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CHI 2020
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Table of Contents

From immersive virtual reality over 3D printed materials to personal health tracking — the German HCI labs cover a manifold range of topics.

This year, the involved labs contribute **113 publications in total** to the 2020 ACM CHI Conference on Human Factors in Computing Systems. At the heart, there are **66 Papers**, including **10 Honorable Mentions**.
Further, we got 28 Late Breaking Works, 5 Demonstrations, 7 organized Workshops & Symposia, 2 Case Studies, 2 Journal Articles, **1 SIGCHI Outstanding Dissertation Award**, 1 SIG, and 1 Student Game Competition accepted to CHI this year.

Paper Publications 66

"It's in my other hand!" - Studying the Interplay of Interaction Techniques and Multi-Tablet Activities

Johannes Zagermann (University of Konstanz), Ulrike Pfeil (University of Konstanz), Philipp von Bauer (University of Konstanz), Daniel Fink (University of Konstanz), Harald Reiterer (University of Konstanz)

Cross-device interaction with tablets is a popular topic in HCI research. Recent work has shown the benefits of including multiple devices into users' workflows while various interaction techniques allow transferring content across devices. However, users are only reluctantly using multiple devices in combination. At the same time, research on cross-device interaction struggles to find a frame of reference to compare techniques or systems. In this paper, we try to address these challenges by studying the interplay of interaction techniques, device utilization, and task-specific activities in a user study with 24 participants from different but complementary angles of evaluation using an abstract task, a sensemaking task, and three interaction techniques. We found that different interaction techniques have a lower influence than expected, that work behaviors and device utilization depend on the task at hand, and that participants value specific aspects of cross-device interaction.

3D-Auth: Two-Factor Authentication with Personalized 3D-Printed Items

Karola Marky (TU Darmstadt, Keio University), Martin Schmitz (TU Darmstadt), Verena Zimmermannl (TU Darmstadt), Martin Herbers (TU Darmstadt), Kai Kunze (Keio University), Max Mühlhäuser (TU Darmstadt)

Two-factor authentication is a widely recommended security mechanism and already offered for different services. However, known methods and physical realizations exhibit considerable usability and customization issues. In this paper, we propose 3D-Auth, a new concept of two-factor authentication. 3D-Auth is based on customizable 3D-printed items that combine two authentication factors in one object. The object bottom contains a uniform grid of conductive dots that are connected to a unique embedded structure inside the item. Based on the interaction with the item, different dots turn into touch-points and form an authentication pattern. This pattern can be recognized by a capacitive touchscreen. Based on an expert design study, we present an interaction space with six categories of possible authentication interactions. In a user study, we demonstrate the feasibility of 3D-Auth items and show that the items are easy to use and the interactions are easy to remember.

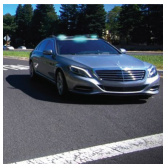
A Human Touch: Social Touch Increases the Perceived Human-likeness of Agents in Virtual Reality

Matthias Hoppe (LMU Munich), Beat Rossmy (LMU Munich), Daniel Peter Neumann (LMU Munich), Stephan Streuber (University of Konstanz), Albrecht Schmidt (LMU Munich), Tonja Machulla (LMU Munich)

Virtual Reality experiences and games present believable virtual environments based on graphical quality, spatial audio, and interactivity. The interaction with in-game characters, controlled by computers (agents) or humans (avatars), is an important part of VR experiences. Pre-captured motion sequences increase the visual humanoid resemblance. However, this still precludes realistic social interactions (eye contact, imitation of body language), particularly for agents. We aim to make social interaction more realistic via social touch. Social touch is non-verbal, conveys feelings and signals (coexistence, closure, intimacy). In our research, we created an artificial hand to apply social touch in a repeatable and controlled fashion to investigate its effect on the perceived human-likeness of avatars and agents. Our results show that social touch is effective to further blur the boundary between computer- and human-controlled virtual characters and contributes to experiences that closely resemble human-to-human interactions.

A Longitudinal Video Study on Communicating Status and Intent for Self-Driving Vehicle – Pedestrian Interaction

Stefanie M. Faas (Mercedes-Benz AG & Ulm University), Andrea C. Kao (Mercedes-Benz R&D NA), Martin Baumann (Ulm University)



With self-driving vehicles (SDVs), pedestrians cannot rely on communication with the driver anymore. Industry experts and policymakers are proposing an external Human-Machine Interface (eHMI) communicating the automated status. We investigated whether additionally communicating SDVs' intent to give right of way further improves pedestrians' street crossing. To evaluate the stability of these eHMI effects, we conducted a three-session video study with N=34 pedestrians where we assessed subjective evaluations and crossing onset times. This is the first work capturing long-term effects of eHMIs. Our findings add credibility to prior studies by showing that eHMI effects last (acceptance, user experience) or even increase (crossing onset, perceived safety, trust, learnability, reliance) with time. We found that pedestrians benefit from an eHMI communicating SDVs' status, and that additionally communicating SDVs' intent adds further value. We conclude that SDVs should be equipped with an eHMI communicating both status and intent.

Honorable Mention

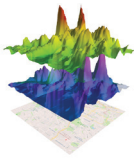
A View on the Viewer: Gaze-Adaptive Captions for Videos

Kuno Kurzhals (ETH Zürich), Fabian Göbel (ETH Zürich), Katrin Angerbauer (University of Stuttgart), Michael Sedlmair (University of Stuttgart), Martin Raubal (ETH Zürich)

Subtitles play a crucial role in cross-lingual distribution ofmultimedia content and help communicate information where auditory content is not feasible (loud environments, hearing impairments, unknown languages). Established methods utilize text at the bottom of the screen, which may distract from the video. Alternative techniques place captions closer to relatedcontent (e.g., faces) but are not applicable to arbitrary videos such as documentations. Hence, we propose to leverage live gaze as indirect input method to adapt captions to individual viewing behavior. We implemented two gaze-adaptive methods and compared them in a user study (n=54) to traditional captions and audio-only videos. The results show that viewers with less experience with captions prefer our gaze-adaptive methods as they assist them in reading. Furthermore, gaze distributions resulting from our methods are closer to natural viewing behavior compared to the traditional approach. Based on these results, we provide design implications for gaze-adaptive captions.

Assessing 2D and 3D Heatmaps for Comparative Analysis: An Empirical Study

Matthias Kraus (University of Konstanz), Katrin Angerbauer (University of Stuttgart), Juri Buchmüller (University of Konstanz), Daniel Schweitzer (University of Konstanz), Daniel Keim (University of Konstanz), Michael Sedlmair (University of Stuttgart), Johannes Fuchs (University of Konstanz)



Heatmaps are a popular visualization technique that encode 2D density distributions using color or brightness. Experimental studies have shown though that both of these visual variables are inaccurate when reading and comparing numeric data values. A potential remedy might be to use 3D heatmaps by introducing height as a third dimension to encode the data. Encoding abstract data in 3D, however, poses many problems, too. To better understand this tradeoff, we conducted an empirical study (N=48) to evaluate the user performance of 2D and 3D heatmaps for comparative analysis tasks. We test our conditions on a conventional 2D screen, but also in a virtual reality environment to allow for real stereoscopic vision. Our main results show that 3D heatmaps are superior in terms of error rate when reading and comparing single data items. However, for overview tasks, the well-established 2D heatmap performs better.

Augmented Reality for Older Adults: Exploring Acceptability of Virtual Coaches for Home-based Balance Training in an Aging Population

Fariba Mostajeran (Uni Hamburg), Frank Steinicke (Uni Hamburg), Oscar Ariza (Uni Hamburg), Dimitrios Gatsios (University of Ioannina), Dimitrios Fotiadis (University of Ioannina)

Balance training has been shown to be effective in reducing risks of falling, which is a major concern for older adults. Usually, exercise programs are individually prescribed and monitored by physiotherapeutic or medical experts. Unfortunately, supervision and motivation of older adults during home-based exercises cannot be provided on a large scale, in particular, considering an ageing population. Augmented reality (AR) in combination with virtual coaches could provide a reasonable solution to this challenge. We present a first investigation of the acceptance of an AR coaching system for balance training, which can be performed at home. In a human-centered design approach we developed several mock-ups and prototypes, and evaluated them with 76 older adults. The results suggest that older adults find the system encouraging and stimulating. The virtual coach is perceived as an alive, calm, intelligent, and friendly human. However, usability of the entire AR system showed a significant negative correlation with participants' age.

Honorable Mention

Augmented Reality to Enable Users in Learning Case Grammar from Their Real-World Interactions

Fiona Draxler (LMU Munich), Audrey Labrie (Polytechnique Montréal), Albrecht Schmidt (LMU Munich), Lewis L. Chuang (LMU Munich)

Augmented Reality (AR) provides a unique opportunity to situate learning content in one's environment. In this work, we investigated how AR could be developed to provide an interactive context-based language learning experience. Specifically, we developed a novel handheld-AR app for learning case grammar by dynamically creating quizzes, based on real-life objects in the learner's surroundings. We compared this to the experience of learning with a non-contextual app that presented the same quizzes with static photographic images. Participants found AR suitable for use in their everyday lives and enjoyed the interactive experience of exploring grammatical relationships in their surroundings. Nonetheless, Bayesian tests provide substantial evidence that the interactive and context-embedded AR app did not improve case grammar skills, vocabulary retention, and usability over the experience with equivalent static images. Based on this, we propose how language learning apps could be designed to combine the benefits of contextual AR and traditional approaches.

Honorable Mention

Augmented Reality Training for Industrial Assembly Work – Are Projection-based AR Assistive Systems an Appropriate Tool for Assembly Training?

Sebastian Büttner (TU Clausthal / TH OWL), Michael Prilla (TU Clausthal), Carsten Röcker (TH OWL)

Augmented Reality (AR) systems are on their way to industrial application, e.g. projection-based AR is used to enhance assembly work. Previous studies showed advantages of the systems in permanent-use scenarios, such as faster assembly times. In this paper, we investigate whether such systems are suitable for training purposes. Within an experiment, we observed the training with a projection-based AR system over multiple sessions and compared it with a personal training and a paper manual training. Our study shows that projection-based AR systems offer only small benefits in the training scenario. While a systematic mislearning of content is prevented through immediate feedback, our results show that the AR training does not reach the personal training in terms of speed and recall precision after 24 hours. Furthermore, we show that once an assembly task is properly trained, there are no differences in the long-term recall precision, regardless of the training method.

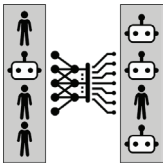
Becoming a Robot –Overcoming Anthropomorphism with Techno-Mimesis

Judith Dörrenbächer (University of Siegen), Diana Löffler (University of Siegen), Marc Hassenzahl (University of Siegen)

Employing anthropomorphism in physical appearance and behavior is the most widespread strategy for designing social robots. In the present paper, we argue that imitating humans impedes the full exploration of robots' social abilities. In fact, their very 'thingness' (e.g., sensors, rationality) is able to create 'superpowers' that go beyond human abilities, such as endless patience. To better identify these special abilities, we develop a performative method called 'Techno-Mimesis' and explore it in a series of workshops with robot designers. Specifically, we create 'prostheses' to allow designers to transform themselves into their future robot to experience use cases from the robot's perspective, e.g., 'seeing' with a distance sensor rather than with eyes. This imperfect imitation helps designers to experience being human and being robot at the same time, making differences apparent and facilitating the discovery of a number of potential physical, cognitive, and communicational robotic superpowers.

Bot or not? User Perceptions of Player Substitution with Deep Player Behavior Models

Johannes Pfau (University of Bremen), Jan David Smeddinck (Newcastle University), Ioannis Bikas (University of Bremen), Rainer Malaka (University of Bremen)



Many online games suffer when players drop off due to lost connections or quitting prematurely, which leads to match terminations or game-play imbalances. While rule-based outcome evaluations or substitutions with bots are frequently used to mitigate such disruptions, these techniques are often perceived as unsatisfactory. Deep learning methods have successfully been used in deep player behavior modelling (DPBM) to produce non-player characters or bots which show more complex behavior patterns than those modelled using traditional AI techniques. Motivated by these findings, we present an investigation of the player-perceived awareness, believability and representativeness, when substituting disconnected players with DPBM agents in an online-multiplayer action game. Both quantitative and qualitative outcomes indicate that DPBM agents perform similarly to human players and that players were unable to detect substitutions. In contrast, players were able to detect substitution with agents driven by more traditional heuristics.

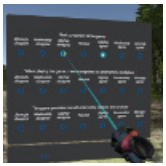
BrainCoDe: Electroencephalography-based Comprehension Detection during Reading and Listening

Christina Schneegass (LMU Munich), Thomas Kosch (LMU Munich), Andrea Baumann (LMU Munich), Marius Rusu (LMU Munich), Mariam Hassib (Bundeswehr University Munich), Heinrich Hussmann (LMU Munich)

The pervasive availability of media in foreign languages is a rich resource for language learning. However, learners are forced to interrupt media consumption whenever comprehension problems occur. We present BrainCoDe, a method to implicitly detect vocabulary gaps through the evaluation of event-related potentials (ERPs). In a user study (N=16), we evaluate BrainCoDe by investigating differences in ERP amplitudes during listening and reading of known words compared to unknown words. We found significant deviations in N400 amplitudes during reading and in N100 amplitudes during listening when encountering unknown words. To evaluate the feasibility of ERPs for real-time applications, we trained a classifier that detects vocabulary gaps with an accuracy of 87.13% for reading and 82.64% for listening, identifying eight out of ten words correctly as known or unknown. We show the potential of BrainCoDe to support media learning through instant translations or by generating personalized learning content.

