

R&D-EQUIPMENT AND SERVICES PORTFOLIO

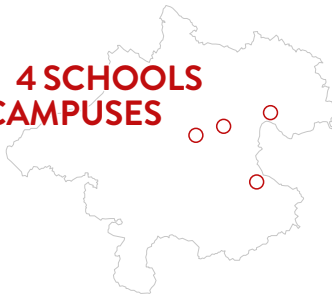
**ACHIEVE MORE
THROUGH RESEARCH & DEVELOPMENT**

AT A GLANCE: RESEARCH & DEVELOPMENT

Since 2003, the University of Applied Sciences Upper Austria has taken an innovative approach to applied research and development in 10 Centers of Excellence and Focal Areas. Today, the University of Applied Sciences Upper Austria is well positioned in the field of research and development. In 2020, around 245 professors and 255 full-time employees were responsible for € 20.27 million in R&D turnover. In addition, 4 research staff members completed their PhDs and 2 employees completed a habilitation degree in 2020. This ensures that practical, high-level research and development with a clear orientation towards economic and social needs will continue. The University of Applied Sciences Upper Austria is not only the clear leader among Austria's universities of applied sciences but also one of the most research-intensive universities of applied sciences in the German-speaking world!

For all R&D-related news at the University of Applied Sciences Upper Austria please see our website at forschung.fh-ooe.at.

**4 SCHOOLS
4 CAMPUSES**



» School of Informatics, Communications and Media
Hagenberg Campus

» School of Medical Engineering and Applied
Social Sciences
Linz Campus

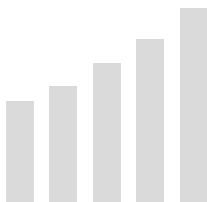
» School of Business & Management
Steyr Campus

» School of Engineering
Wels Campus

€ 40.1 million
in research agreements



10 Centers of Excellence and Focal Areas



**R&D turnover
(in €m)**

2003: 1.14
2010: 9.57
2018: 20.43
2019: 20.88
2020: 20.27



502

scientific publications



4 PhDs | 2 habilitations

ACHIEVE MORE WITH R&D



Unique technologies available across the whole of Upper Austria only at the University of Applied Sciences Upper Austria are available for cooperative use by companies and institutions from industry and society. These synergies strengthen Upper Austria's industrial, export and technology base in the long term.

Mag. Thomas Stelzer, Governor of Upper Austria



In order to successfully compete in both national and international markets, it is necessary to have state-of-art research infrastructure. The University of Applied Sciences Upper Austria uses that infrastructure to create innovations that provide a competitive edge, which generates income and secures jobs.

Markus Achleitner, Minister of Economy and Research of Upper Austria



Our students benefit from the latest R&D equipment at the University of Applied Sciences Upper Austria. Our research-driven teaching imparts cutting-edge knowledge on our graduates who are prepared to create innovative solutions to 21st century challenges.

*Dr. Gerald Reisinger, University President,
University of Applied Sciences Upper Austria*



Our R&D equipment is as versatile as our areas of research. A wide range of equipment and R&D services are available on our campuses, which ensures that our research is state of the art.

*Prof. Priv.Do. DI Dr. Johann Kastner, Executive Vice-President for
Research and Development, University of Applied Sciences Upper Austria*



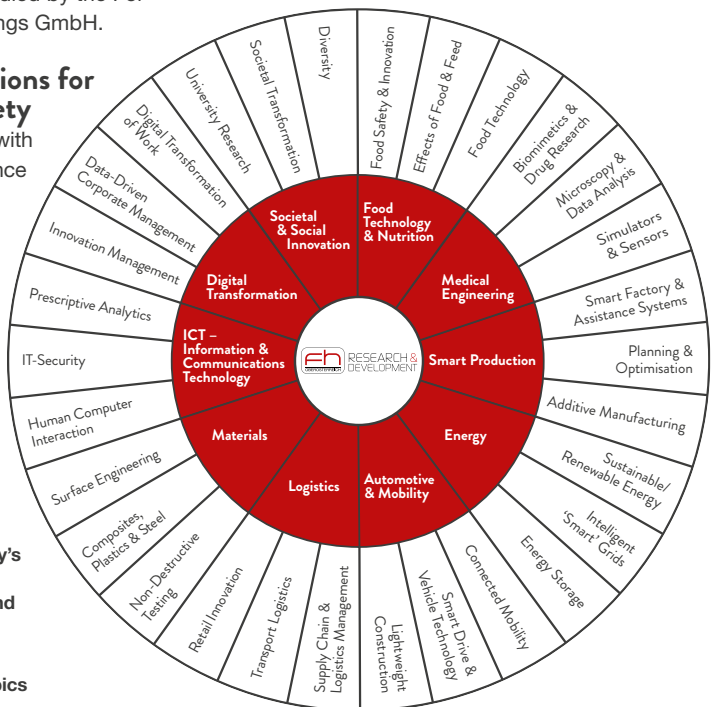
PROGRESS THROUGH INNOVATION

Customised R&D Solutions

The University of Applied Sciences Upper Austria makes innovative results from research and development available to industry and society. The FH OÖ Forschungs & Entwicklungs GmbH (University of Applied Sciences Upper Austria Research & Development GmbH) was founded to carry out research projects and to coordinate the R&D activities of the University of Applied Sciences Upper Austria's degree programmes. All commissioned and subsidised R&D projects are handled by the Forschungs & Entwicklungs GmbH.

Innovative Solutions for Industry & Society

In close coordination with the areas of competence in teaching, a total of ten Centers of Excellence and Focal Areas have been established within the framework of the degree programmes offered at the four schools.



This brochure provides an overview of the equipment and services available for research and development at the University of Applied Sciences Upper Austria.



HAGENBERG CAMPUS

School of Informatics, Communications and Media

| | |
|--|----|
| Focal Area ICT - Information & Communications Technology | 8 |
| Focal Area Digital Transformation | 25 |
| Center of Excellence Medical Engineering | 26 |
| Focal Area Societal & Social Innovation | 27 |

Collaborative Systems

Analysis and Support of Remote and Hybrid Collaboration

Not only since the COVID 19 crisis, a world-wide trend towards distributed work and remote collaboration in various domains and environments can be observed. This in turn leads to an acute need for 1) collaboration tools and devices that support such processes and 2) expertise around the introduction and implementation of remote or hybrid collaboration in the respective (corporate) context.

On the one hand, hybrid forms of collaboration are fundamentally in line with the global trend towards more flexible work. On the other hand, they are also a way to transform the processes, tools and support solutions around remote collaboration that had to be forcibly established during the Covid 19 pandemic, but which prove to be potentially useful also in the future, into planned hybrid scenarios adapted to the respective context. Many aspects of research around CSCW (Computer-Supported Cooperative Work) are highly relevant, for example work on different types of group interaction in web-based environments, and tools as well as support measures within such systems (e.g., awareness mechanisms).

At the Hagenberg campus, this topic is extensively explored by the research group PEEC



(PErsonalised Environments and Collaborative Systems), also in cooperation with industry partners such as Microsoft Research. We not only design collaboration solutions (e.g. collaborative user interfaces), but also develop (preferably web-based) tools and measures for the analysis and support of remote and hybrid collaboration processes. Furthermore, we regularly conduct comprehensive user studies on remote and hybrid collaboration and computer-based support in such settings.

We are happy to discuss your questions about remote and hybrid collaboration in the respective context with you - joint research projects with scientific and industrial partners are just as possible as contract research.



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E-Learning and Blended Learning

Planning and Optimisation of Training Measures Including E-learning

Companies are often faced with the challenge of efficiently and cost-effectively training their employees. E-learning is increasingly complementing classic training courses, in most cases using a Web-based training platform. Training measures can be varied and should be skills oriented and structured for specific target groups. In addition to various e-learning opportunities such as Web-based training, screencasts and learning videos, there are further possibilities for blended learning within the scope of work-integrated learning.

Didactic and psychological aspects of learning are taken into account in order to develop appropriate learning scenarios for employees. The research group offers businesses an evaluation of the measures taken to date and makes recommendations for action in light of a requirements and needs analysis.

Concepts for a training programme and its integration into the company's personnel development and overall business strategy are developed. Specific issues can also be included, such as the acceptance of e-learning, motivation and learning efficiency.

Requirements and needs analysis

Target group and competence analysis

Conception of the further education/e-learning measures

Embedding the measures into personnel development

Evaluation and quality assurance

What We Do

- » Requirements and needs analysis using various methods
- » Target group and competence analysis
- » Evaluation of previous measures
- » Recommendations for action
- » Concept development



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FabSquare – Co-Creation Workspace

Ideate. Fabricate. Innovate.

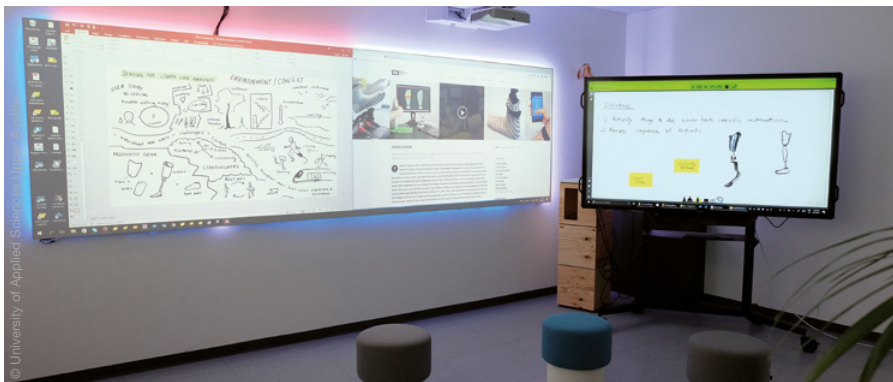
Facilities

- » Innovative space with interactive whiteboards (e.g. Bene Idea Wall and SHARP Big Pad) as well as flexibly-designed furniture (Bene Pixels)
- » A digital tool developed at the University of Applied Sciences Upper Austria for effective realisation of creative workshops and meetings through active integration of methodical knowledge and spatial concepts
- » Direct connection to a MakerSpace with prototyping tools such as a Trotec laser cutter, 3D printer, electronic components (touch foils, smart textiles, etc.) with the goal of creating interactive prototypes during workshops

The Media Interaction Lab at the Hagenberg Campus organises innovation workshops for companies from Austria and abroad to implement new concepts in the field of human-computer interfaces. In regular workshops, interaction concepts are developed in cooperation with our project partners (BMW, Microsoft Research, Google, Bene) from which interactive prototypes are created. For example, several interaction concepts were developed together with BMW that have already been accepted and adopted for serial production. In addition, a creative innovation space called FabSquare was created that makes use of interactive tools such as digitally writable walls and has access to an adjoining MakerSpace for the creation of prototypes during workshops.

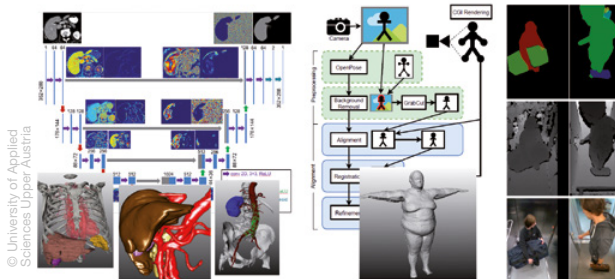


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Framework for Image Processing and Computer Vision

Image-based Analytics in Industry and Medicine



Since many years, the research group AIST (advanced information systems and technologies) addresses image-based research questions in medicine and industry. To process various research projects in an efficient and holistic manner, utilizing state-of-the-art algorithms, a comprehensive framework as common basis of development has been implemented. That way, core procedures and algorithms of image processing and computer vision are covered, ranging from classic image processing and model-based segmentation approaches to modern deep learning networks.

The AIST imaging framework thereby comprehends all aspects of the imaging pipeline, namely image enhancement, data annotation, image registration, pattern

recognition, data synthesis and automated classification – all relevant for comprehensive application domains. The range of input signals thereby comprises RGB images, depth sensor data, radiographic images as well as medical 3D tomography from CT or MRI.

Thereby, our project scope covers the digitalisation and automated classification of 2D building construction plans, emergency detection in elevator systems, 3D reconstruction of the human body from monocular camera feed, automated measurement of wood staples or emotion analysis of human faces. In the field of computer-assisted diagnostics in medicine, modern segmentation approaches allow for accurate quantitative measurements, visualisation and haptic 3D print.

What We Do

- » data analytics and concept
- » signal enhancement and filtering
- » registration and image fusion
- » data synthesis (GAN) and augmentation
- » automated segmentation



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Heuristics and Evolutionary Algorithms Laboratory

Heuristic Optimisation and Machine Learning with HeuristicLab

The research group HEAL¹ deals with the modelling and efficient solution of complex optimisation problems in response to issues in the fields of production, logistics and data analysis. Exact and heuristic optimisation and customised algorithms as well as powerful standard procedures are used. HEAL had a definitive role in the development of HeuristicLab², an open source software and application framework for heuristic optimisation, and has extensive experience and know-how in software development. HEAL provides specialised visualisations and software prototypes for practical issues. A high-performance computing environment is available at the Hagenberg Campus to solve computationally-intensive optimisation problems.



The research group HEAL carries out project-based research and development activities in the form of funded research projects, commissioned industrial projects and study projects. Students also take part through master and bachelor theses and internships. Several dissertations have already been developed in collaboration with the JKU.

Features

- » Machine learning algorithms for data analysis
- » Analysis of industrial data
- » Heuristic algorithms for combinatorial optimisation problems
- » Simulation-based optimisation
- » HeuristicLab software environment
- » High-performance computing environment for optimisation and analysis

¹ <http://heal.heuristiclab.com>

² <http://dev.heuristiclab.com>



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Human-Centered Design

User Experience and Usability


The requirements of different target groups and individual users for computer-based systems, user interfaces or interaction solutions are highly diverse - a trend that is also reflected in the ever-increasing expectations towards technical products. User-friendliness, naturalness or intuitiveness in operation play just as important a role as basic usability - the overall goal is to enable a positive and fulfilling user experience with the help of human-centered design.


At the Hagenberg campus, this topic is represented by Prof. Dr. Mirjam Augstein, professor for personalized and collaborative systems at the degree program Communication and Knowledge, Media (and responsible there for the entire field of Human-Computer Interaction), and Prof. Dr. Werner Kurschl - head of the Master's program Human-Centered Computing.

Thanks to our intense experience in the field of Human-Centered Design, Contextual Design, Interaction Design and Usability and User Experience Evaluation, we also frequently support industry and business partners. For instance, we cooperate with them in the development of new user interfaces, innovative interaction concepts as well as in the integration of human-centered methods and approaches in internal company development processes and in the systematic elicitation of requirements.



Our focus is on the holistic consideration of the human-centered, iterative design process - we are happy to accompany corporate partners throughout the entire course of a solution development, from context and requirements elicitation to prototypical implementation and evaluation. We rely on methods such as Contextual Design after Holtzblatt & Beyer as well as on the ongoing, intensive involvement of later users and other stakeholders, and also conduct intensive user studies.

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ImmunExplorer

Framework for the Analysis of the Human Adaptive Immune System

The human adaptive immune system plays a vital role in, among other things, the detection of potential pathogens or serious or incurable diseases, such as cancer or autoimmune diseases. We also depend on the functionality of our immune system for transplants.

Knowing the composition of the immune cell populations plays a decisive role, especially in diagnostics and therapy. The ImmunExplorer software uses blood or tissue data to depict the repertoire of the adaptive human immune system and predicts potential transplant rejections through the integration of machine-learning algorithms and the use of descriptive statistics. Information on the distribution of B- and T-cell receptors determines the diversity and flexibility of the human immune system.

The ImmunExplorer framework can be downloaded at: <http://bioinformatics.fh-hagenberg.at/immunexplorer>



Features

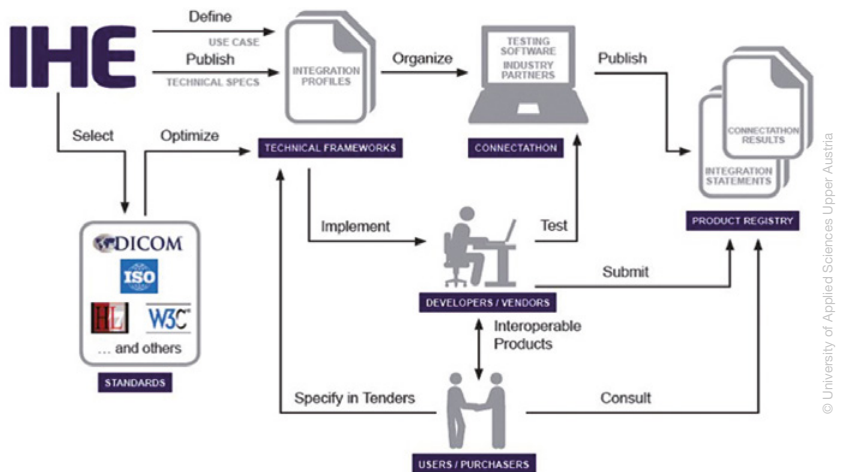
- » NGS data analysis
- » Clonality analysis using B- and T-cell receptors
- » Diversity calculation of the adaptive immune system
- » Primer matching algorithm
- » Clone tracker
- » Automated IMGT genome download
- » (T and B cells)
- » Parameter optimisation of evolution strategies under conditions of diversity
- » Descriptive statistical analysis
- » Comparative analysis of human adaptive immune systems
- » Next generation sequencing analysis (MiXCR)
- » Machine learning integration (HeuristicLab)
- » Desktop client for Windows and command-line tool for UNIX
- » User-friendly
- » Export function for all analyses
- » Freely available



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Interoperability

Best Practices for Producing Syntactic, Semantic and Process Interoperability



Since 2008, the research group AIST has been working intensively on interoperability in the health care sector. The principles and the methodical approach to the various stages – syntax, semantics and processes – have applications beyond e-health. The global initiative

IHE (Integrating the Healthcare Enterprise) defines a process to ensure that complex problems are solved on the basis of existing standards such as HL7. This process can also be applied to other domains and contribute to the harmonisation of information processes.

Features

- » Harmonisation of standardisation activities
- » Specification of integration profiles
- » Analysis of existing standards
- » Guidelines for standardisation
- » Interoperability analysis



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Mixed Reality

Augmented Reality and Virtual Reality



The two mixed reality technologies — augmented and virtual reality—have become more and more popular in recent years. The use of mixed reality goes far beyond classic scenarios such as digital entertainment or virtual manuals. Training, visualisation and planning are just a few of the other areas in which mixed reality plays an important role.

Mixed reality applications are complex in conception and creation as they are interdisciplinary by nature. The input and display hardware must be fit for purpose, and areas such as perception psychology, interaction design and real-time representation play an important role in the conception and development of the software. Since the user is at the centre of any mixed-reality application, appropriate user studies are also necessary.



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What We Do

- » Training in the development of MR applications
- » Analysis of the problem area and creation of concrete application scenarios
- » Technology consulting and prototyping

Mixed Reality Interaction Space (PIESpace) **Multi-User Position Tracking with VR and AR Support**



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PIESpace is an interactive visualisation system for several users. Several different positioning technologies enables up to 10 people to be tracked simultaneously. Combined with virtual and augmented reality displays (VR and AR), virtual spaces can be shared and interacted with. Large-scale projection provides allows an extended circle of viewers to follow the proceedings. This is also suitable for public installations due to the portability of the PIESpace components.

The research group offers well-founded workflows and consulting for the integration of 3D assets and audio in VR and AR as well as many years of experience with interaction and game design for large public display applications.

Features

- » 2D laser positioning
- » 3D tracking of individuals (HTC Vive, Perception Neuron, etc.)
- » Head-mounted displays (HoloLens, HTC Vive, Oculus Rift, GearVR, etc.)
- » Augmented Reality Frameworks (Vuforia, ARcore, ARKit)
- » Modular software framework for the integration of multiple input and output devices (PIEdeck)



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Mixed Reality Training Simulations

Virtual and Augmented Reality Technologies for Training Simulations

Together with partners from the healthcare, public service and business sectors, the research group AIST develops e-health technologies, frameworks and concepts for conducting training simulations for further education, training and medical rehabilitation. Thanks to an innovative in- and outdoor tracking system, the simulations can be carried out completely independent of the location of participants.

A hardware abstraction layer allows the use of gestures and various input methods, such as the Microsoft Kinect, LEAP-Motion, Perception Neuron, USens Fingo, Thalmic Myo, G-Sensors, etc. as well as devices for virtual and augmented reality like Microsoft HoloLens, Oculus Rift, Samsung GearVR, HTC Vive and more.

Computer vision algorithms as well as machine learning allow the simulation to be configured interactively and reactively, the situations to be adapted to trainees their vital data and training progress to be measure and improved.

Features

- » Virtual and augmented reality simulations
- » Input/output device independence
- » Computer vision segmentation and registration
- » Pattern matching and classification
- » Alternative user interfaces
- » In- and outdoor positioning
- » Vital data and progress measurement
- » Training optimisation



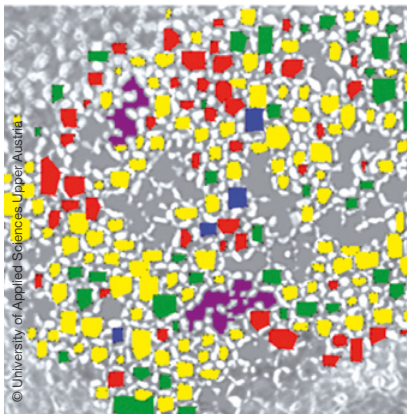
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NanoDetect

Image Processing Framework for the Automated Analysis of Microscopy Images

The correct identification of objects in the micro- or nanometre range plays an important role in the diagnosis or in the prediction of the course of diseases. For example, both the characterisation of serotonin receptors in brain slices of depressed patients and the analysis of the density of bone cells are possible through the combined use of high-resolution microscopy, improved image processing methods and machine learning. The NanoDetect Framework offers algorithms that combine the strengths of modern digital image processing, machine learning and pattern recognition without the need for expert knowledge. Within the framework, specialised modules for analysis areas have been developed, including the analysis of corneal cells for automated analysis of transplantability, the prediction of the mineralisation of membrane tissue and the rhesus classification of red blood cells.

The NanoDetect framework is available for download at: https://bioinformatics.fh-hagenberg.at/bin_typo3/htdocs/fileadmin/user_upload/Downloads/16052016_NanoDetect.zip



Features

- » Biomedical informatics
- » Analysis of microscopy images
- » Recognition and classification of structures such as cells or molecules
- » Integration of machine learning
- » Automated analysis capabilities
- » Specified application modules
- » Use of any image format
- » Usability
- » Web application and desktop client
- » Automated parameter adjustment
- » Statistical analysis
- » Extensive export formats (email, pdf, csv, etc.)



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Networks & Mobility Lab

Traffic Simulation Environment TraffSim

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TraffSim is a microscopic traffic simulator used to test and validate algorithms in the field of networked mobility. The research group Networks and Mobility (nemo) has been developing the tool for several years at the School of Informatics, Communications and Media of the University of Applied Sciences Upper Austria in Hagenberg and has successfully used it in research projects and teaching.

Features

- » Traffic models for longitudinal vehicle movement
- » Lane changing models
- » Highly configurable physics-based fuel consumption and emission model
- » Intelligent, predictive or dynamic (re) routing algorithms
- » V2X communication
- » Intersection control (individual, cooperative)
- » Real or artificially generated road networks
- » Comprehensive evaluation tools

With TraffSim it is possible to analyse the effects of new concepts in road traffic, such as (partially) automated driving, platooning or car sharing with regard to the required resources (fuel, time) and emissions in real traffic scenarios and assess their feasibility.

The expertise of the research group is focused on the modelling and implementation of automated (according to SAE levels of driving automation) or human driving behaviour, the development of intelligent algorithms for traffic flow optimisation as well as the communication of vehicles with other vehicles or the surrounding digital mobility infrastructure (V2X).



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Personalization and Adaptivity

Personalized and Adaptive Systems and User Interfaces

Personalized systems individualize (digital) products and services by taking into account individual user needs and requirements. In addition to the probably best-known application domain in the area of web-based recommendation systems, personalisation also opens up great potential in the area of human-machine interaction, which has so far only been partially exploited. Due to demographic change shortage of skilled workers is becoming a more and more crucial challenge, especially in the industrial sector, and a general increase in the diversity of users are creating numerous challenges with regard to the operation of computer-based devices. Personalised systems not only have to deal with widely diverging preferences, goals, prior knowledge, skills and abilities of their users, but should also be able to react adaptively to these individual conditions. The goals of personalized systems are, for example, an increase in efficiency in the operation of a user interface and user acceptance, the reduction of the error rate through individual assistance measures and the optimized inclusion of as many users as possible.

At the Hagenberg campus, this topic is represented by the research group PEEC (Personalized Environments and Collaborative Systems), headed by Prof. Dr. Mirjam Augstein and Prof. Dr. Johannes Schönböck. The main areas of interest are the conception and design of interactive personalized systems and user interfaces as well as the evaluation of personalized solutions.

We would be happy to discuss your questions about personalisation and adaptivity and to conceptualize and conduct joint research projects with scientific as well as business and industry partners.



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Smart Factory Lab

Data Analysis for Predictive Maintenance*

For the future of production (Industry 4.0), the issue of predictive maintenance (PdM) will be of great importance. The idea of using the actual condition of a machine rather than experience to determine optimal maintenance intervals offers great potential for production-oriented businesses. The aim of this maintenance strategy is the prevention of machine failures and associated downtime as well as improved scheduling of maintenance procedures without having to accept redundancies.

For condition-based maintenance planning, machines with a large number of sensors must be monitored and the resulting time series continuously analysed. A high performance cluster system with appropriate analysis software is available at Hagenberg for real-time analysis of high-dimensional and high-frequency data. Using machine learning techniques, forecast models are first trained on the cluster system and subsequently evaluated in real-time.

What We Do

- » Definition of maintenance strategies and forecast targets
- » Pre-analysis and pre-processing of recorded sensor data
- » Training of forecast models using machine learning
- » Verification and validation of developed models through evaluation sensor data streams in real time



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* Funding under the structural funds programme 'Investments in growth and employment Austria 2014–2020' with EU funds from the ERDF (European Regional Development Fund) and the State of Upper Austria.

