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CHI 2019
Glasgow 2019

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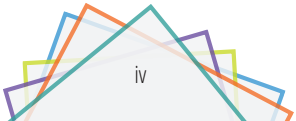


Table of Content

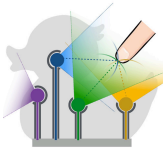
From immersive virtual reality over 3D printed materials to personal health tracking—the German HCI labs cover a manifold range of topics.

This year, we contribute **98 publications in total** to the 2019 ACM CHI Conference on Human Factors in Computing Systems. At the heart, there are **53 Papers**, including **1 Best Paper** and **8 Honorable Mentions**.
Further, we bring 28 Late Breaking Work, 9 Demonstrations, 4 organized Workshops & Symposia, 2 Video Showcases, 1 Case Study, and 1 Doctoral Consortium participation to CHI this year.

Paper Publications 53

./trilaterate: A Fabrication Pipeline to Design and 3D Print Hover-, Touch-, and Force-Sensitive Objects

Martin Schmitz (TU Darmstadt), Martin Stitz (TU Darmstadt), Florian Müller (TU Darmstadt), Markus Funk (TU Darmstadt), Max Mühlhäuser (TU Darmstadt)

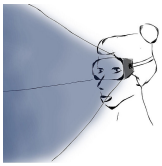


Session: Materials and Fabrication - Tuesday, 11:00, Room Hall 1

Hover, touch, and force are promising input modalities that get increasingly integrated into screens and everyday objects. However, these interactions are often limited to flat surfaces and the integration of suitable sensors is time-consuming and costly. To alleviate these limitations, we contribute Trilaterate: A fabrication pipeline to 3D print custom objects that detect the 3D position of a finger hovering, touching, or forcing them by combining multiple capacitance measurements via capacitive trilateration. Trilaterate places and routes actively-shielded sensors inside the object and operates on consumer-level 3D printers. We present technical evaluations and example applications that validate and demonstrate the wide applicability of Trilaterate.

A Design Space for Gaze Interaction on Head-mounted Displays

Teresa Hirzle (Ulm University), Jan Gugenheimer (Ulm University), Florian Geiselhart (Ulm University), Andreas Bulling (University of Stuttgart), Enrico Rukzio (Ulm University)



Session: AR/VR 2 - Tuesday, 14:00, Room Lomod Auditorium

Augmented and virtual reality (AR/VR) has entered the mass market and, with it, will soon eye tracking as a core technology for next generation head-mounted displays (HMDs). In contrast to existing gaze interfaces, the 3D nature of AR and VR requires estimating a user's gaze in 3D. While first applications, such as foveated rendering, hint at the compelling potential of combining HMDs and gaze, a systematic analysis is missing. To fill this gap, we present the first design space for gaze interaction on HMDs. Our design space covers human depth perception and technical requirements in two dimensions aiming to identify challenges and opportunities for interaction design. As such, our design space provides a comprehensive overview and serves as an important guideline for researchers and practitioners working on gaze interaction on HMDs. We further demonstrate how our design space is used in practice by presenting two interactive applications: EyeHealth and XRay-Vision.

A Review & Analysis of Mindfulness Research in HCI: Framing Current Lines of Research and Future Opportunities

Nađa Terzimehić (LMU Munich), Renate Häuslschmid (LMU Munich), Heinrich Hußmann (LMU Munich), m.c. schraefel (University of Southampton)

Session: Applications of Psychological Theory - Tuesday, 11:00, Room Clyde Auditorium

Mindfulness is a term seen with increasing frequency in HCI literature, and yet the term itself is used almost as variously as the number of papers in which it appears. This diversity makes comparing or evaluating HCI approaches around mindfulness or understanding the design space itself a challenging task. We conducted a structured ACM literature search based on the term mindfulness. Our selection process yielded 38 relevant papers, which we analyzed for their definition, motivation, practice, evaluation and technology use around mindfulness. We identify similarities, divergences and areas of interest for each aspect, resulting in a framework composed of four perspectives and seven lines of research. We highlight challenges and opportunities for future HCI research and design.

Around the (Virtual) World: Infinite Walking in Virtual Reality Using Electrical Muscle Stimulation

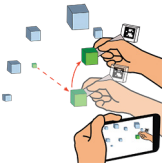
Jonas Auda (University of Duisburg-Essen, paluno), Max Pascher (University of Duisburg-Essen, paluno), Stefan Schneegass (University of Duisburg-Essen, paluno)

Session: Virtual Reality - Tuesday, 11:00, Room Forth

Virtual worlds are infinite environments in which the user can move around freely. When shifting from controller-based movement to regular walking as an input, the limitation of the real world also limits the virtual world. Tackling this challenge, we propose the use of electrical muscle stimulation to limit the necessary real-world space to create an unlimited walking experience. We thereby actuate the users' legs in a way that they deviate from their straight route and thus, walk in circles in the real world while still walking straight in the virtual world. We report on a study comparing this approach to vision shift - the state of the art approach - as well as combining both approaches. The results show that particularly combining both approaches yield high potential to create an infinite walking experience.

ARPen: Mid-Air Object Manipulation Techniques for a Bimanual AR System with Pen & Smartphone

Philipp Wacker (RWTH Aachen University), Oliver Nowak (RWTH Aachen University), Simon Voelker (RWTH Aachen University), Jan Borchers (RWTH Aachen University)



Session: Designing for Haptics and VR - Wednesday, 14:00, Room Dochart 1

Modeling in Augmented Reality (AR) lets users create and manipulate virtual objects in mid-air that are aligned to their real environment. We present ARPen, a bimanual input technique for AR modeling that combines a standard smartphone with a 3D-printed pen. Users sketch with the pen in mid-air, while holding their smartphone in the other hand to see the virtual pen traces in the live camera image. ARPen combines the pen's higher 3D input precision with the rich interactive capabilities of the smartphone touchscreen. We studied subjective preferences for this bimanual input technique, such as how people hold the smartphone while drawing, and analyzed the performance of different bimanual techniques for selecting and moving virtual objects. Users preferred a bimanual technique casting a ray through the pen tip for both selection and translation. We provide initial design guidelines for this new class of bimanual AR modeling systems.

Assessing the Accuracy of Point & Teleport Locomotion with Orientation Indication for Virtual Reality using Curved Trajectories

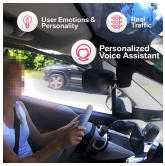
Markus Funk (TU Darmstadt), Florian Müller (TU Darmstadt), Marco Fendrich (TU Darmstadt), Megan Shene (TU Darmstadt), Moritz Kolvenbach (TU Darmstadt), Niclas Dobbertin (TU Darmstadt), Sebastian Günther (TU Darmstadt), Max Mühlhäuser (TU Darmstadt)

Session: Gaming in Virtual Reality - Tuesday, 14:00, Room Hall 2

Room-scale Virtual Reality (VR) systems have arrived in users' homes where tracked environments are set up in limited physical spaces. As most Virtual Environments (VEs) are larger than the tracked physical space, locomotion techniques are used to navigate in VEs. Currently, in recent VR games, point & teleport is the most popular locomotion technique. However, it only allows users to select the position of the teleportation and not the orientation that the user is facing after the teleport. This results in users having to manually correct their orientation after teleporting and possibly getting entangled by the cable of the headset. In this paper, we introduce and evaluate three diferent point & teleport techniques that enable users to specify the target orientation while teleporting. The results show that, although the three teleportation techniques with orientation indication increase the average teleportation time, they lead to a decreased need for correcting the orientation after teleportation.

At Your Service: Designing Voice Assistant Personalities to Improve Automotive User Interfaces

Michael Braun (BMW Group Research, LMU Munich), Anja Mainz (LMU Munich), Ronee Chadowitz (BMW Group Research), Bastian Pfleging (Technische Universiteit Eindhoven), Florian Alt (Bundeswehr University, LMU Munich)

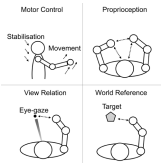


Session: On the Streets - Monday, 11:00, Room Boisdale 1

This paper investigates personalized voice characters for in-car speech interfaces. In particular, we report on how we designed different personalities for voice assistants and compared them in a real world driving study. Voice assistants have become important for a wide range of use cases, yet current interfaces are using the same style of auditory response in every situation, despite varying user needs and personalities. To close this gap, we designed four assistant personalities (Friend, Admirer, Aunt, and Butler) and compared them to a baseline Default in a between-subject study in real traffic conditions. Our results show higher likability and trust for assistants that correctly match the user's personality while we observed lower likability, trust, satisfaction, and usefulness for incorrectly matched personalities, each in comparison with the Default character. We discuss design aspects for voice assistants in different automotive use cases.

Behavioural Biometrics in VR: Identifying People from Body Motion and Relations in Virtual Reality

Ken Pfeuffer (Bundeswehr University), Matthias J Geiger (LMU Munich), Sarah Prange (University of Applied Sciences Munich), Lukas Mecke (University of Applied Sciences), Daniel Buschek (LMU Munich), Florian Alt (Bundeswehr University)



Session: Computational Approaches to Bodily Interaction - Thursday, 14:00, Room Carron 1

Every person is unique, with individual behavioural characteristics: how one moves, coordinates, and uses their body. In this paper we investigate body motion as behavioural biometrics for virtual reality. In particular, we look into which behaviour is suitable to identify a user. This is valuable in situations where multiple people use a virtual reality environment in parallel, for example in the context of authentication or to adapt the VR environment to users' preferences. We present a user study (N=22) where people perform controlled VR tasks (pointing, grabbing, walking, typing), monitoring their head, hand, and eye motion data over two sessions. These body segments can be arbitrarily combined into body relations, and we found that these movements and their combination lead to characteristic behavioural patterns. We present an extensive analysis of which motion/relation is useful to identify users in which tasks using classification methods. Our findings are beneficial for researchers and practitioners alike who aim to build novel adaptive and secure user interfaces in virtual reality.