Breaking The Experience: Effects of Questionnaires in VR User Studies

Susanne Putze (University of Bremen), Dmitry Alexandrovsky (University of Bremen), Felix Putze (University of Bremen), Sebastian Höffner (University of Bremen), Jan David Smeddinck (Newcastle University), Rainer Malaka (University of Bremen)



Questionnaires are among the most common research tools in virtual reality (VR) evaluations and user studies. However, transitioning from virtual worlds to the physical world to respond to VR experience questionnaires can potentially lead to systematic biases. Administering questionnaires in VR (inVRQs) is becoming more common in contemporary research. This is based on the intuitive notion that inVRQs may ease participation, reduce the Break in Presence (BIP) and avoid biases. In this paper, we perform a systematic investigation into the effects of interrupting the VR experience through questionnaires using physiological data as a continuous and objective measure of presence. In a user study (n=50), we evaluated question-asking procedures using a VR shooter with two different levels of immersion. The users rated their player experience with a questionnaire either inside or outside of VR. Our results indicate a reduced BIP for the employed INVRQ without affecting the self-reported player experience.

Honorable Mention

Developing a Personality Model for Speech-based Conversational Agents Using the Psycholexical Approach

Sarah Theres Völkel (LMU Munich), Ramona Schödel (LMU Munich), Daniel Buschek (University of Bayreuth), Clemens Stachl (Stanford University), Verena Winterhalter (LMU Munich), Markus Bühner (LMU Munich), Heinrich Hussmann (LMU Munich)

We present the first systematic analysis of personality dimensions developed specifically to describe the personality of speech-based conversational agents. Following the psycholexical approach from psychology, we first report on a new multi-method approach to collect potentially descriptive adjectives from 1) a free description task in an online survey (228 unique descriptors), 2) an interaction task in the lab (176 unique descriptors), and 3) a text analysis of 30,000 online reviews of conversational agents (Alexa, Google Assistant, Cortana) (383 unique descriptors). We aggregate the results into a set of 349 adjectives, which are then rated by 744 people in an online survey. A factor analysis reveals that the commonly used Big Five model for human personality does not adequately describe agent personality. As an initial step to developing a personality model, we propose alternative dimensions and discuss implications for the design of agent personalities, personality-aware personalisation, and future research.

Enemy Within: Long-term Motivation Effects of Deep Player Behavior Models for Dynamic Difficulty Adjustment

Johannes Pfau (University of Bremen), Jan David Smeddinck (Newcastle University), Rainer Malaka (University of Bremen)

Balancing games and producing content that remains interesting and challenging is a major cost factor in the design and maintenance of games. Dynamic difficulty adjustment (DDA) can successfully tune challenge levels to player abilities, but when implemented with classic heuristic parameter tuning (HPT) often turns out to be very noticeable, e.g. as “rubber-banding”. Deep learning techniques can be employed for deep player behavior modeling (DPBM), enabling more complex adaptivity, but effects over frequent and longer-lasting game engagements, as well as comparisons to HPT have not been empirically investigated. We present a situated study of the effects of DDA via DPBM as compared to HPT on intrinsic motivation, perceived challenge and player motivation in a real-world MMORPG. The results indicate that DPBM can lead to significant improvements in intrinsic motivation and players prefer game experience episodes featuring DPBM over experience episodes with classic difficulty management.

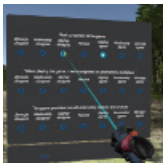
Evaluation of a Financial Portfolio Visualization using Computer Displays and Mixed Reality Devices with Domain Experts

Kay Schroeder (Zuyd University of Applied Sciences), Batoul Ajdadilish (Zuyd University of Applied Sciences), Alexander P. Henkel (Zuyd University of Applied Sciences), André Calero Valdez (RWTH Aachen University)

With the advent of mixed reality devices such as the Microsoft HoloLens, developers have been faced with the challenge to utilize the third dimension in information visualization effectively. Research on stereoscopic devices has shown that three-dimensional representation can improve accuracy in specific tasks (e.g., network visualization). Yet, so far the field has remained mute on the underlying mechanism. Our study systematically investigates the differences in user perception between a regular monitor and a mixed reality device. In a real-life within-subject experiment in the field with twenty-eight investment bankers, we assessed subjective and objective task performance with two- and three-dimensional systems, respectively. We tested accuracy with regard to position, size, and color using single and combined tasks. Our results do not show a significant difference in accuracy between mixed-reality and standard 2D monitor visualizations.

Examining Design Choices of Questionnaires in VR User Studies

Dmitry Alexandrovsky (University of Bremen), Susanne Putze (University of Bremen), Michael Bonfert (University of Bremen), Sebastian Höffner (University of Bremen), Pitt Michelmann (University of Bremen), Dirk Wenig (University of Bremen), Rainer Malaka (University of Bremen), Jan David Smeddinck (Newcastle University)



Questionnaires are among the most common research tools in virtual reality (VR) user studies. Transitioning from virtuality to reality for giving self-reports on VR experiences can lead to systematic biases. VR allows to embed questionnaires into the virtual environment which may ease participation and avoid biases. To provide a cohesive picture of methods and design choices for questionnaires in VR (inVRQ), we discuss 15 inVRQ studies from the literature and present a survey with 67 VR experts from academia and industry. Based on the outcomes, we conducted two user studies in which we tested different presentation and interaction methods of inVRQs and evaluated the usability and practicality of our design. We observed comparable completion times between inVRQs and questionnaires outside VR (outVRQs) with higher enjoyment but lower usability for INVRQS. These findings advocate the application of INVRQS and provide an overview of methods and considerations that lay the groundwork for inVRQ design.

Exploring Human-Robot Interaction with the Elderly: Results from a Ten-Week Case Study in a Care Home

Felix Carros (Uni Siegen), Johanna Meurer (Uni Siegen), Diana Löffler (Uni Siegen), David Unbehaun (Uni Siegen), Sarah Matthies (Uni Siegen), Inga Koch (Uni Siegen), Rainer Wieching (Uni Siegen), Dave Randall (Uni Siegen), Marc Hassenzahl (Uni Siegen), Volker Wulf (Uni Siegen)

Ageing societies and the associated pressure on the care systems are major drivers for new developments in socially assistive robotics. To understand better the real-world potential of robot-based assistance, we undertook a 10-week case study in a care home involving groups of residents, caregivers and managers as stakeholders. We identified both, enablers and barriers to the potential implementation of robot systems. The study employed the robot platform Pepper, which was deployed with a view to understanding better multi-domain interventions with a robot supporting physical activation, cognitive training and social facilitation. We employed the robot in a group setting in a care facility over the course of 10 weeks and 20 sessions, observing how stakeholders, including residents and caregivers, appropriated, adapted to, and perceived the robot. We also conducted interviews with 11 residents and caregivers. Our results indicate that the residents were positively engaged in the training sessions that were moderated by the robot. The study revealed that such humanoid robots can work in a care home but that there is a moderating person needed, that is in control of the robot.

Fairness and Decision-making in Collaborative Shift SchedulingSystems

Alarith Uhde (Uni Siegen), Nadine Schlicker (Ergosign GmbH), Dieter P. Wallach (Ergosign GmbH), Marc Hassenzahl (Uni Siegen)

The strains associated with shift work decrease healthcareworkers' well-being. However, shift schedules adapted to theirindividual needs can partially mitigate these problems. From a computingperspective, shift scheduling was so far mainly treated as anoptimization problem with little attention given to the preferences,thoughts, and feelings of the healthcare workers involved. In thepresent study, we explore fairness as a central, human-orientedattribute of shift schedules as well as the scheduling process. Three in-depth qualitative interviews and a validating vignette study revealedthat while on an abstract level healthcare workers agree on equality asthe guiding norm for a fair schedule, specific scheduling conflictsshould foremost be resolved by negotiating the importance of individualneeds. We discuss elements of organizational fairness, includingtransparency and team spirit. Finally, we present a sketch for fairscheduling systems, summarizing key findings for designers in a readilyusable way.

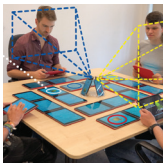
Feminist Living Labs as Research Infrastructures for HCI: The Case of a Video Game Company

Michael Ahmadi (University of Siegen), Rebecca Eilert (University of Siegen), Anne Weibert (University of Siegen), Volker Wulf (University of Siegen), Nicola Marsden (Heilbronn University)

The number of women in IT is still low and companies struggle to integrate female professionals. The aim of our research is to provide methodological support for understanding and sharing experiences of gendered practices in the IT industry and encouraging sustained reflection about these matters over time. We established a Living Lab with that end in view, aiming to enhance female participation in the IT workforce and committing ourselves to a participatory approach to the sharing of women's experiences. Here, using the case of a German video game company which participated in our Lab, we detail our lessons learned. We show that this kind of long-term participation involves challenges over the lifetime of the project but can lead to substantial benefits for organizations. Our findings demonstrate that Living Labs are suitable for giving voice to marginalized groups, addressing their concerns and evoking change possibilities. Nevertheless, uncertainties about long-term sustainability remain.

GazeConduits: Calibration-Free Cross-Device Collaboration through Gaze and Touch

Simon Voelker (RWTH Aachen University), Sebastian Hueber (RWTH Aachen University), Christian Holz (ETH Zurich), Christian Remy (Aarhus University), Nicolai Marquardt (University College London)



We present GazeConduits, a calibration-free ad-hoc mobile device setup that enables users to collaboratively interact with tablets, other users, and content in a cross-device setting using gaze and touch input. GazeConduits leverages recently presented phone capabilities to detect facial features and estimate users' gaze directions. To join a collaborative setting, users place one or more tablets onto a shared table and position their phone in the center, which then tracks present users as well as their gaze direction to predict the tablets they look at. Using GazeConduits, we demonstrate a series of techniques for collaborative interaction across mobile devices for content selection and manipulation. Our evaluation with 20 simultaneous tablets on a table showed that GazeConduits can reliably identify at which tablet or at which collaborator a user is looking, enabling a rich set of interaction techniques.

Getting out of Out of Sight: Evaluation of AR Mechanisms for Awareness and Orientation Support in Occluded Multi-Room Settings

Niklas Osmers (TU Clausthal), Michael Prilla (TU Clausthal)

Augmented Reality can provide orientation and awareness in situations in which objects or people are occluded by physical structures. This is relevant for many situations in the workplace, where objects are scattered across rooms and people are out of sight. While several AR mechanisms have been proposed to provide awareness and orientation in these situations, little is known about their effect on people's performance when searching objects and coordinating with each other. In this paper, we compare three AR based mechanisms (map, x-ray, compass) according to their utility, usability, social presence, task load and users' preferences. 48 participants had to work together in groups of four to find people and objects located around different rooms. Results show that map and x-ray performed best but provided least social presence among participants. We discuss these and other observations as well as potential impacts on designing AR awareness and orientation support.

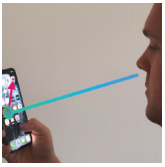
Guess the Data: Data Work to Understand How People Make Sense of and Use Simple Sensor Data from Homes

Albrecht Kurze (Chemnitz University of Technology), Andreas Bischof (Chemnitz University of Technology), Sören Totzauer (Chemnitz University of Technology), Michael Storz (Chemnitz University of Technology), Maximilian Eibl (Chemnitz University of Technology), Margot Brereton (Queensland University of Technology), Arne Berger (Anhalt University of Applied Sciences)

Simple smart home sensors, e.g. for temperature or light, increasingly collect seemingly inconspicuous data. Prior work has shown that human sensemaking of such sensor data can reveal domestic activities. Such sensemaking presents an opportunity to empower people to understand the implications of simple smart home sensors. To investigate, we developed and field-tested the Guess the Data method, which enabled people to use and make sense of live data from their homes and to collectively interpret and reflect on anonymized data from the homes in our study. Our findings show how participants reconstruct behavior, both individually and collectively, expose the sensitive personal data of others, and use sensor data as evidence and for lateral surveillance within the household. We discuss the potential of our method as a participatory HCI method for investigating design of the IoT and implications created by doing data work on home sensors.

HeadReach: Using Head Tracking to Increase Reachability on Mobile Touch Devices

Simon Voelker (RWTH Aachen University), Sebastian Hueber (RWTH Aachen University), Christian Corsten (RWTH Aachen University), Christian Remy (Aarhus University)

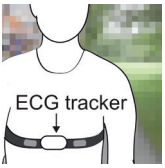


People often operate their smartphones with only one hand, using just their thumb for touch input. With today's larger smartphones, this leads to a reachability issue: Users can no longer comfortably touch everywhere on the screen without changing their grip. We investigate using the head tracking in modern smartphones to address this reachability issue. We developed three interaction techniques, pure head (PH), head+ touch (HT), and head area + touch (HA), to select targets beyond the reach of one's thumb. In two user studies, we found that selecting targets using HT and HA had higher successrates than the default direct touch (DT) while standing (by about 9%) and walking (by about 12%), while being moderately slower. HT and HA were also faster than one of the best techniques, BezelCursor (BC) (by about 20% while standing and 6% while walking), while having the same success rate.