USIVIS

User-Centred Interactive Visualisation of Big Data

For the visualisation of big data, conventional methods of information visualisation are rapidly reaching their limits and becoming obsolete due to the large and polystuctured data sets they must deal with. For example, a column diagram can display only a limited number of data points before the viewer perceives it as illegible. For this reason, it is necessary to use novel visualisations such as treemaps or Sankey diagrams and to evaluate them objectively for their suitability for the representation of big data. For the evaluation of visualisation techniques, eye-tracking in combination with other methods such as observations, interviews, questionnaires, etc. appears very promising.

In the case of very large data sets, concepts for interaction combined with novel visualisations in a user-centred manner are necessary. This allows the user to access the desired data from a screen at any time without having to present the entire amount of information at once. Which interactions are being used and how these can be integrated as best as possible into the presentation forms is of particular importance. In this context, user acceptance and the introduction of users to new operating concepts plays a very important role.

The last step in dealing with big data and the progress of digitalisation is the use of interactive and new media in everyday business situations. Collaboration is not only a matter of working together on a terminal device but also collaborative work using several different output media.

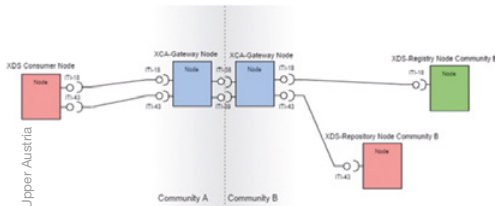


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What We Do

- » Evaluation of new visualisations
- » Big data visualisations
- » Evaluation of interaction possibilities
- » Collaborative work
- » Eye-tracking research

Virtualisation of Distributed Health Information Systems Frameworks for the Evaluation and Simulation of Standards-Based Communication in Healthcare



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Features

- » Simulation of network nodes
- » Verified IHE Actors
- » Quality assurance
- » Evaluation of existing systems
- » Analysis of simulation results
- » Bottleneck analysis



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the simulation of scenarios directly derived from actual operations, such as the introduction of CDA documents into an electronic health record (e.g. ELGA) using the IHE cross-enterprise document sharing profile (XDS). The simulation makes it possible to draw important conclusions for actual operations, thus facilitating an efficient use of resources. In addition, the exercise can make a significant contribution to quality assurance by enabling early simulation (and problem detection) of defined application cases.

Within the research group AIST, frameworks for the development of simulation environments for distributed, service-oriented architectures (SOA) are developed against the background of integration profiles of the global initiative Integrating the Healthcare Enterprise (IHE) as well as the use of established standards such as HL7 and DICOM. These now represent a fundamental technical requirement for integrated care. Numerous systems from various manufacturers in the healthcare sector are already implementing several of the profiles defined by IHE. The harmonisation of communication in the healthcare sector and the enhancement of interoperability, at both the syntactic and semantic levels, are essential for projects such as the Electronic Health Record (ELGA) in Austria.

The framework allows for (1) fast access for evaluating new and existing IHE profiles using a simulated SOA environment, including questions about the effects of changes on existing architectures, and (2)

Software Systems Automation

Frameworks and Algorithms for the Automation of Software Systems

The research group AIST is concerned with the (partial) automation of software systems with a view to decreasing the administrative burden of the Austrian health care system. This includes both system integration and related process automation based on established health standards and frameworks as well as the automation of repetitive activities.

The automation system components include a framework for automatic generation of application elements and model transformations based on standardised data models and paradigms such as the model-view-controller and naked object pattern to fully automate prototyping of both business logic as well as application interfaces, especially those of mobile applications. The automation includes a system for the detection and evaluation of process states and automation through the use of process engines. The system also offers testing automation and the optimisation of test suites to automatically verify manually-prototyped parts of the architecture.

Features

- » Standardised system automation
- » Model-based development
- » Model transformation
- » Automated code generation
- » Automated UI and application generation
- » Process standardisation and partial automation
- » Detection and evaluation of process conditions through computer vision and machine learning
- » Consultations and conceptualisation for software automation



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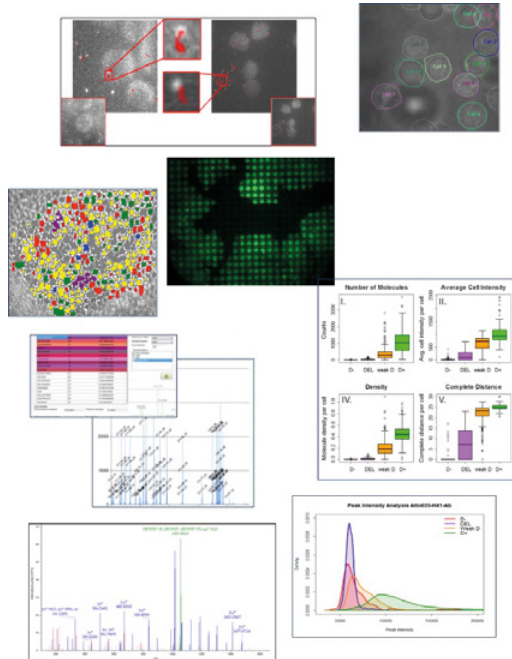
TIMed CENTER Core Facilities

Bioinformatics and Image Processing

Bioinformatics is an area within the scientific field of informatics. Its goal is to lay the foundation for the administration and integration of biological data and to develop different types of analyses for this special data.

Members of the research team bioinformatics at the University of Applied Sciences Upper Austria, Hagenberg Campus develop algorithms and intelligent software systems. These programs help experts in life sciences (medical doctors, biologists, geneticists) to analyze biomedical or molecular biological data. Furthermore, they allow the simulation of biological processes.

The research group for bioinformatics has been working on various research and development projects for years – mostly with partners from science and industry.



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Functions and Services

- » Function 1: Automated editing and analysing of microscopic images
- » Function 2: Identification of relationships in biological and medical data by means of applied statistics and machine learning
- » Function 3: Identification of peptides and proteins in mass spectrums
- » Function 4: Analysis of NGS data
- » Service 1: Spotty, a framework for analyzing microscopic images
- » Service 2: MS Amanda, an algorithm to identify peptides and proteins
- » Service 3: IMEX, a framework for the analysis of NGS data

Higher Education Research and Development

DIVE Model (Describe – Interpret – Verify – Evaluate)

Our unconscious brain is habit-driven and can process a huge amount of information very quickly due to its ability to recognize patterns and use them to assign people, things and situations to specific categories. However, the assumptions we make, are not always correct and likely to be based on experiences we have gained, media coverage and other channels. This may result in unconscious bias or implicit prejudice, which uses shortcuts based on our personal stories, socialisations and cultural norms to make snap decisions.

The DIVE strategy is an easy to use concept that helps to challenge this unconscious bias and to check if assumptions were correct.

In Step 1 – describe – it is necessary to neutrally look at a picture, person or situation and describe what is seen by sticking to objective and observable facts. Step 2 is the interpretation phase that encourages persons to think of the various meanings as to what is going on. All assumptions to describe the situation should be as wide as possible. In step 3, the verification phase, it is vital to double check whether one's interpretations were correct. It might also be necessary to talk to knowledgeable informants and draw on reliable resources. Finally, step 4 should help to evaluate one's own interpretations and engage in a reflective loop.

The DIVE strategy may serve as a useful tool to take more informed decisions, based on analysis rather than instinct.

Video link: <https://www.youtube.com/watch?v=HgaoGubbFJA&t=3s>



Services

- » DIVE stands for Describe, Interpret, Verify and Evaluate
- » By drawing on the “unconscious bias”, it is sought to identify implicit prejudices
- » Identifies appropriate strategies to promote prejudice-conscious thinking and acting
- » Opens up a multi-perspective view by looking at different discrimination mechanisms



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Higher Education Research and Development

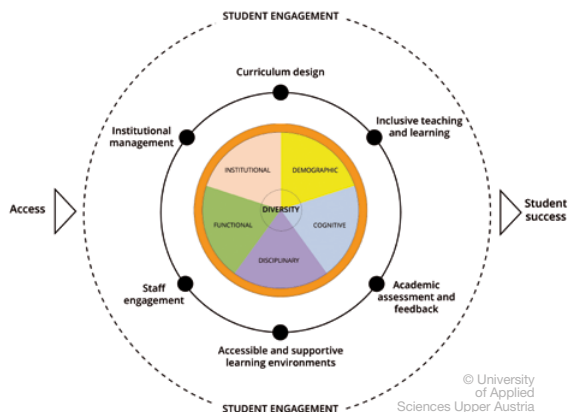
HEAD CD Frame (Higher Education Awareness for Diversity Curriculum Design)

Increasing diversity and strengthening of equality legislation have a deep impact on teaching and learning. To empower all students in ways that they can ultimately fulfill their academic potential calls for re-examination of the management, design and delivery of learning, teaching and assessment - meaning, it requires more inclusive curricula. The HEAD CD Frame can support Higher Education Institutions in this process by offering a framework that describes the entire student lifecycle from access to final student success. The key areas the HEAD CD Frame focusses at are (fair and inclusive) access and integrative student engagement along the different diversity characteristics (see HEAD Wheel) that will lead to student success. The student lifecycle can be positively influenced by a diversity sensitive institutional management and curriculum design, inclusive teaching and learning, excellent academic assessment and feedback, accessible and supportive learning environments as well as positive staff engagement. Making curricula more inclusive is a holistic process and the framework may qualify as a helpful frame of reference. It has the potential to act as a gate opener in curriculum design and delivery. As such, it offers many starting points for teaching staff, managers or program leaders to pave the way for successful academic development of all students.

Video link: <https://www.youtube.com/watch?v=yAL-NFhVntk&t=273s>

Services

- » Holistic approach to inclusive curriculum design
- » Based on the HEAD Wheel of the FH Upper Austria
- » Addresses six fields of action in higher education
- » Shows curricular fields of action for the design of inclusive study programmes

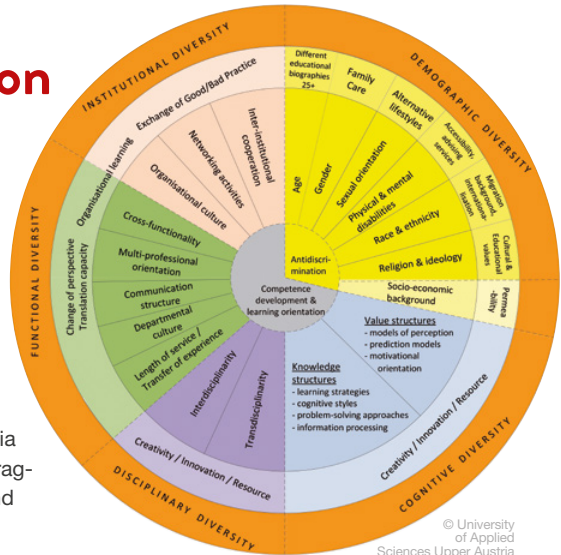


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Higher Education Research and Development

HEAD Wheel (Higher Education Awareness for Diversity)

The HEAD wheel provides a comprehensive overview of five diversity aspects (demographic, cognitive, disciplinary, functional and institutional diversity) that play an integral role at the tertiary level. The FH Upper Austria aims at providing a holistic as well as pragmatic instrument for the organisation and encouragement of a culture of diversity. Due to the intersectional nature of the wheel, different agents can enter diversity-related issues through one of the five HEAD Wheel segments and therefore approach them through different doors, with differing rationales and various purposes. Because of this, it is up to each Higher Education Institution to choose its own key aspects which usually reflect the strategy, the development plan, the charter and the relevant diversity policy. A closer look at the wheel reveals a second ring, which depicts specific challenges and opportunities that HEIs are confronted within this kaleidoscope of diversity. The responsible part of the Higher Education Management actively authorizes and initializes concrete projects and procedures in order to establish a profound diversity management.



Services

- » A holistic framework for diversity management at higher education institutions
- » The concept won the Diversitas Prize awarded by the Austrian ministry of Education, Science and Research (BMBWF)
- » The Wheel goes beyond demographic diversity and takes also account of cognitive, disciplinary, functional and institutional diversity
- » It serves as a frame of reference for a dozen higher education institutions in German-speaking countries

Link zum Video: <https://www.youtube.com/watch?v=TlenqW8csvg&t=24s>



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LINZ CAMPUS

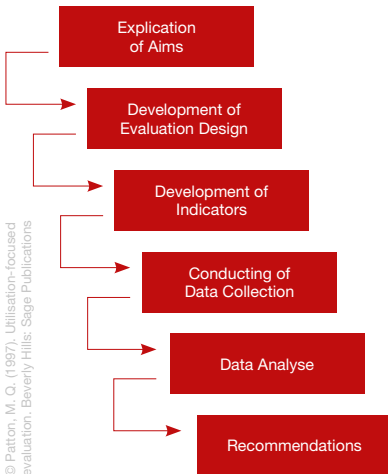
School of Medical Engineering and Applied Social Sciences

Focal Area Societal & Social Innovation
Center of Excellence Medical Engineering

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Conducting and Supervising Evaluation Projects Successfully Mastering Evaluation Projects in Social and Educational Fields

Evaluation model:



» Evidence-based practice in social and educational fields is increasingly demanded by funders, decision-makers or politicians. Evidence-based practice means that practice projects, programs, interventions, measures etc. have to prove their effectiveness. This effectiveness is considered to be empirically proven if the effects intended by the measure were actually achieved. In order to be able to implement evidence-based practice in a professional manner, a special expertise is necessary in evaluation research. This expertise is available in the department Social Work at the University of Applied Sciences Upper Austria (Campus Linz).

- » Expertise:
- » Knowledge in empirical research methods
- » Communication and social skills
- » Practice-related knowledge of organisations and fields



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Procedure

- » Development of a customized evaluation concept
- » Formative evaluation: This kind of evaluation pursues the aim of optimizing the project implementation and improving the project concept. It is targeted on the phase of planning and preparing a project and is aimed at those persons who are involved in project design and implementation (see Gollwitzer & Jäger, 2009).
- » Summative evaluation: This kind of evaluation aims to investigate the effectiveness of a project without optimizing it (see Gollwitzer & Jäger, 2009).

Higher Education Research and -Development

Blended-learning Training on Inclusion and Diversity Management in the Study Programme



© enhanceidm.eu

Features

- » Primary Target Group: Study Programme Leaders in Higher Education, upon request possibility to adapt and extend the training to other target groups
- » Development of personalised training
- » Implementation of blended-learning training:
 - › Face-to-face Workshop (also possible on interactive online platforms)
 - › Self-learning course in Moodle

As one of the main outputs of the international Erasmus+ project EnhanceIDM a blended-learning training on inclusion and diversity management in higher education was developed; it was recently named as a best-practice example by the European funding agency. The aim of the training is to raise awareness among participants for the diverse needs of an increasingly heterogeneous student population in order to ensure student success. Most importantly, the training aims at providing concrete advice that enables participants to implement diversity management in their programmes. The first run of the training has shown, that is it especially exchange and discussion among peers that leads to the most fruitful results. Thus, participants are encouraged to share and exchange their own experiences.

While programme leaders represent the initial target group of the training, it is possible to adapt and extend the training to other target groups as well, even outside of higher education.

The modular training is composed of two parts: first, a face-to-face workshop dealing with theoretical foundations (for example, the concept of implicit bias) but also focusing on the implementation of IDM measures in the study programme (for example by drafting personal 'action plans'). The online Moodle course thematically follows the student life cycle (from fair admissions to inclusive teaching and learning practices) but it also addresses staff management as well as institutional strategies.



Co-funded by the
Erasmus+ Programme
of the European Union



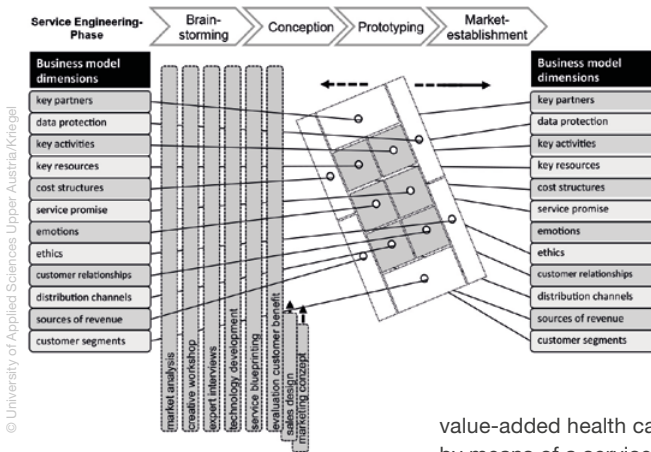
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New Service Engineering in Healthcare

New Service Development and Business Model Engineering



A shortage of skilled workers and digitisation are the current drivers of change in the healthcare system. These challenges will be met with new and enhanced hybrid healthcare services. The purposeful and conceptual development of marketable and

value-added health care services is achieved by means of a service development loom. The different dimensions of the business model (e.g. customer segments, distribution channels, performance promises, etc.) are described as warp threads which are interwoven with weft threads representing the various management and service engineering techniques (e.g. network building, potential analysis, service blueprinting, customer integration, etc.). Here the business model grid (Service Business Model) and the associated performance measurement indicators function as the reed of the loom. Current application options are e-health/AAL, AI/robotics or primary care.

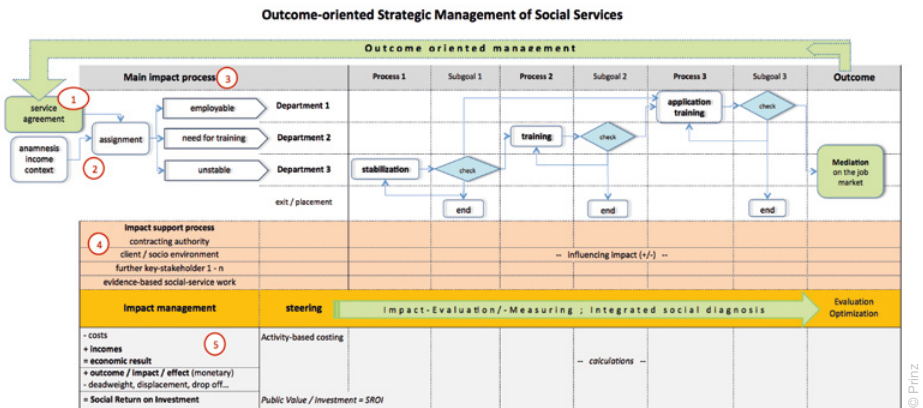
Method

- » Characterise complex initial situation
- » Systematise transparent challenges
- » Identify relevant patient and customer requirements
- » Evaluate required user and technology acceptance
- » Design and develop hybrid solutions
- » Measure and prioritise desired effects
- » Communicate and support market-ready business models



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Outcome-oriented Strategic Management Management of Social Services with Socio-economic Impact Chains



The model sketch shows the process of placing a person with a need for support in the job market. Following agreement of the outcome (long-term placement on the job market), which is the result of negotiations of the stakeholders, the person is assigned to the organisation on the basis of an anamnesis. The impact of influence by other stakeholders is measured at checkpoints. This allows development processes and costs to be controlled. The costs are controlled by means of activity-based costing and the consideration of social savings potential (social return on investment SROI).

What We Do

1. At the beginning, the impact target is agreed and a contract is drawn up.
2. In what context does the social organisation work? What is the person's situation when they join the organisation (income, anamnesis)? Then the assignment takes place.
3. The standardized main process starts with the stabilisation in the corresponding department. Social diagnostic interim checks document the person's path.
4. Taking the impact of influence by stakeholders into consideration.
5. Management of costs and outcomes by means of activity-based costing and SROI.



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Procedural Economy

Service Blueprinting and Patient Journey in Patient Care

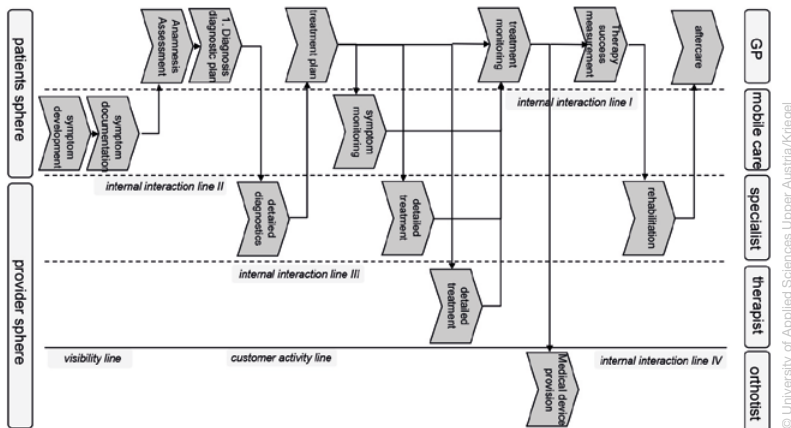
Method

- » Visualise relevant business processes
- » Identify current system and process alignment
- » Identify key internal customers, co-producers and co-designers
- » Measure stakeholder or patient-related value contributions
- » Realise differentiated process optimisation
- » Orient business processes oriented towards patients and customers

The fragmentation and specialisation of the healthcare system presently pose a challenge to a holistic approach to healthcare quality, which can be addressed through comprehensive process and patient orientation. This requires transparent interfaces and coordinated communication across organisational and professional boundaries. Business process reengineering, service blueprinting and patient journey can be used not only to identify gaps, barriers and communication deficits but also to develop approaches and strategies for (added) value optimisation and flow management with regard to patients, buildings and content. Current applications include the management of patients' stays in geriatric care and the optimisation of support processes in hospitals.





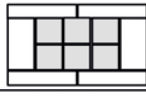
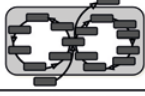
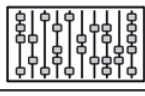
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Strategy Development and Innovation in Healthcare

Requirements of Care and Patient Experience in Patient Care

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| Targets | Service dimensions | Structures | Processes | Results |
|---|--|---|---|---|
| Strategic Targets  | Performance  | Business model  | Service engineering  | Monitoring  |
| Formal goals <ul style="list-style-type: none"> • quality of care • Service quality • market attractiveness • Research and progress Tangible goals <ul style="list-style-type: none"> • autonomy • efficiency • effectiveness • financing | <ul style="list-style-type: none"> • Product • Customer • Lot size • Quality • Time • Delivery • Costs • Ethics • Emotion • Employee • Expedient • Law | <ul style="list-style-type: none"> • Customer relationships • Communication and distribution channels • Sources of revenue • Value propositions • Emotions • Key activities • Key resources • Key partnerships • Cost structure • Ethics • Data protection | <ul style="list-style-type: none"> • Problem identification • Current solution <ul style="list-style-type: none"> - conditions - aims - actors - conditions - processes - interfaces - Resources • Future solution <ul style="list-style-type: none"> - idea - Organization / Service - technology - economics - Law - Ethics / culture - emotion - Prototype • Innovation / Establishment | <ul style="list-style-type: none"> • Customer perspective • Perspective on innovation • Financial perspective • Internal process perspective • Employee perspective • Social perspective • Supplier perspective • Cooperation partner perspective • Social perspective |

Optimising quality of care in health care requires an overarching controlling force to promote quality, efficiency and innovation. By analogy with market forces, patient orientation can function as a comprehensive invisible hand. By means of qualitative research methods (e.g. analytic hierarchy process, critical incident technique), individual instruments (e.g. business models, use cases, patient experience, communication channels, management styles) are used to develop patient-oriented approaches (e.g. communication concepts, care strategies) through application of appropriate survey and evaluation methods (e.g. creative workshops, focus groups, expert interviews, online surveys). Applications include patient-specific drug provision in the hospital or use of technology in the hospital.

Method

- » Communicate individual environmental changes
- » Integrate relevant stakeholders and patient perspectives
- » Moderate creative idea generation
- » Design strategic system alignment
- » Develop customised change management concepts
- » Evaluate meaningful performance measurements and benchmarking

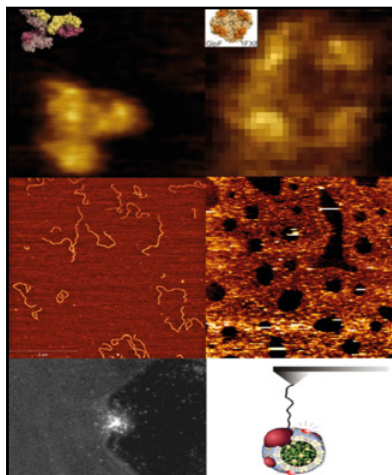


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TIMed CENTER Core Facilities

Dynamics and Interactions of Bio-Nano-Structures

Molecular interactions and the accompanying dynamics form the basis of all biological processes and are thus of great pharmaceutical and medical importance. In order to understand these processes as well as their potential malfunction, it is necessary to examine and characterize their nanoscopic roots in detail. For this purpose, different imaging methods are used. The high-speed atomic force microscopy (HS-AFM) is a technique that allows the examination of protein dynamics, molecular interactions and conformational changes in real-time and at sub-molecular resolution. The combination of fluorescence and atomic force microscopy (FM-AFM) further allows the manipulation of cells as well as the defined transport of bio-molecules to a cell. At the same time, the uptake of molecules and the cellular response are recorded. Single molecule force spectroscopy, quartz crystal microbalance and surface plasmon resonance imaging are used supportively to quantify intermolecular interactions and determine chemical rate constants. In combination with the dynamic-structural data collected by means of HS-AFM, a comprehensive model of a molecular process is generated, which e.g. can be used for the targeted development of drugs.



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Functions and Services

- » Analysis of molecular interactions as well as physical surface properties
- » Chemical rate constants and affinities, stoichiometry, multivalence, interaction forces and energies
- » Label-free real-time visualisation of biomolecules, interactions and conformational changes, cellular interaction studies (drug characterisation)
- » Combination of results and model building, mathematical modelling and simulation

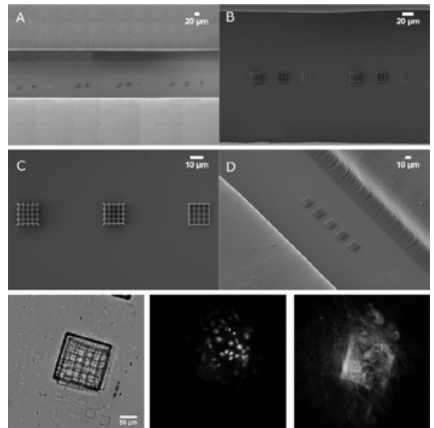


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TIMed CENTER Core Facilities

Medical 3D-Nanolithography for Additive Manufacturing

The latest trends in bio technology show that there is an increasing demand for systems in personalized medicine. As the market for in-vitro-diagnostics is growing, research activities in the fields of tissue engineering and organ printing need to be intensified. All devices are getting smaller, especially in medicine. The predominating reason for this development is the saving of resources: With miniaturisation, the amount of sample material taken from patients for analysis purposes can be reduced. The same is true for the material that is used to produce these devices. To produce biomedical devices of a smaller size in the future, new resources are necessary. The studies of the research group at the University of Applied Sciences Upper Austria, Linz Campus focus on the design of bio-compatible 3D-structures that consist of chemically functional polymers. They carry proteins to imitate tissue environment or contribute to molecular bio sensor technology (microfluidic channels). The methods of choice used to reach the research goal are multiphotone lithography and UV-lithography. Both technologies allow the production of 3D-structures at a micro-scopic, even at a nano-scopic scale.



