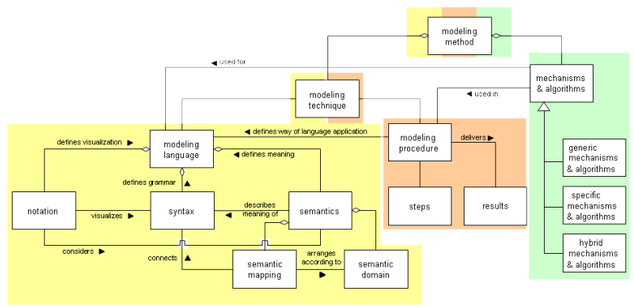


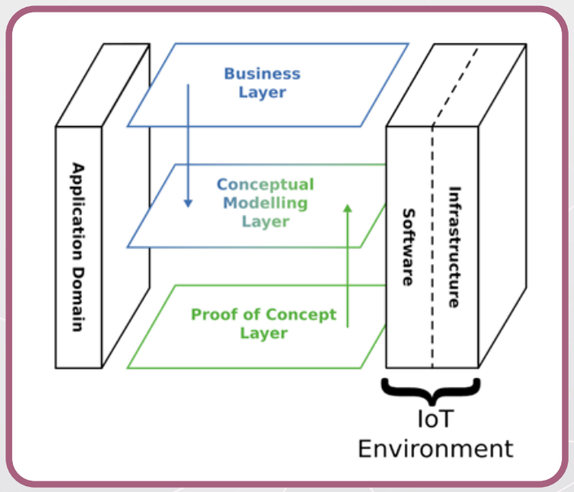
Digital Laboratory: Configuration

Meta-model Designer

Responsible for the modelling language definition and usage.

Generic Modelling Method Framework





Digital Product Designer

Applies the method for a selected domain.

Digital Laboratory: Conceptualization

1 Dimitris Karagiannis, Robert Andrei Buchmann, Xavier Boucher, Sergio Cavalieri, Adrian Florea, Dimitris Kiritsis, Moonkun Lee (2020) OMiLAB: A Smart Innovation Environment for Digital Engineers. In: Camarinha-Matos L.M., Afsarmanesh H., Ortiz A. (eds) Boosting Collaborative Networks 4.0. PRO-VE 2020. IFIP Advances in Information and Communication Technology, vol 598. Springer, Cham. https://doi.org/10.1007/978-3-030-62412-5_23

NEMO Summer School Series

The PLATFORM

ADOxx – The open source Metamodelling Platform

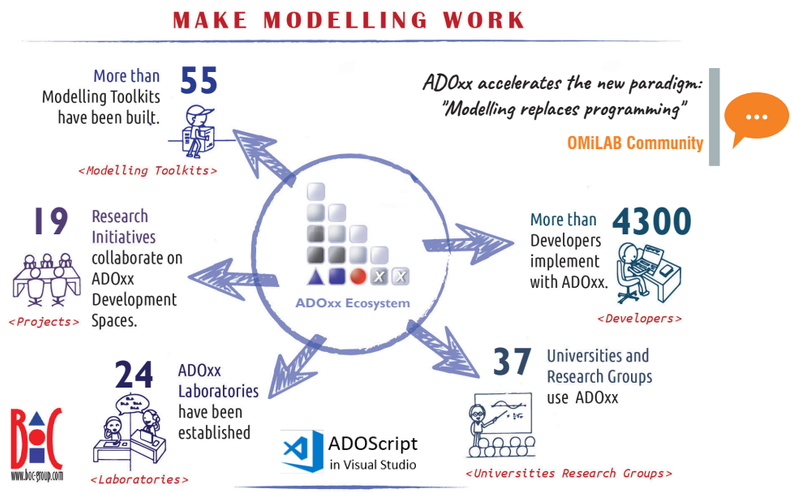
Practical work during NEMO is performed using ADOxx, the meta-modelling and development platform to realize modelling tools.

www.adoxx.org

ADOxx enables to:

- **Create** full-fledged individual modelling tools using pre-build platform features
- **Develop** the notation, syntax, and semantic of a modelling language with a script-based approach
- **Realize** Microservices encapsulating algorithms and mechanisms with the OLIVE Framework
- **Deploy** modelling tools: local or distributed.