Honorable Mention

Heartbeats in the Wild: A Field Study Exploring ECG Biometrics in Everyday Life

Florian Lehmann (LMU Munich & University of Bayreuth), Daniel Buschek (University of Bayreuth)



This paper reports on an in-depth study of electrocardiogram (ECG) biometrics in everyday life. We collected ECG data from 20 people over a week, using a non-medical chest tracker. We evaluated user identification accuracy in several scenarios and observed equal error rates of 9.15% to 21.91%, heavily depending on 1) the number of days used for training, and 2) the number of heartbeats used per identification decision. We conclude that ECG biometrics can work in the wild but are less robust than expected based on the literature, highlighting that previous lab studies obtained highly optimistic results with regard to real life deployments. We explain this with noise due to changing body postures and states as well as interrupted measures. We conclude with implications for future research and the design of ECG biometrics systems for real world deployments, including critical reflections on privacy.

Heatmaps, Shadows, Bubbles, Rays: Comparing Mid-Air Pen Position Visualizations in Handheld AR

Philipp Wacker (RWTH Aachen University), Adrian Wagner (RWTH Aachen University), Simon Voelker (RWTH Aachen University), Jan Borchers (RWTH Aachen University)

In Handheld Augmented Reality, users look at AR scenes through the smartphone held in their hand. In this setting, having a mid-air pointing device like a pen in the other hand greatly expands the interaction possibilities. For example, it lets users create 3D sketches and models while on the go. However, perceptual issues in Handheld AR make it difficult to judge the distance of a virtual object, making it hard to align a pen to it. To address this, we designed and compared different visualizations of the pen's position in its virtual environment, measuring pointing precision, task time, activation patterns, and subjective ratings of helpfulness, confidence, and comprehensibility of each visualization. While all visualizations resulted in only minor differences in precision and task time, subjective ratings of perceived helpfulness and confidence favor a "heatmap" technique that colors the objects in the scene based on their distance to the pen.

HiveFive: Immersion Preserving Attention Guidance in Virtual Reality

Daniel Lange (University of Oldenburg), Tim Claudius Stratmann (OFFIS - Institue for IT), Uwe Gruenefeld (OFFIS - Institute for IT), Susanne Boll (University of Oldenburg)

Recent advances in Virtual Reality (VR) technology, such as larger fields of view, have made VR increasingly immersive. However, a larger field of view often results in a user focusing on certain directions and missing relevant content presented elsewhere on the screen. With HiveFive, we propose a tech- nique that uses swarm motion to guide user attention in VR. The goal is to seamlessly integrate directional cues into the scene without losing immersiveness. We evaluate HiveFive in two studies. First, we compare biological motion (from a prerecorded swarm) with non-biological motion (from an algorithm), finding further evidence that humans can distinguish between these motion types and that, contrary to our hypothesis, non-biological swarm motion results in significantly faster response times. Second, we compare HiveFive to four other techniques and show that it not only results in fast response times but also has the smallest negative effect on immersion.

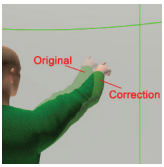
How to Trick AI: Users' Strategies for Protecting Themselves From Automatic Personality Assessment

Sarah Theres Völkel (LMU Munich), Renate Häuslschmid (Madeira Interactive Technologies Institute), Anna Werner (LMU Munich), Heinrich Hussmann (LMU Munich), Andreas Butz (LMU Munich)

Psychological targeting tries to influence and manipulate users' behaviour. We investigated whether users can protect themselves from being profiled by a chatbot, which automatically assesses users' personality. Participants interacted twice with the chatbot: (1) They chatted for 45 minutes in customer service scenarios and received their actual profile (baseline). (2) They then were asked to repeat the interaction and to disguise their personality by strategically tricking the chatbot into calculating a falsified profile. In interviews, participants mentioned 41 different strategies but could only apply a subset of them in the interaction. They were able to manipulate all Big Five personality dimensions by nearly 10%. Participants regarded personality as very sensitive data. As they found tricking the AI too exhaustive for everyday use, we reflect on opportunities for privacy protective designs in the context of personality-aware systems.

Improving Humans' Ability to Interpret Deictic Gestures in Virtual Reality

Sven Mayer (Carnegie Mellon University & University of Stuttgart), Jens Reinhardt (Hamburg University of Applied Sciences), Robin Schweigert (University of Stuttgart), Brighten Jelke (Macalester College), Valentin Schwind (University of Stuttgart & University of Regensburg), Katrin Wolf (Hamburg University of Applied Sciences), Niels Henze (University of Regensburg)



Collaborative Virtual Environments (CVEs) offer unique opportunities for human communication. Humans can interact with each other over a distance in any environment and visual embodiment they want. Although deictic gestures are especially important as they can guide other humans' attention, humans make systematic errors when using and interpreting them. Recent work suggests that the interpretation of vertical deictic gestures can be significantly improved by warping the pointing arm. In this paper, we extend previous work by showing that models enable to also improve the interpretation of deictic gestures at targets all around the user. Through a study with 28 participants in a CVE, we analyzed the errors users make when interpreting deictic gestures. We derived a model that rotates the arm of a pointing user's avatar to improve the observing users' accuracy. A second study with 24 participants shows that we can improve observers' accuracy by 22.9%. As our approach is not noticeable for users, it improves their accuracy without requiring them to learn a new interaction technique or distracting from the experience.

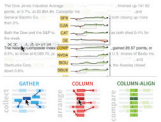
Improving the Usability and UX of the Swiss Internet Voting Interface

Karola Marky (TU Darmstadt, Keio University), Verena Zimmermann (TU Darmstadt), Markus Funk (TU Darmstadt, Cerence GmbH), Jörg Daubert (TU Darmstadt), Kira Bleck (TU Darmstadt), Max Mühlhäuser (TU Darmstadt)

Up to 20% of residential votes and up to 70% of absentee votes in Switzerland are cast online. The Swiss scheme aims to provide individual verifiability by different verification codes. The voters have to carry out verification on their own, making the usability and UX of the interface of great importance. To improve the usability, we first performed an evaluation with 12 human-computer interaction experts to uncover usability weaknesses of the Swiss Internet voting interface. Based on the experts' findings, related work, and an exploratory user study with 36 participants, we propose a redesign that we evaluated in a user study with 49 participants. Our study confirmed that the redesign indeed improves the detection of incorrect votes by 33% and increases the trust and understanding of the voters. Our studies furthermore contribute important recommendations for designing verifiable e-voting systems in general.

Interaction Techniques for Visual Exploration Using Embedded Word-Scale Visualizations

Pascal Goffin (University of Utah), Tanja Blascheck (University of Stuttgart), Petra Isenberg (Inria), Wesley Willett (University of Calgary)



We describe a design space of view manipulation interactions for small data-driven contextual visualizations (word-scale visualizations). These interaction techniques support an active reading experience and engage readers through exploration of embedded visualizations whose placement and content connect them to specific terms in a document. A reader could, for example, use our proposed interaction techniques to explore word-scale visualizations of stock market trends for companies listed in a market overview article. When readers wish to engage more deeply with the data, they can collect, arrange, compare, and navigate the document using the embed-ded word-scale visualizations, permitting more visualization-centric analyses. We support our design space with a concrete implementation, illustrate it with examples from three application domains, and report results from two experiments. The experiments show how view manipulation interactions helped readers examine embedded visualizations more quickly and with less scrolling and yielded qualitative feedback on usabil-ity and future opportunities.

Investigating User-Created Gamification in an Image Tagging Task

Marc Schubhan (German Research Center for Artificial Intelligence (DFKI), Saarland Informatics Campus), Maximilian Altmeyer (German Research Center for Artificial Intelligence (DFKI), Saarland Informatics Campus), Dominic Buchheit (Saarland University), Pascal Lessel (German Research Center for Artificial Intelligence (DFKI), Saarland Informatics Campus)

Commonly, gamification is designed by developers and not by end-users. In this paper we investigate an approach where users take control of this process. Firstly, users were asked to describe their own gamification concepts which would motivate them to put more effort into an image tagging task. We selected this task as gamification has already been shown to be effective here in previous work. Based on these descriptions, an implementation was made for each concept and given to the creator. In a between-subjects study (n=71), our approach was compared to a no-gamification condition and two conditions with fixed gamification settings. We found that providing participants with an implementation of their own concept significantly increased the amount of generated tags compared to the other conditions. Although the quality of tags was lower, the number of usable tags remained significantly higher in comparison, suggesting the usefulness of this approach.

JumpVR: Jump-Based Locomotion Augmentation for Virtual Reality

Dennis Wolf (Ulm University), Katja Rogers (Ulm University), Christoph Kunder (Ulm University), Enrico Rukzio (Ulm University)

One of the great benefits of virtual reality (VR) is the implementation of features that go beyond realism. Common "unrealistic" locomotion techniques (like teleportation) can avoid spatial limitation of tracking but minimize potential benefits of more realistic techniques (e.g., walking). As an alternative that combines realistic physical movement with hyper-realistic virtual outcome, we present JumpVR, a jump-based locomotion augmentation technique that virtually scales users' physical jumps. In a user study (N=28), we show that jumping in VR (regardless of scaling) can significantly increase presence, motivation and immersion compared to teleportation, while largely not increasing simulator sickness. Further, participants reported higher immersion and motivation for most scaled jumping variants than forward-jumping. Our work shows the feasibility and benefits of jumping in VR and explores suitable parameters for its hyper-realistic scaling. We discuss design implications for VR experiences and research.

Leveraging Error Correction in Voice-based Text Entry by Talk-and-Gaze

Korok Sengupta (University of Koblenz), Sabin Bhattarai (University of Koblenz), Sayan Sarcar (University of Tsukuba), Scott MacKenzie (York University), Steffen Staab (University of Stuttgart)

We present the design and evaluation of Talk-and-Gaze (TaG), a method for selecting and correcting errors with voice and gaze. TaG uses eye gaze to overcome the inability of voice- only systems to provide spatial information. The user's point of gaze is used to select an erroneous word either by dwelling on the word for 800 ms (D-TaG) or by uttering a "select" voice command (V-TaG). A user study with 12 participants com- pared D-TaG, V-TaG, and a voice-only method for selecting and correcting words. Corrections were performed more than 20% faster with D-TaG compared to the V-TaG or voice-only methods. As well, D-TaG was observed to require 24% less selection effort than V-TaG and 11% less selection effort than voice-only error correction. D-TaG was well received in a subjective assessment with 66% of users choosing it as their preferred choice for error correction in voice-based text entry

Meaningful Technology at Work – A Reflective Design Case of Improving Radiologists' Wellbeing Through Medical Technology

Matthias Laschke (Uni Siegen), Christoph Braun (Siemens Healthineers), Robin Neuhaus (Uni Siegen), Marc Hassenzahl (Uni Siegen)

In radiology, medical technology providers (MTP) focus mainly on technology-related issues, such as image quality or efficiency of reporting. Broader notions of radiology as "meaningful work" are largely seen as out of scope for an MTP. The present paper challenges this. In a real-world case with a large MTP, we showed that medical technology could be designed more holistically to explicitly improve radiologists' wellbeing. We first gathered work practices experienced as especially conducive to wellbeing. From there, we distilled ideal practices to increase wellbeing and turned them into two software applications. The MTP's initial skepticism dissolved, while radiologists unanimously emphasized wellbeing and demonstrated how they work towards improving it. Based on our insights, the applications resonated well among the radiologists involved, the healthcare provider, and other customers of the MTP. We close with a critical reflection of the challenges and opportunities of designing wellbeing-driven technology in the work domain.

Mix&Match: Towards Omitting Modelling through In-Situ Alteration and Remixing of Model Repository Artifacts in Mixed Reality

Evgeny Stemasov (Ulm University), Tobias Wagner (Ulm University), Jan Gugenheimer (Ulm University), Enrico Rukzio (Ulm University)

The accessibility of tools to model artifacts is one of the core driving factors for the adoption of Personal Fabrication. Subsequently, model repositories like Thingiverse became important tools in (novice) makers' processes. They allow them to shorten or even omit the design process, offloading a majority of the effort to other parties. However, steps like measurement of surrounding constraints (e.g., clearance) which exist only inside the users' environment, can not be similarly outsourced. We propose Mix&Match a mixed-reality-based system which allows users to browse model repositories, preview the models in-situ, and adapt them to their environment in a simple and immediate fashion. Mix&Match aims to provide users with CSG operations which can be based on both virtual and real geometry. We present interaction patterns and scenarios for Mix&Match, arguing for the combination of mixed reality and model repositories. This enables almost modelling-free personal fabrication for both novices and expert makers.

