Industrial Design at TU/eindhoven
Redefining Industrial Design and Inspiring New Generations of Design Engineers
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Short Profile of the Department

The department of Industrial Design is the youngest of the nine departments of Eindhoven University of Technology (TU/e). It is located in the heart of ‘Brainport’, a leading technology region in the South-east of the Netherlands, which includes knowledge institutes such as the TU/e and Fontys University of Applied Sciences, and high-tech companies such as Philips, ASML and TNO.

Research at the department focuses on two areas or thematic clusters: Future Everyday and Systemic Change.

Future Everyday

The Future Everyday cluster investigates the everyday interactions between people and the highly interconnected technology that surrounds them. We measure, model and design for the user experience when individuals interact with social-technological networks in their homes, at work, in transit, while doing sport or going out.

Systemic Change

The Systemic Change cluster focuses on designing innovations that have impact on systemic structures and groups of people, ultimately aiming to address large-scale issues such as urban health and vitality, future mobility and social inclusion. Field data is used in novel iterative and circular Research-through-Design processes involving strategic alliances of stakeholders.

Research and education at the department are highly interconnected. In particular, BSc, MSc and PhD students intensively collaborate with research staff in so-called Squads dedicated to specific research topics. In recent years, average annual numbers of graduates are roughly 100 BScs, 60 MScs and 10 PhDs.

At present the staff at the department totals 32 FTE: 10 full professors, 4 part-time professors, 4 associate professors, 18 assistant professors and 1 postdoctoral fellow. The annual budget is approximately 11M€.

In the most recent Research Review conducted by an international committee of top researchers in design and HCI in December 2017, the department received recognition of being very good in research quality, excellent in relevance to society and very good in viability.

The International Research Review Committee, from left to right Dr. Meg van Boogaert (secretary QANU), Prof. Hiroshi Ishii (MIT), Prof. Jodi Forlizzi (Carnegie Mellon), Prof. Cees de Bont (Hong Kong Polytechnic), Prof. Johan Redström (Umeå) and Prof. Toshimasa Yamanaka (Tsukuba University).
A proud history of research

In the pioneering years (2002-2009), experienced academic and industrial professionals built an educational and academic environment rooted in the practice of design. The attitude of doing theory-inspired design research with and for practitioners resulted in canonical examples of Research-through-Design. The success of this new direction was showcased at the CHI2009 in Boston. There, Overbeeke was invited for the closing plenary and our Design Vignettes celebrated the knowledge generated through prototypes.

Setting new directions was also highlighted by initiating and actively supporting new conferences and venues: Interaction Design for Children (2002), Design & Semantics of Form & Movement (2006), Tangible, Embedded and Embodied Interactions (2007) and Week van het Ontwerp (2002), now Dutch Design Week. The fact that these events are still growing shows that the department commits to making the new trends viable and sustainable.

In the following years (2007-2016) the department matured and the first generation of ID students developed into excellent researchers spreading the reputation of doing Research-through-Design. Many of our PhD students did trend-setting work in Research-through-Design, such as Deckers, Bouwstra, Kaptein, Bakker, and Megens and Peeters. Some of our alumni have already become leading academics in the field and have attained full professorship, such as Van den Hoven, Subramanian and Kaptein.

Nevertheless, in maintaining a self-critical attitude, the department felt a need for fresh influences and outside perspectives. The quality of the research and the environment now attracted new quality and welcomed fresh blood connecting to the East (Chen), West (Wakkary) and Europe (e.g. Tomico, Funk, Karapanos). The international reputation was further confirmed through the PhD programs of Erasmus Mundus Joint Doctorate (EMJD) in Interactive and Cognitive Environments (ICE) and the China Scholarship Council (CSC).

Mission

The mission of the department of Industrial Design at TU/e is

Research on and Education in the Design of Systems with Emerging Technologies in a Societal Context

With this mission, we excel at the integration of various academic disciplines, including engineering, business and social sciences. This puts us in a strong position regarding the acquisition and execution of projects where “integration of emerging technology into everyday life” and “application of technology in a societal context” play a major role. This makes us unique among design departments world-wide and provides a solid basis for collaborations in international consortia, industrial research projects and within the university.