MAKE MODELLING WORK



VISIT: WWW.ADOXX.ORG

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ADOxx-based Modelling Tools realized by international research groups

- For Enterprise Modeling - 4EM -
- ArchiMate 3.0
- ADVISOR
- BEE-UP
- HERMxx
- ARTSS
- Digital Manufacturing Planning Tool - DiMaP -
- Integrated Information System Case - IISC -
- Business Engineering Navigator - BEN -
- Business Process Feature Model - BPFM -
- Data Integration and Cleansing Environment - DICE -
- Capability Oriented Enterprise Knowledge Modelling - CODEK -
- ComVantage
- Design&Engineering Methodology for Organizations - DMT -
- Dig4Biz
- Business Process for Digital Transformation - BPDF -
- Data Integration for Business Analytics - DIBA -
- Business Process Risk Management - AdoBPRIM -
- Decision Model and Notation - DMN -
- Model-based Security System for eGovernment - MoSeS4eGov -
- Evaluation Chains - EC -
- Electric Vehicle Testbed Modeler - EVT -
- Event Calculus Analysis and Visualisation - ECAVI -
- EcoViz
- exemplarische Geschäftsprozess-modellierung - eGPM -
- ENTERKNOW
- Big Data - Data Service - BD-DS -
- Japanese Creative Services - JCS -
- Product-Service Systems Scenario Modeller - PSS -
- Large Scale Collaborative Processes - LSCP -
- Space of Services - SoS -
- itsVALUE
- eduWeaver
- ADOxx Horus Method
- i* Method
- Human Cognitive Model Language Modeler - HCM-L -
- KAMET
- Petrixx
- Modelling Framework for a Semantic Internet of Things - sIoT -
- Historical Information Curation - HIC Model -
- Knowledge Work Designer - KWD -
- Model-based Social Learning for Public Administration - Learn PAd -
- Enterprise Knowledge Development - EKD -
- Multi-Perspective Enterprise Modelling - MEMO -
- Probability Visualized - ProVis -
- LiteStrat
- The KYKLOS Method
- MULTIPROTOCOL
- Conceptual Design of Multi-View Modeling Tools - MuVieMoT -
- Open Knowledge Models - OKM -
- PetriNets
- MultiModal Interface Modeling Language - MMI-ML -
- Process-Goal Alignment Modeling and Analysis Technique - PGA -
- Practical Intelligent Applications - PRINTEPS -
- Structured Entity Relationship Modeling Method - SERM -
- Scene2Model - S2M -
- Regensburg University Process Excellence and Reengineering Toolkit - RUPERT -
- SAVE
- SIMchronization
- Secure Tropos
- DICER
- Semantic-based Modeling Framework for Information Systems - SeMFIS -
- TOGAF based Enterprise Architecture Management - TEAM -
- Checking Constraints for Multi-Perspective Modelling Languages - SemCheck -
- User Story Mapping - USM -
- Semantic Database Design - SDBD -
- Fractal Enterprise Model - FEM -
- Semantic Object Model - SOM -
- SCoRe4Mobility
- Stochastic Petri Nets Modeling - SAPnet -
- Service Engineering Methodology - SEEM -
- BPMN4MoPla