Next Steps in Human-Computer Integration

Florian 'Floyd' Mueller (Monash University), Pedro Lopes (University of Chicago), Paul Strohmeier (University of Copenhagen & Saarland University), Wendy Ju (Cornell Tech), Caitlyn Seim (Stanford University), Martin Weigel (Honda Research Institute Europe), Suranga Nanayakkara (University of Auckland), Marianna Obrist (University of Essex), Zhuying Li (Monash University), Joseph Delfa (Monash University), Jun Nishida (University of Chicago), Elizabeth M. Gerber (Northwestern University), Dag Svanaes (NTNU and IT University of Copenhagen), Jonathan Grudin (Microsoft), Stefan Greuter (Deakin University), Kai Kunze (Keio University), Thomas Erickson (Independent researcher), Steven Greenspan (CA Technologies), Masahiko Inami (University of Tokyo), Joe Marshall (University of Nottingham), Harald Reiterer (University of Konstanz), Katrin Wolf (Beuth University of Applied Sciences Berlin), Jochen Meyer (OFFIS), Thecla Schiphorst (Simon Fraser University), Dakuo Wang (IBM Research), Pattie Maes (MIT Media Lab)

Human-Computer Integration (HInt) is an emerging paradigm in which computational and human systems are closely interwoven. Integrating computers with the human body is not new. However, we believe that with rapid technological advancements, increasing real-world deployments, and growing ethical and societal implications, it is critical to identify an agenda for future research. We present a set of challenges for HInt research, formulated over the course of a five-day workshop consisting of 29 experts who have designed, deployed, and studied HInt systems. This agenda aims to guide researchers in a structured way towards a more coordinated and conscientious future of human-computer integration.

Honorable Mention

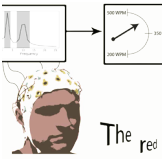
NurseCare: Design and 'In-The-Wild' Evaluation of a Mobile System to Promote the Ergonomic Transfer of Patients

Maximilian Dürr (University of Konstanz), Carla Gröschel (University of Konstanz), Ulrike Pfeil (University of Konstanz), Harald Reiterer (University of Konstanz)

Nurses are frequently required to transfer patients as part of their daily duties. However, the manual transfer of patients is a major risk factor for injuries to the back. Although the Kinaesthetics Care Conception can help to address this issue, existing support for the integration of the concept into nursing-care practice is low. We present NurseCare, a mobile system that aims to promote the practical application of ergonomic patient transfers based on the Kinaesthetics Care Conception. NurseCare consists of a wearable and a smartphone app. Key features of NurseCare include mobile accessible instructions for ergonomic patient transfers, in-situ feedback for the risky bending of the back, and long-term feedback. We evaluated NurseCare in a nine participant 'in-the-wild' evaluation. Results indicate that NurseCare can facilitate ergonomic work while providing a high user experience adequate to the nurses' work domain, and reveal how NurseCare can be incorporated in given practices.

One does not Simply RSVP: Mental Workload to Select Speed Reading Parameters using Electroencephalography

Thomas Kosch (LMU Munich), Albrecht Schmidt (LMU Munich), Simon Thanheiser (LMU Munich), Lewis L. Chuang (LMU Munich)



Rapid Serial Visual Presentation (RSVP) has gained popularity as a method for presenting text on wearable devices with limited screen space. Nonetheless, it remains unclear how to calibrate RSVP display parameters, such as spatial alignments or presentation rates, to suit the reader's information processing ability at high presentation speeds. Existing methods rely on comprehension and subjective workload scores, which are influenced by the user's knowledge base and subjective perception. Here, we use electroencephalography (EEG) to directly determine how individual information processing varies with changes in RSVP display parameters. Eighteen participants read text excerpts with RSVP in a repeated-measures design that manipulated the Text Alignment and Presentation Speed of text representation. We evaluated how predictive EEG metrics were of gains in reading speed, subjective workload, and text comprehension. We found significant correlations between EEG and increasing Presentation Speeds and propose how EEG can be used for dynamic selection of RSVP parameters.

PhysioSkin: Rapid Fabrication of Skin-Conformal Physiological Interfaces

Aditya Shekhar Nittala (Saarland University, Saarland Informatics Campus), Arshad Khan (Saarland University, Saarland Informatics Campus, INM-Leibniz Institute for New Materials, Saarbrücken), Klaus Kruttwig (INM-Leibniz Institute for New Materials, Saarbrücken), Tobias Kraus (INM-Leibniz Institute for New Materials, Saarbrücken), Jürgen Steimle (Saarland University, Saarland Informatics Campus)

Advances in rapid prototyping platforms have made physiological sensing accessible to a wide audience. However, off-the-shelf electrodes commonly used for capturing biosignals are typically thick, non-conformal and do not support customization. We present PhysioSkin, a rapid, do-it-yourself prototyping method for fabricating custom multi-modal physiological sensors, using commercial materials and a commodity desktop inkjet printer. It realizes ultrathin skin-conformal patches (1 µm) and interactive textiles that capture sEMG, EDA and ECG signals. It further supports fabricating devices with custom levels of thickness and stretchability. We present detailed fabrication explorations on multiple substrate materials, functional inks and skin adhesive materials. Informed from the literature, we also provide design recommendations for each of the modalities. Evaluation results show that the sensor patches achieve a high signal-to-noise ratio. Example applications demonstrate the functionality and versatility of our approach for prototyping the next generation of physiological devices that intimately couple with the human body.

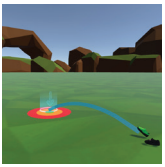
Platform for Studying Self-Repairing Auto-Corrections in Mobile Text Entry based on Brain Activity, Gaze, and Context

Felix Putze (University of Bremen), Tilman Ihrig (University of Bremen), Tanja Schultz (University of Bremen), Wolfganz Stuerzlinger (Simon Fraser University)

Auto-correction is a standard feature of mobile text entry. While the performance of state-of-the-art auto-correct methods is usually relatively high, any errors that occur are cumbersome to repair, interrupt the flow of text entry, and challenge the user's agency over the process. In this paper, we describe a system that aims to automatically identify and repair auto-correction errors. This system comprises a multi-modal classifier for detecting auto-correction errors from brain activity, eye gaze, and context information, as well as a strategy to repair such errors by replacing the erroneous correction or suggesting alternatives. We integrated both parts in a generic Android component and thus present a research platform for studying self-repairing end-to-end systems. To demonstrate its feasibility, we performed a user study to evaluate the classification performance and usability of our approach.

Podoportation: Foot-Based Locomotion in Virtual Reality

Julius von Willich (TU Darmstadt), Martin Schmitz (TU Darmstadt), Florian Müller (TU Darmstadt), Daniel Schmitt (TU Darmstadt), Max Mühlhäuser (TU Darmstadt)



Virtual Reality (VR) allows for infinitely large environments. However, the physical traversable space is always limited by real-world boundaries. This discrepancy between physical and virtual dimensions renders traditional locomotion methods used in real world unfeasible. To alleviate these limitations, research proposed various artificial locomotion concepts such as teleportation, treadmills, and redirected walking. However, these concepts occupy the user's hands, require complex hardware or large physical spaces. In this paper, we contribute nine VR locomotion concepts for foot-based and hands-free locomotion, relying on the 3D position of the user's feet and the pressure applied to the sole as input modalities. We evaluate our concepts and compare them to state-of-the-art point & teleport technique in a controlled experiment with 20 participants. The results confirm the viability of our approaches for hands-free and engaging locomotion. Further, based on the findings, we contribute a wireless hardware prototype implementation.

PolySense: Augmenting Textiles with Electrical Functionality using In-Situ Polymerization

Cedric Honnet (MIT Media Lab), Hannah Perner-Wilson (Kobakant), Marc Teyssier (Télécom Paris), Bruno Fruchard (Saarland University, SIC), Jürgen Steimle (Saarland University, SIC), Ana C. Baptista (CENIMAT/I3N), Paul Strohmeier (Saarland University, SIC)

We present a method for enabling arbitrary textiles to sense pressure and deformation: In-situ polymerization supports integration of piezoresistive properties at the material level, preserving a textile's haptic and mechanical characteristics. We demonstrate how to enhance a wide set of fabrics and yarns using only readily available tools. To further support customisation by the designer, we present methods for patterning, as needed to create circuits and sensors, and demonstrate how to combine areas of different conductance in one material. Technical evaluation results demonstrate the performance of sensors created using our method is comparable to off-the-shelf piezoresistive textiles. As application examples, we demonstrate rapid manufacturing of on-body interfaces, tie-dyed motion-capture clothing, and zippers that act as potentiometers.

Predicting Mid-Air Interaction Movements and Fatigue Using Deep Reinforcement Learning

Noshaba Cheema (Max-Planck Institute for Informatics & German Research Center for Artificial Intelligence (DFKI)), Laura Frey-Law (University of Iowa), Kourosh Naderi (Aalto University), Jaakko Lehtinen (Aalto University & NVIDIA Research), Philipp Slusallek (Saarland University & German Research Center for Artificial Intelligence (DFKI)), Perttu Hämäläinen (Aalto University)

A common problem of mid-air interaction is excessive arm fatigue, known as the "Gorilla arm" effect. To predict and prevent such problems at a low cost, we investigate user testing of mid-air interaction without real users, utilizing biomechanically simulated AI agents trained using deep Reinforcement Learning (RL). We implement this in a pointing task and four experimental conditions, demonstrating that the simulated fatigue data matches human fatigue data. We also compare two effort models: 1) instantaneous joint torques commonly used in computer animation and robotics, and 2) the recent Three Compartment Controller (3CC-r) model from biomechanical literature. 3CC-r yields movements that are both more efficient and relaxed, whereas with instantaneous joint torques, the RL agent can easily generate movements that are quickly tiring or only reach the targets slowly and inaccurately. Our work demonstrates that deep RL combined with the 3CC-r provides a viable tool for predicting both interaction movements and user experience in silico, without users.

Quantification of Users' Visual Attention During Everyday Mobile Device Interactions

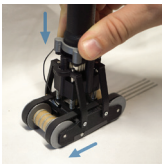
Mihai Bâce (ETH Zürich), Sander Staal (ETH Zürich), Andreas Bulling (University of Stuttgart)

We present the first real-world dataset and quantitative evaluation of visual attention of mobile device users in-situ, i.e. while using their devices during everyday routine. Understanding user attention is a core research challenge in mobile HCI but previous approaches relied on usage logs or self-reports that are only proxies and consequently do neither reflect attention completely nor accurately. Our evaluations are based on Everyday Mobile Visual Attention (EMVA) a new 32-participant dataset containing around 472 hours of video snippets recorded over more than two weeks in real life using the front-facing camera as well as associated usage logs, interaction events, and sensor data. Using an eye contact detection method, we are first to quantify the highly dynamic nature of everyday visual attention across users, mobile applications, and usage contexts. We discuss key insights from our analyses that highlight the potential and inform the design of future mobile attentive user interfaces.

Honorable Mention

Rapid Iron-On User Interfaces: Hands-on Fabrication of Interactive Textile Prototypes

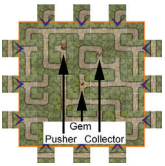
Konstantin Klamka (Technische Universität Dresden), Raimund Dachselt (Technische Universität Dresden), Jürgen Steimle (Saarland University)



Rapid prototyping of interactive textiles is still challenging, since manual skills, several processing steps, and expert knowledge are involved. We present Rapid Iron-On User Interfaces, a novel fabrication approach for empowering designers and makers to enhance fabrics with interactive functionalities. It builds on heat-activated adhesive materials consisting of smart textiles and printed electronics, which can be flexibly ironed onto the fabric to create custom interface functionality. To support rapid fabrication in a sketching-like fashion, we developed a handheld dispenser tool for directly applying continuous functional tapes of desired length as well as discrete patches. We introduce versatile compositions techniques that allow for creating complex circuits, utilizing commodity textile accessories and sketching custom-shaped I/O modules. We further contribute a comprehensive library of components for input, output, wiring and computing. Three example applications, results from technical experiments and expert reviews demonstrate the functionality, versatility and potential of this approach.

Recognizing Affiliation: Using Behavioural Traces to Predict the Quality of Social Interactions in Online Games

Julian Frommel (Ulm University & University of Saskatchewan), Valentin Sagl (University of Saskatchewan), Ansgar E. Depping (University of Saskatchewan), Colby Johanson (University of Saskatchewan), Matthew K. Miller (University of Saskatchewan), Regan L. Mandryk (University of Saskatchewan)



Online social interactions in multiplayer games can be supportive and positive or toxic and harmful; however, few methods caneasily assess interpersonal interaction quality in games. We use behavioural traces to predict affiliation between dyadic strangers, facilitated through their social interactions in an online gaming setting. We collected audio, video, in-game, and self-report data from 23 dyads, extracted 75 features, trained Random Forest and Support VectorMachine models, and evaluated their performance predicting binary (high/low) as well as continuous affiliation toward a partner. The models can predict both binary and continuous affiliation with up to 79.1% accuracy (F1) and 20.1% explained variance (R2) on unseen data, with features based on verbal communication demonstrating the highest potential. Our findings can inform the design of multiplayer games and game communities, and guide the development of systems for matchmaking and mitigating toxic behaviour in online games.

Robustness of Eye Movement Biometrics Against Varying Stimuli and Varying Trajectory Length

Christoph Schröder (University of Bremen), Sahar Mahdie Klim Al Zaidawi (University of Bremen), Martin H.U. Prinzler (University of Bremen), Sebastian Maneth (University of Bremen), Gabriel Zachmann (University of Bremen)

Recent results suggest that biometric identification based on human's eye movement characteristics can be used for authentication. In this paper, we present three new methods and benchmark them against the state-of-the-art. The best of our new methods improves the state-of-the-art performance by 5.9 percentage points. Furthermore, we investigate some of the factors that affect the robustness of the recognition rate of different classifiers on gaze trajectories, such as the type of stimulus and the tracking trajectory length. We find that the state-of-the-art method only works well when using the same stimulus for testing that was used for training. By contrast, our novel method more than doubles the identification accuracy for these transfer cases. Furthermore, we find that with only 90 seconds of eye tracking data, 86.7 % accuracy can be achieved.