“ID is an absolutely top-ranking research department with a unique track record combining design, social science, and engineering research by a Research-through-Design approach.”

Kim Halskov, Aarhus University, Denmark
The research approach shifted from its original focus on single-case, single-designer Research-through-Design towards more systemic approaches to Research-through-Design. This shift was highlighted through three projects within CRISP, a national research program on Design Research founded by us and our sister department at Delft University of Technology. In these projects (Intelligent Play Environments, Grey but Mobile, and Smart Textile Services), cross-over and collaborative design research was initiated, recognized and now continued with national and European funded research.

That the research remained strongly rooted in the practice of design is showcased with two directions. The first concerns the practice of design education, where projects from junior designers inspired and supported by researchers grew into fully funded research directions and projects (e.g. from Bouwstra to neonatal research with Máxima Medical Center; from educational projects in Wearable Senses to Smart Textile Services, Crafting Wearables and H2020 ArchInTex; from the MSc project of S. Van Berlo and Ayoola to DoCHANGE). The other concerns how our research networks expand into industry and society with our PhDs occupying influential positions in industry (e.g. Gardien and Deckers at Philips Design) and our field labs with connections in society (e.g. Kempenhaege, Blixem bosch, Sport Park).

Our proud history of ID shows our adaptivity and willingness to change to pursue the goal of being a leading scholarly force rooted in the practice of design. Our recent organizational innovation, the two complementary research clusters, Future Everyday and Systemic Change, reflects our desire to leverage our past and sustain our tradition of trend-setting and impactful research in the future.

“ID has pioneered Research-through-Design as an approach to social innovation and continues to contribute world leading research on design innovation and digital technologies.”

Peter Wright, Newcastle, UK

Positioning of research

TU/e ID is a department that develops design engineering and design research expertise. From its early days, the department has used a truly multi-disciplinary approach in education and research. The main contributing disciplines have been design, engineering, and social sciences. In recent years the role of health sciences has been growing.

“I am impressed with the interdisciplinary nature of the department and the openness to embrace disciplines that are not within the traditional design fields.”

Gloria Mark, Irvine, USA

Making is key to our research. We have intensely and consistently led and shaped the Research-through-Design paradigm. Research-through-Design typically involves a constructive element to address a design challenge and develop novel directions and opportunities for design, coupled with empirical studies involving individuals or groups interacting with the created artefacts. The artefacts designed at our department are smart products, systems and services involving ICT: we see ourselves thus as creative technologists, our focus on technology mainly concerning embedded systems following the visions of ambient intelligence/ubiquitous computing. We explore interactivity, focusing on aspects such as physicality, playfulness, user experience, etc.

“ID has an internationally leading reputation both because of its core commitment to making as a form of knowledge production and because of its strikingly original conceptual work.”

Bill Gaver, Goldsmiths, UK
We address design research challenges where the main objective is to create value and opportunities in systems with emerging technologies and materials. Additionally, we leverage new forms of interaction where the main objective is to realize and study networks of systems in a societal context and to design and analyze the emerging interaction patterns using recent developments in data acquisition and data analysis technology. These two research streams are reflected in our research clusters Future Everyday and Systemic Change.

While design research is closely tied to different application domains, our efforts aim to develop a more fundamental and general understanding of how to design for interactivity, how to evaluate it, and how we learn from these experiments and thus contribute to the developing epistemological discourse in our field.

The department combines a focus on people, grounded in social sciences, with a focus on smart products that embed computing and communication capabilities. However, we clearly distinguish ourselves from departments in human technology interaction (also in our university) that are primarily analytical, aiming to develop theories that apply to human technology interaction, while staying clear of designing and engineering new technologies. We are also different from traditional human-computer interaction departments given our holistic approach to design, the embedding of our research in a social context, and the prominent role of constructive design research.