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Funktionen

- » Micro- or nanoscopic structuring
- » Research in the field of biomolecular bio sensor technology (microfluidics, microfluidic channels)
- » 3D-lithography which allows the real time-visualisation of biomolecules, interactions and dynamics

Services

- » 2D- and 3D-rapid prototyping of micro- and nano-structures
- » Prototyping of microfluidics
- » Cell growth on biocompatible polymers (application field: bioassays)
- » Modification of surfaces
- » Prototyping: 3D-cell cultures and bio-chips

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Medical Simulators

This research group at the University of Applied Sciences Upper Austria, Linz Campus focuses on developing hybrid simulators, also called mixed-reality simulators. These consist of an artificial patient, a computer model and real surgical instruments that are equipped with sensors. This concept combines the advantages of the different modalities. The artificial patient



phantom provides medical assistants with realistic haptic feedback. As real instruments and implants are used, surgical interventions can be simulated in a very detailed and realistic way. The use of 3D computer models combined with instruments equipped with sensors allows imaging simulation. Furthermore, it is possible to generate patient-specific training scenarios and to assess surgical interventions by means of objective measures. The areas of research include:

1. Artificial anatomical structures: Development of artificial bones and tissue with integrated sensor technology (smart artificial tissue)
2. Surgical instrument equipment: Extending real instruments with sensors to measure the position, location, force, pressure and temperature
3. Imaging simulation: Development of algorithms to simulate established imaging procedures (X-ray, ultrasound)
4. Validation of simulators: Biomechanical and medical validation and measuring of learning curves



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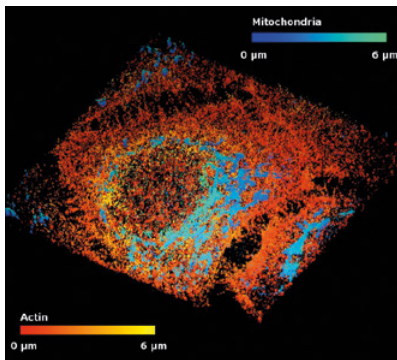
Hybrid Surgical Simulators

- » Artificial patients: Validated artificial vertebral bodies (in relation to the humane preparation), cement application possible (open-cell structure), realistic X-ray-contrast
- » Imaging simulation: Simulated X-ray-projections for imaged interventions (C-arch-position arbitrary selectable)
- » Computer model: real time 3D-visualisation of the anatomy and instruments' position
- » Extended instruments: Sensor integration in existing surgical instruments (location, position, force, pressure etc.), wireless data transmission

TIMed CENTER Core Facilities

Nanoscopic Characterisation of Cellular Processes

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The research group at the University of Applied Sciences Upper Austria, Linz Campus describes medically relevant molecular mechanisms using super-high-resolution microscopy (PALM / STORM) and high-resolution single-molecule fluorescence microscopy (SM-FM). These methods can be used to study biomolecular (antibody/antigen) and cellular (migration, cell invasion, cytokinesis and apoptosis) dynamics, co-localisations and interactions. The multiscale parameters of dynamic cellular processes (e.g., dynamics, movement and interaction of proteins) as well as static cellular processes (e.g., cell morphology, protein clusters, localisation of biomolecules) are then evaluated using

specialized software packages. In this way, processes such as the localisation of individual biomolecules in the tissue or in the cell, the migration of cells or the dynamics of biomolecules can be detected and quantified computer-aided and automated. The imaging techniques are supported and supplemented by molecular biology techniques (real-time qPCR device, multi-well plate reader, photometer, FACS, Western-Blot-tools).

Functions

- » Real time-visualisation of biomolecules, interactions and dynamics
- » (Real time) analysis of dynamic and
- » static cellular and biomolecular processes (diffusion, localisation, morphology, protein cluster) by means of specialized software packages
- » 3D-localisation of biomolecules in cells and tissue by means of super resolution fluorescence microscopy

Services

- » Determining affinities, stoichiometry, multivalence, interaction kinetics of molecules, absorption of molecules by cells
- » Proof of proteins/RNA/DNA in cells from cell cultures in tissue
- » Tests of bio-markers (e.g. fluorescence markers)
- » Toxicity tests (e.g. on surfaces)



STEYR CAMPUS

School of Business & Management

Focal Area Digital Transformation

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Center of Excellence Logistics

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Center of Excellence Smart Production

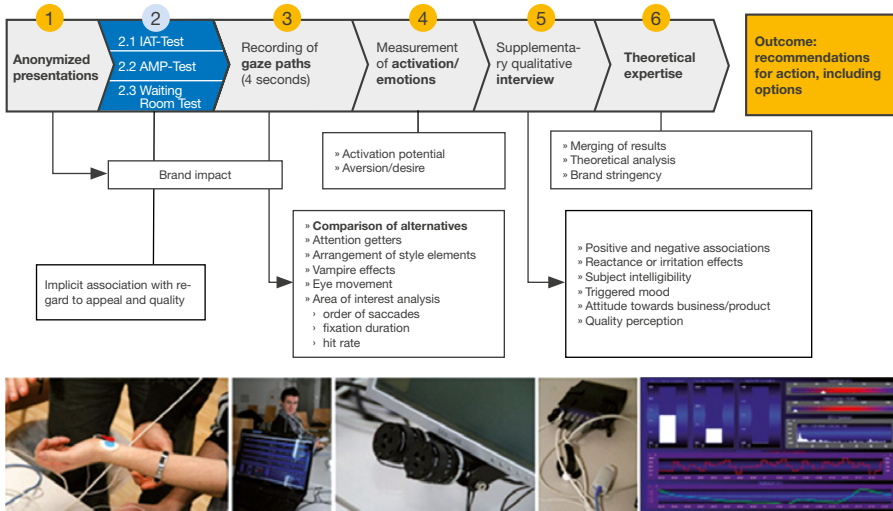
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Center of Excellence Medical Engineering

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Advert Check-Up

Systematic Advertising Analysis



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Based on different analytical steps which are adapted to specific questions, advertising media such as print, spots, posters, packaging, etc. are systematically analysed. Improvement activities are derived from these analysis results. All measurement and survey results which are developed during the methodological setting are pooled and summarized in a final report.

Procedure

- » Anonymized (short) presentation
- » Implicit Association Test (IAT-Test) of Affective Misattribution Procedure (AMP-Test)
- » Waiting-room experiment
- » Eye-Tracking
- » Activation measurement and emotional monitoring
- » Qualitative interview



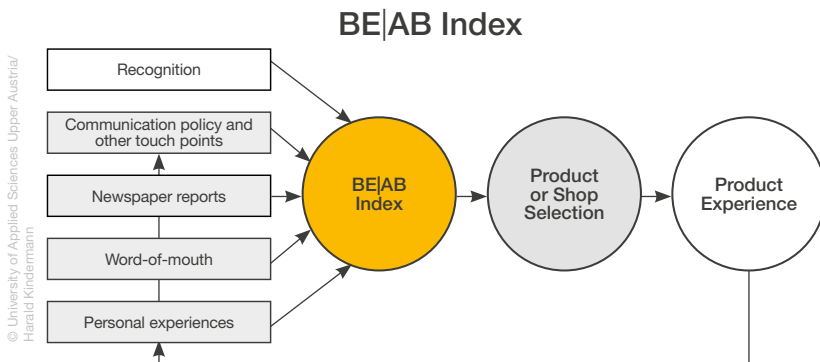
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BE|AB-Index

A Measuring Model for Ascertaining Brand Equity

From a consumer perspective, brand equity significantly influences the willingness to buy and purchase a product. As a consequence, the ability to measure and optimize brand equity is of central importance for a company.

The BE|AB Index is an empirically tested and validated measurement tool for the consumer based brand equity developed as part of a comprehensive research project. The particular advantages of this model are its simplicity, its cost-effectiveness and that brand equity is always determined in comparison to all relevant competitors. As a result, a company always receives important reference points in order to derive corresponding measures for increasing its brand equity.



What We Do

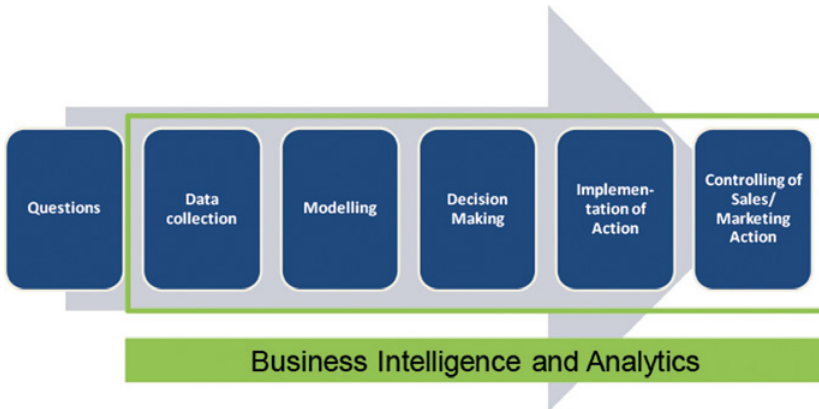
- » Validated surveys:
online, telephone



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Business Intelligence and Analytics for Sales and Marketing

Digitalisation in Sales and B2B Marketing



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Your company wants more target-orientation in its sales planning and wants to control the effects of sales and marketing measures better? In times of digitalisation, CRM data about customers, sales and marketing activities, social media data, web usage data of prospects and customers, market indicators and many more are available for sales management. Using existing business analytics, software tools models can be developed specifically for companies based on data which is available in companies which lead to significant improvement of the predictive power of sales, efficacy of sales and marketing strategies and operative activities. This enables resources to be allocated in an optimized way and risks to be reduced.

Approach

- » Identification of fields of action
- » Data analysis and modelling
- » Generation of knowledge in relation to specific problems
- » Development of prototypes of models and dashboards
- » Outcomes might be: Forecast of sales and customer behavior, forecast of customers and markets for optimized management of sales, marketing, diverse channels and international markets



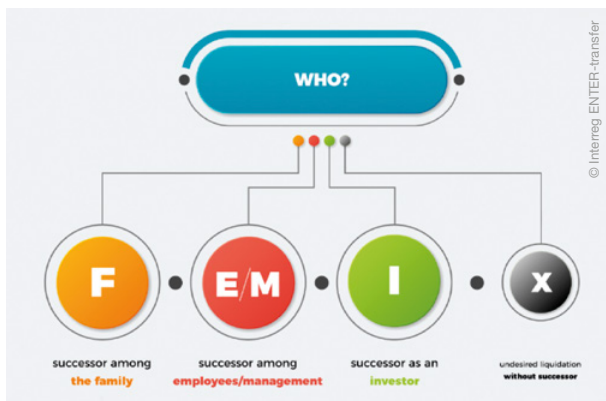
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ENTER-transfer

ENTER-transfer Model for a Successful Company Transfer*

In the cycle of an SME, the handover of the business to the next generation is a critical point. The handover process must be planned on the long term. If this does not happen, an investment backlog and above all, an innovation backlog can be observed.

The research group “Global Business Management” researches in the context of an Interreg project in Central Europe, how to optimize business transfers. A model has been developed which can be used at a very early stage of the handover process and which includes different handover forms. A special focus is on an (international) transfer to external investors. Through the continuation of SMEs, associated jobs, economic resources and company knowledge can be saved.



Procedure

- » Holistic support for entrepreneurs in all phases of the succession process
- » Choice between transfers within the family, within a company or to external investors
- » International Orientation
- » Results provide structured and explanatory self-evaluation



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* Funded by the programme Interreg Central Europe 2014-2020, an initiative of the European Fund for Regional Development

IAT Brand Profiles

An Innovative Measuring Model to Register Semantic Brand Attributes

The characterisation of a brand is determined by combining an implicit measurement technique with an empirical survey. This profile measures the following attributes:

- » The hedonic quality and activation of a brand (to what extent the brand is able to trigger positive emotion).
- » To what extent are certain characteristics assigned to a brand.

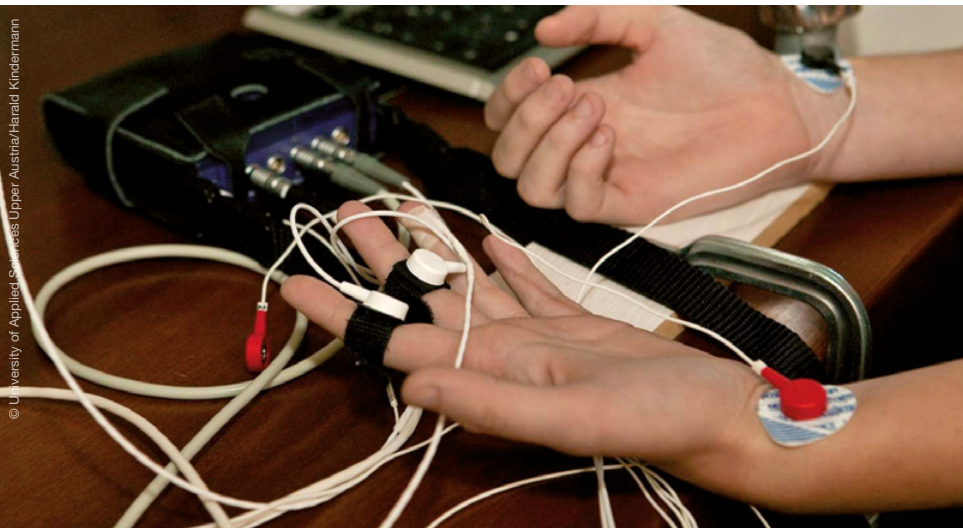
The comparison is always carried out in conjunction with the reference brand.

Procedure

- » Implicit Association Test (IAT-Test)
- » Empirical analysis: online or face to face
- » Test can be supplemented with bio-feedback methods



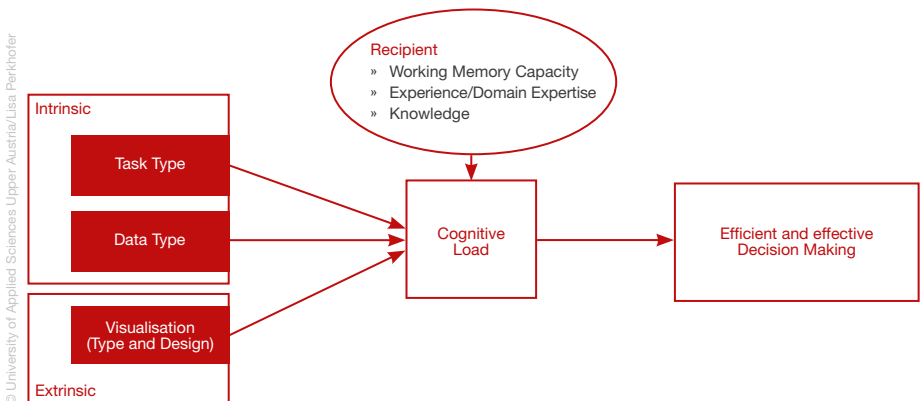
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Information Visualisation

Model for the Determination of Individual Differences in Information Visualisation Recognizing Cognitive Load

Visualisation type as well as design are of utmost importance for the effective and efficient interpretation of information. The tasks the recipient of a report is expected to carry out must be facilitated to the greatest extent possible by visual processing. Using eye-tracking methods, data about the subject's scanning behaviour and cognitive load are collected. The aim of this undertaking is to reduce cognitive load so that the subject can complete the given tasks with as little cognitive effort as possible.



What We Do

- » Visualisation of individual differences
- » Qualitative and quantitative measurements
- » Eye-tracking research

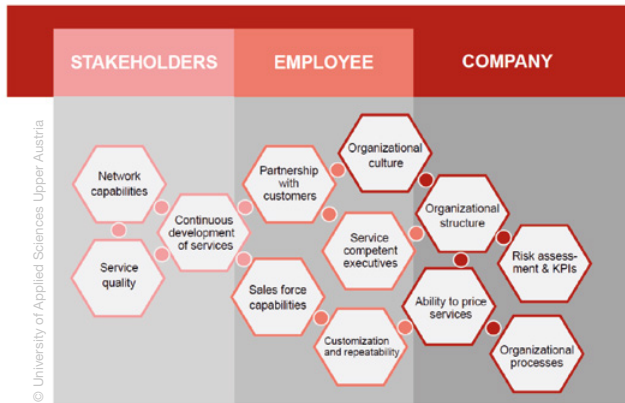


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Industrial Service Excellence Monitor (ISEM) Online Monitoring System for Companies to Measure Their Own Service Performance*



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In order to achieve excellence in the service industry, it is necessary to align companies with the goal of excellence and to adapt the various areas of the business accordingly. This usually entails the implementation of changes. Thus the continuous measurement of one's own development is indispensable. ISEM is designed to do just that. An online monitoring system, the ISE-monitor, has been

What We Do

- » Benchmarking using the Industrial Service Excellence Monitor
- » Monitoring service excellence
- » Comparisons with best-case companies as well as regional comparisons

developed to provide a detailed view of the current status of 'Industrial Service Excellence', comparisons with best-case companies and recommendations for action. A total of 12 service excellence dimensions are analysed: the dimensions (see graphic above) form the basis for a multi-faceted construct depicting the most important factors for the achievement of Industrial Service Excellence. The ISE monitor is based on a broad database, and already 250 companies have used this tool. The Global Business Management team is available to advise on further strategic decisions and operational measures. Link to the monitor: www.ise-monitor.eu/monitor



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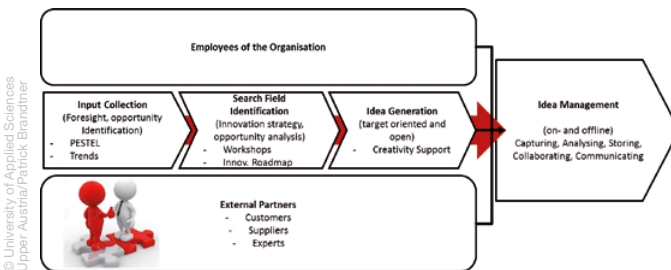
* Funded by the programme Interreg Austria-Bavaria 2014-2020, an initiative of the European Fund for Regional Development



Innovation Capability

Company-Specific Innovation and Strategy Coaching

Company-specific optimisation potential is presented based on a comprehensive situation analysis of current innovation activities. By using tried-and-tested measuring techniques and methods, the early phases of the innovation process—which are highly relevant to company strategy—can be analysed in a targeted manner and optimized according to the respective objectives. As a result, a tailor-made innovation framework is created that facilitates strategic innovation management through comprehensive collection, generation and evaluation of inputs and ideas.



What We Do

- » Innovation capability maturity survey
- » Company-specific innovation coaching
- » Support for strategically-oriented innovation processes
- » On- and offline strategic innovation management tools and methodology
- » Identification and analysis of the status quo
- » Definition of innovation framework requirements
- » Development of the innovation framework
- » Implementation planning and pilot application



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Innovation Platform InnoStrategy 2.0

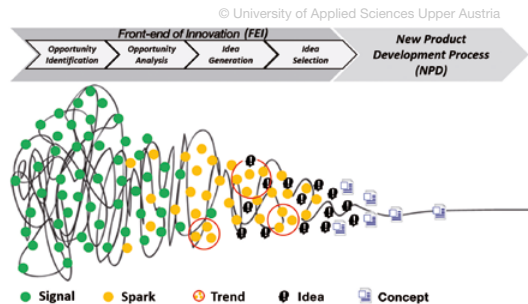
Platform for IT-based, Strategically-Oriented Innovation Processes

A software-based platform to support strategic innovation management was developed using modern methods and tools such as bibliometrics, opinion mining, environmental scanning and corporate foresight. These methods and tools are combined, introduced and implemented individually in the form of a process model that can be adapted to the respective business. As a result, emerging trends are recognized, future opportunities and risks identified in a timely manner and changes in market conditions and customer requirements are captured and incorporated into the innovation process at an early stage.

In addition to classical methods of corporate foresight, the platform also includes semi-automated software-supported methods such as bibliometrics as well as the integration of forums, patent and publication databases. This allows relevant signals to be recognized, collected, processed and imported into the innovation process. These signals are then detailed in a step-by-step process order to serve as a starting point for trend identification and idea generation. Together with the distributor of the software platform (Smartpoint from Linz), the platform can be adapted and implemented according to the respective circumstances of the business.

What We Do

- » Scientific database monitoring
- » Patent monitoring
- » PESTEL module
- » Spark module (input and signal collection)
- » Ideas competitions (challenge module)
- » Trend recognition
- » Idea collection and assessment
- » Scenario workshops and writing



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Intercultural Management

Mastering Internal and International Intercultural Challenges

The Global Sales and Marketing degree programmes have been dealing with intercultural management since 2003. The focus is on the development of intercultural skills and the adaptation of international market strategies based on intercultural challenges.

Development of intercultural skills:

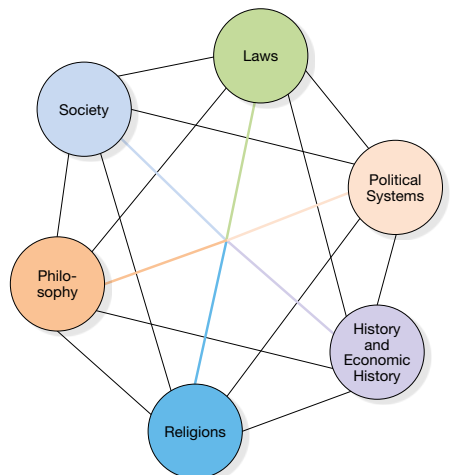
- » Measurement of intercultural sensitivity in the selection of expatriates
- » Expatriation, repatriation
- » Training for future expatriates
- » Intercultural adaptation of training concepts for technicians
- » Sales training for overcoming intercultural challenges
- » Welcome Check Upper Austria for highly qualified international specialists

International marketing and international sales:

- » Intercultural adaptation of marketing concepts, sales concepts and product training
- » International market research for industry and export
- » Analyses of the Austrian market for international companies and organisations
- » Concepts for workshops and training courses for employees and sales partners

What We Do

- » Needs assessment
- » Creation of implementation concept using suite of intercultural methods
- » Different methodological approaches by target group
- » Support for concept realisation



Knowledge Graph and Data Analysis

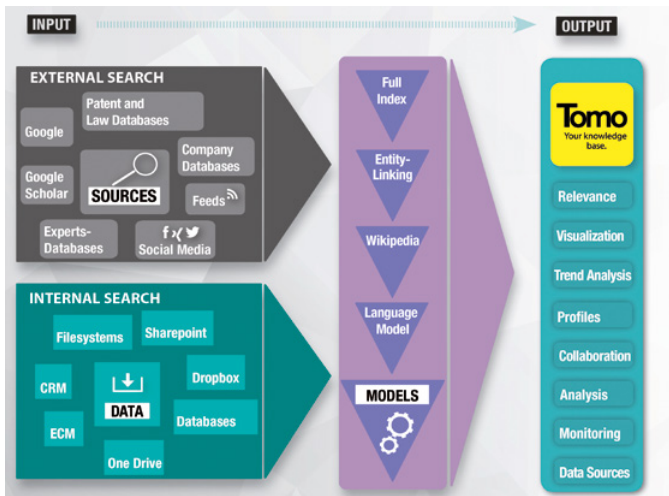
Data Analysis with Big Data Analytics

The 'Knowledge Graph' is a software platform developed in a research project that aggregates, analyses and visualizes data from sources that are external to a company (social media, legal databases, patent databases, search engines) as well as company-internal sources (databases, enterprise content management systems, etc.). The software platform learns from the interaction with its users and delivers relevance-based results. These are represented with different visualisation types—graphs, clouds, circles, etc. Synchronisation with different knowledge bases such as Wikipedia takes place in real time in order to support the analyses. Semantic and linguistic analyses can also be carried out. Big data technologies are used in the back-end to handle the large volume of data.

What We Do

- » Relevance and search profiles
- » Trend analysis
- » Monitoring
- » Linkage of different data sources
- » Visualisation

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(New), Innovative Product-Service Solutions

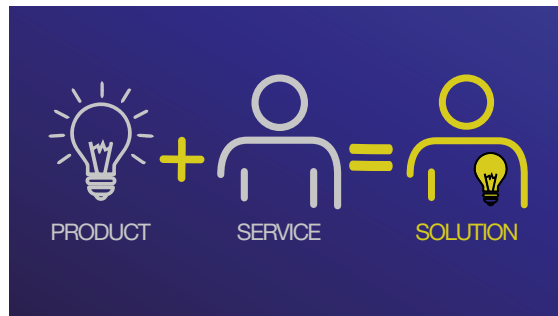
Organisational/Technological Implementation of Existing and New Services, Product-Service Solutions

In order to remain competitive and become established in the market, companies must continue to develop existing services and product-service solutions on an ongoing basis and identify new ones. This enables a company to respond to customers needs, solve their problems and generate real added value. The basis for this approach is profound customer and market knowledge, which in turn enables the targeted development of services and products that customers find useful. The output of such a project is first and foremost the understanding necessary for the identification of new services and product-service solutions as well as know-how about the organisational and technological implementation of these services and product-service solutions.

An online software tool is under development that will contribute to the management of service innovation processes. The tool takes into account the experience of experts and special considerations relating to the management of innovation processes in small and medium-sized enterprises. The tool also provides companies with methodological support and enables them to integrate continuous innovation process management in order to exploit existing innovative potential.