Honorable Mention

Social Acceptability in HCI: A Survey of Methods, Measures, and Design Strategies

Marion Koelle (University of Oldenburg, Saarland University, Saarland Informatics Campus), Swamy Ananthanarayan (University of Oldenburg), Susanne Boll (University of Oldenburg)

With the increasing ubiquity of personal devices, social acceptability of human-machine interactions has gained relevance and growing interest from the HCI community. Yet, there are no best practices or established methods for evaluating social acceptability. Design strategies for increasing social acceptability have been described and employed, but so far not been holistically appraised and evaluated. We offer a systematic literature analysis (N=69) of social acceptability in HCI and contribute a better understanding of current research practices, namely, methods employed, measures and design strategies. Our review identified an unbalanced distribution of study approaches, shortcomings in employed measures, and a lack of interweaving between empirical and artifact-creating approaches. The latter causes a discrepancy between design recommendations based on user research, and design strategies employed in artifact creation. Our survey lays the groundwork for a more nuanced evaluation of social acceptability, the development of best practices, and a future research agenda.

Social Technology Appropriation in Dementia: Investigating the Role of Caregivers in engaging People with Dementia with a Videogame-based Training System

David Unbehaun (Uni Siegen), Konstantin Aal (Uni Siegen), Daryoush Daniel Vaziri (Hochschue Bonn-Rhein-Siegen), Peter David Tolmie (Uni Siegen), Rainer Wieching (Uni Siegen), David Randall (Uni Siegen), Volker Wulf (Uni Siegen),

There has been increasing interest in designing for dementia in recent years. Empirical investigation is now needed of the long-term role of caregivers in appropriating ICTs into the complex daily life of people with dementia (PwD). We present here the outcomes of a 4-month evaluation of the individual, social and institutional impact of a videogame-based training system. The everyday behavior and interactions of 52 PwD and 25 caregivers was studied qualitatively, focusing on the role played by caregivers in integrating the system into everyone's daily routines. Our results indicate that the successful appropriation of ICT depends partly on the physical, cognitive and social benefits for PwD, but especially on the added value perceived by their social care-network. We discuss the need for design in dementia to develop more socially embedded innovations that can address the social actors involved and thus contribute to practical solutions for professional and informal care.

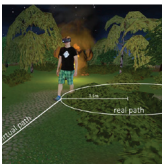
TAGSwipe: Touch Assisted Gaze Swipe for Text Entry

Chandan Kumar (University of Koblenz), Ramin Hedeshy (University of Koblenz), Scott MacKenzie (York University), Steffen Staab (University of Stuttgart)

The conventional dwell-based methods for text entry by gaze are typically slow and uncomfortable. A swipe-based method that maps gaze path into words offers an alternative. However, it requires the user to explicitly indicate the beginning and ending of a word, which is typically achieved by tedious gaze-only selection. This paper introduces TAGSwipe, a bi-modal method that combines the simplicity of touch with the speed of gaze for swiping through a word. The result is an efficient and comfortable dwell-free text entry method. In the lab study TAGSwipe achieved an average text entry rate of 15.46 wpm and significantly outperformed conventional swipe-based and dwell-based methods in efficacy and user satisfaction.

Telewalk: Towards Free and Endless Walking in Room-Scale Virtual Reality

Michael Rietzler (Ulm University), Martin Deubzer (Ulm University), Thomas Dreja (Ulm University), Enrico Rukzio (Ulm University)



Natural navigation in VR is challenging due to spatial limitations. While Teleportation enables navigation within very small physical spaces and without causing motion sickness symptoms, it may reduce the feeling of presence and spacial awareness. Redirected walking (RDW), in contrast, allows users to naturally walk while staying inside a finite, but still very large, physical space. We present Telewalk, a novel locomotion approach that combines curvature and translation gains known from RDW research in a perceivable way. This combination enables Telewalk to be applied even within a physical space of 3m x 3m. Utilizing the head rotation as input device enables directional changes without any physical turns to keep the user always on an optimal circular path inside the real world while freely walking inside the virtual one. In a user study we found that even though motion sickness susceptible participants reported respective symptoms, Telewalk did result in stronger feelings of presence and immersion and was seen as more natural then Teleportation.

Honorable Mention

The Role of Eye Gaze in Security and Privacy Applications: Survey and Future HCI Research Directions

Christina Katsini Human Opsis (Patras), Yasmeen Abdrabou (Bundeswehr University Munich), George E. Raptis Human Opsis (Patras), Mohamed Khamis (University of Glasgow), Florian Alt (Bundeswehr University Munich)

For the past 20 years, researchers have investigated the use of eye tracking in security applications. We present a holistic view on gaze-based security applications. In particular, we canvassed the literature and classify the utility of gaze in security applications into a) authentication, b) privacy protection, and c) gaze monitoring during security critical tasks. This allows us to chart several research directions, most importantly 1) conducting field studies of implicit and explicit gaze-based authentication due to recent advances in eye tracking, 2) research on gaze-based privacy protection and gaze monitoring in security critical tasks which are under-investigated yet very promising areas, and 3) understanding the privacy implications of pervasive eye tracking. We discuss the most promising opportunities and most pressing challenges of eye tracking for security that will shape research in gaze-based security applications for the next decade.

ThermalWear: Exploring Wearable On-chest Thermal Displays to Augment Voice Messages with Affect

Abdallah El Ali (Centrum Wiskunde & Informatica), Xingyu Yang (Delft University of Technology), Swamy Ananthanarayan (University of Oldenburg), Thomas Röggla (Centrum Wiskunde Informatica), Jack Jansen (Centrum Wiskunde Informatica), Jess Hartcher-O'Brien (Delft University of Technology), Kaspar Jansen (Delft University of Technology), Pablo Cesar (Centrum Wiskunde Informatica and Delft University of Technology)

Voice is a rich modality for conveying emotions, however emotional prosody production can be situationally or medically impaired. Since thermal displays have been shown to evoke emotions, we explore how thermal stimulation can augment perception of neutrally-spoken voice messages with affect. We designed ThermalWear, a wearable on-chest thermal display, then tested in a controlled study (N=12) the effects of fabric, thermal intensity, and direction of change. Thereafter, we synthesized 12 neutrally-spoken voice messages, validated (N=7) them, then tested (N=12) if thermal stimuli can augment their perception with affect. We found warm and cool stimuli (a) can be perceived on the chest, and quickly without fabric (4.7-5s) (b) do not incur discomfort (c) generally increase arousal of voice messages and (d) increase / decrease message valence, respectively. We discuss how thermal displays can augment voice perception, which can enhance voice assistants and support individuals with emotional prosody impairments.

Therminator: Understanding the Interdependency of Visual and On-Body Thermal Feedback in Virtual Reality

Sebastian Günther (TU Darmstadt), Florian Müller (TU Darmstadt), Dominik Schön (TU Darmstadt), Omar Elmoghazy (GUC), Max Mühlhäuser (TU Darmstadt), Martin Schmitz (TU Darmstadt)

Recent advances have made Virtual Reality (VR) more realistic than ever before. This improved realism is attributed to today's ability to increasingly appeal to human sensations, such as visual, auditory or tactile. While research also examines temperature sensation as an important aspect, the interdependency of visual and thermal perception in VR is still underexplored. In this paper, we propose Therminator, a thermal display concept that provides warm and cold on-body feedback in VR through heat conduction of flowing liquids with different temperatures. Further, we systematically evaluate the interdependency of different visual and thermal stimuli on the temperature perception of arm and abdomen with 25 participants. As part of the results, we found varying temperature perception depending on the stimuli, as well as increasing involvement of users during conditions with matching stimuli.

Honorable Mention

Towards Inclusive External Communication of Autonomous Vehicles for Pedestrians with Vision Impairments

Mark Colley (Ulm University), Marcel Walch (Ulm University), Jan Gugenheimer (Ulm University), Ali Askari (Ulm University), Enrico Rukzio (Ulm University)

People with vision impairments (VIP) are among the most vulnerable road users in traffic. Autonomous vehicles are believed to reduce accidents but still demand some form of external communication signaling relevant information to pedestrians. Recent research on the design of vehicle-pedestrian communication (VPC) focuses strongly on concepts for a non-disabled population. Our work presents an inclusive user-centered design for VPC, beneficial for both vision impaired and seeing pedestrians. We conducted a workshop with VIP (N=6), discussing current issues in road traffic and comparing communication concepts proposed by literature. A thematic analysis unveiled two important themes: number of communicating vehicles and content (affecting duration). Subsequently, we investigated these in a second user study in virtual reality (N=33, 8 VIP) comparing the VPC between groups of abilities. We found that trust and understanding is enhanced and cognitive load reduced when all relevant vehicles communicate; high content messages also reduce cognitive load.

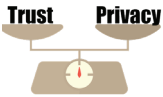
TRACTUS: Understanding and Supporting Source Code Experimentation in Hypothesis-Driven Data Science

Krishna Subramanian (RWTH Aachen University), Johannes Maas (RWTH Aachen University), Jan Borchers (RWTH Aachen University)

Data scientists experiment heavily with their code, compromising code quality to obtain insights faster. We observed ten data scientists perform hypothesis-driven data science tasks, and analyzed their coding, commenting, and analysis practice. We found that they have difficulty keeping track of their code experiments. When revisiting exploratory code to write production code later, they struggle to retrace their steps and capture the decisions made and insights obtained, and have to rerun code frequently. To address these issues, we designed TRACTUS, a system extending the popular RStudio IDE, that detects, tracks, and visualizes code experiments in hypothesis-driven data science tasks. TRACTUS helps recall decisions and insights by grouping code experiments into hypotheses, and structuring information like code execution output and documentation. Our user studies show how TRACTUS improves data scientists' workflows, and suggest additional opportunities for improvement. TRACTUS is available as an open source RStudio IDE addin at http://hci.rwth-aachen.de/tractus.

Trust versus Privacy: Using Connected Car Data in Peer-to-Peer Carsharing

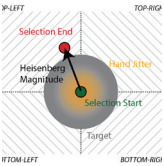
Paul Bossauer (University of Siegen), Thomas Neifer (Hochschule Bonn-Rhein-Sieg Sankt Augustin), Gunnar Stevens (University of Siegen), Christina Pakusch (University of Siegen)



Trust is the lubricant of the sharing economy. This is true especially in peer-to-peer carsharing, in which one leaves a highly valuable good to a stranger in the hope of getting it back unscathed. Nowadays, ratings of other users are major mechanisms for establishing trust. To foster uptake of peer-to-peer carsharing, connected car technology opens new possibilities to support trust-building, e.g., by adding driving behavior statistics to users' profiles. However, collecting such data intrudes into rentees' privacy. To explore the tension between the need for trust and privacy demands, we conducted three focus group and eight individual interviews. Our results show that connected car technologies can increase trust for car owners and rentees not only before but also during and after rentals. The design of such systems must allow a differentiation between information in terms of type, the context, and the negotiability of information disclosure.

Understanding the Heisenberg Effect of Spatial Interaction: A Selection Induced Error for Spatially Tracked Input Devices

Dennis Wolf (Ulm University), Jan Gugenheimer (Ulm University), Marco Combosch (Ulm Universtiy), Enrico Rukzio (Ulm University)



Virtual and augmented reality head-mounted displays (HMDs) are currently heavily relying on spatially tracked input devices (STID) for interaction. These STIDs are all prone to the phenomenon that a discrete input (e.g., button press) will disturb the position of the tracker, resulting in a different selection point during ray-cast interaction (Heisenberg Effect of Spatial Interaction). Besides the knowledge of its existence, there is currently a lack of a deeper understanding of its severity, structure and impact on throughput and angular error during a selection task. In this work, we present a formal evaluation of the Heisenberg effect and the impact of body posture, arm position and STID degrees of freedom on its severity. In a Fitt's law inspired user study (N=16), we found that the Heisenberg effect is responsible for 30.45% of the overall errors occurring during a pointing task, but can be reduced by 25.4% using a correction function.

Understanding what you feel: A Mobile Audio-Tactile System for Graphics Used at Schools with Students with Visual Impairment

Giuseppe Melfi (KIT-SZS), Karin Müller (KIT-SZS), Thorsten Schwarz (KIT-SZS), Gerhard Jaworek (KIT-SZS), Rainer Stiefelhagen (KIT-SZS)

A lot of information is nowadays presented graphically. However, students with blindness do not have access to visual information. Providing an alternative text is not always the appropriate solution as exploring graphics to discover information independently is a fundamental part of the learning process. In this work, we introduce a mobile audio-tactile learning environment, which facilitates the incorporation of real educational material. We evaluate our system by comparing three methods of interaction with tactile graphics: A tactile graphic augmented by (1) a document with key index information in Braille, (2) a digital document with key index information and (3) the TPad system, an audio-tactile solution meeting the specific needs within the school context. Our study shows that the TPad system is suitable for educational environments. Moreover, compared to the other methods TPad is faster to explore tactile graphics and it suggests a promising effect on the memorization of information.