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The INTERNATIONALITY

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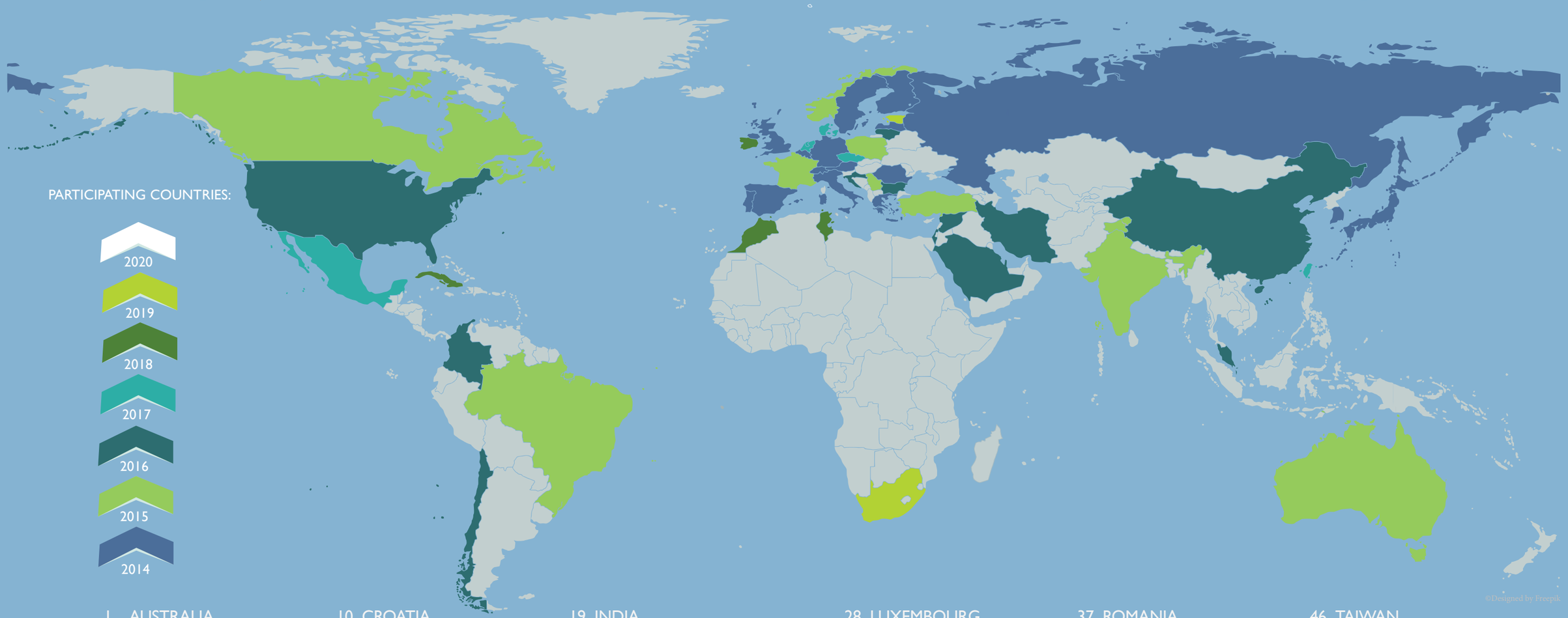
NEMO IS A FANTASTIC OPPORTUNITY TO GAIN BROAD EXPOSURE TO A WIDE RANGE OF CONCEPTUAL MODELLING TECHNIQUES, METHODS, APPROACHES, AND HANDS-ON SKILLS. IT WILL BE AN ELEVATING EXPERIENCE FOR YOU!

Prof. Dr. Eric Yu
University of Toronto, Canada

OMILAB FACILITATES A COMMUNITY WHICH SHARES KNOWLEDGE, TECHNOLOGIES, VALUES AND ENABLES US TO REALIZE OUR OWN IDEAS.

Prof. Dr. Moonkun Lee
Chonbuk National University, South Korea



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The STUDENTS

	STUDENTS	INSTITUTIONS	COUNTRIES	NATIONALITIES
2014	44	25	15	21
2015	50	25	15	18
2016	64	42	25	27
2017	58	36	24	27
2018	47	37	21	25
2019	54	35	20	25

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The CONTRIBUTORS

	CONTRIBUTORS	INSTITUTIONS	COUNTRIES	NATIONALITIES
2014	30	25	15	12
2015	39	31	20	16
2016	45	33	20	16
2017	45	35	19	15
2018	51	36	21	17
2019	54	38	21	17

... AND COUNTING!

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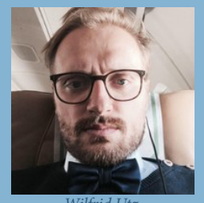
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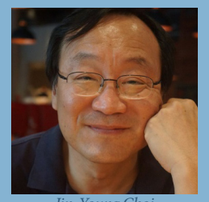
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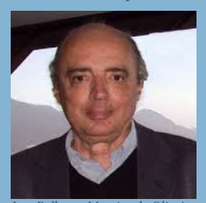
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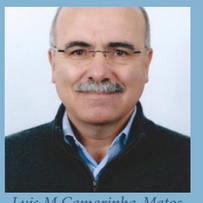
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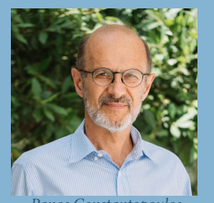
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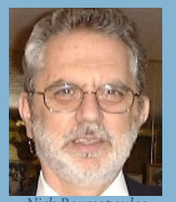
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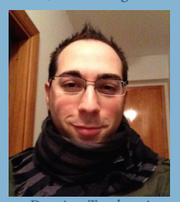
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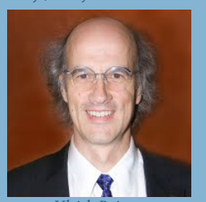
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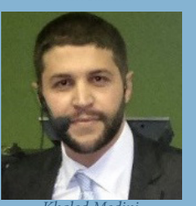
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HILTI

Hilti Group

As a leading-edge provider of solutions and services to the professional construction industry Hilti drives the digital transformation enabling Hilti customers to be more productive while observing the highest health and safety standards.