Changing Perspective: A Co-Design Approach to Explore Future Possibilities of Divergent Hearing

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

Session: Future of Hearing - Wednesday, 11:00, Room Carron 1

Conventional hearing aids frame hearing impairment almost exclusively as a problem. In the present paper, we took an alternative approach by focusing on positive future possibilities of 'divergent hearing'. To this end, we developed a method to speculate simultaneously about not- yet-experienced positive meanings and not-yet-existing technology. First, we gathered already existing activities in which divergent hearing was experienced as an advantage rather than as a burden. These activities were then condensed into 'Prompts of Positive Possibilities' (PPP), such as "Creating a shelter to feel safe in". In performative sessions, participants were given these PPPs and 'Open Probes' to enact novel everyday activities. This led to 26 possible meanings and according devices, such as "Being able to listen back into the past with a rewinder". The paper provides valuable insights into the interests and expectations of people with divergent hearing as well as a methodological contribution to a possibility-driven design.

Honorable Mention

Clairbuoyance: Improving Directional Perception for Swimmers

Francisco Kiss (University of Stuttgart), Paweł W. Woźniak (Utrecht University), Felix Scheerer (University of Stuttgart), Julia Dominiak (Lodz University of Technology), Andrzej Romanowski (Lodz University of Technology), Albrecht Schmidt (LMU Munich)

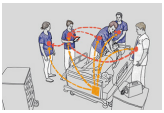
Session: Sport and Fitness - Tuesday, 16:00, Room Carron 1

While we usually have no trouble with orientation, our sense of direction frequently fails in the absence of a frame of reference. Open-water swimmers raise their heads to look for a reference point, since disorientation might result in exhaustion or even drowning. In this paper, we report on Clairbuoyance --- a system that provides feedback about the swimmer's orientation through lights mounted on swimming goggles. We conducted an experiment with two versions of Clairbuoyance: Discrete signals relative to a chosen direction, and continuous signals providing a sense of absolute direction. Participants swam to a series of targets. Proficient swimmers preferred the discrete mode; novice users the continuous one. We determined that both versions of Clairbuoyance enabled reaching the target faster than without the help of the system, although the discrete mode increased error. Based on the results, we contribute insights for designing directional guidance feedback for swimmers.

Honorable Mention

Cognitive Aids in Acute Care: Investigating How Cognitive Aids Affect and Support In-hospital Emergency

Tobias Grundgeiger (University of Würzburg), Stephan Huber (University of Würzburg), Daniel Reinhardt (University of Würzburg), Andreas Steinisch (University Hospital of Würzburg), Oliver Happel (University Hospital of Würzburg), Thomas Wurmb (University Hospital of Würzburg)

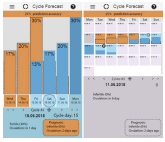


Session: Designing Decision Support - Monday, 11:00, Room Dochart 1

Cognitive aids – artefacts that support a user in the completion of a task at the time – have raised great interest to support healthcare staff during medical emergencies. However, the mechanisms of how cognitive aids support or affect staff remain understudied. We describe the iterative development of a tablet-based cognitive aid application to support in-hospital resuscitation team leaders. We report a summative evaluation of two different versions of the application. Finally, we outline the limitations of current explanations of how cognitive aids work and suggest an approach based on embodied cognition. We discuss how cognitive aids alter the task of the team leader (distributed cognition), the importance of the present team situation (socially situated), and the result of the interaction between mind and environment (sensorimotor coupling). Understanding and considering the implications of introducing cognitive aids may help to increase acceptance and effectiveness of cognitive aids and eventually improve patient safety.

Communicating Uncertainty in Fertility Prognosis

Hanna Schneider (LMU Munich), Julia Wayrauther (LMU Munich),
Mariam Hassib (Bundeswehr University Munich), Andreas Butz (LMU Munich)



Session: Self-tracking for Health - Monday, 16:00, Room Carron 1

Communicating uncertainty has been shown to provide positive effects on user understanding and decision-making. Surprisingly however, most personal health tracking applications fail to disclose the accuracy of their measurements and predictions. In the case of fertility tracking applications (FTAs), inaccurate predictions have already led to numerous unwanted pregnancies and law suits. However, integrating uncertainty into FTAs is challenging: Prediction accuracy is hard to understand and communicate, and its effect on users' trust and behavior is not well understood. We created a prototype for uncertainty visualizations for FTAs and evaluated it in a four-week field study with real users and their own data (N=9). Our results uncover far-reaching effects of communicating uncertainty: For example, users interpreted prediction accuracy as a proxy for their cycle health and as a security indicator for contraception. Displaying predicted and detected fertile phases next to each other helped users to understand uncertainty without negative emotional effects.

Designing for Reproducibility: A Qualitative Study of Challenges and Opportunities in High Energy Physics

Sebastian S. Feger (CERN and LMU Munich), Sünje Dallmeier-Tiessen (CERN),
Albrecht Schmidt (LMU Munich), Paweł W. Woźniak (Utrecht University)

Session: Humans' Work with Data - Wednesday, 9:00, Room Boisdale 2

Reproducibility should be a cornerstone of scientific research and is a growing concern among the scientific community and the public. Understanding how to design services and tools that support documentation, preservation and sharing is required to maximize the positive impact of scientific research. We conducted a study of user attitudes towards systems that support data preservation in High Energy Physics, one of science's most data-intensive branches. We report on our interview study with 12 experimental physicists, studying requirements and opportunities in designing for research preservation and reproducibility. Our findings suggest that we need to design for motivation and benefits in order to stimulate contributions and to address the observed scalability challenge. Therefore, researchers' attitudes towards communication, uncertainty, collaboration and automation need to be reflected in design. Based on our findings, we present a systematic view of user needs and constraints that define the design space of systems supporting reproducible practices.

Does It Feel Real? Using Tangibles with Different Fidelities to Build and Explore Scenes in Virtual Reality

Thomas Muender (University of Bremen), Anke V. Reinschluessel (University of Bremen), Sean Drewes (University of Bremen), Dirk Wenig (University of Bremen), Tanja Döring (University of Bremen), Rainer Malaka (University of Bremen)

Session: Making the Virtual Physical - Wednesday, 9:00, Room Dochart 2

Professionals in domains like film, theater, or architecture often rely on physical models to visualize spaces. With virtual reality (VR) new tools are available providing immersive experiences with correct perceptions of depth and scale. However, these lack the tangibility of physical models. Using tangible objects in VR can close this gap but creates the challenges of producing suitable objects and interacting with them with only the virtual objects visible. This work addresses these challenges by evaluating tangibles with three haptic fidelities: equal disc-shaped tangibles for all virtual objects, Lego-built tangibles, and 3D-printed tangibles resembling the virtual shapes. We present results from a comparative study on immersion, performance, and intuitive interaction and interviews with domain experts. The results show that 3D-printed objects perform best, but Lego offers a good trade-off between fast creation of tangibles and sufficient fidelity. The experts rate our approach as useful and would use all three versions.

Drag:on - A Virtual Reality Controller Providing Haptic Feedback Based on Drag and Weight Shift

André Zenner (DFKI, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

Session: Weighty Interactions - Tuesday, 9:00, Room Dochart 1

Standard controllers for virtual reality (VR) lack sophisticated means to convey a realistic, kinesthetic impression of size, resistance or inertia. We present the concept and implementation of Drag:on, an ungrounded shape-changing VR controller that provides dynamic passive haptic feedback based on drag, i.e. air resistance, and weight shift. Drag:on leverages the airflow occurring at the controller during interaction. By dynamically adjusting its surface area, the controller changes the drag and rotational inertia felt by the user. In a user study, we found that Drag:on can provide distinguishable levels of haptic feedback. Our prototype increases the haptic realism in VR compared to standard controllers and when rotated or swung improves the perception of virtual resistance. By this, Drag:on provides haptic feedback suitable for rendering different virtual mechanical resistances, virtual gas streams, and virtual objects differing in scale, material and fill state.

Effect of Orientation on Unistroke Touch Gestures

Sven Mayer (University of Stuttgart), Valentin Schwind (University of Stuttgart), Huy Viet Le (University of Stuttgart), Dominik Weber (University of Stuttgart), Jonas Vogelsang (University of Stuttgart), Johannes Wolf (University of Stuttgart), Niels Henze (University of Regensburg)

Session: Touch Interfaces - Monday, 16:00, Room AIsh 2

As touchscreens are the most successful input method of current mobile devices, touch gestures became a widely used input technique. While gestures provide users with advantages to express themselves, they also introduce challenges regarding accuracy and memorability. In this paper, we investigate the effect of a gesture's orientation on how well the gesture can be performed. We conducted a study in which participants performed systematically rotated unistroke gestures. For straight lines as well as for compound lines, we found that users tend to align gestures with the primary axes. We show that the error can be described by a Clausen function with R 2 = .93. Based on our findings, we suggest design implications and highlight the potential for recognizing flick gestures, visualizing gestures and improving recognition of compound gestures.