In summary, we are multidisciplinary design researchers, creative technologists, people-centered designers, who contribute to defining and exploring physicality in interaction and its embedding in a societal context.

“ID embodies and extends the modern movement in interaction and user experience design.”
Saul Greenberg, University of Calgary (Emeritus), Canada

“ID is very good at initiating new issues in design such as the Aesthetics of Interaction.”
Kun-Pyo Lee, KAIST, South-Korea
Thematic clusters

Research at ID is organized in two thematic clusters: Future Everyday and Systemic Change.

Future Everyday

Future Everyday aims at bridging the gap between emerging technologies and people’s everyday life: how to deal with uncertainties that come naturally with new and still evolving technologies, and how to translate them into meaningful products, systems and services that seamlessly blend into everyday life.

The cluster Future Everyday conducts research to understand, explore, and shape the everyday life of individuals and small groups. This encompasses the new reality of living, commuting, and working, with routines, rituals, and many nuances, in spaces that are becoming more continuous, dynamic, experiential, and responsive in the future with emerging technologies. We design and analyze the touch-points where humans and technologies meet and extend into each other – the permeable membrane between a system of technologies and a system of people. In the cluster Future Everyday, we carry on the proud tradition of the department to be always in the forefront of experimenting with emerging technologies. We currently focus on technologies such as internet of things, wearables and soft things, additive manufacturing, small and local data, artificial intelligence and machine learning, while exploring smart materials and biomaterials.

Systemic Change

Systemic Change uses design and technology to study socio-technical systems at the level of a community, by designing technology-enabled interventions addressing societal challenges and analyzing their effect on the ecosystem.

In cross-disciplinary teams of specialists and stakeholders, we envision and create socio-technical systems operating in near real-life ecosystems and study their effects in the short and long term. We utilize emerging technologies such as ICT, Big Data, AI, sensors and actuators. We use the aesthetics of interaction of the users with the socio-technical systems to evoke change, applying ethical frameworks and theories from social sciences and humanities. Using a Research-through-Design approach, we develop methods, tools, platforms and field labs that support the co-creation and analysis processes. These can subsequently be repurposed by stakeholders in their own practice.

“TU/e ID offers a unique combination of exceptional design practice, deep commitment to understanding human desires and capacity to realize those desires through innovative technologies.”

Frank Vetere, University of Melbourne, Australia
We design, describe and analyze systems that typically intervene on the scale of medium-sized groups (commonly between 50 and 5000 people) with a given social relation, such as neighborhoods, social groups, clubs, patient groups, etc. We closely cooperate with members of these groups, other multi-helix stakeholders, and specialists from other fields.

In order to create impact, we currently limit ourselves to three contexts: Vitality, the Health Continuum and Social Resilience. For these contexts we already have a number of field labs in place, such as Genneper Parken, ENSAFE Community Lab and Studio for Connected Society. We have built strong regional and national networks with social groups, stakeholders, institutes and specialists, including Máxima Medical Centre, Fontys University of Applied Sciences, Philips Design, Province Noord-Brabant and Utrecht University.

“\textit{I would argue that the department is known by anyone in the field as one of the most important intellectual centers when it comes to industrial design in the world.}”

\textit{Erik Stolterman, Indiana, USA}

Research highlights

Most research projects at the department fall under one of the thematic clusters, although some projects bridge the clusters. Research topics include Wearable Senses, Data-Enabled Design, Internet of Things, Shape-Changing Interfaces, Smart Mobility, Intelligent Lighting, Materializing Memories, Peripheral Interaction, Sports and Vitality, Playful Interactions, Serious Gaming, Rehabilitation, Social Resilience, Medical Simulation, Ambient Persuasion, and many more. Below, two example projects are highlighted: \textit{Intelligent Play Environments} and \textit{Smart Textile Services}. These projects give a flavor of the type of research carried out at the department.

Intelligent Play Environments

Intelligent Play Environments (I-PE) was a project within the CRISP program. The project addressed the issue that children are becoming physically less and less active and therefore have an increased risk of obesity and isolation.