What We Do

- » Initial situation analysis
- » Evaluation of results
- » Identification of new services, product-service solutions: innovation process
- » Technological feasibility, organisational adaptations for implementation of new services, product-service solutions
- » Market launch



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Online-Tool for Measuring Service Innovation Processes of Companies

Service Innovation Processes for SMEs (SIP-SME)*

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Approach

- » Measurement of innovation status
- » Recommendations for the improvement of innovation processes
- » Benchmarking with other companies in the region and in the industry



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Due to an increasing global competition, it is essential that small and medium-sized enterprises focus on the development of innovative services and products. The research area Global Business Management at the University of Applied Sciences Upper Austria and the South Bohemian University, together with Business Upper Austria and the South Bohemian Science and Technology Park, develop an online tool as a part of the SIP-SME project, which will enable continuous service innovation process management for SMEs in Upper Austria and South Bohemia. The development of the tool is based on prior analyses and interviews with business experts. With the tool, companies can measure the status of their organisation, management, processes, KPIs, collaboration, resources, customer experience, and market situation. The SIP tool will provide more methodological support for innovation management to all innovation-oriented SMEs in both regions. All project outputs and the SIP tool will be available at the end of the project at www.sip-sme.com.

* The project is funded by the European Regional Development Fund of the European Union as a part of the INTERREG V-A Austria-Czech Republic program.

Opinion Mining/Social Media Analysis

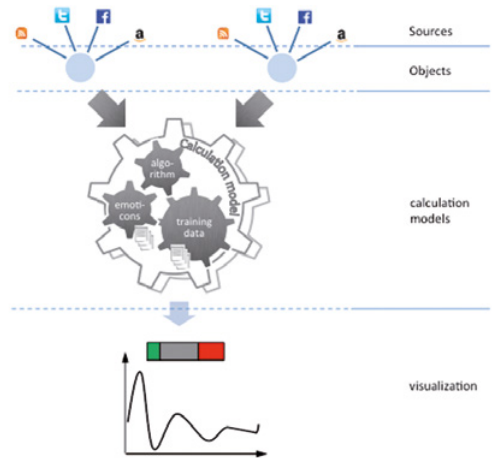
Visualisation of Internet Information on Companies, Brands and Products

What We Do

- » Extraction of content from social media sources
- » Studies using analysis models
- » Dataset compression
- » Visualisation and data processing



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A tool for social media analysis and opinion mining was developed within the scope of several research projects. The objective of opinion mining is to aggregate, analyse and systematically process consumers' attitudes towards products, brands, organisations or individuals.

The tool employs various methods and algorithms from text mining and machine learning to continuously monitor and assess the tenor of various social media sources (such as Facebook, Twitter, etc.) as well as other Internet sources (RSS feeds, forums, websites, patent databases, Amazon reviews, publication databases, etc.).

The tool is also used, among other things, as a basis for the InnoStrategy platform for corporate foresight (see page 48).

Persona Descriptions and Competence Catalogs for Employees in Finance and Accounting

Digital Accounting Change Management in Digital Finance and Accounting

In the past, accounting has always been a reliable job engine and an attractive career field for many people with strong professional qualifications. Just as in industry, digital upheaval is now imminent. This digital upheaval poses challenges for companies. However, research and practical experience must not be limited to technological possibilities and rationalisation potentials, but must also focus more on employees, their ability to work, their job satisfaction, and their long-term job prospects. The project therefore focuses on people in this development. In order to be able to deal with digital change and the complexity of technology, social, cognitive-analytical and IT competencies are required in addition to technical knowledge. As part of the project, competence profiles will be developed for the professional fields in finance and accounting that are influenced by digitalisation. These profiles can be used in the course of successful change management to support employees in their development.

| A digital accounting... | ...brings changes for employees... | ...and requires action. |
|---|--|---|
| <ul style="list-style-type: none">• technologies• organisation• team structures• human-machine collaboration | <ul style="list-style-type: none">• roles• tasks• professional occupations• competences• job satisfaction• employment | <ul style="list-style-type: none">• catalogue of competences• training concepts• support for companies in Upper Austria• highlighting opportunities• strengthening the attractiveness of the profession |

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What We Do

- » Combining theory and practice
- » Broad-based studies on digital accounting
- » Expert workshops
- » Cooperation with leading companies in Upper Austria
- » Development of a competence catalog and training and further education concepts

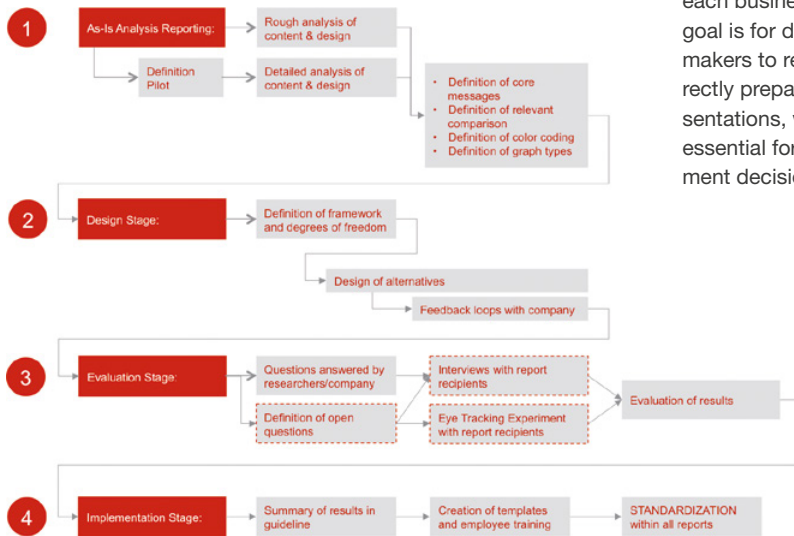


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Reporting Design

Improving Effectiveness and Efficiency in the Information Processing of Management Reports

Businesses can use this concept to objectively measure their reporting design with the help of eye-tracking analyses. Based on a situation analysis, the requirements of the reports, the report recipients as well as the report creator are processed in order to generate and evaluate customized reports for each business. The goal is for decision-makers to receive correctly prepared presentations, which are essential for management decisions.



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What We Do

- » Validated procedure model
- » Qualitative and quantitative measurements
- » Eye-tracking research
- » Individual/company-specific report design



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SMI Remote Eye-Tracker RED (60/120)

Stationary Device for Recording and Analysing Visual Data

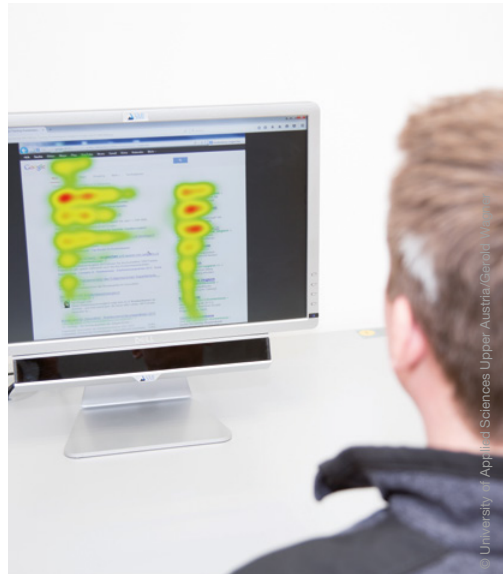
The remote eye-tracker makes it possible to record and analyse gaze data on stationary screens. The device measures eye fixations and saccade pathways and thus enables to track and understand the attention of users on different user interfaces. Standard monitors as well as TV sets or projectors are used as output screens. The device's sensors allow free head movement, which enables a very authentic testing situation.



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Technical Data and Features

- » Contact-free setup of eye-tracking studies
- » Binocular viewing and pupil data
- » Monitors: TVs (from 19", 22" ... 60") and projectors (... 300")
- » Free head movement (within 40 cm x 20 cm at a distance of 70 cm)
- » Working range: 60 cm–80 cm
- » High precision: 0.4°
- » Spatial resolution (RMS): 0.03°
- » Sampling rate: 120 Hz
- » Short latency: <8 ms
- » Variable calibration modes: 2, 5, 9 points, child friendly versions
- » Fast and automated calibration: <3 sec (2 point)
- » Suitable for wearers of glasses/contact lenses
- » Royalty-free API/SDK

SMI Mobile Eye-Tracking Glasses 2.0

Mobile Device for Recording and Analysing Visual Data

Eye-tracking glasses enable the flexible recording of visual data through infrared sensors built into the frame of an eyewear. A forward-looking camera also captures the test person's field of view. Test persons therefore have a great deal of freedom of movement and are hardly limited in their actions.

Many research scenarios for behaviour analysis in different contexts are possible: usability and UX studies with mobile devices such as smartphones, tablets or industrial displays as well as studies to explore customer behaviour in normal surroundings such as supermarkets, etc.



Technical Data and Features

- » 0-, 1- and 3-point calibration
- » Binocular eye-tracking with automatic parallax compensation
- » Sampling rate: 60Hz and 30Hz binocular
- » Precision: 0.5° across all distances and parallax compensation
- » Tracking distance: from 40 cm
- » Tracking field: 80° horizontal, 60° vertical
- » Front camera resolution: 1280x960p @24 fps, 960x720p @30 fps
- » Front camera video format: H.264
- » Front camera field of view: 60° horizontal, 46° vertical
- » Suitable for contact-lens wearers
- » Integrated microphone
- » Data connector: Ethernet/UDP



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Tool for Simulation for Sales and Project Planning

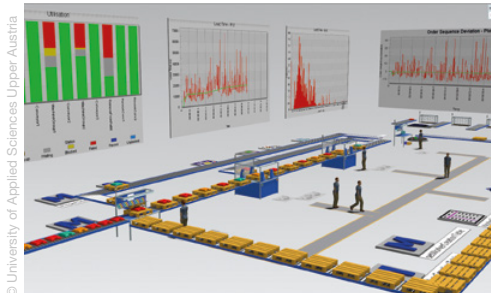
Simulation Aided Communication of Complex Systems in Sales and Project Planning

With the increasing complexity of production systems and their processes, it is becoming increasingly important for planners, machine builders and system integrators to communicate the advantages and unique selling points of solution concepts in a readily understood way. A good method to understand the complexity of production processes, influencing factors and performance indicators is to use simulation. In particular, the animation of the process sequences is of special importance: while the two-dimensional, process-oriented presentation gives experts detailed insights into the temporal behaviour of a system, the 3D visualisation executed in parallel also enables non-experts to quickly find themselves in the presented process sequences. In addition, the ability to quickly and intuitively define one's own experiments and even intervene interactively in the simulation process helps to build confidence in the presented solution.

Furthermore, the simulation models provide well-founded key performance indicators for the technical and business evaluation of scenarios. Stochastic influences can be considered as well as the interactions of system.

Functionality

- » Modelling of processes in production, logistics and administration by discrete event simulation
- » Visualisation and analysis in 2D and 3D
- » Analysis of stochastic influences and interactions of system components
- » Determination and visualisation of key figures and derivation of KPIs and business valuations
- » Capability to interact with simulation model during its execution and observing the reaction
- » Integrating the simulation models with optimisation methods



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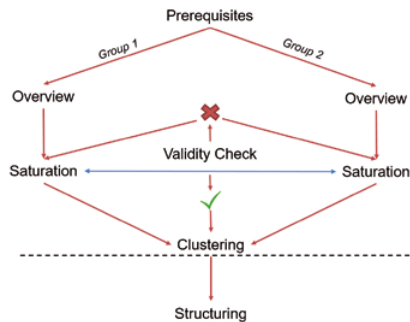
Touchpoint Analysis in Digital Retail

Identifying Brand-Owned Touchpoints along the Digital Retail Customer Journey

Today's stationary retail is facing great challenges when competing with e-commerce. However, with the advent of digitally supported multi-channel retailing, which uses modern technologies to bridge the boundaries between online and offline channels and thus offer a unique customer experience, the competitive conditions seem to converge. Nevertheless, the number of possible customer touchpoints, both online and stationary, is constantly increasing in digital retail. In order to maximise the use of touchpoints to drive sales, retailers need a comprehensive overview of the touchpoints they control along the entire digital retail customer journey. We offer a multi-level workshop concept that combines focus groups with creative techniques such as World Café, Channel CARDS, Instant Polls and Instant Word Clouds to generate a comprehensive overview of all of your company's brand-owned touchpoints. Based on this, detailed insights into the distribution along the customer journey, brand perception, and the value of the identified touchpoints can be derived from the resulting systematics of all brand-owned touchpoints.

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Robert Zimmermann

What We Do

- » Creation of an overview of all brand-owned touchpoints in a multi-level creative process (World Café, Channel CARDS, Instant Polls, Instant Word Clouds)
- » Validation of the overview with a statistical measure (Cohens Kappa)
- » Further evaluation of the overview tailored to requirements and wishes (distribution along the customer journey, brand perception, value of the identified touchpoints)

TYPO-PROG

A Consumer Based Purchasing Forecast Model

This novel model enables the prediction of a purchase probability of a product. Furthermore the forecast model is used to determine which product traits significantly impact the purchase of a product.

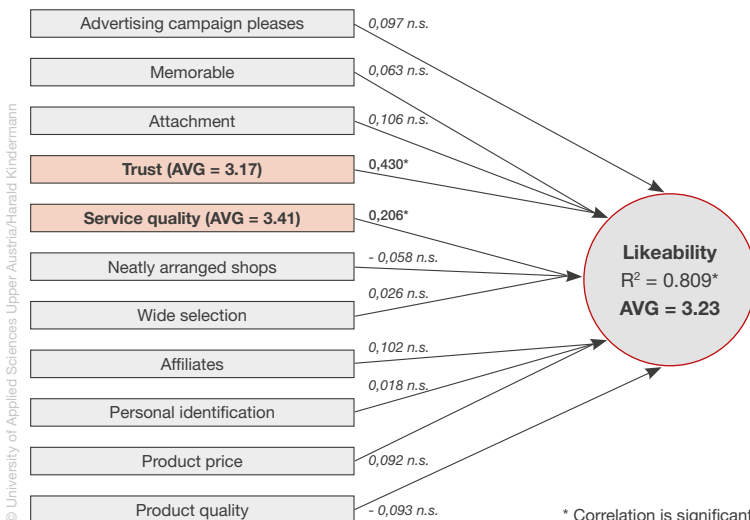
With this approach, the probability of a product purchase can be reliably calculated and necessary information to optimize advertising activities may be derived.

Procedure

- » Determination of specific purchase probabilities
- » Development of a forecast model that predicts a purchase of a product based on a logistic regression analyses
- » Empirical surveys



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USIVIS

User-Centred Interactive Visualisation of Big Data

For the visualisation of big data, traditional methods of information visualisation are rapidly reaching their limits and becoming obsolete due to the large and polystructured data sets they must deal with. For example, a column diagram can display only a limited number of data points before the viewer perceives it as illegible. For this reason, it is necessary to use novel visualisations such as treemaps or Sankey charts and to evaluate them objectively for their suitability for the representation of big data. For the evaluation of visualisation techniques, eye-tracking in combination with other methods such as observations, interviews, questionnaires, etc. appears very promising.

In the case of very large data sets, concepts for interaction combined with novel visualisations in a user-centred manner are necessary. This allows the user to access the desired data from a screen at any time without having to present the entire amount of information at once. Which interactions are being used and how these can be integrated as best as possible into the presentation forms is of particular importance. In this context, user acceptance and the introduction of users to new operating concepts plays a very important role.

The last step in dealing with big data and the progress of digitisation is the use of interactive and new media in everyday business situations. Collaboration is not only a matter of working together on one terminal device but also collaborative work using different output media like tablets, smartphones or surface hubs.



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What We Do

- » Evaluation of new visualisations
- » Big data visualisations
- » Evaluation of interaction possibilities
- » Collaborative work
- » Eye-tracking research

Web & Mobile Usability Studies

Improvement of User Experience on Mobile Devices

Due to the increasing complexity of user interfaces, their usability (user friendliness) and the user experience are becoming increasingly important in the web and on mobile devices (smartphones, tablets). The research focus on digital business is therefore concerned with the analysis and assessment of the usability of these interfaces in connection with electronic and mobile commerce, web presence, mobile web pages, etc. Usability and UX studies are also being offered to the business sector within the scope of research partnerships.

Due to extensive methodological competence and available technical devices (e.g. eye-tracking), this research focus area is able to combine methods (e.g. method triangulations) which allows multidimensional analysis and evaluation. Both quantitative and qualitative methods as well as user tests and expert methods are typically combined.



What We Do

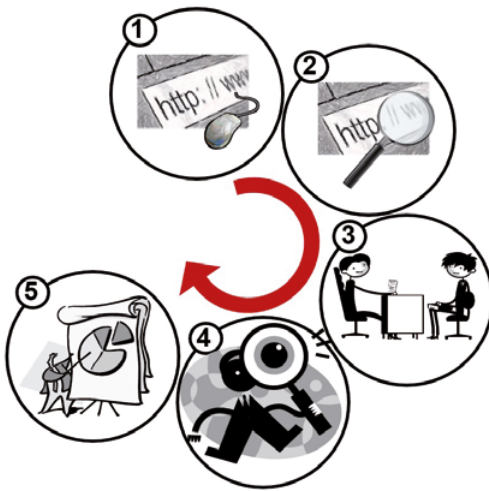
- » Multi-method approach
- » Stationary eye-tracking
- » Mobile eye-tracking
- » Usability testing
- » Cognitive walkthrough
- » Heuristic evaluation
- » Card sorting
- » Surveys (qualitative, quantitative)
- » Focus groups



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Logistics Check-Up

A Tool for Diagnosing and Benchmarking Logistical Performance



What We Do in Five Steps

1. Completion of questionnaire using the online tool
2. Analysis of questionnaire by Logistikum's experts
3. On-site company interviews
4. Inspection of the company concerned
5. Evaluation and reporting

The Logistics Check-up is a constantly improved and tested instrument developed by Logistikum, the logistics centre of University of Applied Sciences Upper Austria Steyr Campus, for ascertaining a company's logistics performance on the basis of a comprehensive questionnaire (> 300 questions). Through detailed analysis of logistical processes in all areas of the company, concrete proposals are made for improving logistics at all hierarchical levels.

The constantly growing database provides anonymized comparative data on performance indicators of logistics companies, enabling companies to make concrete assessments about their logistical capabilities.

The check-up is especially suited for small and medium-sized enterprises and is carried out by the Logistikum, a scientific and neutral research facility that provides objective feedback. The output is a written report comparing the company-related performance indicators with reference values from the database and also providing recommendations for improving logistical processes.



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MobiLab OÖ

Mobility Laboratory for Developing, Testing and Implementing New Mobility Solutions

The Mobility Laboratory Upper Austria (MobiLab OÖ) supports companies, start-ups, cities and regions in developing, testing and implementing new mobility solutions. The subject areas of the MobiLab Upper Austria are based on traffics, induced by economic processes, like freights-traffic, commuter traffic and service traffic.

The main objectives of the MobiLab is to support and initiate research in the fields of logistics and mobility in the central region of Upper Austria in order to implement it more efficiently. The innovative approach of MobiLab is linking together technical innovations with social aspects, as well as monetary- or organisational aspects, therefore innovation is seen as a socio-technical system.

In this context, the MobiLab works on the interfaces between current economic, political and social interests and tries to link them in an efficient and intelligent way.

MobiLab is funded by the Austrian Research Promotion Agency (FFG).



What We Do

- » Creative space for the design of methodical supported creative workshops
- » Geographic information systems for processing and visualizing spatial data
- » Simulations-Set for visualizing of data



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Quick Scan Audit Methodology (QSAM)

Systematic Health Check-Up for Your Supply Chain

The Quick Scan Audit Methodology (QSAM) is a tool for diagnosing and identifying problems and major obstacles as well as opportunities and the potential for success along the entire supply chain. Within five days, three of which are spent with experts visiting the company, concrete statements can be made about a company's performance, including its customer and supplier relationships. QSAM gives companies a holistic view of their supply chain structures. This is essential for a leading market position.

Following the analysis, which includes an on-site survey, a company report documenting possible risks, obstacles and unused potential is prepared and presented. Finally, a coordinated action plan with recommendations is provided to company representatives. The analysis, evaluation and documentation are carried out by a scientific team. With the help of QSAM, conclusions about more general circumstances can be drawn and sectoral as well as cross-sectoral benchmark comparisons can be made.



Quick Scan Audit Methodology



What We Do

- » Become acquainted with company processes
- » Define interviewees and arrange appointments
- » Select survey questions for questionnaires
- » Present and analysed material and information flows
- » Conduct interviews
- » Collect documents and other material
- » Conduct in-depth interview
- » Verify and quantify good and bad habits
- » Identify major obstacles
- » Analyse cause and effect relationships of major obstacles
- » Develop, evaluate and rank potential for improvement
- » Select measures for improving potential with the greatest leverage
- » Define an agreed action plan



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Resilience Profiler

Survey of Company and Individual Resilience

Resilience describes the ability to cope with crises and disturbances and to use them as an occasion for development. The resilience test is carried out at the company as well as at the individual level. Cooperation partners can assess their resilience in the area of process capability, organisational and personnel management, company culture, communication and coordination, information technology and company development. These criteria have been identified as the most important aspects of corporate resilience for companies in the course of a research project (in collaboration with international research partners from Germany, the USA, Singapore and Austria).

The individual resilience test centers on the evaluation of a personality profile. Resilience is manifested through questionnaires regarding the qualities of persons in whose areas of responsibility resilience as an ability plays an important role.

The Logistikum at University of Applied Sciences Upper Austria Steyr Campus is the focal point for this issue. Over several years, an experienced research team has been working on profile development to identify tailor-made abilities that are required for resilience.

What We Do

- » Online survey
- » Company resilience
 - › Process capability
 - › Organisation and staff
 - › Corporate culture
 - › Communication and coordination
 - › Information technology
 - › Corporate development
- » Individual resilience
 - › Attitude
 - › Personal development
 - › Character
 - › Situational assessment



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REWWAY & RETrans

Inland Waterway Logistics in the Classroom

Is there a need for interactive and innovative teaching material on the subject of sustainable freight transport or inland waterway logistics? If so, suitable teaching material has been developed by the Logistikum's research team. On the REWWAY online information platform (www.rewway.at/en), you will find a selection of teaching materials on the subject of inland waterway logistics as well as sustainable freight transport. These materials are available to interested parties at any time and free of charge. They cover both general topics of inland navigation as well as innovative topics such as technology. The teaching materials are prepared in the form of bundled teaching materials consisting of a slide set, a reader, a short film and interactive exercises such as case studies, film exercises or crossword puzzles. The bundled teaching materials can be used in their entirety or just individual elements thereof. In addition, the teaching materials can be modified and adapted according to the requirements and wishes of the user. The learning app LOGISTIFY with three games on the topic of transport and one game on the topic of retail is very popular with all users.

REWWay is part of RETrans, a web platform (www.retrans.at) with general information about transport logistics and career opportunities in the field of logistics.



Features

- » Offers for different age groups, school levels and people with different levels of logistics knowledge
- » Diverse selection of teaching materials
- » Standard teaching materials (PowerPoint, Reader)
- » General and innovative topics Interactive exercises (case studies, film exercises, etc.)
- » Success stories of inland shipping from practice
- » Additional links to related content
- » Additional lectures, excursions and Transport School Lab
- » Combination of theory and practice
- » Customised teaching materials



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Supply Chain Cyber Security Management

Minimize Cyber Risks Across Your Supply Chain

New developments, technological progress in information technology and global networking of companies are the main drivers of supply chain management. Companies increasingly rely on the use of technology for a variety of processes. The increasing dependence on modern technologies exposes supply chains to additional risks that may have a major impact on operational processes. In this context, cyber risks are becoming increasingly important. Several companies (FACC, A1 Telekom, Maersk, TNT) who have suffered enormous financial losses caused by cyber attacks confirm the growing threat of cyber crime.

The Allianz Risk Barometer (2018) emphasizes the significance of these risks and ranks cyber risks in second place among top business risks in 2018. Current examples from 2017 and 2018 show that a cyber attack can be realized in a few moments, while the impact of the attack on companies and their supply chains can last for months. The dependency of companies on a stable and secure company-wide IT infrastructure continues to increase rapidly. Rising networking and additional trends, such as 3D printing, e-commerce, industry 4.0, Internet of Things, physical Internet and smart homes, are providing additional targets for cyber attacks. Therefore it is even more important to actively manage cyber risks along your supply chain. The flow of material, information and money should be considered. The experience we have gained in advanced research helps you and your company to manage those risks along your supply chain.

Cooperation opportunities

- » Integration of Cyber Security and Cyber Risk Management into everyday business in Purchasing, Supply Chain and Sales
- » Classic risk management to manage cyber risks in your supply chain
- » Adaptation of contractual framework conditions to your supply chain partners
- » Auditing, evaluation and monitoring of supply chain partners (suppliers, customers, service providers)
- » Employee training (profit from a current research project in IT and OT-security)
- » Supply Chain Resilience - Business continuity planning



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Supply Chain Risk Management

Minimisation of Risk Along the Supply Chain

The relationship between increasing globalisation and the specialisation, focus and individualisation of business partners presents companies with the challenge of recognizing potential risks to their supply chain at an early stage and taking timely corrective measures. The difficulty lies in the fact that the necessary stability from both an economic point of view (financial crises) as well as from an environmental perspective (natural disasters) is no longer a given.

This growing turbulence is further exacerbated by the much higher dependency of companies and their operations on complex and global supply chains. This makes it all the more important for companies to mitigate supply chain risks by identifying the risks along their supply chain as well as selecting and implementing suitable strategies for minimizing risk. Through continuous monitoring of these risks, optimal preparation for increasingly turbulent market conditions is ensured.

The Logistikum of University of Applied Sciences Upper Austria's Steyr Campus is the focal point for supply chain risk management. The insights from advanced research help prospective clients to effectively manage their risks along the supply chain.



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What We Do

- » Identification of risks
 - › internal
 - › external (customer, supplier, market)
- » Risk assessment
 - › application of appropriate methods
 - › quantitative and qualitative
- » Selection of appropriate strategies for risk reduction
 - › risk avoidance, risk reduction, risk shifting
 - › risk transfer or insurance
- » Implementation of selected supply chain risk management strategies
- » Mitigation of supply chain risks
 - › preparation for unforeseen risks
 - › continuous monitoring

Transport (School) Labs

Workshop in the Field of Sustainable Freight Transport

In-depth information on inland waterway transport or sustainable transports in general provides a change of pace for students and employees alike who spend a day at the University of Applied Sciences Upper Austria to learn more about viable, sustainable freight transport. Interested parties can spend a day in a creative and interactive environment in teams engaging with sustainable freight transport. The Transport School Labs encompasses a multitude of programme points, which can also be customised according to the needs of the participants: In addition to an interactive presentation by experts, which raises exciting questions about sustainable freight transport, interactive and creative team exercises such as the app LOGISTIFY are integrated into the programme. Different tasks such as transport cost calculation are solved and ideas for the future of transport are presented.