"Enable or Disable Gamification?" - Analyzing the Impact of Choice in a Gamified Image Tagging Task

Pascal Lessel (DFKI, Saarland Informatics Campus), Maximilian Altmeyer (DFKI, Saarland Informatics Campus), Lea Verena Schmeer (Saarland University, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

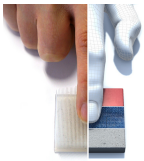
Session: Gamification - Wednesday, 14:00, Room Forth

This paper investigates a simple form of customization: giving users the choice to enable or disable gamification. We present a study (N=77) in the context of image tagging, in which a gamification approach was shown to be effective in previous work. In our case, some participants could enable or disable gamification after they had experienced the task with and without it. Other participants had no choice and did the task with or without game elements. The results indicate that those who are not attracted by the elements can be motivated to tag more through this choice. In contrast, those that like the elements are not affected by it. This suggests that systems should provide the option to disable gamification in the absence of more sophisticated tailoring.

Honorable Mention

Enhancing Texture Perception in Virtual Reality Using 3D-Printed Hair Structures

Donald Degraen (IVCI, Saarland Informatics Campus), André Zenner (DFKI, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)



Session: Making the Virtual Physical - Wednesday, 9:00, Room Dochart 2

Experiencing materials in virtual reality (VR) is enhanced by combining visual and haptic feedback. While VR easily allows changes to visual appearances, modifying haptic impressions remains challenging. Existing passive haptic techniques require access to a large set of tangible proxies. To reduce the number of physical representations, we look towards fabrication to create more versatile counterparts. In a user study, 3D-printed hairs with length varying in steps of 2.5 mm were used to influence the feeling of roughness and hardness. By overlaying fabricated hair with visual textures, the resolution of the user's haptic perception increased. As changing haptic sensations are able to elicit perceptual switches, our approach can extend a limited set of textures to a much broader set of material impressions. Our results give insights into the effectiveness of 3D-printed hair for enhancing texture perception in VR.

Evaluation of Appearance-Based Methods and Implications for Gaze-Based Applications

Xucong Zhang (Max Planck Institute for Informatics Saarland Informatics Campus), Yusuke Sugano (Osaka University, Graduate School of Information Science and Technology), Andreas Bulling (University of Stuttgart)

Session: Look, Smell, Draw - Wednesday, 16:00, Room Clyde Auditorium

Appearance-based gaze estimation methods that only require an off-the-shelf camera have significantly improved but they are still not yet widely used in the human-computer interaction (HCI) community. This is partly because it remains unclear how they perform compared to model-based approaches as well as dominant, special-purpose eye tracking equipment. To address this limitation, we evaluate the performance of state-of-the-art appearance-based gaze estimation for interaction scenarios with and without personal calibration, indoors and outdoors, for different sensing distances, as well as for users with and without glasses. We discuss the obtained findings and their implications for the most important gaze-based applications, namely explicit eye input, attentive user interfaces, gaze-based user modelling, and passive eye monitoring. To democratise the use of appearance-based gaze estimation and interaction in HCI, we finally present OpenGaze (www.opengaze.org), the first software toolkit for appearance-based gaze estimation and interaction.

ExerCube vs. Personal Trainer: Evaluating a Holistic, Immersive, and Adaptive Fitness Game Setup

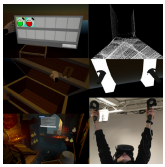
Anna Lisa Martin-Niedecken (Zürich University of the Arts), Katja Rogers (Ulm University), Laia Turmo Vidal (Uppsala University), Elena Márquez Segura (Uppsala University), Elisa D. Mekler (University of Basel)

Session: Get Out and Play - Tuesday, 11:00, Room Gala

Today's spectrum of playful fitness solutions features systems that are clearly game-first or fitness-first in design; hardly any sufficiently incorporate both areas. Consequently, existing applications and evaluations often lack in focus on attractiveness and effectiveness, which should be addressed on the levels of body, controller, and game scenario following a holistic design approach. To contribute to this topic and as a proof-of-concept, we designed the ExerCube, an adaptive fitness game setup. We evaluated participants' multi-sensory and bodily experiences with a non-adaptive and an adaptive ExerCube version and compared them with personal training to reveal insights to inform the next iteration of the ExerCube. Regarding flow, enjoyment and motivation, the ExerCube is on par with personal training. Results further reveal differences in perception of exertion, types and quality of movement, social factors, feedback, and audio experiences. Finally, we derive considerations for future research and development directions in holistic fitness game setups.

Exploring Interaction Fidelity in Virtual Reality: Object Manipulation and Whole-Body Movements

Katja Rogers (Ulm University), Jana Funke (Ulm University), Julian Frommel (Ulm University), Sven Stamm (Ulm University), Michael Weber (Ulm University)



Session: Gaming in Virtual Reality - Tuesday, 14:00, Room Hall 2

High degrees of interaction fidelity (IF) in virtual reality (VR) are said to improve user experience and immersion, but there is also evidence of low IF providing comparable experiences. VR games are now increasingly prevalent, yet we still do not fully understand the trade-off between realism and abstraction in this context. We conducted a lab study comparing high and low IF for object manipulation tasks in a VR game. In a second study, we investigated players' experiences of IF for whole-body movements in a VR game that allowed players to crawl underneath virtual boulders and 'dangle' along monkey bars. Our findings show that high IF is preferred for object manipulation, but for whole-body movements, moderate IF can suffice, as there is a trade-off with usability and social factors. We provide guidelines for the development of VR games based on our results.

ForceRay: Extending Thumb Reach via Force Input Stabilizes Device Grip for Mobile Touch Input

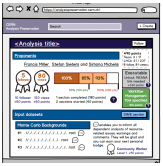
Christian Corsten (RWTH Aachen University), Marcel Lahaye (RWTH Aachen University), Jan Borchers (RWTH Aachen University), Simon Voelker (RWTH Aachen University)

Session: Mobile Interactions - Wednesday, 11:00, Room Clyde Auditorium

Smartphones are used predominantly one-handed, using the thumb for input. Many smartphones, however, have grown beyond 5". Users cannot tap everywhere on these screens without destabilizing their grip. ForceRay (FR) lets users aim at an out-of-reach target by applying a force touch at a comfortable thumb location, casting a virtual ray towards the target. Varying pressure moves a cursor along the ray. When reaching the target, quickly lifting the thumb selects it. In a first study, FR was 195 ms slower and had a 3% higher selection error than the best existing technique, BezelCursor (BC), but FR caused significantly less device movement than all other techniques, letting users maintain a steady grip and removing their concerns about device drops. A second study showed that an hour of training speeds up both BC and FR, and that both are equally fast for targets at the screen border.

Gamification in Science: A Study of Requirements in the Context of Reproducible Research

Sebastian S. Feger (CERN and LMU Munich), Sünje Dallmeier-Tiessen (CERN), Paweł W. Woźniak (Utrecht University), Albrecht Schmidt (LMU Munich)



Session: Gamification - Wednesday, 14:00, Room Forth

The need for data preservation and reproducible research is widely recognized in the scientific community. Yet, researchers often struggle to find the motivation to contribute to data repositories and to use tools that foster reproducibility. In this paper, we explore possible uses of gamification to support reproducible practices in High Energy Physics. To understand how gamification can be effective in research tools, we participated in a workshop and performed interviews with data analysts. We then designed two interactive prototypes of a research preservation service that use contrasting gamification strategies. The evaluation of the prototypes showed that gamification needs to address core scientific challenges, in particular the fair reflection of quality and individual contribution. Through thematic analysis, we identified four themes which describe perceptions and requirements of gamification in research: Contribution, Metrics, Applications and Scientific practice. Based on these, we discuss design implications for gamification in science.

Gamified Ads: Bridging the Gap Between User Enjoyment and the Effectiveness of Online Ads

Maximilian Altmeyer (DFKI, Saarland Informatics Campus), Kathrin Dernbecher (DFKI, Saarland Informatics Campus), Vladislav Hnatovskiy (DFKI, Saarland Informatics Campus), Marc Schubhan (DFKI, Saarland Informatics Campus), Pascal Lessel (DFKI, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

Session: Gamification - Wednesday, 14:00, Room Forth

While the use of ad blockers prevents negative impacts of advertising on user experience, it poses a serious threat to the business model of commercial web services and freely available content on the web. As an alternative, we investigate the user enjoyment and the advertising effectiveness of playfully deactivating ads. We created eight game concepts, performed a pre-study assessing the users' perception of them (N=50) and implemented three well-perceived ones. In a lab study (N=72), we found that these game concepts are more enjoyable than deactivating ads without game elements. Additionally, one game concept was even preferred over using an ad blocker. Notably, playfully deactivating ads was shown to have a positive impact on users' brand and product memory, enhancing the advertising effectiveness. Thus, our results indicate that playfully deactivating ads is a promising way of bridging the gap between user enjoyment and effective advertising.

Grasping Microgestures: Eliciting Single-hand Microgestures for Handheld Objects

Adwait Sharma (Saarland Informatics Campus, Saarland University HCI Lab), Joan Sol Roo (Saarland Informatics Campus, Saarland University HCI Lab), Jürgen Steimle (Saarland Informatics Campus, Saarland University HCI Lab)

Session: Gesture Sensing - Tuesday, 16:00, Room Boisdale 1

Single-hand microgestures have been recognized for their potential to support direct and subtle interactions. While pioneering work has investigated sensing techniques and presented first sets of intuitive gestures, we still lack a systematic understanding of the complex relationship between microgestures and various types of grasps. This paper presents results from a user elicitation study of microgestures that are performed while the user is holding an object. We present an analysis of over 2,400 microgestures performed by 20 participants, using six different types of grasp and a total of 12 representative handheld objects of varied geometries and size. We expand the existing elicitation method by proposing statistical clustering on the elicited gestures. We contribute detailed results on how grasps and object geometries affect single-hand microgestures, preferred locations, and fingers used. We also present consolidated gesture sets for different grasps and object size. From our findings, we derive recommendations for the design of microgestures compatible with a large variety of handheld objects.