Vibrotactile Funneling Illusion and Localization Performance on the Head

Oliver Beren Kaul (Leibniz University Hannover), Michael Rohs (Leibniz University Hannover), Benjamin Simon (Leibniz University Hannover), Kerem Can Demir (Leibniz University Hannover), Kamillo Ferry (Leibniz University Hannover)

The vibrotactile funneling illusion is the sensation of a single (non-existing) stimulus somewhere in-between the actual stimulus locations. Its occurrence depends upon body location, distance between the actuators, signal synchronization, and intensity. Related work has shown that the funneling illusion may occur on the forehead. We were able to reproduce these findings and explored five further regions to get a more complete picture of the occurrence of the funneling illusion on the head. The results of our study (24 participants) show that the actuator distance, for which the funneling illusion occurs, strongly depends upon the head region. Moreover, we evaluated the centralizing bias (smaller perceived than actual actuator distances) for different head regions, which also showed widely varying characteristics. We computed a detailed heat map of vibrotactile localization accuracies on the head. The results inform the design of future tactile head-mounted displays that aim to support the funneling illusion.

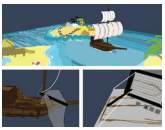
Virtual Field Studies: Conducting Studies on Public Displays in Virtual Reality

Ville Mäkelä (LMU Munich, Tampere University), Rivu Radiah (Bundeswehr University Munich), Saleh Alsherif (German University in Cairo), Mohamed Khamis (University of Glasgow), Chong Xiao (LMU Munich), Lisa Borchert (LMU Munich), Albrecht Schmidt (LMU Munich), Florian Alt (Bundeswehr University Munich)

Field studies on public displays can be difficult, expensive, and time-consuming. We investigate the feasibility of using virtual reality (VR) as a test-bed to evaluate deployments of public displays. Specifically, we investigate whether results from virtual field studies, conducted in a virtual public space, would match the results from a corresponding real-world setting. We report on two empirical user studies where we compared audience behavior around a virtual public display in the virtual world to audience behavior around a real public display. We found that virtual field studies can be a powerful research tool, as in both studies we observed largely similar behavior between the settings. We discuss the opportunities, challenges, and limitations of using virtual reality to conduct field studies, and provide lessons learned from our work that can help researchers decide whether to employ VR in their research and what factors to account for if doing so.

VRSketchIn: Exploring the Design Space of Pen and Tablet Interaction for 3D Sketching in Virtual Reality

Tobias Drey (Ulm University), Jan Gugenheimer (Ulm University), Julian Karlbauer (Ulm University), Maximilian Milo (Ulm University), Enrico Rukzio (Ulm University)



Sketching in virtual reality (VR) enhances perception and understanding of 3D volumes, but is currently a challenging task, as spatial input devices (e.g., tracked controllers) do not provide any scaffolding or constraints for mid-air interaction. We present VRSketchIn, a VR sketching application using a 6DoF-tracked pen and a 6DoF-tracked tablet as input devices, combining unconstrained 3D mid-air with constrained 2D surface-based sketching. To explore what possibilities arise from this combination of 2D (pen on tablet) and 3D input (6DoF pen), we present a set of design dimensions and define the design space for 2D and 3D sketching interaction metaphors in VR. We categorize prior art inside our design space and implemented a subset of metaphors for pen and tablet sketching in our prototype. To gain a deeper understanding which specific sketching operations users perform with 2D and which with 3D metaphors, we present findings of usability walkthroughs with six participants.

Walk The Line: Leveraging Lateral Shifts of the Walking Path as an Input Modality for Head-Mounted Displays

Florian Müller (TU Darmstadt), Martin Schmitz (TU Darmstadt), Daniel Schmitt (TU Darmstadt), Sebastian Günther (TU Darmstadt), Markus Funk (TU Darmstadt), Max Mühlhäuser (TU Darmstadt)

Recent technological advances have made head-mounted displays (HMDs) smaller and untethered, fostering the vision of ubiquitous interaction in a digitally augmented physical world. Consequently, a major part of the interaction with such devices will happen on the go, calling for interaction techniques that allow users to interact while walking. In this paper, we explore lateral shifts of the walking path as a hands-free input modality. The available input options are visualized as lanes on the ground parallel to the user's walking path. Users can select options by shifting the walking path sideways to the respective lane. We contribute the results of a controlled experiment with 18 participants, confirming the viability of our approach for fast, accurate, and joyful interactions. Further, based on the findings of the controlled experiment, we present three example applications.

Walking by Cycling: A Novel In-Place Locomotion User Interface for Seated Virtual Reality Experiences

Jann Philipp Freiwald (Uni Hamburg), Oscar Ariza (Uni Hamburg), Omar Janeh (Uni Hamburg), Frank Steinicke (Uni Hamburg)

We introduce VR Strider, a novel locomotion user interface (LUI) for seated virtual reality (VR) experiences, which maps cycling biomechanics of the user's legs to virtual walking movements. The core idea is to translate the motion of pedaling on a mini exercise bike to a corresponding walking animation of a virtual avatar while providing audio-based tactile feedback on virtual ground contacts. We conducted an experiment to evaluate the LUI and our novel anchor-turning rotation control method regarding task performance, spatial cognition, VR sickness, sense of presence, usability and comfort in a path-integration task. The results show that VR Strider has a significant positive effect on the participants' angular and distance estimation, sense of presence and feeling of comfort compared to other established locomotion techniques, such as teleportation and joystick-based navigation. A confirmatory study further indicates the necessity of synchronized avatar animations for virtual vehicles that rely on pedalling.

Watch+Strap: Extending Smartwatches with Interactive StrapDisplays

Konstantin Klamka (Technische Universität Dresden), Tom Horak (Technische Universität Dresden), Raimund Dachselt (Technische Universität Dresden)

While smartwatches are widely adopted these days, their input and output space remains fairly limited by their screen size. We present StrapDisplays—interactive watchbands with embedded display and touch technologies—that enhance commodity watches and extend their input and output capabilities. After introducing the physical design space of these StrapDisplays, we explore how to combine a smartwatch and straps in a synergistic Watch+Strap system. Specifically, we propose multiple interface concepts that consider promising content distributions, interaction techniques, usage types, and display roles. For example, the straps can enrich watch apps, display visualizations, provide glanceable feedback, or help avoiding occlusion issues. Further, we provide a modular research platform incorporating three StrapDisplay prototypes and a flexible web-based software architecture, demonstrating the feasibility of our approach. Early brainstorming sessions with 15 participants informed our design process, while later interviews with six experts supported our concepts and provided valuable feedback for future developments.

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A Virtual Reality Couch Configurator Leveraging Passive Haptic Feedback
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All Fun and Games: Obtaining Critical Pedestrian Behavior Data from an Online Simulation
Kai Holländer (LMU Munich), Luca Schellenberg (LMU Munich), Changkun Ou (LMU Munich), Andreas Butz (LMU Munich)

All in One! User Perceptions on Centralized IoT Privacy Settings
Karola Marky (TU Darmstadt, Keio University), Verena Zimmermann (TU Darmstadt), Alina Stöver (TU Darmstadt), Philipp Hoffmann (TU Darmstadt), Kai Kunze (Keio University), Max Mühlhäuser (TU Darmstadt)

AmbiPlant - Ambient Feedback for Digital Media through Actuated Plants
Donald Degraen (DFKI, Saarland Informatics Campus), Marc Schubhan (DFKI, Saarland Informatics Campus), Kamila Mushkina (DFKI, Saarland Informatics Campus), Akhmajon Makhsadov (DFKI, Saarland Informatics Campus), Felix Kosmalla (DFKI, Saarland Informatics Campus), André Zenner (DFKI, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

Augmentation Concepts with HUDs for Cyclists to Improve Road Safety in Shared Spaces
Tamara von Sawitzky (Human-Computer Interaction Group, Technische Hochschule Ingolstadt), Philipp Wintersberger (CARISSMA, Technische Hochschule Ingolstadt), Andreas Löcken (Human-Computer Interaction Group, Technische Hochschule Ingolstadt), Anna-Katharina Frison (Human-Computer Interaction Group, Technische Hochschule Ingolstadt), Andreas Riener (Human-Computer Interaction Group, Technische Hochschule Ingolstadt)

Autonomous Vehicle-Pedestrian Interaction Across Cultures: Towards Designing Better External Human Machine Interfaces (eHMIs)
Champika Ranasinghe (University of Twente), Kai Holländer (LMU Munich), Rebecca Currano (Stanford University), David Sirkin (Stanford University), Dylan Moore (Stanford University), Stefan Schneegass (University of Duisburg-Essen), Wendy Ju (Cornell Tech)

Beep Beep: Building Trust with Sound
Matthias Schmidmaier (LMU Munich), Dominik Maurice Runge (LMU Munich), Heinrich Hußmann (LMU Munich)

Combining Embedded Computation and Image Tracking for Composing Tangible Augmented Reality
Tim Düwel (DFKI, Saarland Informatics Campus), Nico Herbig (DFKI, Saarland Informatics Campus), Denise Kahl (DFKI, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

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Gaze'N'Touch: Enhancing Text Selection on Mobile Devices Using Gaze
Radiah Rivu, Yasmeen Abdrabou, Ken Pfeuffer, Mariam Hassib, Florian Alt (Bundeswehr University Munich)

Hybridity as Design Strategy for Service Robots to Become Domestic Products
Diana Löffler (USI), Judith Dörrenbächer (USI), Julika Welge (USI), Marc Hassenzahl (USI)

I Wish You Were Smart(er): Investigating Users' Desires and Needs Towards Home Appliances
Sarah Prange (Bundeswehr University Munich, LMU Munich), Florian Alt (Bundeswehr University Munich)

Improvising with Machines – Designing Artistic Non-Human Actors
Matthias Laschke (Uni Siegen), Robin Neuhaus (Uni Siegen), Marc Hassenzahl (Uni Siegen), Claudius Lazzeroni (Folkwang University)

Introducing Functional Biometrics: Using Body-Reflections as a Novel Class of Biometric Authentication Systems
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It's Not Always Better When We're Together: Effects of Being Accompanied in Virtual Reality
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MazeRunVR: An Open Benchmark for VR Locomotion Performance, Preference and Sickness in the Wild
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Opportunities and Challenges of Text Input in Portable Virtual Reality
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PneumoVolley: Pressure-based Haptic Feedback on the Head through Pneumatic Actuation
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Simo: Interactions with Distant Displays by Smartphones with Simultaneous Face and World Tracking
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The Importance of Virtual Hands and Feet for Virtual Reality Climbing
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Towards a Design Space for External Communication of Autonomous Vehicles
Mark Colley (Ulm University), Enrico Rukzio (Ulm University)

Toward Agile Situated Visualization: An Exploratory User Study
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Towards Progress Assessment for Adaptive Hints in Educational Virtual Reality Games
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Unveiling the Lack of Scalability in Research on External Communication of Autonomous Vehicles
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Using Hexad User Types to Select Suitable Gamification Elements to Encourage Healthy Eating
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Watch my Painting: The Back of the Hand as a Drawing Space for Smartwatches
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VRsneaky: Stepping into an Audible Virtual World with Gait-Aware Auditory Feedback
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Exploring Potentially Abusive Ethical, Social and Political Implications of Mixed Reality Research in HCI
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Momentary Emotion Elicitation and Capture (MEEC)
Abdallah El Ali (Centrum Wiskunde & Informatica Amsterdam), Monica Perusquía-Hernández (NTT Communication Science Laboratories Atsugi), Pete Denman (Intel Corp Portland), Yomna Abdelrahman (Bundeswehr University Munich), Mariam Hassib (Bundeswehr University Munich), Alexander Meschtscherjakov (University of Salzburg), Denzil Ferreira (University of Oulu), Niels Henze (University of Regensburg)

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Yogesh Kumar Meena (Swansea University), Xing-Dong Yang (Dartmouth College), Markus Löchtefeld (Aalborg University), Matt Carnie (Swansea University), Niels Henze (University of Regensburg), Steve Hodges (Microsoft Research), Matt Jones (Swansea University), Nivedita Arora (Georgia Institute of Technolgy), Gregory D. Abowd (Georgia Institute of Technology)

Should I Stay or Should I Go? Automated Vehicles in the Age of Climate Change
Shadan Sadeghian Borojeni (University of Siegen), Alexander Meschtscherjakov (University of Salzburg), Bastian Pfleging (Eindhoven University of Technology), Birsen Donmez (University of Toronto), Andreas Riener (Technische Hochschule Ingolstadt), Christian P. Janssen (Utrecht University), Andrew L. Kun (University of New Hampshire), Wendy Ju (Cornell Tech), Christian Remy (Aarhus University), Philipp Wintersberger (Technische Hochschule Ingolstadt)

Case Studies 2

Co-Design Futures for AI and Space: A Workbook Sprint
Henrik Mucha (Fraunhofer IOSB), Ricarda Jacobi (Technische Hochschule Ostwestfalen-Lippe), Kirsten Meyer (Technische Hochschule Ostwestfalen-Lippe), Dennis Mevißen (Fraunhofer IOSB), Sebastian Robert (Fraunhofer IOSB), Winfried Heusler (Schüco International KG), Daniel Arztmann (Schüco International KG)

Evaluation of Natural User Interfaces in the Creative Industries
Georg Volkmar (University of Bremen), Thomas Muender (University of Bremen), Dirk Wenig (University of Bremen), Rainer Malaka (University of Bremen)

Journal Articles 2

Improving User Experience of Eye Tracking-based Interaction: Introspecting and Adapting Interfaces
Raphael Menges (University of Koblenz), Chandan Kumar (University of Koblenz), Steffen Staab (University of Koblenz, University of Stuttgart)

WindowWall: Towards Adaptive Buildings with Interactive Windows As Ubiquitous Displays
Patrick Bader (University of Stuttgart), Alexandra Voit (adesso AG), Huy Viet Le (University of Stuttgart), Paweł W. Woźniak (Utrecht University), Niels Henze (University of Regensburg), Albrecht Schmidt (LMU Munich)

SIGCHI Outstanding Dissertation Award 1

Paul Strohmeier - Shaping Material Experiences

University of Copenhagen and Saarland University, Saarland Informatics Campus

When interacting with materials, we infer many of their properties through tactile stimuli. These stimuli are caused by our manual interaction with the material, they are therefore closely coupled to our actions. Similarly, if we are subjected to a vibrotactile stimulus with a frequency directly coupled to our actions, we do not experience vibration – instead we experience this as a material property. My thesis explores this phenomenon of 'material experience' in three parts. Part I contributes two novel devices, a flexible phone which provides haptic feedback as it is being deformed, and a system which can track a finger and simultaniously provide haptic feedback. Part II investigates how vibration is perceived, when coupled to motion: what are the effects of varying feedback parameters and what are the effects of different types of motion? Part III reflects and contextualizes the findings presented in the previous sections. In this extended abstract I briefly outline the most important aspects of my thesis and questions I've left unanswered, while also reflecting on the writing process.