We created an inspirational test bed to develop knowledge, insights and guidelines for the design of intelligent playful environments. How to design an environment that senses and interprets players’ behavior and creates appealing opportunities for social and physical play? Crucially, we designed the interaction opportunities in an open-ended fashion to encourage multiple players to jointly explore the possibilities in their own manner and improvise during play. In addition, we used a decentralized approach, i.e., without a central algorithm controlling the game.

One of the results of the project is the Lenses of Play tool. This is a tangible, card-based design tool for design students and professionals. The cards include five different ‘lenses’ or perspectives, such as emergence and open-ended play, which provide guidance when developing playful interactions. We also developed Glowsteps, an installation consisting of interactive tiles that can emit light and make sound. Besides Glowsteps, a number of different interactive play designs were developed, supporting a range of play forms, such as fantasy play, social play and physical play.

The design research approach developed in this project is currently being applied to other domains, such as way-finding (e.g. in a hospital) and education.
Smart Textile Services

Smart Textile Services (STS) was a collaborative project within the CRISP Program. The project created a platform of methods, tools, materials, multiple partners, and many prototypes through which the creative industries explored the opportunities and challenges of joining their expertise towards designing smart textile product service systems. The final portfolio of STS contained eleven design projects targeting multiple user groups, such as the elderly, parents and children, and dementia patients, their partners and therapists.

The main research challenge was to develop the tools and methods to design for smart textile services. This challenge branched out in several directions, such as crafting communities, craft qualities for STS, and the role of prototypes for embodied STS.

As part of the larger CRISP program, STS prominently contributed to the leading insights for designing product service systems, i.e. ‘Orchestration’, ‘Embracing Complexity’, ‘Designing Relationships’ and ‘Creating Value’.

STS produced several industrial innovations, including innovative business models for the technology partners involved, moving from consultancy to introducing a technology platform for wearables; a renewed outlook on the innovative potential of the Dutch textile industry; and the potential for cross-over collaboration between service providers, technology and textile partners.

Finally, the project sparked new research projects: one NWO project ‘Crafting Wearables’, which already started during the project, and a European Program ArchInTex, which is currently continued in an STW project on Ultra-Personalized Products and Services.

“The Department of Industrial Design at the TU Eindhoven in The Netherlands is, without a doubt, one of the top educational institutions in this domain in Europe, possibly the world.”

Roel Vertegaal, Queen’s University, Canada
Graduate School

Our Master and PhD programs are part of the TU/e Graduate School. We aim to provide high-quality education, personal coaching and guidance (master-apprenticeship), freedom of choice on courses, international orientation, career orientation, attention to the development of social and academic skills, a strong relation between research and education, and a sense of community.

The educational program of ID focuses on designing through five different perspectives: math, data and computing; user and society; technology and realization; business and entrepreneurship; and creativity and aesthetics. In authentic projects students learn to make connections between the different lenses, thereby coming to innovations within specific professional and societal contexts. The program offers a variety of projects, aligned with the departmental research clusters and industrial partners, in which students develop skills in both academic and professional processes.

“IT’S ALWAYS A PLEASURE AND A REAL EDUCATION TO VISIT THE ID DEPT AT EINDHOVEN TO SEE WHAT THE WONDERFUL STUDENTS THERE HAVE BEEN UP TO LATELY.”

Liam Bannon, (Emeritus) University of Limerick, Ireland

In the Master, students choose their two preferred perspectives and focus on the societal and professional context in which they envision to thrive. Dedicated courses enable them to develop expertise in the research domains relating to the five perspectives. Through personal, industrial and research projects, students develop a unique competence and design approach. The program supports students in setting up a startup or becoming a consultant, joining the R&D or design department of a company, or applying for a PhD program. Master students in the so-called Constructive Design Research track are well trained in Research-through-Design through diverse research methods and engineering skills. Alumni have been accepted to PhD programs at Umeå, Simon Fraser, Aarhus, Northumbria, UTS, TU Delft, Southern Denmark, Hasso Plattner, etc.