Best Paper

GuerillaWarfare and the Use of New (and Some Old) Technology: Lessons from FARC-EP's Armed Struggle in Colombia

Débora de Castro Leal (University of Siegen), Max Krueger (University of Siegen), Kaoru Misaki (International Institute of Socio-Informatics), David Randall (University of Siegen), Volker Wulf (University of Siegen)

Session: Empowerment and Minorities - Wednesday, 11:00, Room Dochart 1

Studying armed political struggles from a CSCW perspective can throw the complex interactions between culture, technology, materiality and political conflict into sharp relief. Such studies highlight interrelations that otherwise remain under-remarked upon, despite their severe consequences. The present paper provides an account of the armed struggle of one of the Colombian guerrillas, FARC-EP, with the Colombian army. We document how radio-based communication became a crucial, but ambiguous infrastructure of war. The sudden introduction of localization technologies by the Colombian army presented a lethal threat to the guerrilla group. Our interviewees report a severe learning process to diminish this new risk, relying on a combination of informed beliefs and significant technical understanding. We end with a discussion of the role of HCI in considerations of ICT use in armed conflicts and introduce the concept of counter-appropriation as process of adapting one's practices to other's appropriation of technology in conflict.

In UX We Trust: Investigation of Aesthetics and Usability of Driver-Vehicle Interfaces and Their Impact on the Perception of Automated Driving

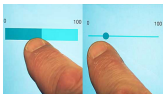
Anna-Katharina Frison (TH Ingolstadt & Johannes Kepler University), Philipp Wintersberger (TH Ingolstadt & Johannes Kepler University), Andreas Riener (TH Ingolstadt), Clemens Schartmüller (TH Ingolstadt & Johannes Kepler University), Linda Ng Boyle (University of Washington), Erika Miller (Colorado State University), Klemens Weigl (Katholic University of Eichstätt-Ingolstadt & TH Ingolstadt)

Session: On the Streets - Monday, 11:00, Room Boisdale 1

In the evolution of technical systems, freedom from error and early adoption plays a major role for market success and to maintain competitiveness. In the case of automated driving, we see that faulty systems are put into operation and users trust these systems, often without any restrictions. Trust and use are often associated with users' experience of the driver-vehicle interfaces and interior design. In this work, we present the results of our investigations on factors that influence the perception of automated driving. In a simulator study, N=48 participants had to drive a SAE level 2 vehicle with either perfect or faulty driving function. As a secondary activity, participants had to solve tasks on an infotainment system with varying aesthetics and usability (2x2). Results reveal that the interaction of conditions significantly influences trust and UX of the vehicle system. Our conclusion is that all aspects of vehicle design cumulate to system and trust perception.

Investigating the Effect of Orientation and Visual Style on Touchscreen Slider Performance

Ashley Colley (University of Lapland), Sven Mayer (University of Stuttgart),
Niels Henze (University of Regensburg)



Session: Human-Smartphone Interaction - Monday, 14:00, Room Hall 2

Sliders are one of the most fundamental components used in touchscreen user interfaces (UIs). When entering data using a slider, errors occur due e.g. to visual perception, resulting in inputs not matching what is intended by the user. However, it is unclear if the errors occur uniformly across the full range of the slider or if there are systematic offsets. We conducted a study to assess the errors occurring when entering values with horizontal and vertical sliders as well as two common visual styles. Our results reveal significant effects of slider orientation and style on the precision of the entered values. Furthermore, we identify systematic offsets that depend on the visual style and the target value. As the errors are partially systematic, they can be compensated to improve users' precision. Our findings provide UI designers with data to optimize user experiences in the wide variety of application areas where slider based touchscreen input is used.

Kyub: a 3D Editor for Modeling Sturdy Laser-Cut Objects

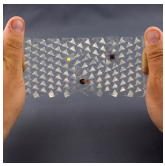
Patrick Baudisch (HPI), Arthur Silber (HPI), Yannis Kommana (HPI), Milan Gruner (HPI),
Ludwig Wall (HPI), Kevin Reuss (HPI), Lukas Heilman (HPI), Robert Kovacs (HPI),
Daniel Rechlitz (HPI), Thijs Roumen (HPI)

Session: Fabrication - Monday, 11:00, Room Alsh 2

We present an interactive editing system for laser cutting called kyub. Kyub allows users to create models efficiently in 3D, which it then unfolds into the 2D plates laser cutters expect. Unlike earlier systems, such as FlatFitFab, kyub affords construction based on closed box structures, which allows users to turn very thin material, such as 4mm plywood, into objects capable of withstanding large forces, such as chairs users can actually sit on. To afford such sturdy construction, every kyub project begins with a simple finger-joint "boxel"—a structure we found to be capable of withstanding over 500kg of load. Users then extend their model by attaching additional boxels. Boxels merge automatically, resulting in larger, yet equally strong structures. While the concept of stacking boxels allows kyub to offer the strong affordance and ease of use of a voxel-based editor, boxels are not confined to a grid and readily combine with kuyb's various geometry deformation tools. In our technical evaluation, objects built with kyub withstood hundreds of kilograms of loads. In our user study, non-engineers rated the learnability of kyub 6.1/7.

LASEC: Instant Fabrication of Stretchable Circuits Using a Laser Cutter

Daniel Groeger (Saarland Informatics Campus, Saarland University HCI Lab),
Jürgen Steimle (Saarland Informatics Campus, Saarland University HCI Lab)

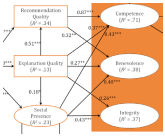


Session: Fabricating Electronics - Wednesday, 9:00, Room Hall 1

This paper introduces LASEC, the first technique for instant do-it-yourself fabrication of circuits with custom stretchability on a conventional laser cutter and in a single pass. The approach is based on integrated cutting and ablation of a two-layer material using parametric design patterns. These patterns enable the designer to customize the desired stretchability of the circuit, to combine stretchable with non-stretchable areas, or to integrate areas of different stretchability. For adding circuits on such stretchable cut patterns, we contribute routing strategies and a real-time routing algorithm. An interactive design tool assists designers by automatically generating patterns and circuits from a high-level specification of the desired interface. The approach is compatible with off-the-shelf materials and can realize transparent interfaces. Several application examples demonstrate the versatility of the novel technique for applications in wearable computing, interactive textiles, and stretchable input devices.

Let Me Explain: Impact of Personal and Impersonal Explanations on Trust in Recommender Systems

Johannes Kunkel (University of Duisburg-Essen), Tim Donkers (University of Duisburg-Essen),
Lisa Michael (University of Duisburg-Essen), Catalin-Mihai Barbu (University of Duisburg-Essen),
Jürgen Ziegler (University of Duisburg-Essen)



Session: Algorithmic Systems and Society - Wednesday, 14:00, Room Dochart 2

Trust in a Recommender System (RS) is crucial for its overall success. However, it remains underexplored whether users trust personal recommendation sources (\ie other humans) more than impersonal sources (\ie conventional RS), and, if they do, whether the perceived quality of explanation provided account for the difference. We conducted an empirical study in which we compared these two sources of recommendations and explanations. Human advisors were asked to explain movies they recommended in short texts while the RS created explanations based on item similarity. Our experiment comprised two rounds of recommending. Over both rounds the quality of explanations provided by users was assessed higher than the quality of the system's explanations. Moreover, explanation quality significantly influenced perceived recommendation quality as well as trust in the recommendation source. Consequently, we suggest that RS should provide richer explanations in order to increase their perceived recommendation quality and trustworthiness.

Honorable Mention

Like a Second Skin: Understanding How Epidermal Devices Affect Human Tactile Perception

Aditya Shekhar Nittala (Saarland Informatics Campus, Saarland University HCI Lab), Klaus Kruttwig (INM-Leibniz Institute for New Materials), Jaeyeon Lee (HCI Lab), Roland Bennewitz (INM-Leibniz Institute for New Materials), Eduard Arzt (INM-Leibniz Institute for New Materials), Jürgen Steimle (Saarland Informatics Campus, Saarland University HCI Lab)

Session: Skin and Textiles - Thursday, 14:00, Room Hall 2

We report on the results of three psychophysical experiments that investigated the effect of epidermal devices of different rigidity on passive and active tactile perception. We analyzed human tactile sensitivity thresholds, two-point discrimination thresholds, and roughness discrimination abilities on three different body locations (fingertip, hand, forearm). Generally, a correlation was found between device rigidity and tactile sensitivity thresholds as well as roughness discrimination ability. Surprisingly, thin epidermal devices based on PDMS with a hundred times the rigidity of commonly used tattoo paper resulted in comparable levels of tactile acuity. The material offers the benefit of increased robustness against wear and the option to re-use the device. Based on our findings, we derive design recommendations for epidermal devices that combine tactile perception with device robustness.

Honorable Mention

Mind the Tap: Assessing Foot-Taps for Interacting with Head-Mounted Displays

Florian Müller (TU Darmstadt), Joshua McManus (Simon Fraser University), Sebastian Günther (TU Darmstadt), Martin Schmitz (TU Darmstadt), Max Mühlhäuser (TU Darmstadt), Markus Funk (TU Darmstadt)

Session: X Reality Evaluations - Tuesday, 9:00, Room Dochart 2

From voice commands and air taps to touch gestures on frames: Various techniques for interacting with head-mounted displays (HMDs) have been proposed. While these techniques have both benefits and drawbacks dependent on the current situation of the user, research on interacting with HMDs has not concluded yet. In this paper, we add to the body of research on interacting with HMDs by exploring foot-tapping as an input modality. Through two controlled experiments with a total of 36 participants, we first explore direct interaction with interfaces that are displayed on the floor and require the user to look down to interact. Secondly, we investigate indirect interaction with interfaces that, although operated by the user's feet, are always visible as they are floating in front of the user. Based on the results of the two experiments, we provide design recommendations for direct and indirect foot-based user interfaces.