Special Interest Group 1

Automated Cars as Living Rooms and Offices: Challenges and Opportunities

Clemens Schartmüller (Technische Hochschule Ingolstadt), Andreas Riener (Technische Hochschule Ingolstadt), Orit Shaer (Wellesley College), Shamsi Iqbal (Microsoft Research), Sayan Sarcar (University of Tsukuba), Andrew L. Kun (University of New Hampshire), Linda Ng Boyle (University of Washington)

Student Game Competition 1

TimeBOMB: An Interactive Game Station Showcasing the History of Computer Games

Severin Engert (Technische Universität Dresden), Remke Albrecht (Technische Universität Dresden), Constantin Amend (Technische Universität Dresden), Felix Meyer (Technische Universität Dresden)

German HCI Community

Contact Details Labs

RWTH Aachen University

Media Computing Group

Jan Borchers *(borchers@cs.rwth-aachen.de)*

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At the Media Computing Group, headed by Prof. Dr. Jan Borchers, we work in Human-Computer Interaction. We develop and study new interaction theories, techniques, and systems in areas like personal digital fabrication and personal design, tangible, mobile, and wearable user interfaces, interactive textiles, multitouch tables and interactive surfaces, augmented reality, and visual coding environments. Our goal is to make the Brave New World of interactive technologies useful by making it usable. Since starting in October 2003, we have become one of Germany's best-published research groups at CHI.

Website: hci.rwth-aachen.de

Universität Bremen

Digital Media Lab, TZI

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Bibliothekstr. 5, 28359 Bremen

CGVR, TZI

Gabriel Zachmann *(zach@uni-bremen.de)*

Bibliothekstr. 5, 28359 Bremen

The Center for Computing Technologies (TZI) at the University of Bremen conducts research at the core of a massive societal trend: The digital revolution, which affects all areas of our lives. Important research questions include: What kind of technologies will we have in 10 to 20 years? How can we make sure that they will be safe, dependable, and beneficial for society? And most of all: How can technology serve humans–instead of replacing them? TZI has conducted research in these areas since its foundation in 1995, working on approximately 120 projects per year. One main goal is to transfer results from basic research to industry as quickly as possible in order to generate the greatest benefits for society.

Website: tzi.de

TU Chemnitz

Medieninformatik

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The chair media informatics at TU Chemnitz does research and teaching in Human Computer Interaction, Multimedia Information Retrieval, and Media Distribution.

Website: www.tu-chemnitz.de/informatik/mi

Clausthal University of Technology

Human-Centered Information Systems

Michael Prilla *(Michael.Prilla@tu-clausthal.de)*

Prof. Dr.-Ing. Michael Prilla, Technische Universität Clausthal, Julius-Albert Str. 4, Raum 203, 38678 Clausthal-Zellerfeld, Deutschland

We investigate the work, learning and behavior of people in order to support them with IT tools. In this we focus on the practice of people, which includes multiple (individual) factors and constraints that shape the way people act and develops of time an constantly. IT is then one factor that influences work, and the understanding of all other factors enables us to support individuals and group appropriately. Our work includes individuals (human computer interaction) as well as support for groups (computer supported cooperative work and collaborative learning).

Website: hcis.in.tu-clausthal.de

Technische Universität Darmstadt
Telecooperation Lab

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The Telecooperation Lab (TK) under the supervision of Prof. Max Mühlhäuser at Darmstadt Technical University, Department of Computer Science, researches concepts and methods for human-centered smart spaces of all sizes where telecooperation means targeted cooperation among humans and machines, based on information & communication technology. At the HCI group of the Telecooperation Lab, we investigate and study novel interaction concepts and techniques in the research fields that cover Fabrication, Augmented and Virtual Reality, Interactive Surfaces, On-body Haptics, Usable Security and Assisting Technology for children and people with special needs.

Website: www.teamdarmstadt.de

Technische Universität Dresden
Interactive Media Lab

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Faculty of Computer Science, Interactive Media Lab Dresden, 01062 Dresden

The Interactive Media Lab at the Technische Universität Dresden is conducting research primarily in the field of modern Human-Computer Interaction and interactive Information Visualization. Our main focus are natural user interfaces, in particular the development of interaction techniques and data visualization approaches using various interaction modalities (multitouch, pen, gaze, tangibles, gestures) and their combination. Typical research setups are multi-display and Mixed Reality environments as well as wearables for augmenting humans. We apply our basic research results to several application domains, like biology, medicine and cyber-physical systems, and develop domain-specific solutions.

Website: imld.de

University of Duisburg-Essen
paluno, HCI Group

Stefan Schneegass *(stefan.schneegass@uni-due.de)*

Schützenbahn 70, 45127 Essen

The HCI Group at the University of Duisburg-Essen (Campus Essen) researches on the crossroads of human-computer interaction and ubiquitous computing. We explore how mobile, wearable, and ubiquitous computer can be used to create a benefit to the user. We particularly focus in our current research projects on providing novel and implicit ways to authenticate users, improve user´s health through digital technology, interacting with autonomous systems, and providing immerse multi-user environments in virtual reality. We are part of the paluno, the Ruhr Institute for Software Technology.

Website: www.hci.wiwi.uni-due.de

Universität Hamburg
Human-Computer Interaction

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The Human-Computer Interaction (HC) research group is part of the Department of Informatics at the Faulty of Mathematics, Informatics and Natural Sciences at the Universität Hamburg (UHH). Our group is particularly interested in developing innovative user interfaces for computer-mediated blended realities in which the two-dimensional digital world and intelligence meets human intelligence and the three-dimensional physical world we live in. In our group we combine methods from computer science (software development, in particular computer graphics and artificial intelligence), engineering (hardware prototyping, in particular with sensors and actuators for novel user interface technology) and basic principles and models of psychology (such as perception, cognition or action) as well as interaction design (e.g. usability and user experience engineering) to reform the future interaction between humans and technology. The results advance the state-of-the-art in basic research, applied research, and experimental development in the area of augmented/virtual reality, virtual agents and avatars, and 3D user interfaces as well as spatial user interaction. The results can be applied in a variety of application domains such as health, simulation, training, communication, entertainment, education or training.

Website: www.inf.uni-hamburg.de/en/inst/ab/hci.html

Leibniz University Hannover
Human-Computer Interaction Group

Michael Rohs *(michael.rohs@hci.uni-hannover.de)*

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The Human-Computer Interaction Group is part of the Faculty of Electrical Engineering and Computer Science at Leibniz University Hannover. Our research and teaching focuses on the design, implementation, and evaluation of mobile, wearable, and ubiquitous interactive systems. Current topics include the application of machine learning techniques in sensor-based mobile interactions and mobile haptic feedback, e.g. for pedestrian navigation and visually impaired people.

Website: hci.uni-hannover.de

Technische Hochschule Ingolstadt (THI)
Human-Computer Interaction Group

Andreas Riener *(Andreas.Riener@thi.de)*

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The Human-Computer Interaction Group (HCIG) at THI, headed by Prof. Andreas Riener, is an interdisciplinary team with particular focus on usability research for intelligent user interfaces and user experience design. The research group is interested in augmented, mixed, and virtual reality applications to study novel and efficient interaction metaphors, motion/simulator sickness, trust/acceptance of technology, and usability/UX of (adaptive) interfaces. The group's particular interest lies in the automotive domain, with prototypes/systems evaluated in driving simulator studies, lab experiments and in the field. The research agenda of the HCIG can be expressed as the "development of future interaction concepts and intelligent user interfaces that include cognitive elements to reflect the uniqueness of its users".

Website: hcig.thi.de

Karlsruhe Institute of Technology (KIT)

Study Centre for the Visually Impaired (SZS) and Computer Vision for Human-Computer Interaction Lab

Rainer Stiefelhagen *(rainer.stiefelhagen@kit.edu)*

Engesserstr. 4, 76131 Karlsruhe

Karlsruhe Institute of Technology (KIT) – Study Centre for the Visually Impaired (SZS) The Study Centre for the Visually Impaired (SZS) is part of the Faculty of Computer Science at the Karlsruhe Institute of Technology (KIT). The SZS supports and advises visually impaired students and prospective students in all study courses offered at KIT. The work of the SZS aims at continuously developing innovative and individual solutions for accessible studies, especially in STEM (science, technologies, engineering and informatics) fields. Thereby, students with blindness or low vision get the opportunity to study in a self-determined and inclusive way at KIT and to find access to professional life. Moreover, the SZS does research on Assistive Technologies and on new ways of getting access to STEM fields together with the Computer Vision for Human-Computer Interaction Lab (cv:hci) which are both directed by Prof. Rainer Stiefelhagen.

Website: www.szs.kit.edu

University of Konstanz

HCI Group

Harald Reiterer *(harald.reiterer@uni-konstanz.de)*

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Harald Reiterer's HCI Group is part of the Department of Computer and Information Science at the University of Konstanz, which is one of the eleven Universities of Excellence in Germany. Our group designs individual and collaborative user interfaces using virtual and augmented realities to ubiquitous computing systems while following our vision of "Blended Interaction." Based on embodiment theory, Blended Interaction describes the successful blend of physically embodied interaction and computational power. Our research and teaching unify the areas of human-computer interaction, information visualization, and usability engineering. We integrate user-centred design and traditional engineering methods into our research philosophy. Typically, we define our research around realistic application scenarios in close cooperation with domain experts from areas such as visual computing, psychology, or healthcare. Together with our partners, we seek to identify the real needs of practitioners and then design and implement innovative user interfaces that live up to real-world requirements.

Website: hci.uni-konstanz.de

Hochschule Anhalt (Köthen)

Professor for HCI

Arne Berger *(arne.berger@hs-anhalt.de)*

Lohmannstrasse 23, 06366 Köthen

I am a full professor for Human-Computer-Interaction at Hochschule Anhalt. I work at the intersection of creating future technology and our responsibility for the unintended side-effects of yesterday's technology.

Website: www.hs-anhalt.de/hochschule-anhalt/service/personenverzeichnis/prof-dr-arne-berger.html

LMU München
Media Informatics Group

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At LMU Munich, three groups are working closely together in HCI research under the general title "Media Informatics". All three groups conduct research on the crossroads of human behavior and machine computation. This comprises a broad range of topics, including novel interfaces and interaction technologies, development methodologies, and application case studies – always with a human-centered focus. The core Media Informatics group (Heinrich Hussmann) focuses on methods for smooth transitions along the mixed reality continuum, on the application of physical sensing methods to improve interaction and learning, and on interdisciplinary research in the interaction between humans and intelligent assistants. An important application area is the automotive domain. Research in the LMU HCI group (Andreas Butz) centers around the idea of mixing the digital and the physical world. This includes Ubiquitous Computing environments in the classical sense, be they living rooms, handball courts, or the public space, but also our interaction with autonomous cars and robots, and generally the interplay between human and artificial intelligence. The Human-Centered Ubiquitous Media group (Albrecht Schmidt) explores digital technologies that allow augmenting and amplifying human cognition and perception. The focus is on experimental research aiming at designing and implementing human-centered intelligent interactive systems. Technically this includes work on physiological user interfaces, augmented and virtual reality, and novel input and output channels.