Hilti IT is a key pillar of the digital activities of the Hilti group, running a single-instance global ERP system and providing with the Hilti Cloud a common application platform for all internal and customer-facing digital activities. Global IT is a valued business partner in the Hilti Group that is business-driven, value-focused, and competitively strives for customer satisfaction, business and operational excellence in every area.

FOR MY SOLUTION ARCHITECTS AND ENTERPRISE ARCHITECTS, IT IS INSPIRING TO EXCHANGE THE LATEST INSIGHTS IN ENTERPRISE MODELLING WITH OTHER PRACTITIONERS AND TALENTED STUDENTS PARTICIPATING IN THE NEMO SUMMER SCHOOL.

Dr. Martin Petry, CIO, HILTI AG

FUJITSU

Fujitsu

Fujitsu is a global ICT company that originated in Japan with over 80-years of history. We are the world's fifth-largest IT services provider and No.1 in Japan.

Today digital technology is transforming the business, society, and everyday lives of people. In this digital era, we want to be a trusted technology partner of enterprises and public institutions to help them drive their growth. To co-create new value with our customers, Fujitsu focuses on providing breakthrough digital technologies including AI and IoT and works on shaping open-innovation ecosystems with enterprises, startup companies, academic institutions, and governments. Through co-creation, we aim to realize a better future for everyone.

IT IS VERY IMPORTANT FOR US TO HAVE A GOOD PARTNERSHIP WITH WORLD-LEADING ACADEMIC INSTITUTIONS AND CONTRIBUTE TO DEVELOPING NEXT-GENERATION TALENT.

Dr. Yoshikuni Takashige, Vice President, Marketing Strategy and Vision, Fujitsu Limited

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Atos

Atos is a worldwide Information Technology Partner with a global focus on decarbonization and circular economy. Every day 110 000 employees in 73 countries are developing and implementing innovative, digital solutions that support the business transformation of clients and address the environmental and social challenges we all face.
To meet the requirements of the digital world Atos' IoT solutions for example address a variety of areas, such as connected cars, connected homes and industrial IoT especially for retail, healthcare and the financial sector. The focus is on integrating technologies such as blockchain, cognitive learning, artificial intelligence and machine learning. The sustainable and responsible use of these technologies and the acceptance by the people are essential.

SEEING DIGITALIZATION AS A KEY FACTOR IN THE SUCCESS OF OUR ECONOMY, WE BELIEVE THAT DIGITAL SKILLS MUST BE STRONGLY PROMOTED IN THE FIELD OF EDUCATION. WE ARE PROUD TO BE PART OF THE SUMMER SCHOOL - AN INTERNATIONAL PLATFORM FOR STUDENTS, SCIENTISTS, AND INDUSTRY LEADERS TO EXCHANGE IDEAS AND DISCUSS NEW DEVELOPMENTS FOR THE DIGITAL AGE.

Dipl.-Kfm.Ing. Johann Martin Schachner, CEO, ATOS Austria

City of Vienna

Vienna is on its way to becoming the digitisation capital. It is essential to focus on the benefits of technology for people. Digital humanism is an essential principle in all digital change processes. The "Digital Agenda Vienna" shows the relevant fields of action of digitalization: security, service, knowledge, working world 4.0, economy, infrastructure, and governance.

IN VIENNA, IT IS ALWAYS SAID: "THE HUMAN BEING IS THE CENTRE OF ATTENTION. TECHNOLOGY FOLLOWS PEOPLE, NOT PEOPLE FOLLOWING TECHNOLOGY.

Dipl.-Vw. Klemens Himpele, CIO, Stadt Wien

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AFIL

AFIL is an Italian private association, recognized by Lombardy Region as the regional technological cluster for Advanced Manufacturing. The cluster aims at promoting and facilitating R&I actions by creating and animating communities of stakeholders with the final goal to improve the Lombardy manufacturing system sustaining its leadership and competitiveness.