Multi-Modal Approaches for Post-Editing Machine Translation

Nico Herbig (DFKI, Saarland Informatics Campus), Santanu Pal (Saarland University, Saarland Informatics Campus), Josef van Genabith (Saarland University, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

Session: Text, Language, and Communication - Thursday, 11:00, Room Forth

Current advances in machine translation increase the need for translators to switch from traditional translation to post-editing (PE) of machine-translated text, a process that saves time and improves quality. This affects the design of translation interfaces, as the task changes from mainly generating text to correcting errors within otherwise helpful translation proposals. Our results of an elicitation study with professional translators indicate that a combination of pen, touch, and speech could well support common PE tasks, and received high subjective ratings by our participants. Therefore, we argue that future translation environment research should focus more strongly on these modalities in addition to mouse- and keyboard-based approaches. On the other hand, eye tracking and gesture modalities seem less important. An additional interview regarding interface design revealed that most translators would also see value in automatically receiving additional resources when a high cognitive load is detected during PE.

NaviBike: Comparing Unimodal Navigation Cues for Child Cyclists

Andrii Matviienko (OFFIS - Institute for IT), Swamy Ananthanarayan (University of Oldenburg), Abdallah El Ali (Centrum Wiskunde & Informatica), Wilko Heuten (OFFIS - Institute for IT), Susanne Boll (University of Oldenburg)

Session: On the Streets - Monday, 11:00, Room Boisdale 1

Navigation systems for cyclists are commonly screen-based devices mounted on the handlebar which show map information. Typically, adult cyclists have to explicitly look down for directions. This can be distracting and challenging for children, given their developmental differences in motor and perceptual-motor abilities compared with adults. To address this issue, we designed different unimodal cues and explored their suitability for child cyclists through two experiments. In the first experiment, we developed an indoor bicycle simulator and compared auditory, light, and vibrotactile navigation cues. In the second experiment, we investigated these navigation cues in-situ in an outdoor practice test track using a mid-size tricycle. To simulate road distractions, children were given an additional auditory task in both experiments. We found that auditory navigational cues were the most understandable and the least prone to navigation errors. However, light and vibrotactile cues might be useful for educating younger child cyclists.

On the Latency of USB-Connected Input Devices

Raphael Wimmer (University of Regensburg), Andreas Schmid (University of Regensburg), Florian Bockes (University of Regensburg)

Session: Developers, Developers, Developers! - Thursday, 9:00, Room Dochart 1

We propose a method for accurately and precisely measuring the intrinsic latency of input devices and document measurements for 36 keyboards, mice and gamepads connected via USB. Our research shows that devices differ not only in average latency, but also in the distribution of their latencies, and that forced polling at 1000 Hz decreases latency for some but not all devices. Existing practices - measuring end-to-end latency as a proxy of input latency and reporting only mean values and standard deviations - hide these characteristic latency distributions caused by device intrinsics and polling rates. A probabilistic model of input device latency demonstrates these issues and matches our measurements. Thus, our work offers guidance for researchers, engineers, and hobbyists who want to measure the latency of input devices or select devices with low latency.

Online, VR, AR, Lab, and In-Situ: Comparison of Research Methods to Evaluate Smart Artifacts

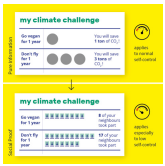
Alexandra Voit (University of Stuttgart), Sven Mayer (University of Stuttgart), Valentin Schwind (University of Stuttgart), Niels Henze (University of Regensburg)

Session: X Reality Evaluations - Tuesday, 9:00, Room Dochart 2

Empirical studies are a cornerstone of HCI research. Technical progress constantly enables new study methods. Online surveys, for example, make it possible to collect feedback from remote users. Progress in augmented and virtual reality enables to collect feedback with early designs. In-situ studies enable researchers to gather feedback in natural environments. While these methods have unique advantages and disadvantages, it is unclear if and how using a specifc method afects the results. Therefore, we conducted a study with 60 participants comparing fve different methods (online, virtual reality, augmented reality, lab setup, and in-situ) to evaluate early prototypes of smart artifacts. We asked participants to assess four diferent smart artifacts using standardized questionnaires. We show that the method signifcantly afects the study result and discuss implications for HCI research. Finally, we highlight further directions to overcome the efect of the used methods.

Only one item left? Heuristic Information Trumps Calorie Count When Supporting Healthy Snacking Under Low Self-Control

Daniel Reinhardt (University of Würzburg) and Jörn Hurtienne (University of Würzburg)



Session: Computational Approaches to Bodily Interaction - Thursday, 14:00, Room Carron 1

Pursuing the goal of a healthy diet may be challenging, especially when self-control resources are low. Yet many persuasive user interfaces fostering healthy choices are designed for situations with ample self-control, e.g. showing nutritional information to support reflective decision making. In this paper we propose that under low self-control, persuasive user interfaces need to rely on simple heuristic decision making to be successful. We report an experiment that tested this assumption in a 2 (low vs. high self-control) x 2 (calorie vs. heuristic information) design. The results reveal a significant interaction effect. Participants with low self-control resources chose the healthy snack more often when snacks were labelled with heuristic information than when they were labelled with calorie information. Both strategies were about equally successful for participants with high self-control. Exploiting situations of low self-control with heuristic information is a new and promising approach to designing persuasive technology for healthy eating.

Passquerade: Improving Error Correction of Text Passwords on Mobile Devices by using Graphic Filters for Password Masking

Mohamed Khamis (University of Glasgow & LMU Munich), Tobias Seitz (LMU Munich), Leonhard Mertl (LMU Munich), Alice Nguyen (LMU Munich), Mario Schneller (LMU Munich), Zhe Li (LMU Munich)

Session: Are You Sure It's Me? - Wednesday, 11:00, Room Hall 1

Entering text passwords on mobile devices is a significant challenge. Current systems either display passwords in plain text: making them visible to bystanders, or replace characters with asterisks shortly after they are typed: making editing them harder. This work presents a novel approach to mask text passwords by distorting them using graphical filters. Distorted passwords are difficult to observe by attackers because they cannot mentally reverse the distortions. Yet passwords remain readable by their owners because humans can recognize visually distorted versions of content they saw before. We present results of an online questionnaire and a user study where we compared Color-halftone, Crystallize, Blurring, and Mosaic filters to Plain text and Asterisks when 1) entering, 2) editing, and 3) shoulder surfing one-word passwords, random character passwords, and passphrases. Rigorous analysis shows that Color-halftone and Crystallize filters significantly improve editing speed, editing accuracy and observation resistance compared to current approaches.

Personal Mobile Messaging in Context: Chat Augmentations for Expressiveness and Awareness

Daniel Buschek (LMU Munich), Mariam Hassib (LMU Munich),
Florian Alt (LMU Munich and Munich University of Applied Sciences)

Session: Augmenting Interactions - Thursday, 11:00, Room Hall 1

Mobile text messaging is one of the most important communication channels today, but it suffers from lack of expressiveness, context and emotional awareness, compared to face-to-face communication. We address this problem by augmenting text messaging with information about users and contexts. We present and reflect on lessons learned from three field studies, in which we deployed augmentation concepts as prototype chat apps in users' daily lives. We studied (1) subtly conveying context via dynamic font personalisation (TapScript), (2) integrating and sharing physiological data - namely heart rate - implicitly or explicitly (HeartChat) and (3) automatic annotation of various context cues: music, distance, weather and activities (ContextChat). Based on our studies, we discuss chat augmentation with respect to privacy concerns, understandability, connectedness and inferring context in addition to methodological lessons learned. Finally, we propose a design space for chat augmentation to guide future research, and conclude with practical design implications.

Honorable Mention

Springlets: Expressive, Flexible and Silent On-Skin Tactile Interfaces

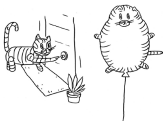
Nur Al-huda Hamdan (RWTH Aachen University), Adrian Wagner (RWTH Aachen University), Simon Voelker (RWTH Aachen University), Jürgen Steimle (Saarland Informatics Campus, Saarland University HCI Lab), Jan Borchers (RWTH Aachen University)

Session: Vibrotactile Feedback - Monday, 16:00, Room Carron 2

We introduce Springlets, expressive, non-vibrating mechano- tactile interfaces on the skin. Embedded with shape memory alloy springs, we implement Springlets as thin and flexible stickers to be worn on various body locations, thanks to their silent operation even on the neck and head. We present a technically simple and rapid technique for fabricating a wide range of Springlet interfaces and computer-generated tactile patterns. We developed Springlets for six tactile primitives: pinching, directional stretching, pressing, pulling, dragging, and expanding. A study placing Springlets on the arm and near the head demonstrates Springlets' effectiveness and wearability in both stationary and mobile situations. We explore new interactive experiences in tactile social communication, physical guidance, health interfaces, navigation, and virtual reality gaming, enabled by Springlets' unique and scalable form factor.