Website: www.mimuc.de & ubicomp.net

Bundeswehr University Munich
Usable Security and Privacy Group, Research Institute CODE

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The Usable Security and Privacy Group is part of the Research Institute CODE at the Bundeswehr University Munich. The group is headed by Prof. Florian Alt. We explore the design of secure systems that blend with the way in which users interact with computing devices. In particular, our research focuses on understanding users' behavior in security critical contexts, in building security mechanisms based on users' behavior (behavioral biometrics), in leveraging users' physiology to both enhance existing security mechanisms as well as build novel security mechanisms (physiological security) and in understanding and investigating threats that emerge from novel ubiquitous technologies (ubiquitous security). Specific application areas are smart homes, social engineering and virtual reality. The group has won best paper and honorable mention awards at CHI, MobileHCI, IDC, and AmI. The research has been funded by the DFG, the ZD.B / Bavarian State Ministry for Education and Science, BMW, the Humboldt Foundation, the DAAD, Google, and the Telekom Innovation Labs.

Website: www.unibw.de/usable-security-and-privacy

University of Oldenburg

Media Informatics and Multimedia Systems

Susanne Boll *(susanne.boll@uol.de)*

Escherweg 2, 26122 Oldenburg

The Media Informatics and Multimedia Systems Group is working in the fields of Human Computer Interaction. We develop interactive systems and computing technologies to enhance users' lives. We focus primarily on mobile and ambient user interfaces, where we explore different novel modalities such as visual, auditory and tactile channels in pervasive displays. We strongly embed our research in the fields of personal health and safe transportation, that serve as major application domains. The group is headed by Prof. Dr. Susanne Boll. She is leading several national and international scientific projects with strong cooperation with research experts world wide. She head one of the few leading groups in Europe that works on mobile and ambient user interfaces exploring different novel modalities such as visual, auditory and tactile in pervasive displays. The research groups makes competitive contributions to the field of human computer interaction and ubiquitous computing. The research projects also have a strong connection to industry partners and application partners and addresses highly relevant challenges in the applications field of automation in transportation systems as well as health care technologies.

Website: uol.de/en/media-informatics

OFFIS - Institute for Information Technology (Oldenburg)

Interactive Systems Group

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Escherweg 2, 26122 Oldenburg

Wilko Heuten *(heuten@offis.de)*

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OFFIS Interactive Systems Group develops interactive systems and computing technologies to enhance users' lives. We focus primarily on mobile and ambient user interfaces, where we explore different novel modalities such as visual, auditory and tactile channels in pervasive displays. We strongly embed our research in the fields of personal health and safe transportation, that serve as major application domains.

Website: www.offis.de

University of Regensburg

Media Informatics

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The Chair of Media Informatics is the part of the Institute for Information and Media, Language and Culture at the University of Regensburg. We are interested in how users use computers today and how they will use them in the future. We develop interaction techniques, interactive systems, and applications that change the way users perceive and capture information. We investigate human perception and cognitive processes to understand how future technologies should be designed. Our research areas include mobile interactive systems, virtual, augmented and mixed reality, interactive systems for cultural heritage, and machine learning.

Website: interactionlab.io and mi.uni-regensburg.de

Saarland University, German Research Center for Artificial Intelligence (DFKI)

Ubiquitous Media Technology Lab

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German Research Center for Artificial Intelligence (DFKI), Campus D 3.2, 66123 Saarbrücken

Agents and Simulated Reality

Philipp Slusallek *(slusallek@cg.uni-saarland.de)*

German Research Center for Artificial Intelligence (DFKI), Campus D 3.2, 66123 Saarbrücken

The Ubiquitous Media Technologies Lab (UMTL) is part of the Saarland Informatics Campus and the Cognitive Assistants department (COS) at the German Research Center for Artificial Intelligence (DFKI). Our research activities focus on human factors in interactive systems, in particular, in the fields of multi-modal interaction, ubiquitous computing and gaming. Our research areas include augmented & virtual reality, assistive technologies in health & sports, gamification & games user research, human-robot interaction & collaboration, interactive & applied machine learning, mobile & wearable computing and usable privacy & security. We publish our research findings at renowned scientific conferences and apply our results in the retail domain in our living lab called the Innovative Retail Laboratory. Through our activities in the study program Media Informatics at Saarland University, we contribute to the education of the next generation of HCI practitioners and researchers. We offer lectures, courses, media projects, Bachelor's & Master's theses and an engaging work environment in which interactive systems are designed, prototyped, fabricated & evaluated.

Website: umtl.cs.uni-saarland.de and graphics.cg.uni-saarland.de

Saarland University

HCI Lab

Jürgen Steimle *(steimle@cs.uni-saarland.de)*

Human-Computer Interaction Lab, Campus E 1.7, 66123 Saarbrücken

Our research mission is to contribute toward a future of embodied user interfaces that merge seamlessly with the physical world and with the human body, creating more effective, expressive and engaging interactions with interactive systems. In our work, we conceive new principles for interaction and novel interaction techniques; we develop user interface technologies for advanced sensing and display; we contribute design and fabrication tools for rapid prototyping of embodied user interfaces; and we model and empirically investigate user behavior with these interfaces. Embodied interaction has manifold applications in diverse areas, including consumer electronics, mobile computing, wearable computing, robotics, smart home, health and fitness devices.

Website: hci.cs.uni-saarland.de

University of Siegen

Information Systems and New Media

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Information and communications technology (ICT) pervades most aspects of our lives and changes everyday's practices in work and leisure time. To design innovative ICTs we need to engage with practices, institutional arrangements, and technological infrastructures. All of these issues are interrelated and historical grown, they need appropriate design methods. The challenge in the field of human-centred computing is to design innovative applications so that their appropriation leads to a better quality of life, sustainable development, and social integration. We are investigating into innovative ICTs, especially in the practice fields of cooperative work, community support, entertainment, ageing societies, and sustainability. In doing so, we contribute to the research fields of Human Computer Interaction, Computer Supported Cooperative Work, Ubiquitous Computing, and Software Engineering. The investigations into innovative ICTs in specific domains are related to each other via cross-cutting issues. These issues are currently ubiquitous and software technologies, methods of participatory design, end-user development, integration of organization and technology development, and the foundations of design science.

Website: www.wineme.uni-siegen.de

Computer Supported Cooperative Work and Social Media

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We are an interdisciplinary research group of the University of Siegen dealing with IT-supported cooperations between humans. Particularly we deal with questions of the arrangement and acquirement of cooperative software systems in organizations, questions about communication based knowledge management and also with the support of communities. The last topic involves questions of social structuring by and with information technology (for instance in the fields of E-democracy or in civil security). Computer-Supported Cooperative Work / CSCW is an interdisciplinary field of research which includes not only methodology and contents of Computer Science and Information Systems, but also disciplines of business administration, organizations theory, ergonomics, sociology, psychology and anthropology/ethnography. Seen from the view of Computer Science CSCW is a subarea of Information Systems and HCI (Human-Computer Interaction).

Website: www.cscw.uni-siegen.de

Experience & Interaction Design

Marc Hassenzahl *(marc.hassenzahl@uni-siegen.de)*

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We explore design between the material and experiential, touching upon industrial, interaction and critical design.

Website: www.experienceandinteraction.com

Cyber-Physical Systems

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Kohlbettstr. 15, 57072 Siegen

Our research group is engaged in research and teaching about the conception and design of cyber-physical systems, its technical development as well as its appropriation by users in different fields of application. Cyber-physical systems (CPS) describe the coupling of physical or biological components that can be integrated, observed and controlled via a computing unit. Essential components of cyber-physical systems are information and software technology components with mechanical or electronic components that communicate with each other via a communication infrastructure (e.g. the internet). Today, cyber-physical systems can be found wherever complex physical systems can be improved by communicating with the virtual, digital world. Examples are smart production facilities (industry 4.0) or e-health.

Website: cps.wineme.fb5.uni-siegen.de/en/

IT for the Ageing Society

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It is common knowledge that demographic change gives rise to numerous challenges and problems. The teaching and research at the heart of the assistant Professorship are concerned with finding solutions to these issues; solutions which are supported by information technology. The aim is to maintain and improve the social inclusion of the elderly, particularly their mobility and independence, as well as to enable them to lead a comfortable, healthy life at home, even at an advanced age.

Website: www.wineme.uni-siegen.de/en/team/mueller/

IT-Security and Consumer Computing

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Kohlbettstr. 15, 57072 Siegen

The Chair of Information Systems, in particular IT-Security and Consumer Computing researches the digital transformation of society from the consumer's point of view with the aim of increasing digital sovereignty. The chair is located in the new research field of consumer informatics. Consumer informatics is the systematic, methodically guided investigation and design of information and communication technologies to support the household economies and everyday practices of consumers as well as their appropriation and social embedding. Consumer informatics thereby undergoes a change of perspective in which not only the role as a user of a system or customer of a company, but also the individual and collective life worlds of consumers are focused as comprehensively as possible.

Website: www.itsec.wiwi.uni-siegen.de

University of Stuttgart

Institute for Visualisation and Interactive Systems - Perceptual User Interfaces Group

University of Stuttgart
Germany

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The Human-Computer Interaction and Cognitive Systems group focuses on developing next-generation human-machine interfaces that offer human-like perceptual, cognitive, and interactive capabilities. To this end we research fundamental computational methods as well as ambient and on-body systems to sense, model, and analyse everyday non-verbal human behaviour.

Website: perceptualui.org

Institute for Parallel and Distributed Systems - Analytic Computing Group

Steffen Staab *(Steffen.Staab@ipvs.uni-stuttgart.de)*

Universitätsstraße 32, 70569 Stuttgart

The group on Analytic Computing works on issues related to Artificial Intelligence (AI, Web, and Society; AI and HCI; KR and data bases) and Machine Learning (Machine Learning and Natural Language; Machine Learning and Sensing). The research group has been newly founded by Prof. Staab in 2020 as part of the Cyber Valley initiative of the local state of Baden-Württemberg. With this initiative the local region is supported by the state to become a major hub for AI. The group on Analytic Computing will comprise 12 researchers by the middle of 2020. It has already a range of projects running in the above-mentioned 5 project areas.

Website: www.ipvs.uni-stuttgart.de/departments/ac/

Institute for Visualisation and Interactive Systems - Visualization Research Center

Daniel Weiskopf *(Daniel.Weiskopf@visus.uni-stuttgart.de)*

Allmandring 19, 70569 Stuttgart

Michael Sedlmair *(michael.sedlmair@visus.uni-stuttgart.de)*

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At the Visualization Research Center 30 scientists research in different areas of scientific visualisation, visual analytics, visual computing and computer graphics, as well as interdisciplinary, applied research. The latter results in a very close co-operation with non-visualization disciplines of the University of Stuttgart.

Website: www.visus.uni-stuttgart.de/en/

Ulm University

Institute of Media Informatics - Human-Computer-Interaction Group

Enrico Rukzio *(enrico.rukzio@uni-ulm.de)*

Universität Ulm, Institut für Medieninformatik, James-Franck-Ring, 89081 Ulm

The Human-Computer-Interaction Group is located at the Institute of Media Informatics at Ulm University, and is headed by Enrico Rukzio. We are interested in designing intelligent interactive systems that enable people to be more efficient, satisfied and expressive in their daily lives. We design, implement (hard- and software) and evaluate novel interaction techniques, applications and services which either solve existing problems or provide new opportunities. Our research approach is based on design thinking, user centred design and iterative prototyping. At this, we involve potential users in all steps of the process, use a large body of low- and high-fidelity prototyping techniques and conduct a large number of user studies, evaluations and field tests. Our research focuses on the design of novel interaction concepts, devices and applications in areas such as mobile and wearable interaction, projected user interfaces, computerized eyewear, cross-device interactions, interaction in smart environments, human-technology interaction for elderly people, automotive user interfaces and interactive production planning.

Website: www.uni-ulm.de/in/mi/

German HCI Team

Since 2017, the German HCI event accompanies the ACM CHI Conference on Human Factors in Computing Systems and serves as a platform to promote our publications & labs as well as to get in contact with researchers from all over the world. In the recent years, we already hosted the German CHI event in

- Denver, US (2017)
- Montreal, Canada (2018)
- Glasgow, UK (2019)

Unfortunately, this year's CHI in Hononlulu cannot be held as planned. In order to honor the tradition of the German HCI event and to spark fruitful discussion on our research in the CHI community, we curated this booklet and a website:

germanhci.de

Our website provides you with further details on this year's publications, playlists with paper videos and recorded talks, as well as information about the involved labs, the German HCI in general and offers the opportunity to get in contact with us.

You can also find us as German HCI on Twitter and Youtube.

@GermanHCI

The organization of all those activities is a notable team effort from volunteers from all our labs. Here, we want to thank all involved persons!

Konstantin Aal
University of Siegen

Katrin Angerbauer
University of Stuttgart

Donald Degraen
Saarland University

Tobias Drey
Ulm University

Jann Philipp Freiwald
Universität Hamburg

Sebastian Günther
Technische Universität Darmstadt

Nico Herbig
Saarland University

Tom Horak
Technische Universität Dresden

Oliver Beren Kaul
Leibniz University Hannover

Chandan Kumar
University of Stuttgart

Jonathan Liebers
University of Duisburg-Essen

Giuseppe Melfi
Karlsruhe Institute of Technology

Raphael Menges
University of Koblenz

Leonal Merino
University of Stuttgart

Fariba Mostajeran
University of Hamburg

Heiko Müller
OFFIS - Institute for IT, Oldenburg

Niklas Osmers
Clausthal University of Technology

Johannes Pfau
University of Bremen

Sarah Prange
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Anke Reinschluessel
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