A LEGO simulator is also available. Here, transport sequences can be adjusted and optimised. A company visit and a trip by bus or boat can also be integrated into the day's activities.

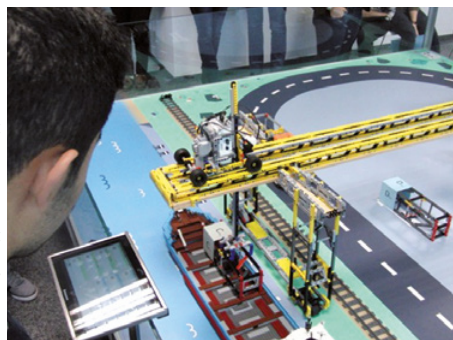
What We Do

- » Target group-specific topics and programme design
- » Relate theory to practice
- » Interactive sustainable transport of goods
- » Interactive expert presentations
- » LEGO® logistics simulator
- » Bus tour or optional boat excursion (for a fee) in the port
- » Company visit
- » Interactive and creative group work
- » Target groups: pupils, students, adults, researchers, representatives of industry



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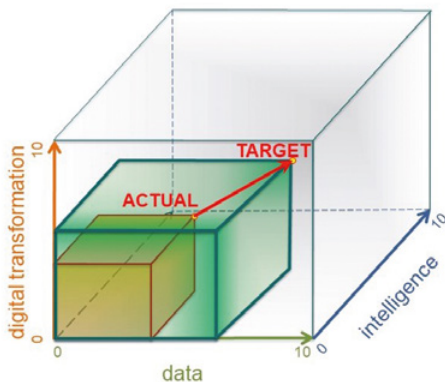


Maturity Model Industry 4.0

Navigation System for Enterprises on the Way to Industry 4.0

Advanced manufacturing and Industry 4.0 have become essential components for every (production) company trying to survive in the face of global competition. The Maturity Model, developed at the Center of Excellence for Smart Production, is used to measure the readiness of a company for Industry 4.0 along three dimensions: data, intelligence and digital transformation. In addition, support is provided to companies in finding and realising their potential for improvement.

The results of the assessments are stored in a benchmark database, which allows to identify current market conditions in the industry. An anonymized comparison is possible, which juxtaposes one's own progress to that of the industry as a whole. Development and project implementation take place in cooperation with the Upper Austrian Mechatronics Cluster.



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What We Do

- » Definition of strategy, objectives, fields of application and supporters
- » Analysis of the status quo
- » Identification of potential for improvement
- » Determination of the current and target maturity levels
- » Development of company-specific project proposals in relation to Industry 4.0



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Smart Factory Lab

Mixed Reality for Smart Production*

The complexity of production is on the rise as a result of increasing individualisation. The trend is moving more and more toward variant manufacturing with small batch sizes. Employees have an ongoing need for information, for example in assembly. Augmented reality (AR) and virtual reality (VR) technologies provide valuable support for minimizing error rates and decreasing lead times. At the Steyr Campus, the possibilities of MR and VR in an industrial context are currently being investigated. The technology is intended to support people in their activities by providing context-related MR assistance in various areas of production. In immersive VR training scenarios, processes can be trained safely and efficiently. For this purpose, use cases are prototypically implemented and evaluated in close cooperation with corporate partners and the findings are scientifically processed.



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What We Do

- » Development of concrete use cases and concepts for the industrial use of AR and VR technologies in the areas of assembly, commissioning, maintenance, servicing, training, factory planning, product design, etc.
- » Implementation of prototype concepts in the laboratory at Steyr Campus in close cooperation with businesses
- » Implementation at the company's location and joint evaluation of the results



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* Funding under the structural funds programme 'Investments in growth and employment Austria 2014–2020' with EU funds from the ERDF (European Regional Development Fund) and the State of Upper Austria.



Workshop Production Planning

Understanding PPS Approaches for the Efficient Use of PPS Systems



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There is little room for experimentation in day-to-day business operations where the costs of incorrect decisions, the necessary time and the duration to achieve results make changes difficult. After a few hours in this production planning workshop, participants will understand not only the functions and the advantages and disadvantages of different PPS systems but will also develop strategies for managing frequently occurring problems in practice (excessively high inventory, too long and highly fluctuating lead times, poor delivery reliability, etc.).

The workshop can be a crucial tool for in-house projects by promoting higher motivation, co-operation across departments, willingness to change and a reduction of prejudices as well as greater understanding for future projects.

What We Do

- » Short theoretical introductions to MRP, KANBAN and CONWIP systems
- » Active setting of parameters within a PPS system
- » Production planning game for testing parameters produced by participants
- » Gradual improvement of logistics indicators of sample productions
- » Demonstration of opportunities for change in one's own operations
- » Workshops for 6 to 16 participants lasting 7 to 8 hours

Workshop contents:

- » Introduction to the basics of PPS systems
- » Hands-on experience with and comparison of three PPS systems: MRP, KANBAN and CONWIP
- » Demonstration of possibilities for change in one's own operations



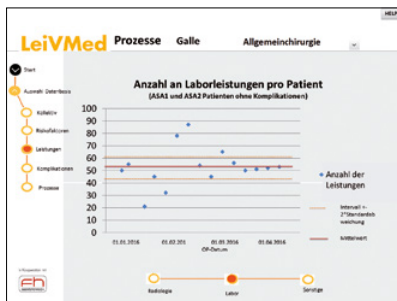
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LeiVMed – BENCHMARKING MEDICINE

Benchmarking Programme for Hospitals

LeiVMed is a benchmarking ram that enables participating hospitals to compare their core clinical processes. The focus is on the risk-adjusted comparison (benchmarking) of clinical outcomes, processes and costs. These data form the basis for standardisation efforts in the context of process management, which enables medical departments to increase medical and nursing quality while reducing costs.

Hospital costs are rising continuously, making further efforts to control costs unavoidable. There is also a growing need for even better medical quality in the treatment of patients. The main task of medical controlling is to ensure that medical services are provided effectively and efficiently. However, it is difficult to compare variable costs in the provision of medical services, such as operations, or to determine on a case-by-case basis whether the treating physicians and nurses have chosen the most economically sensible in addition to the medically 'best' route to diagnosis or therapy. LeiVMed measures and compares the quality of medical results and variable costs using a web application.



What We Do

- » Collection and/or preparation of data with focus on data quality
- » Mapping of hospital data to international standards (SNOMED)
- » Regular reporting with key figures on medical quality, business outcomes and processes
- » Fair comparison of departments (patient characteristics) through risk adjustment
- » Support for analysis and subsequent adaptation of clinical processes



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WELS CAMPUS

School of Engineering

| | |
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Assistance Systems in Practice

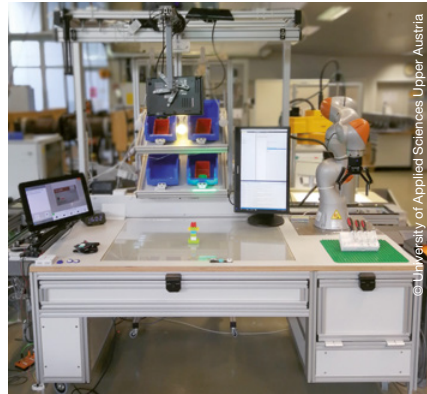
Laboratory for Digital Assistance Systems in Assembly

In many manual assembly situations, activities are becoming increasingly complex. In order to support employees, digital assistance measures are playing an increasingly important role. At the Center for Smart Manufacturing, a fully equipped assembly station is available for testing and evaluating various assistance measures. These assistance measures range from product-specific work instructions on a screen, projection systems on components, 3D animations of assembly processes to collaborative robots at the workplace.

In order to be able to optimally adapt these assistance measures to the employees and the assembly process, they shall be tested and evaluated before being introduced in the company. In the course of this

Procedure

- » Specification of the workflow and the required parts
- » Modeling of the workflow
- » Photographic preparation of the individual work steps
- » Optional: 3D modeling and animation of work steps
- » Execution of test assembly series
- » Evaluation and analysis



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evaluation, the assembly process to be assisted is precisely digitally modeled and the appropriate assistance measures are also configured. Each assembly step is recorded, for example, with photos and/or a 3D model which is then displayed on the worker guidance system. In several test runs, it is then determined which method and which level of assistance is optimal for the employees and the process.



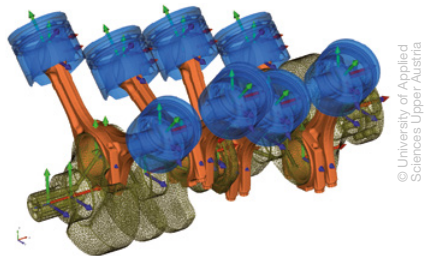
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Competence Center for Multibody Systems Simulation, Optimisation, Parameter Identification and Control of Multi Body Systems

Multibody simulation has developed in recent years into an important discipline in the product creation process. It can be used to reliably describe movements and deformations of complex mechanical systems, such as a crankshaft drive, a multi-axis robot or the human body.

At the University of Applied Sciences Upper Austria in Wels, a research group is concerned with questions of multibody simulation that are difficult to solve with commercial software packages. Therefore, one of the priorities of the Competence Center is the development and implementation of the multibody simulation programme FreeDyn based on the latest research results. The software package FreeDyn is freely available at www.freedyn.at (GPL3.0 licence) and offers an interface to Scilab such that coupled simulations of mechatronic systems are possible.

Projects adapted to client wishes are possible in the form of service projects, funded projects and bachelor's and master's theses.



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What We Do

- » Optimal control problems
- » Time/Energy optimal problems
- » Trajectory tracking
- » Parameter identification
- » Optimal test bed control for maximum information value
- » Robotic applications
- » Vehicle dynamics
- » Coupled simulations of multi-physical models for describing mechatronic systems



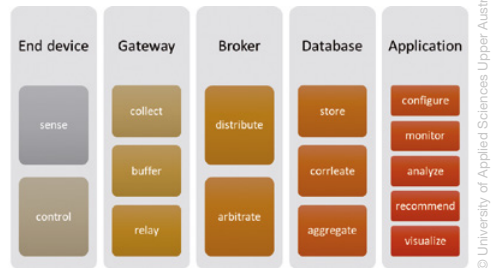
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Digital Data Flows as Success Factor

Industrial Internet of Things and Modern Process Control

Digital integration can be a decisive competitive advantage in the manufacturing industry. Digital integration can enable the automation of various tasks. An important example for that is the information flow between production and production management as well as business management. Formerly certain events such as job completion or machine breakdown had to be reported orally or in written form, while today these events can be notified digitally without delays. Through this speed-up of the information flow decisions such as the re-scheduling of resource usage can be taken faster, and the decisions can turn out to be more economical due to the more recent information base.

Realizing a suitable digital integration represents a challenge for many manufacturing enterprises. Firstly, you need a reasonable strategy, which describes the way to your digitally integrated enterprise and which your enterprise can realize. Furthermore, you need digitalisation experts, who know available technologies and who can assess their value for your enterprise. The- rebly, short- and long-term benefits should be weighed carefully against each other. A



too short-term perspective can cause significant extra cost at later development stages. A too long-term perspective, on the other hand, can impede getting even any digitalisation performance on the road.

We are happy to support you in finding and realizing your personal winning strategy!

Functions

- » End device (> sense and control)
- » Gateway (> collect, buffer, and relay)
- » Broker (> distribute and arbitrate)
- » Database (> store, correlate, and aggregate)
- » Application (> Configure, monitor, analyze, recommend, and visualize)



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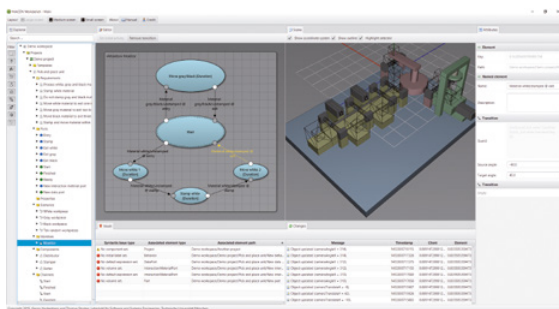
Digital Factory Models as Success Factor

Digital Factory Modeling and Simulation

The design and operation of modern factories represents a major challenge for engineers and operators due to rising system complexities. The complexities show for example in the number of product variants, the quality of the products, the effectiveness and efficiency of resources, as well as the degree of automation and digitalisation.

Today a wide range of modeling and simulation tools is available, which can support the design and operation of modern factories. At Campus Wels we use, e.g., Enterprise Architect for requirements specification and (interdisciplinary) architecture definition. Thereby, i.a., acceptance criteria can be described systematically, and a coarse modularisation can be derived. Furthermore, we use Siemens Plant Simulation for shaping the overall production processes. With it, i.a., the logistics principle as well as the resource dimensioning can be determined. Finally, we use CoppeliaSim for finetuning work areas. Therewith, i.a., the exact positions and motions can be established.

Within the scope of our R&D-activities we investigate for you, how you can apply the tools that are available today to your problems best, how you can integrate the tools optimally into your organisation and infrastructure, and how the tools can be extended/adapted to suite your requirements even better in the future.



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Component-based factory modeling
and simulation with MaCon

Approach

- » Requirements specification and architecture definition (using SysML)
- » Production process determination (using DES)
- » Work area fine-tuning (using MBS)



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KISTLER Multi-Component Dynamometer, Type 9257B

Cutting Force Measurement in Machining Applications

The multi-component dynamometer from Kistler is used for the quasistatic and dynamic measurement of cutting forces in all machining processes: turning, milling, grinding and drilling. The measurement is carried out by four 3-component force sensors installed between the base plate and a cover plate. The force sensors consist of quartz crystal plate pairs, which are sensitive in the x-, y- and z directions. By combining the force sensors, it is possible to take force and torque measurements of several components at once. Due to its high resolving power it is possible to measure small dynamic changes and forces from -5 to 5 kN. With its 100 x 170 mm cover plate and provisions for mounting with screws or claws, the device is universally applicable in many areas and can be easily set up. The type 5070A charge amplifier converts the charge signals from the dynamometer into an output voltage proportional to the measured forces and torque and sends them to the DynoWare software. This software provides a real-time representation of the measurement curves as well as useful calculation and graphics functions to evaluate the measured data.

Thus, the multi-component dynamometer is a useful tool for the overall analysis and optimisation of machining processes, minimising tool wear and geometrical error and improving surface and dimensional accuracy.



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Technical Data

- » Measuring range F_x, F_y, F_z from -5...5 kN
- » Sensitivity F_x, F_y from $\approx -7,5 \frac{\mu C}{N}$
 F_z from $\approx -3,7 \frac{\mu C}{N}$
- » Mounting surface 100x170 mm
- » Operating temperature range 0...70 °C



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Methods–Processes–Models–Tools

Mechatronic System Design

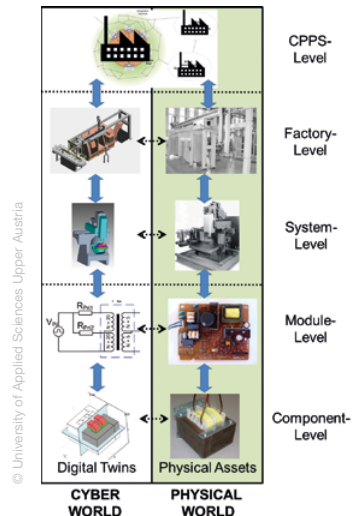
The increasing complexity of mechatronic products and their production processes – development is often spread over several sites – makes it increasingly difficult to maintain an overview of interdependencies. The main challenge is to develop, describe with system modeling languages and evaluate mechatronic solutions. Data that can be used to these ends can typically be found at the company level but are often scattered or stored in different development tools. The interfaces are therefore important as are the parameters and how they are exchanged between the models.

‘The focus is not on the individual results, but on achieving consistency in how the models integrate and the highest possible level of transparency’.

The interdisciplinary research group at the University of Applied Sciences Upper Austria in Wels works on the integration of detailed modelling of individual physical effects into superordinate system models. Because it is difficult to model in detail complex systems such as production plants or vehicles in order to evaluate system properties, various techniques are explored to describe the system in a formalised system model.

What We Do

- » Product development: from concept to production
- » Product lifecycle management
- » Systems engineering, complex system design
- » Design automation
- » Modelling and simulation of mechatronic components/systems
- » System models, hierarchical modelling techniques
- » Digital Twin, virtual commissioning, cyberphysical (production) systems
- » Design for Sustainability



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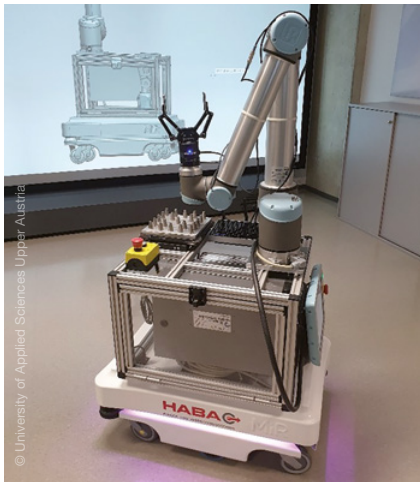
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Human-Robot Collaboration

Collaborative Robotics Experimental Laboratory

With collaborative robotics, manual and automatic activities can be usefully combined in an industrial environment. A collaboratively equipped robot system can interact directly with humans and, under certain conditions, does not require a protective fence or the like. With high-performance control, these robots recognize contours quickly and in a force-controlled manner. Thanks to joint torque sensors, contacts with material or people can be detected immediately and force as well as speed can be reduced. Sensitive or even soft components can thus be handled without shearing or pinching points. Similarly, the robots can be easily guided by hand by humans, e.g. for learning new processes.

At the Center for Smart Manufacturing, a total of 3 permanently mounted and one mobile version mounted on an AGV, of these robots are available for studies, prototype analysis, etc. Likewise, the corresponding powerful 3D simulations are available to test processes and also human-robot collaboration in advance using virtual reality.



Procedure

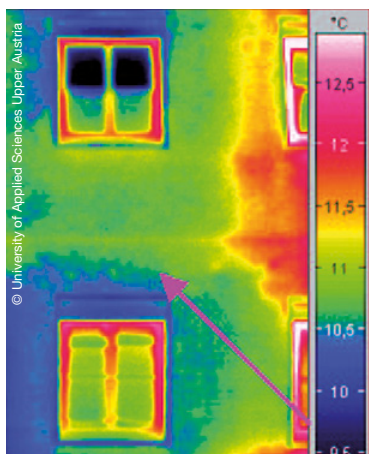
- » Creation of a handling and process concept
- » Simulation by means of 3D path planning and virtual reality
- » Safety evaluation
- » Cycle time analysis
- » Test with real components



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Blower Door Test and Building Thermography

Differential Pressure Method for Measuring Airtightness of Buildings; Infrared Thermography of Buildings



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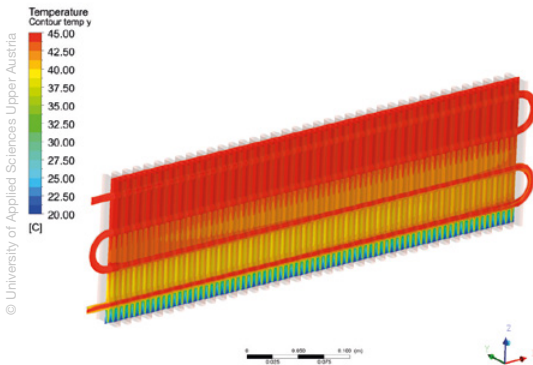
Technical Data

- » **Blower Door:**
 - » Performance testing
 - » For n50 value at 50 Pa pressure differential
 - » Flow rate: 35 to 7800 m³/h
 - » Opening dimensions from 0.70 x 1.30 m
 - » Accuracy of volume flow measurement +/- 4%
- » **Building Thermography:**
 - » Temperature measurement range: -40 to 500° C
 - » FPA: 320 x 240p, uncooled
 - » Spectral range: 7.5-13 µm
 - » Thermal resolution: 0.05° K at 30° C
 - » Spatial resolution: 1.3 mrad

The blower door test measures the airtightness of a building. This consists of a strong fan, which is installed and sealed in a door frame. The fan can generate negative pressure or overpressure in the building, depending on the direction. For this test, all windows must be closed and all interior doors must be open; only the comfort ventilation is sealed. The measured result is the 'n50 value' which describes the air exchange ('volume flow') of the building as a function of the internal volume at 50 Pascal underpressure or overpressure. This value can be used to draw conclusions about the size of the leakages of the building envelope ('leakage'). This test should be carried out after completion of the air-tightness layer (vapour inhibitor and vapour barrier) and before the building is finished and ready to use. The n50 value for buildings with window ventilation must be 3; for buildings with ventilation systems the value should be 1.5 and for passive houses the value 0.6 per hour.

Excel, EES, ANSYS Fluent

Fluid Dynamics and Heat Transfer



Technical Data

- » Analytical methods using real fluid properties
- » CFD training using ANSYS Fluent: workflow and validation
- » Pressure loss and heat transfer calculations in industrial processes and buildings
- » Design and operation of heat exchangers.
- » Heat conduction, forced and natural convection, radiation in fluids.
- » Parameter studies, optimisation

Fluidynamic and thermodynamic calculations are required for many engineering applications. Internal flow through pipe and channel networks require pressure loss calculations. Drag- and lift coefficients are determined for external flow applications around vehicles, wings or other "obstacles". Heat transfer through single- or multi-layer walls, straight or curved walls must be determined, taking into account conduction, convection and radiation. Various types

of heat exchangers – recuperators, regenerators, cooling towers using plates or tube bundles, countercurrent flow or cross-flow - must to be designed and their behavior must be evaluated under changing operating conditions.

Based on the existing knowledge in the above-mentioned areas experience was built up in projects and cooperations with well-known companies within and outside Upper Austria. This experience can be called up, for example, in the form of training courses in the field of fluid dynamics and heat transfer. Emphasis is placed on both analytical and numerical methods. The validation and comparison of calculated results with measured values is essential before parameter studies for optimisation are set up.



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Long-term Analysis of Building Structures

In-Situ-investigations of the Heat Flow Through Monolithic and Multilayer Wall Constructions

The energy rating of buildings is determined by the energy loss through the enveloping building components. In practice, various constructions of exterior building components are common, which, regardless of their different materials and the like, sometimes have very similar heat transfer coefficients. To verify building simulations based on building physics, in-situ investigations are necessary, which can be used to determine, among other things, which wall construction can actually achieve the simulated values and for which the deviations are particularly large. With the help of these heat flow investigations, the quality of wall constructions can be determined not only in terms of the usual values such as heat transfer coefficients and wall thickness. Rather, the humidity, temperature fluctuations, surface temperatures and other building physics parameters are also determined which have a significant influence on the subjective perception of indoor temperature as well as other indoor climate parameters.



The measured data of the weather station allow a building simulation with real weather data. These data can be imported by building simulation software like IDA-ICE and enable dynamic building physics simulations and allow verifying the simulation results with the measured data.

Functions

- » Weather station
 - › Air temperature
 - › Humidity
 - › Air pressure
 - › Wind speed
 - › Wind direction
 - › Global solar radiation
- » Globe Thermometers
- » Surface temperature sensors
- » Temperature and humidity sensors
- » Heat flux measurement foils
- » Building simulation software IDA-ICE



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Olfactometer TO Evolution 6 FC

Odour Measurement Using the Latest Standards



Modern odour measurement is based on EN 13725. The olfactometer is the most important element in this measurement. By precisely diluting the samples, the concentration of the sample can be determined by the odour detection thresholds of up to six subjects. Dilution over a wide concentration range can be extended with the aid of a predilution unit.

Complex questions can be answered in combination with chemical and biological analysis methods. Modern software for data management and analysis complements the olfactometry. For the implementation of dissemination calculations, validated simulation models such as GRAL, LASAT and AUSTAL2000 are available at the Wels campus. These two-stage simulation models take into account terrain and building structures. In stage 1, the wind field is calculated on the basis of meteorological input variables and the immission prognosis is completed in stage 2.

Technical Data

- » State-of-the-art 6-position olfactometer
- » Y/N and dual forced choice
- » Dilution 2^3 to 2^{17}
- » EPD predilution system 1:10 / 1:100
- » Measurement of intensity and hedonics
- » Device compliant with EN 13725, AS 4323.3, NCh 3190, VDI 3882 and NVN

R&D Services

- » Sampling and odour measurement
- » Combined measurements—chemical and microbiological tests
- » Analysis and optimisation of odour removal (biofilters, bio-scrubbers, activated carbon systems)



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Process Heat Up to 200° C

Heat Engineering Laboratory

Process heat is renewable. The modular test bed at the heat engineering laboratory offers numerous possibilities to simulate and precisely measure thermal processes at temperatures of up to 200° C, which can be used to study, for example, the use of solar energy in industrial processes. The central heat source is a concentrating solar collector that provides renewable heat up to 200° C with an efficiency of approximately 50%. Furthermore, the well-equipped heat engineering laboratory can handle numerous tasks for research and development in the low-temperature range up to 95° C. A simulation environment in MATLAB/Simulink greatly expands the laboratory's range of applications and allows the treatment of complex hydraulic systems with optimised effort. In addition to its research applications, the laboratory serves as a demonstration and training facility for industry and science. Furthermore, external analysis of process heat in plants can be performed using portable and highly accurate ultrasonic heat meters in the clamp-on principle.