The Inflatable Cat: Idiosyncratic Ideation Of Smart Objects For The Home

Arne Berger (TU Chemnitz), William Odom (Simon Fraser University), Michael Storz (TU Chemnitz), Andreas Bischof (TU Chemnitz), Albrecht Kurze (TU Chemnitz), Eva Hornecker (Bauhaus-Universität Weimar)



Session: Designing the Things in IoT - Wednesday, 14:00, Room Clyde Auditorium

Research on product experience has a history in investigating the sensory and emotional qualities of interacting with objects. However, this notion has not been fully expanded to the design space of co-designing smart objects. In this paper, we report on findings from a series of co-design workshops where we used the toolkit Loaded Dice in conjunction with a card set that aimed to support participants in reflecting the sensory qualities of domestic smart objects. We synthesize and interpret findings from our study to help illustrate how the workshops supported co-designers in creatively ideating concepts for emotionally valuable smart objects that better connect personal inputs with the output of smart objects. Our work contributes a case example of how a co-design approach that emphasizes situated sensory exploration can be effective in enabling co-designers to ideate concepts of idiosyncratic smart objects that closely relate to the characteristics of their domestic living situations.

The Mental Image Revealed by Gaze Tracking

Xi Wang (Technische Universität Berlin), Andreas Ley (Technische Universität Berlin), Sebastian Koch (Technische Universität Berlin), David Lindlbauer (Technische Universität Berlin & ETH Zurich), James Hays (Georgia Institute of Technology), Kenneth Holmqvist (Universität Regensburg), Marc Alexa (Technische Universität Berlin)

Session: All Eyes On Us: Gaze Interactions - Monday, 16:00, Room Hall 2

Humans involuntarily move their eyes when retrieving an image from memory. This motion is often similar to actually observing the image. We suggest to exploit this behavior as a new modality in human computer interaction, using the motion of the eyes as a descriptor of the image. Interaction requires the user's eyes to be tracked but no voluntary physical activity. We perform a controlled experiment and develop matching techniques using machine learning to investigate if images can be discriminated based on the gaze patterns recorded while users merely think about image. Our results indicate that image retrieval is possible with an accuracy significantly above chance. We also show that this result generalizes to images not used during training of the classifier and extends to uncontrolled settings in a realistic scenario.

The Role of Physical Props in VR Climbing Environments

Peter Schulz (University of Bremen), Dmitry Alexandrovsky (University of Bremen), Felix Putze (University of Bremen), Rainer Malaka (University of Bremen), Johannes Schöning (University of Bremen)

Session: Virtual Reality - Tuesday, 11:00, Room Forth

Dealing with fear of falling is a challenge in sport climbing. Virtual reality (VR) research suggests that using physical and reality-based interaction increases the presence in VR. In this paper, we present a study that investigates the influence of physical props on presence, stress and anxiety in a VR climbing environment involving whole body movement. To help climbers overcoming fear of falling, we compared three different conditions: Climbing in reality at 10 m height, physical climbing in VR (with props attached to the climbing wall) and virtual climbing in VR using game controllers. From subjective reports and biosignals, our results show that climbing with props in VR increases the anxiety and sense of realism in VR for sport climbing. This suggests that VR in combination with physical props are an effective simulation setup to induce the sense of height.

Honorable Mention

Transcalibur: A Weight Shifting Virtual Reality Controller for 2D Shape Rendering based on Computational Perception Model

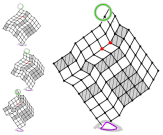
Jotaro Shigeyama (HPI), Takeru Hashimoto (University of Tokyo), Shigeo Yoshida (University of Tokyo), Takuji Narumi (University of Tokyo), Tomohiro Tanikawa (University of Tokyo), Michitaka Hirose (University of Tokyo)

Session: Weighty Interactions - Tuesday, 9:00, Room Dochart 1

Humans can estimate the shape of a wielded object through the illusory feeling of the mass properties of the object obtained using their hands. Even though the shape of hand-held objects influences immersion and realism in virtual reality (VR), it is difficult to design VR controllers for rendering desired shapes according to the perceptions derived from the illusory effects of mass properties and shape perception. We propose Transcalibur, which is a hand-held VR controller that can render a 2D shape by changing its mass properties on a 2D planar area. We built a computational perception model using a data-driven approach from the collected data pairs of mass properties and perceived shapes. This enables Transcalibur to easily and effectively provide convincing shape perception based on complex illusory effects. Our user study showed that the system succeeded in providing the perception of various desired shapes in a virtual environment.

Understanding Metamaterial Mechanisms

Alexandra Ion (HPI), David Lindlbauer (TU Berlin, ETH Zurich), Philipp Herholz (ETH Zurich), Marc Alexa (ETH Zurich), Patrick Baudisch (HPI)

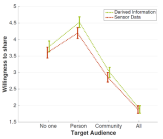


Session: Fabrication - Monday, 11:00, Room Alsh 2

In this paper, we establish the underlying foundations of mechanisms that are composed of cell structures—known as metamaterial mechanisms. Such metamaterial mechanisms were previously shown to implement complete mechanisms in the cell structure of a 3D printed material, without the need for assembly. However, their design is highly challenging. A mechanism consists of many cells that are interconnected and impose constraints on each other. This leads to unobvious and non-linear behavior of the mechanism, which impedes user design. In this work, we investigate the underlying topological constraints of such cell structures and their influence on the resulting mechanism. Based on these findings, we contribute a computational design tool that automatically creates a metamaterial mechanism from userdefined motion paths. This tool is only feasible because our novel abstract representation of the global constraints highly reduces the search space of possible cell arrangements.

Understanding the Impact of Information Representation on Willingness to Share Information

Stefan Schneegass (University of Duisburg-Essen, paluno), Romina Poguntke (University of Stuttgart), Tonja Machulla (LMU München)



Session: UX Theory - Monday, 14:00, Room Boisdale 2

Since the release of the first activity tracker, there has been a steady increase in the number of sensors embedded in wearable devices and with it in the amount and diversity of information that can be derived from these sensors. This development leads to novel privacy threats for users. In a web survey with 248 participants, we explored whether users' willingness to share private data is dependent on how the data is requested by an application. Specifically, requests can be formulated as access to sensor data or as access to information derived from the sensor data (e.g., accelerometer vs. sleep quality). We show that non-expert users lack an understanding of how the two representation levels relate to each other. The results suggest that the willingness to share sensor data over derived information is governed by whether the derived information has positive or negative connotations (e.g., training intensity vs. life expectancy). Using the results of the survey, we derive implications for supporting users in protecting their private data collected via wearable sensors.

Understanding the Social Acceptability of Mobile Devices using the Stereotype Content Model

Valentin Schwind (University of Stuttgart), Niklas Deierlein (University of Hagen), Romina Poguntke (University of Stuttgart), Niels Henze (University of Regensburg)

Session: Applications of Psychological Theory - Tuesday, 11:00, Room Clyde Auditorium

Understanding social perception is important for designing mobile devices that are socially acceptable. Previous work not only investigated the social acceptability of mobile devices and interaction techniques but also provided tools to measure social acceptance. However, we lack a robust model that explains the underlying factors that make devices socially acceptable. In this paper, we consider mobile devices as social objects and investigate if the stereotype content model (SCM) can be applied to those devices. Through a study that assesses combinations of mobile devices and group stereotypes, we show that mobile devices have a systematic effect on the stereotypes' warmth and competence. Supported by a second study, which combined mobile devices without a specific stereotypical user, our result suggests that mobile devices are perceived stereotypically by themselves. Our combined results highlight mobile devices as social objects and the importance of considering stereotypes when assessing social acceptance of mobile devices.

Usability of Gamified Knowledge Learning in VR and Desktop-3D

Sebastian Oberdörfer (University of Würzburg), David Heidrich (University of Würzburg), Marc Erich Latoschik (University of Würzburg)

Session: VR/AR in Collaborative Settings - Thursday, 9:00, Room Alsh 2

Affine Transformations (ATs) often escape an intuitive approach due to their high complexity. Therefore, we developed GEtiT that directly encodes ATs in its game mechanics and scales the knowledge's level of abstraction. This results in an intuitive application as well as audiovisual presentation of ATs and hence in a knowledge learning. We also developed a specific Virtual Reality (VR) version to explore the effects of immersive VR on the learning outcomes. This paper presents our approach of directly encoding abstract knowledge in game mechanics, the conceptual design of GEtiT and its technical implementation. Both versions are compared in regard to their usability in a user study. The results show that both GEtiT versions induce a high degree of flow and elicit a good intuitive use. They validate the effectiveness of the design and the resulting knowledge application requirements. Participants favored GEtiT VR thus showing a potentially higher learning quality when using VR.

Using Presence Questionnaires in Virtual Reality

Valentin Schwind (University of Stuttgart), Pascal Knierim, (LMU),
Nico Haas (University of Stuttgart), Niels Henze (University of Regensburg)

Session: X Reality Evaluations - Tuesday, 9:00, Room Dochart 2

Virtual Reality (VR) is gaining increasing importance in science, education, and entertainment. A fundamental characteristic of VR is creating presence, the experience of 'being' or 'acting', when physically situated in another place. Measuring presence is vital for VR research and development. It is typically repeatedly assessed through questionnaires completed after leaving a VR scene. Requiring participants to leave and re-enter the VR costs time and can cause disorientation. In this paper, we investigate the effect of completing presence questionnaires directly in VR. Thirty-six participants experienced two immersion levels and filled three standardized presence questionnaires in the real world or VR. We found no effect on the questionnaires' mean scores; however, we found that the variance of those measures significantly depends on the realism of the virtual scene and if the subjects had left the VR. The results indicate that, besides reducing a study's duration and reducing disorientation, completing questionnaires in VR does not change the measured presence but can increase the consistency of the variance.