“ON VISITING THE INDUSTRIAL DESIGN DEPARTMENT (ID) AT TU/E I WAS VERY IMPRESSED WITH THE QUALITY OF THE FACILITIES, THE WORKING SPACE DEDICATED TO STUDENTS, AND THE WHOLE-HEARTED FLIPPED CLASSROOM APPROACH.”

Sheelagh Carpendale, University of Calgary, Canada

The PhD program is primarily a job-based education aiming to educate PhD students towards becoming qualified and independent research professionals. Besides ‘regular’ PhD students funded through research grants, the department also welcomes PhD students who receive external funding (or time) from their employers, such as Philips via the TU/e Impuls Program, as well as PhD students that receive scholarships from their home countries, such as the Chinese Scholarship Council and Conacyt Mexico. In general, PhD students work on predefined research projects in the context of larger research programs. In addition, each PhD student follows a personalized training program consisting of project-related courses and summer schools, personal development-related training, and research seminars. Almost all our PhD students obtain a job prior to or soon after graduation, often quickly rising to influential positions in academia and industry (Philips, Umeå University, Carnegie Mellon, UTS, etc.).
Please meet our Team
Dr. Kristina Andersen is interested in how we can allow each other to imagine possible technological futures through the making of exploratory objects.

Dr. ir. Saskia Bakker has expertise in Research-through-Design in the areas of tangible interaction, calm technology, peripheral interaction, classroom technologies and design for everyday life.

Dr. ir. Emilia I. Barakova is an expert in the field of embodied social interaction with and through technology, social robotics, modeling expressiveness of movement, designing technologies for socially isolated individuals, special-needs groups.

Dr. ir. Tilde Bekker is interested in designing playful interactions between multiple people and multiple objects in contexts of play, health and learning for children and older adults.

Prof. Ad van Berlo is part-time professor ‘Entrepreneurial Design of Intelligent Systems’. He focuses on transferring the vast amount of knowledge he has gained as founder and director of VanBerlo design studios.

Prof. dr. Regina Bernhaupt is full professor ‘Measuring and Analyzing Quality of Dynamic Real Life Systems’ and focuses on how to evaluate technologies during all design and development phases – from idea generation to product deployment.

Prof. dr. Lin-Lin Chen is full professor ‘Design Innovation Strategy’ and conducts research on user interface for internet of things, design innovation strategy, and aesthetics of forms and intelligence. As of 1 March 2018, she is dean of the department.

Prof. dr. Aarnout Brombacher is full professor ‘Design Theory and Information Flow Analysis’. He has an interest in field-data analysis of complex systems in interaction with users/user communities, data analytics and the resulting customer-perceived design quality models.

Dr. ir. Rens Brankaert focuses on designing for people living with dementia from a person-centered perspective, and he is interested in the impact of design on the various stakeholders and organizations in healthcare.

Dr. ir. Miguel Bruns Alonso investigates the aesthetics and emotional expressivity of interactive products with programmable material qualities (interactive materiality), particularly haptic and shape-changing interfaces.

Dr. ir. Frank Delbressine is interested in Smart Mobility and in health-related Industrial Design. Especially he is interested in design for Autonomous Vehicles and Medical Simulation.

Dr. Yaliang Chuang is interested in design methodologies for investigating unmet user needs and facilitating ideations in generating good ideas. His research focuses on exploring the applications of connected technologies, such as Smart Home and Smart Manufacturing.
Prof. dr. ir. Berry Eggen
is full professor ‘Design for User Experience in Ambient Intelligent Systems’. He has an interest in ubiquitous computing, multimodal interaction (including intelligent lighting and sound design) and seamless interaction design for everyday life.

Dr. ir. Harm van Essen
is interested in experience design, interaction design, design methodology, and the integration of technology and insights from social sciences (in particular social psychology) in systems design focusing on Interactive Lighting and Shared Systems.