What We Do

- » Maximum operating temperature: 200° C
- » Maximum thermal power: 110 kW
- » Measurement accuracy < 1 %
- » Liquid heat transfer medium
- » Concentrating solar collector as a renewable heat source
- » Simulation of complex hydraulic systems in MATLAB/Simulink
- » Measurement of pressure losses, volume flows, temperatures
- » Determination of pipe and pump characteristics
- » Measurement of the transfer capacity of plate heat exchangers
- » Determination of standby heat losses of thermal storages
- » Characterisation of recooling units
- » COP determination of heat pumps
- » Measurement of district heating transfer stations

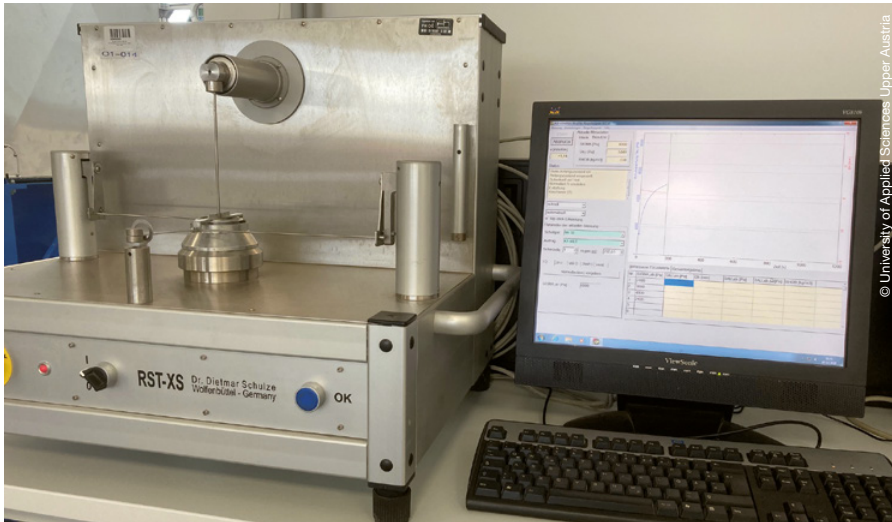


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Schulze RST-XS and RST-01.pc

Annular Shear Tester for the Characterisation of Powder Flowability



Annular shear tester RST-XS

Shear testers are used for the characterisation of the flowability of granular materials. Thereby, the yield locus is determined (effective angle of friction, flowability, bulk density as a function of the consolidation stress) as well as the wall yield locus with various wall materials (wall friction angle as a function of the wall normal stress). To investigate storage conditions, especially the humidity, the samplers can be stored in a climatic cabinet before testing.

Data

- » Maximum vertical stress:
22000 Pa
- » Minimum vertical stress:
600 Pa (RST-XS); 0 Pa (RST-01.pc)
- » Required sample volume:
0.1 dm³ (RST-XS); 1.2 dm³ (RST-01.pc)
- » Maximum particle size:
ca. 1 mm (RST-XS); ca. 10 mm (RST-01.pc)



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Solar Research at the Wels Campus

Research Laboratory for the Conversion of Solar Radiation Into Heat or Electricity

The solar laboratory at the Wels campus offers a wide range of both indoor and outdoor possibilities to test the influence of solar radiation on materials and components as well as to precisely measure the performance and reliability of solar thermal collectors, PV modules and PVT – hybrid collectors.

The sun simulator at the indoor laboratory can be used, for example, to determine the thermal properties of combinations of materials and coatings under solar irradiation (AM 1,5). Examples are the investigation of various temperature profiles for the door and window industries as well as investigations of the thermal load of inverters under solar irradiation. Studies of this kind can be made for all components exposed to the sun that do not exceed the maximum dimensions of our test area ($w=1500\text{mm}$ x $l=2500\text{mm}$ x $h=500\text{mm}$). In addition to its application in research, the facility serves as a demonstration and training facility for students of the Applied Energy Engineering and Sustainable Energy Systems degree programmes.



Technical Data

- » Two-axle automatic follow-up outdoor tracker
- » Solar simulator with variable irradiance ($400 - 1000 \text{ W/m}^2$)
- » Accuracy of power measurement $< 1.5 \%$
- » Maximum working temperature: 95°C
- » High precision measurement of wind speed, irradiation, pressure, volume flows and temperatures
- » Testing-equipment for mechanical stress
- » Current-voltage characteristics for PV modules



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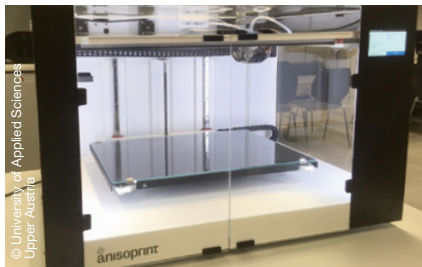


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Anisoprint Composer A3

Endless Fiber – Reinforced Additive Manufacturing

The Composer A3 co-extrusion 3D printer for fiber-reinforced materials enables novel areas of application for 3D-printed components. The composite fiber co-extrusion technology (CFC) allows the integration of a continuous fiber within FDM-printed objects. The fiber, consisting of thousands of thin carbon or basalt filaments and supported by a special polymer carrier compound, is encased by the selected thermoplastic material during printing and firmly incorporated into the component. Composite parts produced in this way are characterised by high stiffness and strength. The minimum layer thickness is 0.06 mm and the printer provides an enclosed building space as well as a print bed that can be heated up to 120 °C for improved object adhesion and, thanks to the open material system, is suitable for a large number of different polymers. The dual nozzle print head has two extruders (FDM and FDM + CFC with reinforced, fiber-cutting mechanism) and can be used both as a normal FDM 3D printer and as a co-extrusion printer for composite materials. The slicer software contains integrated material profiles for recommended filament types with which carbon fiber-reinforced 3D prints can be implemented. The print files remain exclusively on the system and are not transferred to a data cloud.



Technical Specifications

- » building space: 420 x 297 x 210 mm
- » min. layer thickness: 0,06 mm
- » print speed: 10 - 60 mm/s
- » print speed incl. carbon fiber: 1 - 10 mm/s
- » max. nozzle temperature: up to 270°C
- » max. bed temperature: up to 120°C
- » print bed: glass
- » building space: enclosed
- » print head: Single head with 2 extruders
- » filament type: e.g.: PLA, PET-G, Polyamid, ABS, PC
- » Carbon fiber bundle cross section: 0,37 mm
- » Polymer filament cross section: 1,75 mm
- » Software: Anisoprint Aura (FFF+CFC)
- » - Touch panel: 3,4" LCD display



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GOM ARAMIS/WESTCAM

3D Motion and Deformation Sensor

ARAMIS is a non-contact and material-independent measuring system based on digital image correlation. ARAMIS offers a stable solution for full-field and point analyses of samples of just a few millimetres up to structural components several metres in size.

The system performs high-precision measurements with a 3D measurement resolution in the sub-micrometer range regardless of the specimen's geometry and temperature and with no need for time-consuming and expensive preparation. For statically or dynamically loaded specimens and components, ARAMIS provides accurate data such as:

- » 3D coordinates
- » 3D displacements, velocities, accelerations
- » surface strain
- » evaluations with 6 degrees of freedom (6DoF)

The ARAMIS measuring data are used to determine material properties. These material properties are typically used as parameters for numerical simulations and contribute to improving the results of finite element simulations.

The 3D measuring data generated by ARAMIS is also used to validate simulation results in prototype and component testing in order to more precisely optimise simulations.

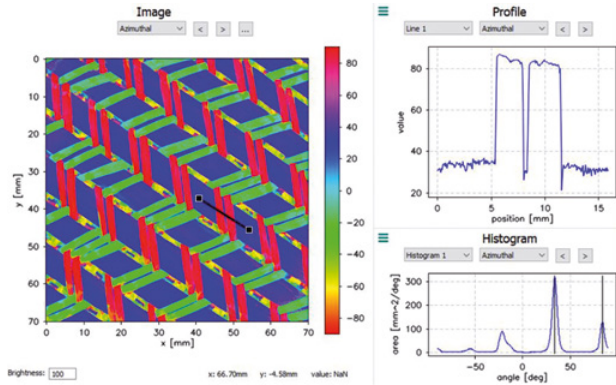
Technical Data

- » 12M sensor and accessories
- » Resolution 4000 x 3000 pixels
- » Measures deformations with an accuracy of ~ 0.005%
- » Frame rate 58–464 Hz
- » Lenses (focal length)
 - › 24 mm
 - › 100 mm
- » Calibration cube and cross for various measuring ranges:
 - › 51 x 39 mm² to 88 x 66 mm²
 - › 87 x 66 mm² to 130 x 97 mm²
 - › 1000 x 800 mm²
 - › 2000 x 1600 mm²
- » Dual LED lighting (measuring ranges up to approx. 500 x 400 mm²)



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PROFACTOR FScan-H2 Fiber Orientation Sensor



The FScan sensor is used to measure the fiber angle of carbon or glass fibers on surfaces. In principle, this technology can be used for all types of semi-finished fiber products such as fabrics, scrims, NFC, etc. and all process steps in the production of a fiber composite component, from the raw material to the finished, clear coated component can be examined with it. The FScan sensor can be used in static manual mode as well as in continuous robot-assisted scan mode for 3D surfaces. To determine the fiber angle, images of the surface with different, circularly arranged, exposure directions are recorded with the camera. The fiber angle is determined from the known distances between the surface and the LED light sources to the camera. The data of the fiber orientation on the surface of a component are used to validate draping simulations, as this enables the comparison of simulation and experiment. In addition, the sensor can also be used in quality assurance to examine whether the actual fiber orientation in a component is within the maximum permissible angular deviation as planned or to detect typical surface defects such as inclusions, distortions or cracks in the semi-finished fiber product.

Technical Data / Equipment

- » Camera: DALSA GENIE NANO-M1930 Gigabit Ethernet Monochrome Camera, 1920 x 1200 pixels.
- » Lens: SCHNEIDER KMP-IR XENOPLAN 17/1,4, ruggedised low distortion fixed focus lens.
- » Operating modes:
 - › Hand Mode – Full frame still images
 - › Robot/Scan Mode – Continuous 3D acquisition



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BMG POLARstar Omega

Cytotoxicity and Oxidative Stress Tests | Determination of Physicochemical Sum Parameters

Technical Data – BMG POLARstar Omega

- » UV Vis measurement (220–1000 nm)
- » Fluorescence intensity measurement (Ex/ Em (nm): 355/460, 485/520, 544/590, 584/620, 546/675)
- » Luminescence measurement (including BRET)
- » Time-resolved fluorescence measurement (TRF)
- » Fluorescence polarisation measurement
- » Endpoint and kinetic measurements
- » Spectral scanning (absorption)
- » Well scanning
- » Measurement of 6–1536 well microplates
- » Temperature regulation

R&D Services

- » Cell-based cytotoxicity studies to determine maximum drug concentrations in food and feed
- » Cell-based oxidative stress tests
- » Determination of physicochemical parameters in food and feed (e.g. total phenol content, TPC, antioxidative potential, ORAC, etc.)



The POLARstar Omega is a versatile, filter-based multifunctional microplate reader.

Routine work currently includes important areas in basic research but above all in applied research areas:

- » Cytotoxicity studies
- » Oxidative stress tests
- » Determination of physicochemical sum parameters



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* Funding under the structural funds programme 'Investments in growth and employment Austria 2014–2020' with EU funds from the ERDF (European Regional Development Fund) and the State of Upper Austria.

Brewing at the Wels Campus

Experimental and Teaching Brewery Training and Product Development

The Wels campus offers a small, technically-oriented experimental and training brewery. In addition to brewing and refining containers, four temperature-controlled fermentation tanks and twelve pressure tanks (some cylindroconical) are available. Cooling rooms, bottle and drum filling and labelling machines can be used. Eight hobbyist brewing sets developed in Wels for the company Bielmeier and marketed through Amazon are available for brewing courses. For analytical purposes, a chemico-analytical laboratory including the Anton Paar Alcolyzer beer analysis system

and a complete microbiological laboratory are available.

The brewery's offerings include:

- » Development of recipes and brewing processes
- » Chemical microbiological analysis (beer defects, etc)
- » State-of-the-art sensory studies and tastings
- » Product development
- » Hygiene and sensory training
- » Brewing courses for hobbyists
- » In-depth courses for microbrewers



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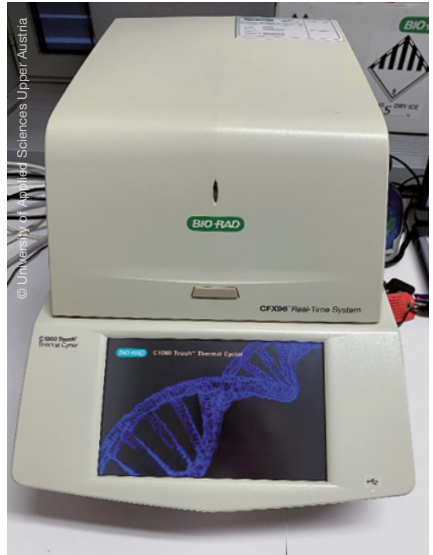
DI Robert Burgholzer
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Technical Data

- » 100 L Gruber microbrewery
- » 4 120 L fermentation tanks (temperature-controlled)
- » 12 pressure tanks, 100 L
- » 50 L portable demonstration brewing set
- » 10 brewing sets for courses 25 L
- » Bottling equipment
- » Foam Stability measurement
- » Keg filler
- » 8°C cool room
- » 2°C cool room
- » Laboratory chemical analysis
- » Laboratory microbiology
- » State of the Art Tasting Lab

C1000 Thermal Cycler | CFX96 RT-PCR Gene Expression Analysis*

The CFX Touch and CFX Connect cyclers with CFX96 Real-Time module are precise and flexible real-time PCR systems. The instruments allow sensitive gene expression analysis of various starting products such as cell lysates, model organisms (*C. elegans*, *D. melanogaster*), tissue samples or foodstuff. Thus, influences on selected parameters (e.g.: heat stress, inflammation, oxidative stress, carcinogenicity, toxicity, etc.) of various substances, such as phytochemical compounds, can be tested and quantified *in vivo* and *in vitro*.



Technical Data

- » 96-well modules
- » individual reaction sequences
- » small reaction volumes
- » CFX Maestro software for advanced data analysis
- » amplification / real-time PCR
- » original BioRad kits and plates

R&D services

- » Gene expression analysis (mRNA) in cell and tissue material.
- » Detection of pathogens
- » Detection of mutations
- » Food analysis (e.g.: GMOs,...)



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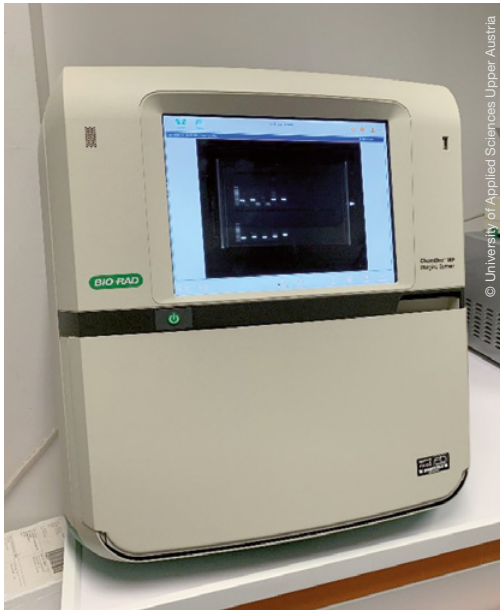


* Funding under the structural funds programme 'Investments in growth and employment Austria 2014–2020' with EU funds from the ERDF (European Regional Development Fund) and the State of Upper Austria.

ChemiDoc MP Imaging System

DNA- and Protein Expression Analysis

Agarose gels and Western blots can be analysed with the ChemiDoc MP Imaging System. A variety of chemiluminescent, colorimetric or label-free methods are used for visualisation. In addition to protein detection by Western blots, ELISA tests are also used for quantification of proteins in the picogram range.



Technical Data

- » Detection of DNA and proteins
- » Multiplexed, fluorescent Western blotting
- » Label-free imaging for protein normalisation
- » Fast imaging via autofocus and auto-exposure

R&D services

- » Identification and quantification of proteins, nucleic acids and protein-ligand interactions
- » Allergen detection
- » 96-well sandwich ELISA



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Chromatography and Spectroscopy

Food and Feed Analysis

A wide range of systems and methods are available for the analysis of food and feed. The Thermo UltiMate 3000 standard HPLC is a liquid chromatographic system. Using HPLC, non-volatile substances are identified and quantified.

Equipped with an 8-channel diode array as well as refractive index and fluorescence detector, this HPLC can generate high-quality data for application in many fields such as food, feed and environmental chemistry.

The Thermo ISQ QD Single Quadrupole MS is a gas chromatography system coupled to a mass spectrometer. The GC is mainly used in food chemistry (determination of food ingredients and foreign substances), environmental analysis, aroma analysis, sensor technology and trace analysis.

R&D Services

- » Identification and quantification of substances in food and feed
- » Development of methods for the qualitative and quantitative determination of different substances
- » Determination of carbohydrates in beverages
- » Nitrogen determination according to Dumas in solid and liquid samples



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Design | Implementation | Evaluation | Publication

Bioavailability, Pharmacokinetics and Analysis of Physiological Parameters *In Vivo*

Clinical studies aim to verify the efficacy and safety of drugs, certain forms of treatment, medical interventions or medical devices. The first use of a promising medical treatment in humans should therefore be a clinical study with the aim of testing the efficacy and tolerance of new therapies. However, this can only take place if sufficient data are available for safe implementation and the ethics committee concerned takes an affirmative vote. Such studies are carried out in a controlled environment in order to minimise external interferences. Great expertise is available for all project phases due to successful studies in various areas such as hypertension, dental health, blood glucose level and bioavailability. Thanks to excellent networking, we can mediate between clinical facilities, doctors, volunteers, companies and scientific partners, thus ensuring successful implementation.



R&D Services

- » Study design
- » Ethics committee submissions
- » Scientific support as well as general implementation
- » Recruitment of subjects
- » Contact to clinics and hospitals
- » Scientific evaluation including statistics
- » Publication of study results in renowned peer-reviewed journals



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Chemistry and Biology

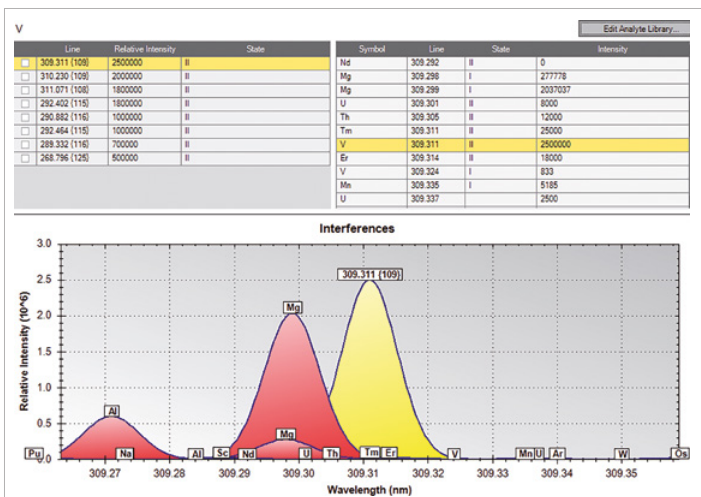
Environmental- and Agricultural Analysis

The department of chemistry and biology of the University of Applied Sciences Upper Austria is a provider for chemical, microbiological and biotechnological analysis.

We have more than 10 years of service provider experience for national and international organisations. Routine analytics are covered, as well as individualised special analytics in order to custom tailored answer to their individual and unique requests.

Selection of analytical activities

- » Heavy metals
- » Micro- and macro-nutrients
- » Feed analysis
- » Fertilizer analysis
- » Biogas examination
- » Bio-ethanol examination
- » Environmental toxicological analysis
- » Mineral oil examination
- » Trace analysis in soil / water / air



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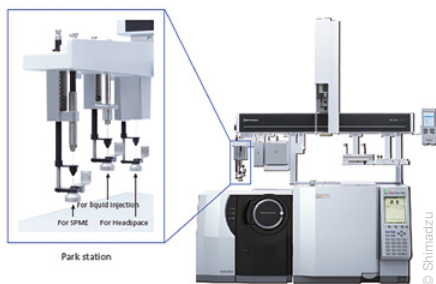
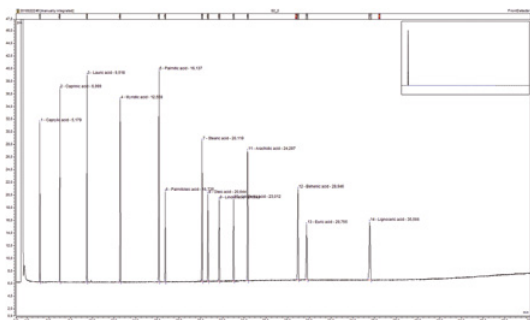


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Chemistry and Biology

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Selection of analytical activities

- » Fatty acids (omega-3, cis/trans)
- » carbohydrates
- » organic acids
- » proteins
- » amino acid composition
- » macro- & micro-nutrients
- » vitamins
- » flavour substances
- » additives



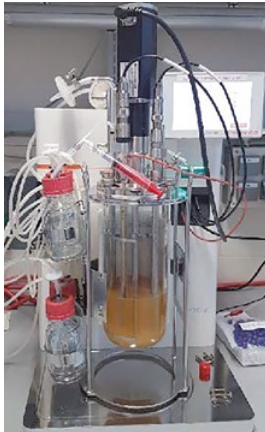
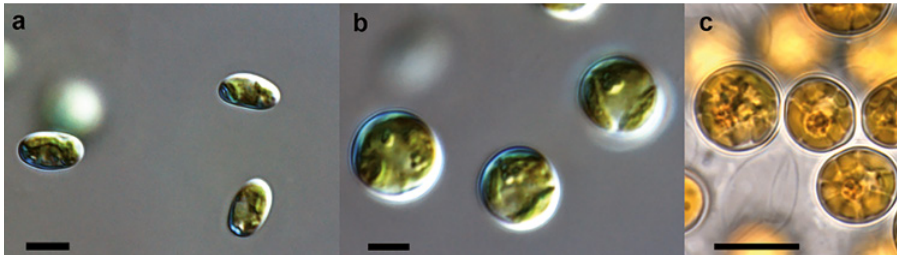
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Chemistry and Biology

Microbiology and Fermentation

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Selection of analytical activities

- » Cultivation and screening of microorganisms (e.g. bacteria, yeasts, fungi, microalgae)
- » Fermentation in laboratory scale using lab-fermenters, e.g. for product development
- » Colony Count Determination
- » Hygiene concepts
- » Potable water analysis, coliforms/E.coli
- » Fermentative biofuel production
- » Determination of antimicrobial potential



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Chemistry and Biology

Molecular Biology, Biotechnology, Bio-analytics

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Selection of analytical activities

- » Molecular biology of yeasts and cyanobacteria
- » biological significance examination of extracts using bioassays
- » Polyphenol analysis
- » FACS
- » Custom tailored molecular biology analysis
- » Technology of plasmids



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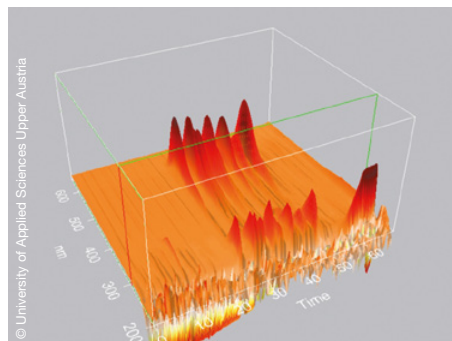
Chemistry and Biology

Research Laboratory for Chemical and Microbiological Analysis

The research team in the Department of Chemistry/Biology at the Wels campus has been conducting successful commissioned analytical work for over 5 years. The customer portfolio includes industrial enterprises, public institutions, NGOs, universities and private individuals. The range of services extends from nonrecurring routine work to months-long research projects in cooperation with clients.



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What We Do (Research Examples)

- » Analysis of sedimentary precipitation in the cooling water cycle of an industrial process
- » Long-term study of imported bees wax for harmful diluents in cooperation with a European ministry
- » Identification of an unknown, transmission-reducing precipitation in solar thermal collectors of a domestic manufacturer
- » University co-operation for the characterisation of protein complexes for the food industry
- » Routine analysis of sugars, volatile and non-volatile fatty acids, heavy metals, macro- and micronutrients, (drinking) water testing

Analytical Equipment

- » HPLC Systems with UV/VIS, DAD, RI, FL detectors and sample fractionation capability
- » IC systems for anion and cation analysis
- » GC FID/WLD/ECD
- » GC MS, liquid, Headspace, SPME, DIP, sniffing module
- » ICP OES
- » TOC analyses of solids/liquids
- » Nitrogen analysis using Dumas and Kjeldahl methods
- » Spectrometry (UV/VIS, FTIR, fluorescence)
- » Polarimetry
- » Microbiological studies (germ counts, identification, hygiene advice)

Determination of Nitrogen Content

DUMATHERM® – the Nitrogen Analyser

The DUMATHERM® is an automatic nitrogen analyzer for the determination of the nitrogen content in food and feed. The DUMATHERM® uses the Dumas assay as a reference method in nitrogen/protein analysis. The sample material is combusted at high temperatures and the resulting nitrogen oxide is reduced to elemental nitrogen via a metallic copper surface and subsequently measured. Since the Dumas assay does not use aggressive chemicals, it is safer and more environmentally safe than the Kjeldahl nitrogen assay. Routine work currently covers important areas in food and feed research.



Technical data DUMATHERM®

- » Analysis time: 3 - 5 minutes
- » Detection limit: 0.003 mg nitrogen absolute
- » Suitable for solid and liquid samples
- » 64 individual samples + 8 additional samples
- » DUMATHERM® Manager as comfortable control software for clear results

R&D services

- » Nitrogen/protein analysis of solid and liquid foods and feeds



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Food and Feed Technology

Product Development | Analysis of Production Processes | Problem Solving



R&D Services

- » Work on current problems in the production process
- » Scientific support in the development of functional food and feed
- » Optimisation strategies for production processes
- » Expertise in research funding
- » Drafting and submission of research applications

Since the beginning of 2017, the Weghuber research group at the Wels campus has been one of three scientific partners—along with the University of Natural Resources and Life Sciences, Vienna and the University of Veterinary Medicine, Vienna—at the new competence center FFoQSI (Austrian Competence Center for Feed and Food Quality, Safety and Innovation), the first COMET competence center aimed at safeguarding feed and food production. The goal of FFoQSI is to make feed and food production better, safer and more sustainable and to drive innovation. Within the scope of this applied research center as well as beyond, our employees deal with a wide range of food and feed production issues using innovative technologies. We offer sound scientific support to companies in the food and feed industry from the idea to the finished product, making the entirety of our extensive know-how and infrastructure available.



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Food Safety

Identification and Quantification of Mold Species



© Nicki Ollinger

Mold growth can occur rapidly in the production of food due to the abundance of nutrient media available due to the large amount of biological material. If the spores eventually get onto the food, it will rapidly spoil and become unfit for consumption. Some molds are harmless, but others produce toxic mycotoxins that can cause problems in the gastrointestinal tract if consumed.

That is why we have developed a method for identifying mold species that can be used in food-producing plants.

Swabs are taken from surfaces at neuralgic sites using sterile cotton and airborne microbial samples are collected. DNA samples are extracted from the cultures grown further in the laboratory and their genetic fingerprint (DNA barcoding) is analysed using polymerase chain reaction (PCR).