Honorable Mention

Using Time and Space Efficiently in Driverless Cars: Findings of a Co-Design Study

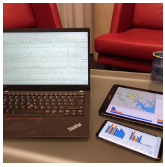
Gunnar Stevens (University of Siegen), Paul Bossauer (Bonn-Rhein-Sieg University), Stephanie Vonholdt (Bonn-Rhein-Sieg University), Christina Pakusch (Bonn-Rhein-Sieg University)

Session: Cars - Tuesday, 16:00, Room Clyde Auditorium

The alternative use of travel time is one of the widely discussed benefits of driverless cars. We therefore conducted 14 co-design sessions to examine how people manage their time, to determine how they perceive the value of time in driverless cars and to derive design implications. Our findings suggest that driverless mobility will affect both people's use of travel time as well as their time management in general. The participants repeatedly stated the desire of completing tasks while traveling to save time for activities that are normally neglected in their everyday life. Using travel time efficiently requires using car space efficiently, too. We found out that the design concept of tiny houses could serve as common design pattern to deal with the limited space within cars and support diverse needs.

Vistribute: Distributing Interactive Visualizations in Dynamic Multi-Device Setups

Tom Horak (Technische Universität Dresden), Andreas Mathisen (Aarhus University), Clemens N. Klokmose (Aarhus University), Raimund Dachselt (Technische Universität Dresden), Niklas Elmqvist (University of Maryland)



Session: Displays, Devices, and Interaction for Visualization - Tuesday, 14:00, Room Hall 1

We present Vistribute, a framework for the automatic distribution of visualizations and UI components across multiple heterogeneous devices. Our framework consists of three parts: (i) a design space considering properties and relationships of interactive visualizations, devices, and user preferences in multi-display environments; (ii) specific heuristics incorporating these dimensions for guiding the distribution for a given interface and device ensemble; and (iii) a web-based implementation instantiating these heuristics to automatically generate a distribution as well as providing interaction mechanisms for user-defined adaptations. In contrast to existing UI distribution systems, we are able to infer all required information by analyzing the visualizations and devices without relying on additional input provided by users or programmers. In a qualitative study, we let experts create their own distributions and rate both other manual distributions and our automatic ones. We found that all distributions provided comparable quality, hence validating our framework.

VRsneaky: Increasing Presence in VR Through Gait-Aware Auditory Feedback

Matthias Hoppe (LMU Munich), Jakob Karolus (LMU Munich), Felix Dietz (LMU Munich), Paweł W. Woźniak (University Utrecht), Albrecht Schmidt (LMU Munich), Tonja Machulla (LMU Munich)

Session: VR and Immersive Video - Tuesday, 11:00, Room Alsh 2

While Virtual Reality continues to increase in fidelity, it remains an open question how to effectively reflect the user's movements and provide congruent feedback in virtual environments. We present VRsneaky, a system for producing auditory movement feedback, which helps participants orient themselves in a virtual environment by providing footstep sounds. The system reacts to the user's specific gait features and adjusts the audio accordingly. In a user study with 28 participants, we found that VRsneaky increases users' sense of presence as well as awareness of their own posture and gait. Additionally, we find that increasing auditory realism significantly influences certain characteristics of participants' gait. Our work shows that gait-aware audio feedback is a means to increase presence in virtual environments. We discuss opportunities and design requirements for future scenarios where users walk through immersive virtual worlds.

Further Publications 45

Late Breaking Work 28

3DTactileDraw: A Tactile Pattern Design Interface for Complex Arrangements of Actuators

Oliver Beren Kaul (Leibniz University Hannover), Leonard Hansing (Leibniz University Hannover), Michael Rohs (Leibniz University Hannover)

Affective Assistants: a Matter of States and Traits

Michael Braun (BMW Group Research, LMU Munich), Florian Alt (Bundeswehr University Munich, LMU Munich)

Analysis of Previsualization Tasks for Animation, Film and Theater

Thomas Muender (University of Bremen), Georg Volkmar (University of Bremen), Dirk Wenig (University of Bremen), Rainer Malaka (University of Bremen)

BrainShare: A Glimpse of Social Interaction for Locked-in Syndrome Patients

Sarah Faltaous (University of Duisburg-Essen), Gabriel Haas (Ulm University), Liliana Barrios (ETH Zurich), Andreas Seiderer (Augsburg University), Sebastian Felix Rauh (Heilbronn University), Han Joo Chae (Seoul National University), Stefan Schneegass (University of Duisburg-Essen), Florian Alt (Bundeswehr University Munich)

Can Privacy-Aware Lifelogs Alter Our Memories?

Passant Elagroudy (University of Stuttgart), Mohamed Khamis (University of Glasgow), Florian Mathis (LMU Munich), Diana Irmscher (LMU Munich), Andreas Bulling (University of Stuttgart), Albrecht Schmidt (LMU Munich)

CooperationCaptcha: On-The-Fly Object Labeling for Highly Automated Vehicles

Marcel Walch (Ulm University), Mark Colley (Ulm University), Michael Weber (Ulm University)

Deep Player Behavior Models: Evaluating a Novel Take on Dynamic Difficulty Adjustment

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

Eating Ads With a Monster: Introducing a Gamified Ad Blocker

Maximilian Altmeyer (DFKI, Saarland Informatics Campus), Pascal Lessel (DFKI, Saarland Informatics Campus), Kathrin Dernbecher (DFKI, Saarland Informatics Campus), Vladislav Hnatovskiy (DFKI, Saarland Informatics Campus), Marc Schubhan (DFKI, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

Evaluating a Wearable Camera's Social Acceptability In-the-Wild

Marion Koelle (University of Oldenburg), Torben Wallbaum (OFFIS), Wilko Heuten (OFFIS), Susanne Boll (University of Oldenburg)

Go for GOLD: Investigating User Behaviour in Goal-Oriented Tasks

Sarah Prange (University of Applied Sciences, LMU Munich), Daniel Buschek (LMU Munich), Ken Pfeuffer (Bundeswehr University Munich), Lukas Mecke (University of Applied Sciences, LMU Munich), Peter Ehrich (LMU Munich), Jens Le (University of Applied Sciences, Technical University of Munich), Florian Alt (Bundeswehr University Munich)

Hands-On Math: A Training System for Children with Dyscalculia

Georg Erfurt (Bauhaus-Universität Weimar), Eva Hornecker (Bauhaus-Universität Weimar), Jan Ehlers (University of Weimar), Silke Plaschkies (IPF Institut für pädagogische Förderung)

HappyPermi: Presenting Critical Data Flows in Mobile Application to Raise User Security Awareness

Mehrdad Bahrini (University of Bremen), Nina Wenig (University of Bremen), Marcel Meissner (University of Bremen), Karsten Sohr (University of Bremen), Rainer Malaka (University of Bremen)

HedgewarsSGC: A Competitive Shared Game Control Setting

Pascal Lessel (DFKI, Saarland Informatics Campus), Maximilian Altmeyer (DFKI, Saarland Informatics Campus), Matthias Hennemann (Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

I Drive - You Trust: Explaining Driving Behavior Of Autonomous Cars

Gesa Wiegand (fortiss GmbH, LMU Munich), Matthias Schmidmaier (fortiss GmbH, LMU Munich), Thomas Weber (fortiss GmbH, LMU Munich), Yuanting Liu (fortiss GmbH), Heinrich Hussmann (LMU Munich)

Immersive Process Models

André Zenner (DFKI, Saarland Informatics Campus), Sören Klingner (DFKI, Saarland Informatics Campus), David Liebemann (DFKI, Saarland Informatics Campus), Akhmajon Makhsadov (DFKI, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

Improving the Input Accuracy of Touchscreens using Deep Learning

Abinaya Kumar (University of Stuttgart), Aishwarya Radjesh (University of Stuttgart), Sven Mayer (University of Stuttgart), Huy Viet Le (University of Stuttgart)

Off-Surface Tangibles: Exploring the Design Space of Midair Tangible Interaction

Christian Cherek (RWTH Aachen University), David Asselborn (RWTH Aachen University), Simon Voelker (RWTH Aachen University), Jan Borchers (RWTH Aachen University)

Overgrown: Supporting Plant Growth with an Endoskeleton for Ambient Notifications

Donald Degraen (IVCI, Saarland Informatics Campus), Felix Kosmalla (DFKI, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

(Over)Trust in Automated Driving: The Sleeping Pill of Tomorrow?