Prof. dr. ir. Loe Feijs
is full professor ‘Industrial Design of Embedded Systems’. His current research interests include generative design, unobtrusive monitoring and bio-feedback.

Prof. dr. Elise van den Hoven MTD
is interested in different disciplines, including human-computer interaction, design and psychology, and more specifically people-centered design, designing interactive systems, physical interaction and supporting human remembering.

Dr. ir. Joep Frens
is interested in the question of ‘how to design for rich interaction in growing systems’ and takes a hands-on, making approach in exploring this research question together with his students.

Dr. Mathias Funk
is interested in design theory and processes for systems, designing systems for musical expression, and designing with data.

Dr. ir. Bart Hengeveld
is interested in the ‘body language’ of the internet of things: how does embedded technology present itself to us in the most appropriate form? A particular interest is in the role of sound in this world of ubiquitous computational technologies.

Dr. Annika Hupfeld
is interested in designing for the home and urban settings, everyday consumption practices, materiality and dematerialization, and design ethnography.

Dr. ir. Javed Khan
is interested in investigating the value of crowdsourcing for design and how to design such platforms.

Dr. Jun Hu
has interests in the fields of social cyber-physical systems, IoT, HCI, industrial design, computer science and design education.

Prof. dr. ir. Caroline Hummels
is full professor ‘Design and Theory for Transformative Qualities’ and is researching through design how the aesthetic qualities of materiality and interaction can elevate (transform) personal and social ethics and related behavior.

Dr. ir. Lenneke Kuijer
is a leading expert in practices-oriented design, a field within design and HCI research that draws on social practice theories.

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Dr.ir. Pierre Lévy
is interested in applications of philosophy to interaction design, especially of phenomenology and Japanese philosophy, to the everyday.

Dr. Rong-Hao Liang
has an interest in technical Human-Computer Interaction research, with a specific focus on innovative tangible and wearable sensors, ubiquitous displays, and rapid prototyping tools.

Dr. Yuan Lu
is interested in exploring the use of design probes to create innovation opportunities and support design decisions with multi-stakeholders.

Dr.ir. Carl Megens
has developed a design research method called Experiential Design Landscapes, which brings design research into the everyday life.

Dr.ir. Peter Peters
is interested in medical simulation and improving the quality of life of elderly.

Prof.dr. Matthias Rauterberg
is full professor ‘Designing Interactive Systems’. He is interested in designing interactive systems addressing the cultural sub- or even unconscious layer of the user.

Prof.dr. Ben Schouten
is part-time professor ‘Playful Interactions in Intelligent Systems’. He is interested in games & play design for social innovations, citizen empowerment and culture.

Dr. Erik van der Spek
is interested in the design of games and play for entertainment, learning, vitality and empathy.

Dr. Jacques Terken
is interested in the user experience for autonomous vehicles (both private cars and trucks).
Dr. Daniel Tetteroo
is interested in the design of physical rehabilitation technology, end-user development, personalization and playful interaction.

Dr. Oscar Tomico
focuses on the textile industry and how to involve stakeholders during the design process to create ultra-personalized smart textile services in the form of soft wearables or soft interiors.

Prof.dr. Steven Vos
is part-time professor ‘Design and Analysis of Intelligent Systems for Vitality and Leisure Time Sports’. He is interested in designing tailored services and products to improve sports, physical activity, and vitality.

Prof.dr. Ron Wakkary
is full professor ‘Impact of Interaction Design on Everyday Life’. He aims to reflectively create new interaction design exemplars, concepts, and emergent practices of design that help to shape design and its relations to technologies.

Prof.dr.ir. Stephan Wensveen
is full professor ‘Constructive Design Research in Smart Products, Services and Systems’. His interest is in using the power of Research-through-Design design to foster collaboration between research, education and innovation.

“The mission of the Department Industrial Design in Eindhoven is unique among design departments worldwide … The Department is in an excellent position to redefine the field of industrial design and to emerge as one of the leaders in the discipline.”

Research Review, QANU, 2017