The germs are quantified by transferring representative volumes to full medium. The samples are incubated and the bacterial count is determined after the cultures have grown.

Technical data

- » Recirculating air laminar flow systems for contamination- and risk-free work
- » BIO-RAD Thermal Cycler for DNA barcoding with 96-well module
- » Data analysis software
- » Sequencing
- » Bioinformatic analysis



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HET-CAM

Influence of Phytamines on Blood Glucose Levels and Cytotoxicity *In Ovo*

The HET-CAM, also known as the Hen's Egg Test, is a method for testing the irritation potential of chemicals and their cytotoxicity. The HET-CAM can also be used to study glucose-regulating substances. Insulin resistance and the failure of insulin-producing beta cells are major problems of type 2 diabetes mellitus. Since common drugs are associated with many side effects, researchers are increasingly turning to secondary plant compounds with insulin-mimetic character.

With the HET-CAM, we have established a system to test these substances *in ovo*. For this purpose, the chicken embryos are treated with the compounds to be tested. Blood is subsequently taken from the chicken embryos and the blood glucose level is determined. Thus it is possible to easily measure the effect of a substance on blood glucose levels over time in a living organism. Furthermore, this system is suitable for testing the toxicity of substances to the organism.

Technical Data – HET-CAM

- » Test system with high physiological relevance (*in ovo*)
- » No pain sensation of the chicken embryo due to the shortened incubation period
- » Alternative to controversial irritation tests

R&D Services

- » Characterisation of selected phytamines for insulin-mimetic properties
- » Characterisation of selected substances with regard to toxicological properties



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In Vivo High-throughput System for the Characterisation of Various Substances and Drugs

Model Organism *Caenorhabditis Elegans*

Caenorhabditis elegans (*C. elegans*) is a soil nematode of about 1 mm in size, which is used as a sensitive and reliable in vivo high-throughput system for the characterisation of various substances and drugs. The worm shares large sequence homologies to higher organisms, respectively some major metabolic pathways are highly conserved. Thus, the holistic live animal model offers extensive opportunities for detailed identification of regulatory mechanisms as well as prediction of effects on higher organisms.



Technical Data

- » Test system with high physiological relevance
- » Living whole animal model
- » Does not account as animal trial (no ethical concerns/restrictions)
- » High sample throughput

R&D services

- » Toxicity (DART assay, Lifespan assay, LD50 values).
- » Gene expression analyses and next generation sequencing (NGS) for characterisation of substance effects
- » Fluorescence reporter genes for substance characterisation
- » Model system for heat stress and oxidative stress
- » oxidativen Stress



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Minifors 2 Laboratory Bioreactor

The Minifors 2 is a compact and easy-to-use bioreactor with a full range of applications. It allows easy and continuous culture of microorganisms such as *Escherichia coli*, *Saccharomyces cerevisiae* and various *Lactobacilli*. Fermentation can be carried out under oxygen supply (aerobic) or in the absence of air (anaerobic). The biotic raw material is modified by microbial as well as autolytic enzymatic processes.



Technical Data

- » 3.0 L total volume with rounded, flat bottom
- » Stirrer speed from 150 to 1600 min⁻¹
- » Two 6-blade disc stirrers (Rushton)
- » 2 integrated mass flow controllers for air, air/O₂ or air/N₂ (for culture of microorganisms)
- » Temperature control via exchangeable heating/cooling block
- » Acquisition of online parameters by means of the bioprocess platform software eve®

R&D services

- » Fermentation of food products (lactofermented vegetables, sourdoughs)
- » Production of specific fermentation products (organic acids, bioethanol, phyto-pharmaceutical agents)
- » Accompanying chemical analysis of the fermentation products



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Olympus IX81 | Nikon Eclipse Ti2

Light and Fluorescence Microscopy

The Olympus IX81 and the Nikon Eclipse Ti2 are fully automated inverted microscopes for light and fluorescence microscopy. Both microscopes are equipped with motorised microscope stages, the most common laser lines for fluorescence microscopy, a focus-hold system for stable long-term experiments, a FRAP (fluorescence recovery after photobleaching) module for kinetic live cell studies, a TIRF module (total internal reflection fluorescence) for selective fluorophore excitation in the cell membrane and high-resolution cameras.

These microscopy setups are suitable for a wide range of applications in cell and molecular biology due to their high-end features.



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Technical Data – Olympus IX81

- » Motorised microscope stage
- » 405, 488, 515, 561, 640 nm laser lines
- » Focus-hold system
- » FRAP module
- » TIRF module
- » Spinning-disk confocal unit (IX2-DSU)
- » Differential interference contrast (DIC)
- » Temperature and CO₂ chamber
- » Mercury vapour lamp

R&D Services

- » Screening of insulin-mimetic phytamines
- » Fluorescence microscopy studies in the live cell model
- » Development of fluorescence microscopy-based methods

* Funding under the structural funds programme 'Investments in growth and employment Austria 2014–2020' with EU funds from the ERDF (European Regional Development Fund) and the State of Upper Austria.



Precellys Evolution Bertin Homogenizer

With the Precellys Evolution, a wide variety of samples can be homogenised under standardised conditions within a very short time. The DNase- and RNase-free tubes contain beads of different sizes and hardnesses, allowing optimal sample digestion for any sample material. In combination with the cold trap, the degradation of thermosensitive molecules can be actively prevented.



R&D services

- » Environmental Sampling
- » Agronomy
- » Pharmacology
- » Microbiology
- » Foodstuff
- » Forensics
- » DNA, RNA, Proteins, Lipids
- » Tissue samples

Technical Data

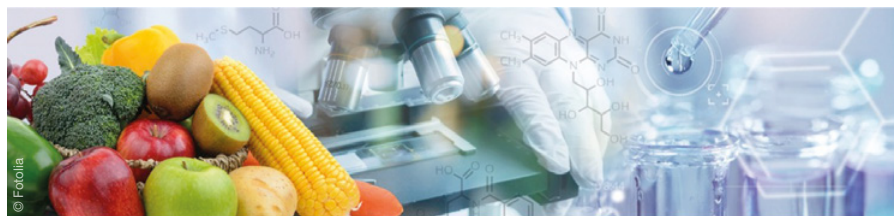
- » 4,500 to 10,000 RPM
- » Short preparation time 1-5 minutes
- » Sterile single-use tubes in 2, 7 and 15 mL size
- » Ceramic or stainless-steel beads
- » Up to 24 samples simultaneously



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TIMed CENTER Core Facilities

Bioactive Ingredients Research



There is a wealth of substances and plant substances, so-called phytamines, in nature. Adequate natural extracts and plant substances with measurable biological effects are increasingly used in modern medicine and nutrition for the prevention and treatment of diseases. In the future, they may become a potential alternative to the conventional drugs of today. For specific applications, it is of great importance to know and to describe the basic molecular mechanisms involved. This research group therefore focuses its work on the identification and characterisation of phytamines and the analysis of physiological effects in suitable in-vitro and in-vivo experimental systems. Molecular, biochemical, biophysical and cell biological levels can be investigated to explore the influence of plant components and their active pharmaceutical constituents.

The thematic fields cover everything from the investigation of the components of cosmetic products to the modification of nutritional products. Moreover, a wide variety of active ingredients and unknown interactions in the food sector are being researched. A further topic is quality assurance in the area of food quality (food control) through various measuring methods (microbiological and molecularbiological analyses, HPLC, GC-MS). In addition to basic research, the research group at the University of Applied Sciences Upper Austria, Wels Campus develops functional foods and highly effective natural pharmaceuticals and nutraceuticals. This is done in cooperation with innovative partners from science and industry.

Services

- » Analytics of plant raw materials
- » Characterisation of bioactive ingredients
- » Development of in-vitro and in-vivo test systems
- » Design and engineering of functional foods
- » Development of dietary supplements
- » Testing of cosmetics
- » Conducting clinical studies in humans and animals with partner institutes



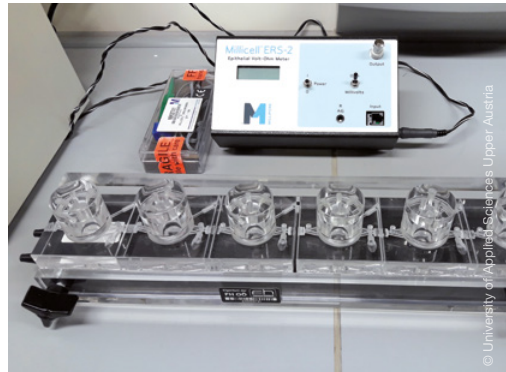
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Transwell System | Ussing Chamber

Bioavailability Studies | Influence of Phytamines on Intestinal Glucose Transport

Caco-2 (human colorectal cancer cell line) and IPEC-J2 (small intestinal cell line from pigs) cells are adherent cells that share physiological similarities to human intestinal epithelial cells.

For transport studies in living tissue, a multichannel Ussing chamber is also available to carry out continuous long-term studies. The Caco-2 and IPEC-J2 models are recognised pharmaceutical models for the initial assessment of the bioavailability of orally administered drugs and are thus widely used in many fields.



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Technical Data for the Caco-2/ IPEC-J2 Transwell System

- » Simulation of the human intestine through formation of a polarised cell monolayer in 6- / 12- / 24-well formats
- » Recognised pharmaceutical cell model for the assessment of bioavailability of active ingredients
- » Extension of methodology and adaptation for food and feed production and optimisation

R&D Services

- » Assessment of the bioavailability of food and feed ingredients
- » Assessment of the bioavailability of food supplements
- » Development of nutraceuticals to inhibit intestinal glucose uptake

Vilber Lourmat BIO-SUN UV Irradiation System

Influence of UV Emission on Cellular Systems



The BIO-SUN from Vilber Lourmat is a microprocessor-controlled, cooled UV irradiation system for petri dishes and microtiter plates. The emission of UV light in the BIO-SUN is constantly monitored by a microprocessor.

The irradiation stops automatically when the set dose (energy) is reached. Thanks to the UV sensor, the irradiation cycles can be reproduced perfectly and independent of the intensity fluctuations of the UV source.

Technical Data – BIO-SUN UV Irradiation System

- » Two UV sources (4 x 30 W 365 nm and 2 x 30 W 312 nm)
- » Irradiation for microtiter plates and petri dishes
- » High irradiation homogeneity
- » Irradiation of cellular systems with UV radiation under controlled conditions

R&D Services

- » Identification and characterisation of substances that reduce the negative effect of UV radiation
- » Applications include the cosmetics industry (skin cells) and the development of food supplements

Human as well as animal cell cultures (various cell lines are available in our laboratory) can be exposed precisely to specific UV radiation in petri dishes or microtiter plates in order to simulate the influence of sunlight on certain cell systems such as eye or skin cells. Combined with cytotoxicity or oxidative stress tests, the negative effect of UV radiation can be quantified. Subsequently, substances (synthetic or natural) can be identified and tested which reduce the harmful effects of UV radiation. The system is highly relevant to product development (e.g. in the cosmetics industry).



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VideometerLab 4

Non-invasive Multispectral Analysis Using VideometerLab

The VideometerLab 4 is one of the most advanced instruments for multispectral analysis. Videometer technology offers accuracy, robustness and high reproducibility of measurements. Especially in the food industry, pollutants, foreign substances or contaminations in food are critical. Many of these substances are difficult to detect. In such difficult cases, multispectral analysis is of great importance.

This method is suitable for:

- » The identification of mold contamination on cereal grains
- » The determination of quality parameters of wrong stored meat
- » The quality control of fresh vegetables as well as fried vegetables
- » The concentration determination of astaxanthin in fish food coatings
- » The authenticity measurement of meat (beef mixed with horsemeat or pork)
- » The measurement of processing defects or germination of seeds



Technical Data

- » Multispectral Imaging System
- » For science and industry
- » 19 wavelengths / 20 channels 365 nm to 970 nm + external channel
- » Broad spectrum focusing lens
- » Absolute reflectance / CIELab / sRGB calibration
- » High resolution CCD camera (2992 x 2992 active pixels)
- » Special data analysis software



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BRUKER D8 Advance

Identification and Quantification of Crystal Systems Using the X-Ray Diffractometer (XRD)

With the XRD it is possible to record diffractograms (or diffraction diagrams). X-ray diffraction is one of the most important non-destructive analysis methods to detect the chemical composition of crystalline materials and to determine crystal parameters (e.g. lattice parameters) and volume fraction of constituents in alloys (e.g. retained austenite determination). The lattice parameters of a crystal system can be determined from the diffraction angles of the X-ray diffraction and the wavelength of the used X-ray radiation. The diffractograms are analysed using a database in which more than 100,000 crystal systems are stored.

Technical Data

- » D8 Advance Series 2
- » Configuration: Theta/2 Theta
- » Measuring circle diameter: 435, 500, 600 mm
- » Smallest addressable increment: 0.0001°
- » Angle positioning: stepper motors with optical encoders
- » Max. angular speed: $1500^\circ/\text{min}$
- » X-ray sources: molybdenum and copper



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Collin E20 M with Collin CR 136/350 Chill Roll

Laboratory Single Screw Extruder for Film Production and Rheological Characterisation

The single-screw extruder is used for processing plastic bulk material. Amorphous and semi-crystalline thermoplastics can be processed. The material is fed to a rotating screw via a hopper.

The screw takes up the material, compresses it, plastifies it and ensures a sufficiently homogeneous kneading. Heating jackets along the barrel both dissipate and add heat to the raw material during the plasticisation process. At the end of the barrel a corresponding tool gives the plastic melt the desired shape. The laboratory extruder has a temperature and pressure sensor system at the barrel wall in order to characterise the material behaviour during the extrusion process. Various screw modifications and different tools are available.



Technical Data

- » Screw geometry: three-zone screw
Ø20 mm with length to diameter ratio of 25
- » Flight depth ratio: 3.64
- » Screw modifications: nitrided, TiN coated, CrN coated, TiAlN coated
- » 150 mm wide slit-die
- » 50 mm wide slit-die with adjustable gap height (0.05–2 mm)
- » Rheological slit-die with two pressure and temperature sensors each (nozzle lips (L/H in mm): 5/0.25, 10/0.25, 5/0.35, 10/0.35)
- » Three pressure transducers in the barrel
- » Three thermocouples in the barrel (melt temperature)



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Concept Laser M1 cusing 3D Metal Printer

The M1 3D metal printer by Concept Laser produces metallic parts by means of a complete, layered melting process. This additive manufacturing process is called selective laser melting (SLM) or LaserCUSING. This kind of production is particularly suitable for small to medium-sized parts with complex geometries or integrated features.

In this three-dimensional production process, a fine metal powder is melted locally by means of a high-energy fibre laser (max. 200 watts). Depending on the material selection, the part is built up with layer thicknesses between 20 and 80 μm . The geometry of the part is generated using 3D CAD data (.stp or .stl). The process chamber, which determines the maximum part size, measures 150 x 150 x 200 mm (x, y, z). Depending on the material selection, production speed ranges from 2 to 5 cm^3 per hour. Tool steels, stainless steels, cobalt-chromium and nickel-based alloys can be processed in the M1 SLM system.

Features

- » Additive manufacturing of metallic parts
- » Build rate of 2 to 5 cm^3/h (depending on material)
- » Max. 200 W fibre laser
- » Max. part size 150 x 150 x 200 mm
- » Steels, cobalt-chromium alloys and nickel-based alloys
- » Complex geometries can be produced
- » Integration of features (e.g. cooling channels)
- » Finished parts
- » Prototyping and mold making
- » Heating system 600°C



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Concept Laser M2 cusing 3D Metal Printer

The slightly larger M2 3D metal printer from Concept Laser, like the Concept Laser M1 cusing, produces metallic parts by means of a complete, layered melting process. This additive manufacturing process is called selective laser melting (SLM) or LaserCUSING. The system is particularly suitable for the manufacture of larger components with complex geometries. The starting material for part production in this system is likewise metallic powders. Another special feature of the M2 LaserCUSING system is the significantly higher build rate and the capabilities of a 400-watt fibre laser.

The dimensions of the process chamber in which the parts are manufactured are 250 x 250 x 280 mm. In addition, reactive powders such as titanium and aluminum alloys can be processed. These materials are especially suitable for the production of reduced-mass parts.

Direct components for the jewellery, medicine, dental, automotive and aerospace sectors as well as mould inserts with close-contour cooling can be manufactured with this process.



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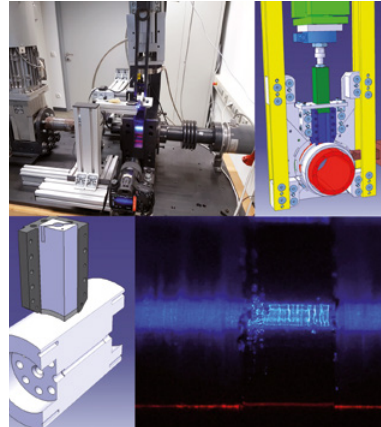
Features

- » Additive manufacturing of metallic parts
- » Max. 400 W fibre laser
- » Max. part size 250 x 250 x 280 mm
- » Build rate of 2 to 20 cm³/h (depending on material)
- » Steels, cobalt-chromium alloys and nickel-based alloys
- » Aluminium alloy, titanium, titanium alloy
- » Argon or nitrogen shielding gas
- » Complex geometries can be produced
- » Integration of features (e.g. cooling channels)
- » Prototyping and mold making
- » Very fine structures are possible
- » Heating system 600°C

Custom Development Plastics Tribometer

Technical Data

- » Measurement of the external coefficient of friction as a function of speed, pressure and temperature
- » Determination of wear and wear mechanisms
- » Measurement of the bulk density of granules and powders
- » Measurement of melting behaviour
- » Speeds up to 1.5 m/s
- » Pressures up to 200 bar
- » Temperatures up to 300° C



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In the processing of plastics with screw plasticising units, the properties of the bulk materials often play a decisive role. If the same material is present in different bulk forms (powder, granules, different granulate forms), this can have a great effect on its behavior during processing.

In addition to feed behavior, friction—and thus the conveying as well as the melting behaviour—also changes significantly when a different granule geometry is used. This plastics tribometer enables the measurement of several properties of plastic bulk goods relevant to their processing. In addition to tribological properties such as friction and wear, bulk density and the melting behavior can also be analysed. Tribological tests can be carried out at speeds of up to 1.5 m/s. Pressures of up to 200 bar and temperatures of up to 300° C are possible. Apart from practical research, this apparatus is also used to carry out basic research for a better understanding of the basic behaviour of plastic bulk goods during processing (extrusion, injection molding) and create new computational models.



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Deben CT500, CT5000, CT Coolstage In Situ CT Testing Systems for Tensile, Compression and Temperature Testing

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The CT500, CT5000 and CT Coolstage in situ test systems from Deben are suitable for carrying out experiments under the influence of tension, pressure or temperature, which are intended to trigger a specific process in the material, and are used in high-resolution CT systems (Nanotom, EasyTom). These test systems enable, for example, time-resolved, mechanical testing of glass fibre-reinforced plastics within computed tomography systems. The relevant damage mechanisms (fibre breakage, fibre pull outs, matrix debonding and matrix cracks), which ultimately lead to component failure, can be examined three-dimensionally. By means of special segmentation methods, important parameters such as fibre orientation, length and content can also be determined with high accuracy and assigned to individual stress stages or times. The results of these studies provide the foundation for further development of these material systems regarding safer and more efficient component design.

Technical Data

- » CT500: tensile and compression testing device
 - › Forces up to 500 N
 - › Traversing distance < 10 mm
 - › Sample size approx. (8 x 4 x 30) mm³
 - › Minimum voxel size (Nanotom): approx. 2 µm
- » CT5000: tensile and compression testing device up to 5 kN
 - › Forces up to 5 kN
 - › Traversing distance < 10 mm
 - › Sample size approx. (30 x 6 x 128) mm³
 - › Minimum voxel size (Nanotom): approx. 4 µm
- » CT Coolstage: temperature testing device
 - › Temperature range from -20 to 160° C
 - › Maximum heating / cooling rate 20° C/min.
 - › Minimum voxel size (Nanotom): approx. 2 µm



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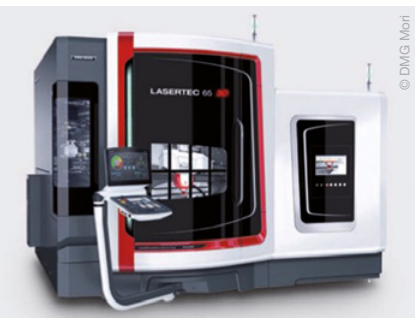
* Funding under the structural funds programme 'Investments in growth and employment Austria 2014–2020' with EU funds from the ERDF (European Regional Development Fund) and the State of Upper Austria.



DMG MORI Lasertec 65 3D

Laser Welding and Milling

The Lasertec 65 3D from DMG MORI integrates laser application welding into a 5-axis milling machine which combines the flexibility and build rate of laser application welding with the precision and surface quality of milling. The material is fed in powder form through a coaxial nozzle and melted with a 2500 watt laser stabilised by shielding gas. In contrast to powder-based processes, the material is applied only where it is needed and no supporting structures are necessary. As a result, the generative process in laser application welding is up to 10 times faster than in powder bed processes. The flexibility of changing between laser and milling processing enables the finishing of part segments that due to the part's geometry would be inaccessible in the finished part. This hybrid process can be used to manufacture and repair tools and molds or to apply wear-resistant coatings to stressed component surfaces. Further possibilities for application include light weight construction, small batches, prototypes and the production of large parts.



Features

- » Laser application welding and 5-axis milling
- » Complete machining of high quality finished parts
- » High material utilisation combined with high surface quality
- » No support structures are necessary
- » Process monitoring for highest process reliability and part quality
- » Workpieces up to ø600 mm, 400 mm in height and max. 600 kg
- » Materials tested to date: stainless steels, weldable tool steels, bronze and measuring alloy, nickel base alloys, tungsten carbide alloys, chrome cobalt molybdenum alloys, Stellite



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EasyTom 160

Ultra-High Resolution Industrial Computed Tomography for Materials Characterisation

The EasyTom 160 CT system is equipped with 160 kV nano focus X-ray source, a transmission target and replaceable filaments for various energy and resolving ranges allowing resolutions in the sub-micron range. The detection system can be switched between a flat panel detector with 1920 x 1536 pixels (for high energy) and a CCD camera with 4008 x 2672 pixels (for materials with low absorption) depending on the requirements and application. The system has been designed to realise and observe in-situ experiments (while a material is subjected to an ongoing process, e.g., changes of load or temperature), which allows new insights into material processes. The main features of the system are the large chamber, the stable mechanical construction with very high precision, the nanofocus X-ray source and the combination of several detectors. The CT system is mainly used for high-resolution and in-situ characterisation of inhomogeneous materials.



Technical Data

- » 160 kV nanofocus X-ray source with a variable focal spot diameter
- » 1920 x 1536 pixel, 16-bit flat panel detector
- » 4008 x 2672 pixel, 14-bit CCD camera
- » Minimum voxel size from approx. 50 nm
- » Component diameter < 200 mm
- » Component height < 700 mm
- » Component weight < 20 kg
- » Maximum transmission lengths of nanofocus X-ray tubes
 - › plastic: 50 mm
 - › aluminium: 30 mm
 - › steel: 4 mm
- » Virtually enlarged field of view



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* Funding under the structural funds programme 'Investments in growth and employment Austria 2014–2020' with EU funds from the ERDF (European Regional Development Fund) and the State of Upper Austria.



FLIR X8400sc/FLIR X6900sc

High-Resolution, Passive and Active Thermography

Thermography is an imaging method for displaying the surface temperature of objects. The intensity of the infrared radiation emitting from a test object is used as a measure of its temperature. In passive thermography, the temperature distribution of the component surface is determined by the environment or the process (e.g. finding heat bridges, defects in electrical components). In the case of active thermography, a time-variable heat flow is generated in the test object by means of additional energy sources used for thermographic testing. The thermal excitation can be achieved with different sources: absorption of optical radiation, electromagnetic induction, ultrasound or convection. A thermal diffusion process takes place in the test object, which becomes visible to the infrared camera through the emitted infrared radiation. Material properties can be determined very precisely and material defects can be reliably detected through mathematical analysis of the temporal temperature profile. The infrared camera FLIR X8400sc and X6900sc in particular boasts maximum thermal measurement performance.



Technical Data

- » High-resolution megapixel sensors (up to 1280 x 1024 pixel)
- » Excellent temperature resolution (NETD < 25 mK)
- » High image capture rate (1000 Hz full-frame up to 20 000 Hz subframe)
- » Lenses (focal length) with wide aperture (f/2)
 - › 50 mm
 - › 100 mm
- » Mikroscope lens (close up lens) 3x magnification – spatial resolution 5 µm
- » Multispectral sensor system using filter wheel
- » Pulse excitation with 12 kJ flash energy
- » 3 kW induction generator
- » 250 W semiconductor laser



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* Funding under the structural funds programme 'Investments in growth and employment Austria 2014–2020' with EU funds from the ERDF (European Regional Development Fund) and the State of Upper Austria.



FRIMO FTE 40/55 Laboratory Vacuum Thermoforming Machine

The Frimo single-station thermoforming system is used for forming thermoplastic materials. A semi-finished product (film/sheet) is fixed with a clamping frame and heated up to the forming temperature on one or both sides with infrared radiation. The power of the used quartz heaters (24 individual heaters in the upper heating bank, 8 in the lower heating bank) can be individually altered, to achieve a homogenous heating of the semi-finished part prior to forming. The forming process is triggered either by a pyrometer or by a timer.

The semi-finished product can be pre-blown with compressed air in order to ensure uniform wall thickness in the mould. The contact of the heated and, if necessary, pre-stretched semi-finished part to the mould is ensured by the application of a vacuum. Both positive and negative moulds can be used.

Various tools are available; special tools can be designed and manufactured externally upon request. Tools belonging to partners and clients can be used by arrangement.

Features

- » Positive or negative forming of thermoplastic polymer semi-finished products
- » Pneumatic pre-stretching via the blow box
- » Vacuum-assisted forming
- » Adjustable clamping frame (clamping frame inserts available)
- » Maximum semi-finished product size: 450 mm by 540 mm
- » Infrared heater (quartz)



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Göttfert RHEOGRAPH 6000 High Pressure Capillary Rheometer (HRCP)

With the high-pressure capillary rheometer, the flow and viscosity curve of thermoplastics and elastomeres can be determined. To this end, the plastic granulate or powder to be tested is loaded into one of three available barrels of the capillary rheometer where it is heated and compressed. A piston subsequently extrudes the plastic melt through a capillary die at a predetermined force or speed.