Thomas Kundinger (AUDI AG & Technische Hochschule Ingolstadt), Philipp Wintersberger (Technische Hochschule Ingolstadt & Johannes Kepler University), Andreas Riener (Technische Hochschule Ingolstadt & Johannes Kepler University)

Pseudo-haptic Controls for Mid-air Finger-based Menu Interaction

Marco Speicher (DFKI, Saarland Informatics Campus), Jan Ehrlich (DFKI, Saarland Informatics Campus), Vito Gentile (Universita degli Studi di Palermo Palermo), Donald Degraen (IVCI, Saarland Informatics Campus), Salvatore Sorce (Universita degli Studi di Palermo Palermo), Antonio Krüger (DFKI, Saarland Informatics Campus)

Proxemo or How to Evaluate User Experience for People with Dementia

Stephan Huber (University of Würzburg), Alexander Bejan (Furtwangen University), Beate Radzey (Demenz Support Stuttgart gGmbh), Jörn Hurtienne (University of Würzburg)

Supporting Data Workers To Perform Exploratory Programming

Krishna Subramanian (RWTH Aachen University), Ilya Zubarev (RWTH Aachen University), Simon Voelker (RWTH Aachen University), Jan Borchers (RWTH Aachen University)

Tangible Organs - Introducing 3D Printed Organ Models with VR to Interact with Medical 3D Models

Anke V. Reinschluessel (University of Bremen), Thomas Muender (University of Bremen), Verena Uslar (Pius-Hospital Oldenburg), Dirk Weyhe (Pius-Hospital Oldenburg), Andrea Schenk (Fraunhofer Institute for Digital Medicine MEVIS), Rainer Malaka (University of Bremen)

The Impact of Placebic Explanations on Trust in Intelligent Systems

Malin Eiband (LMU Munich), Daniel Buschek (LMU Munich), Alexander Kremer (LMU Munich), Heinrich Hussmann (LMU Munich)

The Point-of-Choice Prompt or the Always-On Progress Bar?: A Pilot Study of Reminders for Prolonged Sedentary Behavior Change

Yunlong Wang (University of Konstanz), Harald Reiterer (University of Konstanz)

Towards Narrative-Driven Atmosphere for Virtual Classrooms

Jean-Luc Lugrin (University of Würzburg, HCI), Marc Erich Latoschik (University of Würzburg, HCI), Birgit Lugrin (University of Würzburg, Media Informatics), Anne-Gwenn Bosser (ENIB Lab-STICC), Yann Glemarec (ENIB Lab-STICC), Mathieu Chollet (University of Glasgow, Institute of Neuroscience and Psychology)

Usability of Code Voting Modalities

Karola Marky (TU Darmstadt), Martin Schmitz (TU Darmstadt), Felix Lange (TU Darmstadt), Max Mühlhäuser (TU Darmstadt)

Using Spatial-Targets for User-Authentication on HMDs

Markus Funk (TU Darmstadt), Karola Marky (TU Darmstadt), Iori Mizutani (University of St. Gallen), Mareike Kritzler (Siemens CT), Simon Mayer (University of St. Gallen), Florian Michalles (Siemens CT)

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Demonstrating Kyub: a 3D Editor for Modeling Sturdy Laser-Cut Objects

Patrick Baudisch (HPI), Arthur Silber (HPI), Yannis Kommana (HPI), Milan Gruner (HPI), Ludwig Wall (HPI), Kevin Reuss (HPI), Lukas Heilman (HPI), Robert Kovacs (HPI), Daniel Rechlitz (HPI), Thijs Roumen (HPI)

Demonstrating VRBox—A Virtual Reality Augmented Sandbox

Dmitry Alexandrovsky (University of Bremen), Tanja Döring (University of Bremen), Susanne Putze (University of Bremen), Thomas Fröhlich (University of Bremen), Timo Stabbert (University of Bremen), Rainer Malaka (University of Bremen)

Demonstration of Springlets: Expressive, Flexible and Silent On-Skin Tactile Interfaces

Nur Al-huda Hamdan (RWTH Aachen University), Adrian Wagner (RWTH Aachen University), Simon Voelker (RWTH Aachen University), Jürgen Steimle (Saarland Informatics Campus Saarbrücken), Jan Borchers (RWTH Aachen University)

Flowboard: A Visual Flow-Based Programming Environment for Embedded Coding

Anke Brocker (RWTH Aachen University), Simon Voelker (RWTH Aachen University), Tony Zelun Zhang (RWTH Aachen University), Mathis Müller (RWTH Aachen University), Jan Borchers (RWTH Aachen University)

ScaleDial: A Novel Tangible Device for Teaching Musical Scales & Triads

Konstantin Klamka (Technische Universität Dresden), Jannik Wojnar (Technische Universität Dresden), Raimund Dachselt (Technische Universität Dresden)

Slackliner 2.0: Real-Time Training Assistance through Life-size Feedback

Christian Murlowski (Saarland Informatics Campus), Florian Daiber (DFKI, Saarland Informatics Campus), Felix Kosmalla (DFKI, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

StringTouch - A Scalable Low-Cost Concept for Deformable Interfaces

Beat Rossmy (LMU Munich), Alexander Wiethoff (LMU Munich)

Transcalibur: A Weight Shifting Virtual Reality Controller for 2D Shape Rendering based on Computational Perception Model

Jotaro Shigeyama (HPI), Takeru Hashimoto (University of Tokyo), Shigeo Yoshida (University of Tokyo), Takuji Narumi (University of Tokyo), Tomohiro Tanikawa (University of Tokyo), Michitaka Hirose (University of Tokyo)

VRChairRacer: Using an office chair backrest as a locomotion technique for VR racing games

Julius von Willich (TU Darmstadt), Dominik Schön (TU Darmstadt), Sebastian Günther (TU Darmstadt), Florian Müller (TU Darmstadt), Max Mühlhäuser (TU Darmstadt), Markus Funk (TU Darmstadt)

Organized Workshops & Symposia 4

Challenges Using Head-Mounted Displays In Shared and Social Spaces

Jan Gugenheimer (Ulm University), Christian Mai (LMU Munich), Mark McGill (University of Glasgow), Julie Williamson (University of Glasgow), Frank Steinicke (University of Hamburg), Ken Perlin (New York University)

iHDI – International Workshop on Human-Drone Interaction

Anke M. Brock (ENAC, Université Toulouse), Jessica Cauchard (Interdisciplinary Center Herzliya Israel), Markus Funk (TU Darmstadt), Jérémie Garcia (ENAC, Université Toulouse), Mohamed Khamis (University of Glasgow), Matjaž Kljun (University of Primorska)

Looking into the Future: Weaving the Threads of Vehicle Automation

Shadan S. Borojeni (Fraunhofer Institute), Alexander Meschtscherjakov (University of Salzburg), Bastian Pfleging (LMU Munich), Wendy Ju (Cornell Tech), Frank Flemisch (RWTH University), Christian P. Janssen (Utrecht University), Andrew L. Kun (University of New Hampshire), Andreas Riener (Technische Hochschule Ingolstadt)

WISH – Workgroup on Interactive Systems in Healthcare

Nadir Weibel (UC San Diego), Kim Unertl (Vanderbilt University), Susanne Boll (University of Oldenburg)

Video Showcases 2

Gamified Ads: Bridging the Gap Between User Enjoyment and the Effectiveness of Online Ads

Vladislav Hnatovskiy (DFKI, Saarland Informatics Campus), Maximilian Altmeyer (DFKI, Saarland Informatics Campus), Pascal Lessel (DFKI, Saarland Informatics Campus), Kathrin Dernbecher (DFKI, Saarland Informatics Campus), Marc Schubhan (DFKI, Saarland Informatics Campus), Antonio Krüger (DFKI, Saarland Informatics Campus)

Slappyfications: Towards Ubiquitous Physical and Embodied Notifications

Sebastian Günther (TU Darmstadt), Florian Müller (TU Darmstadt), Markus Funk (TU Darmstadt), Max Mühlhäuser (TU Darmstadt)

Case Study 1

Effects of Participatory Evaluation – A Critical Actor-Network Analysis

Katta Spiel (TU Wien), Christopher Frauenberger (TU Wien), Geraldine Fitzpatrick (TU Wien), Eva Hornecker (Bauhaus-Universität Weimar)

Doctoral Consortium 1

Designing for Visual Data Exploration in Multi-Device Environments

Tom Horak (Technische Universität Dresden)

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German HCI Party

We are excited to contribute to the CHI community by hosting the **German HCI Party**—now the third time in a row. The organization of this event is a notable team effort from volunteers from all the German labs. Here, we want to take the chance and thank all involved persons!

You want to be part of this? Talk to us during the CHI conference or send us an email to: germanhciparty@gmail.com.

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University of Konstanz

The 2019

German HCI Party

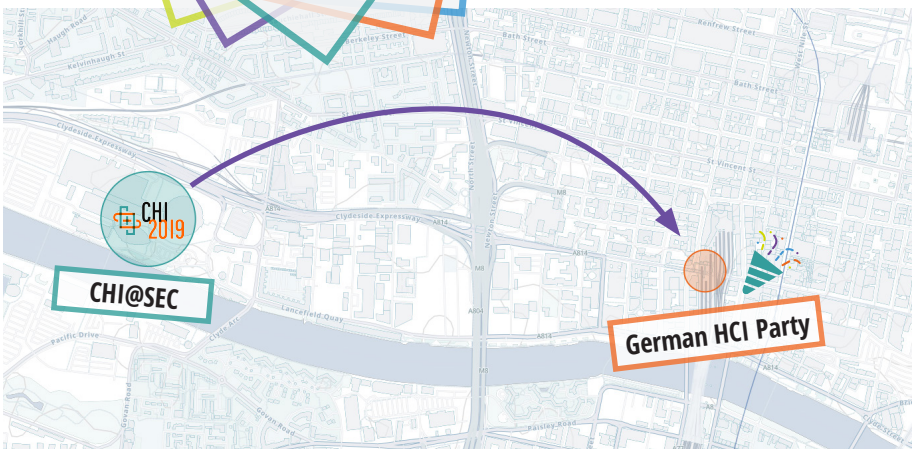
- Glasgow -

When?

Wednesday, May 8, 2019
20:00 to 01:00

Where?

Argyle St. Arches
253 Argyle St., Glasgow



How?

Step 1: Walk to ScotRail station *Exhibtion Centre*, just north of the SEC

Step 2: Take a train to the *Glasgow Central Station* (departing every 10min)

Step 3: Head to *Argyle Street*; the location is right under the Central Station

Step 4: Relax, have fun, and enjoy an awesome night at CHI

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German Pre-CHI Event 2020

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19-20 March 2020, Ulm, Germany

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