WE ARE KEEN TO HAVE THE OPPORTUNITY TO GET IN TOUCH WITH NEMO PARTICIPANTS AND FOSTER THE FUTURE OF INDUSTRIAL TRANSFORMATION.

Dr. Andrea Mazzoleni, Project Manager, AFIL

CIMES

CIMES is dedicated to engineering, smart manufacturing, and intelligent mechanical systems and gathers almost 300 members from the industrial and academic ecosystems. These stakeholders aim to accelerate innovation and enable the emergence of innovative collaborative projects. CIMES aims to help any company that is requesting support in its Industry of the Future approach.

OUR ROADMAP IS ALIGNED WITH THE NEMO OBJECTIVES, NAMELY ENCOURAGING DIGITAL INNOVATORS AND DIGITAL ENGINEERS.

Arnaud Bocquillon, Head of Foresight, Scientific Coordination and European Activities, CIMES

Metal Processing Cluster

It is the largest cluster of the metal and machine industries in Poland, (awarded "Key National Cluster" in 2015) bringing together more than 100 entities. The cluster carries out initiatives on behalf of its members, strengthening cooperation across sectors, such as automotive, construction, energy, medical equipment, eco-industry and industry of the future, etc.

WE ARE GLAD TO BE PART OF SUCH INITIATIVES CONNECTED WITH INTERNATIONALIZATION AND COMPETENCE DEVELOPMENT IN THE AREA OF DIGITAL INNOVATION.

Sebastian Rynkiewicz, President, Metal Processing Cluster

PrelMet

PrelMet's mission is to increase the capacity for innovation, research, technological transfer of members' competitiveness as a sustainable regional development policy by interconnecting knowledge, technologies, and people. Currently, PrelMet Transylvania has 51 members (companies, HEIs, local administrations, and NGOs).

THE INTERNATIONAL PLATFORM OF NEMO ENABLES US TO ENHANCE OUR MISSION AND TO GAIN KNOWLEDGE ON THE LATEST ACADEMIC RESEARCH.

Dr. Ing. Ioan Bele, President, Prelmet

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The EVENTS

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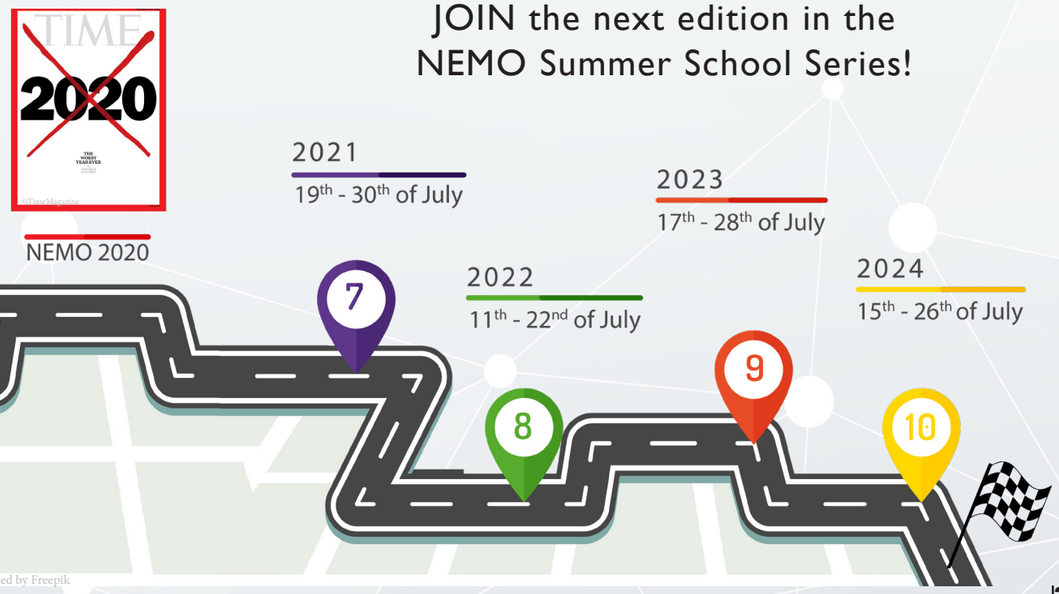

The LOCATION

UNIVERSITY OF VIENNA

universität wien

650
YEARS OF ACADEMIC EXCELLENCE

9
NOBEL PRIZE LAUREATES

1st
UNIVERSITY IN AUSTRIA

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Founded in 1365 as Alma Mater Rudolphina Vindobonensis by Rudolph IV the University of Vienna is the oldest higher education institution in Austria and one of the oldest in Europe. In 1848 article 17 of the Austrian Basic Law, which is still valid today, was instituted stating that "Science and teaching are free." In 1897, 532 years after its foundation the University of Vienna permitted women to enroll, although initially only at the faculty of Philosophy.