Three heating circuits are used that can be controlled individually and brought to different temperatures. The high-pressure capillary rheometer can be equipped with a single or triple barrel system. This makes it possible to test either the same material with different nozzle dimensions or different materials with the same nozzle geometry. Furthermore, rheological measurements can also be carried out with a slit-die measuring nozzle. The measurements can be carried out in a temperature range from 60° C to 400° C and at shear rates from 0.1 to 100 000 1/s. It is also possible to perform Rheotens, pvT, back pressure chamber, thermal conductivity and die-swell measurements on the device. The pvT and thermal conductivity measurements can be performed with the test sample in plasticised as well as solid states.



Features

- » Optional single- or triple-bore system
- » Measurement with round hole nozzle
- » Measurement with slotted nozzle
- » Rheotens measurements (extensional viscosity of polymer melts)
- » pvT measurements
- » Die-swell measurements
- » Thermal conductivity measurements as a function of pressure and temperature
- » Counterpressure chamber (pressure dependence of viscosity)
- » Slit-die with interchangeable flow channel inserts (nozzle height 0.5 mm, 1 mm, 2 mm; different surface roughness and coatings)



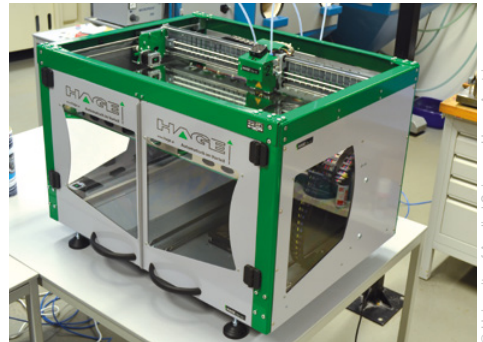
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HAGE 3DP-A2 3D Printer

Fused Deposition Modelling (FDM)

The HAGE 3D printer uses the Fused Deposition Modeling (FDM) process and promises high precision and accuracy when creating objects. During the melt-layer process, individual layers are applied to a surface. These layers are produced by the application of molten plastic at the desired position by an extruder. Depending on the application, the layer thicknesses are between 50 μm and 400 μm . Solid bodies and hollow bodies can be produced. The part is built up, layer by layer which combine to form complex products. Projecting elements manufactured with this process may require supporting structures.

The Hage printer uses 2 extruders (0.5 mm nozzle) in its standard configuration but can also be equipped with a 0.3 mm nozzle. The 3D printer processes all common 1.75 mm filaments such as ABS, PLA, PVA, HIPS, nylon, Laywood and Laybrick.



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Specifications

- » Highly dynamic FDM rapid prototyping processes
- » Dual extruders with DirectDrive and cooled extruder wheels
- » Approximately 40 W heat output for prints at higher speeds
- » Accuracy in XY plane approx. 0.1 mm
- » Layer thickness with 0.5 mm nozzle 50 μm –400 μm
- » Maximum speeds XY ~ 250 mm/s Z ~ 100 mm/min
- » Filament diameter: 1.75 mm, independent of manufacturer
- » Printable materials: PLA, ABS, PVA, HIPS, nylon, Laybrick, Laywood, etc.
- » Printing area A2 (620x400 mm)/printing height approx. 290 mm
- » 1000 W heater



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Isi.sys SE3 Sensor with isi-Studio Software

Digital Shearography: Deformation Measurement in the Nanometer Range



Technical Data

- » Non-destructive
- » Contactless
- » Imaging
- » Quick setup
- » Rapid measurement and analysis
- » Michelson interferometer shearing device
- » x-, y- or xy-shearing possible
- » Phase-shifting technology
- » Measurement of fault-induced deformations
- » Well suited for CFRP structures
- » Resolution in nanometer range
- » 1024 x 768 pixel optical resolution
- » Binning mode for faster data readout
- » Various loading methods

Digital shearography is a non-contact, optical imaging measuring method for non-destructive material testing (NDT). With an optical resolution of 1024 x 768 pixels, the measurement of a relatively large area is possible. For the measurement, a speckle pattern is projected onto the component surface and intensity images are recorded with the component in an unloaded and a loaded state. This loading leads to fault-induced, tiny deformations on the component surface in the nanometer range and are detected by the phase shifting of interfering light beams. The loaded state can be achieved by means of mechanical or thermal excitation as well as by pressure differences or dynamic oscillation coupling.

The method benefits from the quick setup of the measuring equipment as well as rapid measurement and analysis. The first signs of deformation are shown in grayscales or false colors in the resulting image which allows the deformation to be directly displayed.



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Langzauner LZT-OK-220-L Organosheet Thermoforming Press

The Langzauner LZT-OK-220-L is used for forming thermoplastic composites (organosheets). This downstroke press with four separately controllable press cylinders can apply forces of 2200 kN to the press table with the dimensions of 800 mm x 900 mm. The parallel clamping plates can hold tools with a total weight of up to 2,000 kg, which can be easily placed on the extendible transfer table. The maximum stroke is 700 mm with a clear span of 900 mm.

Before forming, the sheets are heated to forming temperature via two infrared heating fields with a total output of 64 kW and are then transferred to the mold and automatically placed in less than 3 seconds using a mobile transport frame. The tools can either be heated to up to 350 °C via the clamping plates or to over 500 °C by means of additional heating with a total output of 13.2 kW for the direct-impregnation of high-temperature thermoplastics. An integrated oil temperature control unit ensures uniform temperature control and can also be used for cooling in direct-impregnation processes.

Functions

- » Pressing force of up to 220 tons
- » Four separately controllable press cylinders
- » Infrared heating fields with a total output of 64 kW
- » Variothermic processes via tool heating concepts



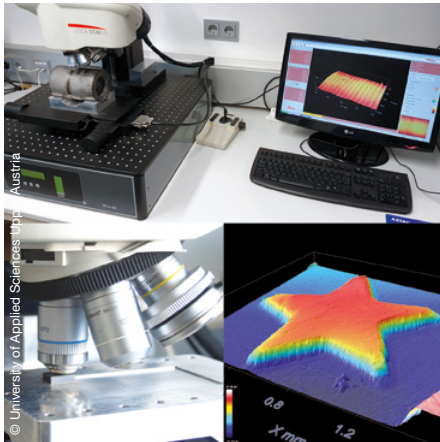
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Leica DCM 3D

Confocal Microscope for 3D Surface Measurement

The confocal microscope is used for highly accurate, non-contact, three-dimensional measurements of surfaces. The structure is similar to an optical microscope. The shallow depth of field and an aperture are used to measure surfaces three-dimensionally. In contrast to the contact profile method, an entire surface is measured, allowing more accurate analyses. A vertical resolution of less than 3 nanometers can be achieved. For highly polished surfaces there is also the possibility of interferometric measurement whereby a vertical resolution of less than 0.1 nanometer can be achieved. A motorised table can also be used to measure larger areas. Bright, glossy and non-transparent surfaces are ideal for measurement. In case of problems the surface can be coated with gold.

A range of software is available for data processing depending on the application. The software programme Leica Map can perform surface characterisation and analysis in compliance with metrology standards and methods. Further analyses are possible with custom programmes.



Technical Data

- » Optical/non-contact 3D surface measurement
- » Optical resolution (X/Y) up to 0.15 μm possible
- » Vertical resolution in confocal mode <3 nm
- » Vertical resolution possible in interference mode <0.1 nm
- » Maximum sample weight 10 kg
- » Maximum sample height approx. 150 mm



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Leistritz ZSE 27 MAXX Compounder Twin-Screw Compounder with Strand Granulation for Producing Polymer Compounds

The compounder is used for incorporating various fillers and additives into plastics as well as for producing blends. Both semicrystalline and amorphous thermoplastics can be processed. Up to three different components can be fed and compounded using dosing scales. The temperature in the individual cylinder zones is kept constant with heating cartridges and cooling bores. The two helically rotating screws have a diameter of 28.3 mm and are modular. Fillers or reinforcing materials can be incorporated into the plastified polymer through a side feeder. The nozzle forms strands from the melt, which are led through a water bath for cooling. Strand granulation produces granules for further processing. Throughputs up to a maximum of 100 kg/h are possible.



Technical Data

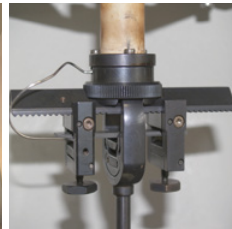
- » Screw geometry:
 - Ø 28.3 mm with L/D = 40
- » OD/ID: 1.66
- » Axial distance between screws: 23 mm
- » 11 heating zones
- » 9 cooling zones
- » Max. screw speed: 600 rpm
- » Max. melting temperature: 350° C



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METTLER TOLEDO DMA/STDA861e

Dynamic Mechanical Analyzer (DMA)



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Dynamic mechanical analysis offers the possibility of determining the properties of a polymeric material depending on temperature, time, frequency or deflection under a sinusoidal mechanical load. Both thermoplastic polymers and thermosets or elastomers can be tested. The METTLER TOLEDO DMA / STDA861 has a shear clamping assembly for plate-shaped samples, a tensile clamping assembly for rods and a three-point bending clamping assembly for rod or plate materials, depending on the type of load required. Thus, viscoelastic material properties such as the complex modulus, the loss modulus, the storage modulus and the loss factor $\tan \delta$ can be determined. The glass transition temperature can also be detected very precisely via the temperature-dependent measurement. Thanks to the cooling with liquid nitrogen and a powerful heating system, a temperature range of -150°C to 500°C can be achieved. The force range from 0.001 to 40 N allows specimen of different hardness to be tested. With 0.001 to 1000 Hz, a frequency range can be covered that mimics almost every realistic load case.

Functions

- » Determination of the complex shear, tension and bending modulus
- » Frequency and temperature dependent determination of storage modulus, loss modulus and loss factor
- » Determination of the glass transition temperature of thermoplastic polymers
- » Determination of thermal application limits
- » Determination of mechanical application limits



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METTLER TOLEDO DSC3

Dynamic Differential Scanning Calorimeter (DSC)

Dynamic differential scanning calorimetry is used to determine the conversion process of polymer materials. For this purpose, samples are placed in a crucible and the temperature-dependent heat flow is measured. By simultaneously measuring an empty reference crucible, the endo- and exothermic transitions of the material can be determined. In the case of polymers, this serves to determine the glass transition temperature and the melting temperature range in the case of partially crystalline thermoplastics. The characteristics of these transitional regions can be used for the qualitative characterisation of plastics. Furthermore, the enthalpy of fusion can be calculated from the curve shape. A further function of the DSC is the determination of the specific heat capacity (c_p), which is essential for phase transition calculations and the design of plastic processing machines.

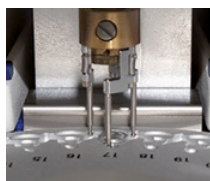
The measurements can be carried out in a temperature range from -150°C to 700°C . Typical heating rates are 0.02 to 300 K/min. In the case of samples that could easily oxidise or degrade, it is possible to flush the measuring chamber with inert gas in order to counteract the degradation.

Features

- » Determination of melting and glass transition temperatures
- » Determination of enthalpy of fusion
- » Measurement of specific heat capacity
- » Determination of the disintegration point
- » Qualitative characterisation of plastics

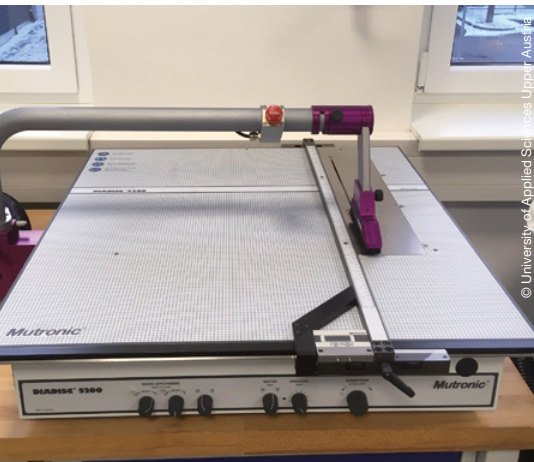


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MuTronic Diadisc 5200R

Precision Cutting of (fiber – reinforced) Coupons



The machine has a special aluminium table top in which mounting holes provide fixation of various clamping systems.

The system allows a wide range of cutting speeds, which means that different types of materials can be processed with optimal cutting quality. To reduce the formation of cutting burrs, a micro-Spray device can be used. In the case of brittle, hard materials this ensures the necessary cooling of the diamond cutting discs. Cut surfaces with roughness depths of RZ 4-6 µm can be achieved.

The system is equipped with an EX - protected dedusting system. For materials that generate fine or hazardous dusts, this extraction system is used.

This applies particularly to the processing of fiber-reinforced material (circuit boards, fiber-reinforced plastics, etc.). The extraction system prevents the finest dust particles from being blown out into the environment and is equipped with a special fine dust filter. Chips and dust particles are captured and removed by the air flow of the extraction system.

Technical Specifications

- » cutting depth: 0 - ca. 24 mm, infinitely variable
- » cutting speed: 2000 - 10000 min⁻¹
- » tools: Ø 100 mm (diamond, PKD, carbide tools)
- » torque cut-off
- » drive system: belt
- » operating temperature: +15° C to 25° C
- » Humidity range: 30% to 50%



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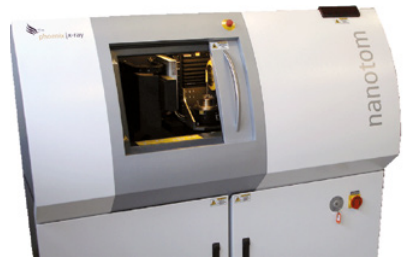
Nanotom 180 NF

High-Resolution Industrial Computed Tomography for Materials Characterisation

The high-resolution sub- μm CT device Nanotom 180 is mainly used for materials characterisation of light metal alloys, plastics and biological material systems, but it is also possible to inspect small plastic components. This system provides very good results, especially for low-absorbing samples. High-resolution and good contrast allow quantitative evaluation of many types of fibres (glass, carbon, polymer, natural).

Technical Data

- » 180 kV nanofocus X-ray source with a minimum focal spot diameter of $<1\ \mu\text{m}$
- » 2304 x 2304 pixel, 12-bit flat panel detector
- » Minimum voxel size from approx. $0.5\ \mu\text{m}$
- » Component diameter $< 68\ \text{mm}$
- » Component height $< 150\ \text{mm}$
- » Component weight $< 2\ \text{kg}$
- » Maximum transmission lengths of nanofocus X-ray tubes
 - › plastic: $50\ \text{mm}$
 - › aluminium: $30\ \text{mm}$
 - › steel: $4\ \text{mm}$
- » 3-fold virtually enlarged field of view



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open_iA

Visual Analysis & Processing of Industrial Computed Tomography Data

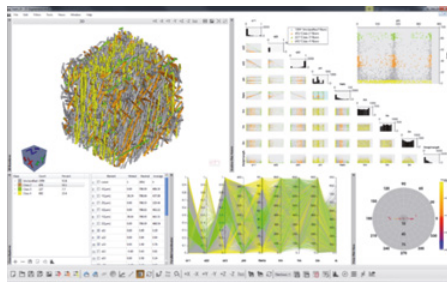
open_iA is a platform-independent, open source software tool for the visual analysis and processing of volumetric data sets with a focus on industrial computer tomography data. open_iA permits the loading of a wide range of volumes and polygonal formats and offers 2D editing views as well as customisable 3D views of the data sets.

These views, combined with many image processing and feature extraction filters, make open_iA the ideal tool for generic volume data analysis. In addition, open_iA offers interfaces for the expansion of new modules for specific analysis scenarios. Some of these in-house developed modules are already included in open_iA, such as FiberScout (see graphic), a module for the visual analysis of the characteristics of fibre-reinforced plastics (e.g. fibre length distribution, fibre orientation analysis) or InSpectr for the interactive analysis of registered scalar and spectral data sets. GEMSE is also included for interactive analysis of parameter and result space of multimodal and multi-channel segmentation algorithms as well as many other modules.

Technical Data

- » Segmentation
- » Feature extraction
- » Noise reduction
- » Image fusion
- » Multimodal/Multiscale data analysis
- » Analysis of time-varying data (3D + time)
- » Fibre, pore and cavity analysis
- » Parameter space analysis
- » Open source
- » Platform independent (Windows, Linux, macOS)

Take the opportunity to become familiar with it and test open_iA on GitHub: https://github.com/3dct/open_iA



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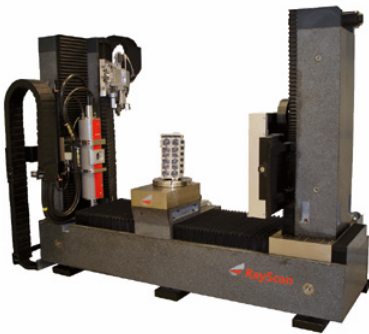


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RayScan 250E

Industrial Computed Tomography for Component Testing

The dual source computed tomography (CT) system RayScan 250E was installed in November 2004 at Wels campus. The speciality of this CT is that it features two X-ray sources for different requirements: the 225 kV microfocus X-ray source is especially suited for higher-resolution measurements of smaller components and the 450 kV minifocus X-ray source for high penetration lengths. A flat panel detector is used to convert the X-rays into visible light via a scintillation layer. On the basis of the generously dimensioned CT system, relatively large and heavy components can be tested for internal defects, material properties and geometries. The main applications of the RayScan 250E CT system are the non-destructive testing of multi-material and cast components e.g., from the aircraft and automotive industries, dimensional measurements and metrology as well as the material characterisation of small steel samples.



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Technical Data

- » 225 kV microfocus X-ray tube with a variable focal spot diameter
- » 450 kV minifocus X-ray tube with a constant focal spot diameter of approx. 0.4 mm
- » 2048 x 2048 pixel, 16-bit flat panel detector
- » Minimum voxel size from approx. 5 μm
- » Component diameter < 300 mm
- » Component height < 2 m
- » Component weight < 80 kg
- » Maximum transmission lengths
 - › plastic: 200–500 mm
 - › aluminium: 120–250 mm
 - › steel: 30–70 mm
- » 2-fold virtually enlarged field of view
- » Region of interest mode for measuring flat components



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SimCT

Simulation Tool for X-ray Imaging

Technical Data

- » Computation of X-ray spectra
- » Modelling of the interaction of X-rays with matter (photoelectric effect, Compton and Rayleigh scattering)
- » *.STL and *.GEO support
- » Generation of virtual records with known properties
- » Optimisation of recording parameters
- » Design studies for new devices
- » Evaluation of image processing, reconstruction and artifact correction algorithms
- » Estimation of measurement uncertainty

SimCT is a tool for numerical simulations of imaging radiography and X-ray computed tomography. The tool facilitates the generation of data sets and the accumulation of know-how for the design of new devices as well as the development of artifact corrections and reconstruction algorithms. SimCT also offers procedures for optimising image quality by automatically determining acquisition parameters for user-specific inspection tasks. These minimise the influence of image noise, image blur and artifacts. The tool also provides routines for generating X-ray spectra and models X-ray interactions with components and the X-ray detector. SimCT can be extended with additional models, acquisition geometries and reconstruction routines.



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SkyScan 1294

Talbot-Lau Grating Interferometer Computed Tomography for Materials Characterisation

The Talbot-Lau grating interferometer μ CT system “SkyScan 1294” went into operation in January 2015 at the campus in Wels. The system is characterized by a microfocus X-ray source, an 11 MP detector and 3 X-ray gratings: a source grating (G0) for generating coherence after the X-ray source, a phase grating (G1) for generating a defined interference pattern and an analyzer grating (G2) that converts the incoming signal into an intensity modulation. Using this setup, it is possible to extract the information about absorption, refraction (differential phase contrast) and scattering (dark field signal) simultaneously in a single scan. Grating interferometer μ CT systems are already being used in biomedical research but their potential is far from being exploited in materials research. For example, the anisotropic properties of ultra-small angle scattering can be used to extract directional information of microstructural details of a sample, e.g. in carbon fiber reinforced polymer laminates. The Talbot-Lau grating interferometer μ CT system at the Wels campus is mainly used for the characterisation of (fiber reinforced) polymers, polymer foams, multi-material systems, and biological samples.



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Technical Data

- » 60 kV microfocus X-ray source with a constant focal spot diameter of approx. 33 μ m
- » 4008 x 2672 pixel, 12-bit CCD camera
- » Minimum voxel size approx. 5.7 μ m
- » Component diameter < 20 mm
- » Component height < 60 mm
- » Component weight < 0,1 kg
- » Maximum transmission lengths of nanofocus X-ray tubes
 - › plastic: 20 mm
 - › aluminium: 5 mm
- » Simultaneous extraction of absorption, phase and dark field contrast



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SPECTRUM Z510

Powder-Based 3D Printer



Technical Data

- » Build chamber: 250 x 350 x 210 mm
- » Layer thickness: 0.1 to 0.2 mm
- » Part precision: 0.2 mm
- » Min. part wall thickness: 2-3 mm
- » Material: gypsum powder
- » Material options: elastomeric material for elastic components
- » File formats: STL, WRL



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The Spectrum system is based on the patented 3DP (3D printing) technology of the Massachusetts Institute of Technology. The software first converts a three-dimensional CAD image into cross-sections or layers between 0.0875– 0.1 mm thick. The printer then prints these cross sections one after the other starting from the bottom of the part and working its way up. In order to begin the 3D printing process, the printer first spreads a layer of powder in the same thickness as the cross-section to be printed. The print heads then apply a binder solution to the powder, causing the particles to bind to each other and the printed cross-section one level below. Subsequently, a new layer of powder is spread and the process is repeated.

TESCAN MIRA3 LMH FE-REM

Visualisation and Elemental Analysis of Surfaces by Means of Scanning Electron Microscopy

The Tescan MIRA 3 LMH is a high-performance field emission scanning electron microscope (FE-SEM) with a Schottky FE cathode system. The FE-SEM differs from a conventional tungsten cathode scanning electron microscope in its ability to image very small surface structures of <1.2nm with a high depth of field.

The wide range of applications extends from the visualisation of the smallest surface structures of coatings, foils, fractures, etc. to material analysis. Two detectors are available for analysis. For energy-dispersive X-ray analysis (EDX analysis), X-rays released during the interaction between electrons and the sample are detected. The element-specific bands are used for element analysis. Detection can be carried out by means of point analysis or surface analysis (elemental distribution images). With the backscattering detector (BSE detector) it is possible to display the material contrast in grayscale.



Technical Data

- » TESCAN MIRA3 LMH FE-REM
- » Schottky FE cathode system;
0.2 to 30 kV
- » Resolution 1nm at 30 kV
- » 5-axis eucentric, fully motorised
sample table with: X: 80 mm;
Y: 60 mm; Z: 47 mm; R = 360°;
tilting angle +/- 80°
- » Maximum sample height: 81 mm
- » EDX system OXFORD
AZtecEnergy XT with a 10 mm²
detector window
- » BSE-YAG detector



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* Funding under the structural funds programme 'Investments in growth and employment Austria 2014–2020' with EU funds from the ERDF (European Regional Development Fund) and the State of Upper Austria.



Support | Implementation

Usability Support for Technical Systems

In technical systems, “design” goes beyond aesthetics – it is essential that systems have the required functionality and are easy to use. Good usability can save money: by reducing the amount of training, the time needed for completing processes and the number of errors.

To support developing usable systems, it is crucial to understand the needs behind them: the knowledge and experience of the users, the tasks being performed and aspects of the environment that affect the interaction. This information then needs to be communicated to the developers in an effective manner. Designs and prototypes must be created early in the development, and then tested for effectiveness, efficiency and user satisfaction.

We can help you choose the right methods – and assist you in applying them. Even small projects can bring tangible benefits.



What We Do

- » Provide support for selecting suitable software development methods
- » Analyse the user requirements
- » Document relevant usability information for development teams
- » Develop prototypes to get early user input
- » Provide design support
- » Evaluate the usability and user experience of systems – also of user documentation



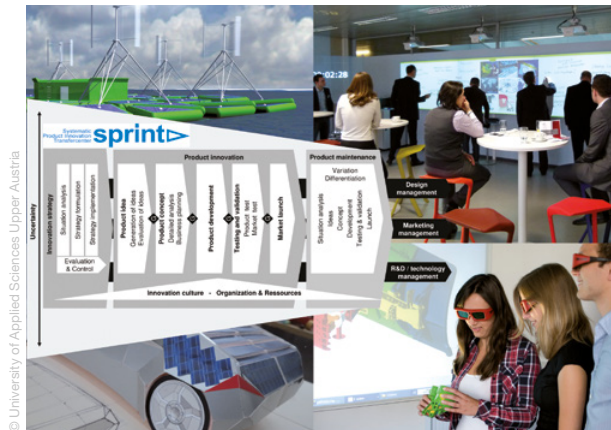
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sprint>transfercenter

Laboratory for the Early Stages of Product Innovation

What We Do

- » Product innovation laboratory
- » Creativity workshops
- » Design thinking projects
- » Concept tests
- » Acceptance tests
- » Focus group workshops
- » Lead user workshops
- » Foresight methods
- » Market potential analyses
- » Success factor studies



The sprint>transfercenter is a research-driven competence center for exchange and cooperation with industry on topics regarding the early stages of product innovation. The sprint>lab has equipment (e.g. stereoscopic CAD wall, multitouch whiteboard, digital paper, smartboard, 3D camera) available to efficiently support creative processes. The laboratory focuses on issues that are central to the entire front-end process such as: utility evaluation of product concepts using multivariate statistical methods, conception and execution of acceptance tests for product ideas and concepts, trend monitoring through strategy, ideas workshops, design and rapid and virtual prototyping as well as conception of innovation processes and processes for commercialisation.

Cooperation with industry in the interdisciplinary research field of Innovation and Technology Management is focused on the development of models, methods and tools for the early phases of innovation.



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Imprint: Responsible for the content: University of Applied Sciences Upper Austria President Dr. Gerald Reisinger, Prok. Prof. Priv.Doz. DI Dr. Johann Kastner | Text: Lisa Eidenhammer BA BA MA; Research Center Heads | Photos: University of Applied Sciences Upper Austria, State of Upper Austria, Fotolia, iStock, Thinkstock, WK-Fotografie GmbH/ Wimmer, B. Plank – imBILDE.at | Updated: October 2021



RESEARCH &
DEVELOPMENT