The university's current main building was built between 1877 and 1884 by Heinrich von Ferstel in the city center of Vienna. Currently, the university distributes its activities in more than 60 locations. A total of 9.900 employees work for the university, about 70% of them in research and teaching.

Source: https://www.univie.ac.at/en/

Nine scientists associated with the University of Vienna, through either research or teaching, have been awarded the most prestigious distinction in science: the Nobel Prize.

- Robert Bárány , otology - 1914: Nobel Prize for Medicine
- Julius Wagner-Jauregg, psychiatry - 1927: Nobel Prize for Medicine
- Hans Fischer, chemistry - 1930: Nobel Prize for Chemistry
- Karl Landsteiner, immunology - 1930: Nobel Prize for Medicine
- Erwin Schrödinger, physics - 1933: Nobel Prize for Physics
- Viktor Franz Hess, physics - 1936: Nobel Prize for Physics
- Otto Loewi, physiology and pharmacology - 1936: Nobel Prize for Medicine
- Konrad Lorenz, biology - 1973: Nobel Prize for Medicine
- Friedrich A. von Hayek, economics - 1974: Nobel Memorial Prize in Economic Sciences

Source: https://www.univie.ac.at/en/

Besides being Austria's oldest university, the University of Vienna is also the biggest one. More than 6.800 scientists research in 15 faculties and 5 centers, from humanities to computer science.

They teach more than 88.000 students in 178 different study programs. 26.600 or about 30% of all students enrolled at the University of Vienna come from abroad. About 9.600 of the total student population graduates each year from either Bachelor, Master or PhD studies.

The University of Vienna strives to be a top research and teaching university. It promotes international research and teaching cooperation based on strong disciplinary research and identifies cross-sectional topics that can be worked on beyond the boundaries of disciplines and faculties.

Source: https://www.univie.ac.at/en/

The CITY

VIENNA - AUSTRIA

no. 1
IN INTERNATIONAL QUALITY OF LIVING

no. 2
THE WORLD'S MOST REPUTABLE CITIES 2016

no. 3
INNOVATION CITIES WORLDWIDE 2015

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In 2019, for the 10th consecutive time, Mercer has again ranked Vienna first in its international quality of living survey as the city with the highest quality of living worldwide. The study compares 230 cities worldwide based on 39 criteria such as political, social, economic, and environmental factors.

The survey, which included a separate ranking of each city's infrastructure for the first time this year, called the category "pivotal" in determining the overall quality of living for expats. Factors assessed included: reliable electricity; drinkable water; the availability of telephone and mail services, and international flights from local airports; traffic congestion; and access to public transportation.

Source: https://www.wien.gv.at/english/politics/international/comparison/mercer-study.html

The City RepTrak study from the global Reputation Institute ranks the world's 100 most reputable cities based on factors such as trust, esteem, admiration, and respect. Among the attributes used for ranking, the two most important are whether the city is considered beautiful and whether it is viewed as a safe place for visitors and residents.

A city's ranking is believed to be linked to the amount of support that a city can generate from its reputation in the form of business, travel, tourism, and investment.

The Reputation Institute also tracks the reputations of global brands and companies across important international markets, interviewing 55,000 consumers across 15 countries.

Source: https://www.thelocal.at/20141128 vienna-has-worlds-best-reputation

The Innovation Cities Index measures the quantifiable drivers of innovation, which all form the pre-conditions for an innovation ecosystem. A total of 162 indicators is used for ranking 500 cities from all over the world. They are grouped into 3 main categories: Cultural Assets, Human Infrastructure, and Networked Markets. This maps the process of innovation, from idea to implementation and communication. In 2015 Vienna was ranked the 3rd most innovative city in the world.

Source: https://placebrandobserver.com/insights-innovation-cities-index-2016-2017/

NEMO SUMMER SCHOOL SERIES

The NOTES

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