

Annual Report



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Dear readers, dear members and friends of the SFB-TRR 161!



Prof. Dr. Daniel Weiskopf SFB-TRR 161 Spokesperson

Dr. Heike Lehmann

SFB-TRR 161 Manager



SFB-TRR 161 Annual Report 2023

ABOUT THE SFB-TRR 161

The SFB-TRR 161 "Quantitative Methods for Visual Computing" is a Transregional Collaborative Research Center. Partner institutions are the University of Stuttgart, University of Konstanz, Ulm University, and LMU Munich.

In this interdisciplinary research center, around 50 scientists in the fields of visualization, computer vision, computer graphics, human-computer interaction, linguistics, and applied psychology are working together to establish quantification as a key ingredient of visual computing research.

We see quantification as a cornerstone to further advance visual computing as an established and maturing research field.

EDITORIAL

Since the last annual report, extraordinary months lie behind

projects, to aligning our topics with the challenges of the future - and to bring visual computing into the world!

In addition to an outlook on the new funding period, in this annual report you will find an overview of what has happened in the SFB-TRR 161 since May 2022. We are pleased to report on numerous successes of our scientists and to draw your attention to the events and publications in which members of the SFB were involved. In addition, you will learn about our broad activities with which we have presented our work to the public. Especially in view of the coming shortage of specialists in any field, it is a special concern of ours to inspire young people for our topics - today and in the next four years!

We are looking forward to an inspiring new research period and wish you pleasure while reading the Annual Report 2023!

> Heike Lehmann & Daniel Weiskopf

> > hl, dw

SPECIAL – THIRD FUNDING PERIOD

READY FOR THE 3RD FUNDING PERIOD

On May 19, 2023, it became official: The SFB-TRR 161 will receive funding for a third funding period. With a total sum of more than 8 million Euros, researchers at the University of Stuttgart, the University of Konstanz, Ulm University, and LMU Munich are thus able to continue with their goal of advancing the field of visual computing and establishing an overarching tradition of quantitative methods for visual computing. With their work, they make a significant contribution to handling the challenge which ever-increasing amounts of data poses to science, industry, and society in general.

We greatly look forward to continuing our work for another four years. On the following two pages we want to sketch some of the directions our research will take in the third funding period.

Mixed Reality (MR)

While immersion was a key

focus of SFB-TRR 161 re-

search during the second

funding period, research

during the third funding pe-

riod will also look at other

dimensions relevant for a

coherent MR experience. By

extending our research to

include the extent of world

knowledge and coherence, the SFB-TRR 161 reflects cur-

rent trends in research and

actively contributes to the

quality of future applica-

tions.

Visual Explainability

We plan to assess and quan-tify how well recipients of visualizations or users of visual analytics systems understand the phenomena shown visually. Those include quality metrics, interaction, and algorithms. By addressing the topic of visual explainability from different angles, the SFB-TRR 161 will contribute to the trustworthiness of the whole visual analysis process and help establish visual computing techniques for decision-making.

RESEARCH STRUCTURES AND FOCUS

In the third funding period, we will continue to pursue the long-term goals of the SFB-TRR 161: developing quantitative models and algorithms that promote reproducibility and replicability. The four project groups, which were established at the beginning of the first funding period, remain: quantitative models and measures, adaptive algorithms, interaction, and applications. In addition, the SFB-TRR 161 will investigate three new research themes, which span across the four project areas and their individual projects: visual explainability, mixed reality, and bringing research results in-the-world.



In-the-world

Our third new cross-cutting research theme aims to bring research results in-theworld, moving away from experiments in-the-laboratory and in-the-wild to openly accessible data, knowledge, and applications employing research results. Those will include opensource software and libraries as well as freely accessible datasets and benchmarks.



Research structure of the SFB-TRR 161 for the third funding period.

SPECIAL INTEREST GROUPS

To allow for more flexibility for reacting to new research developments or topics that are shared by several researchers or projects, we will discontinue our task forces from the first two funding periods and replace them with Special Interest Groups (SIGs). SIGs are not set up for the whole funding period, and can start or end any time during the funding period. Currently, four SIGs are active in the SFB-TRR 161: dimensionality reduction, eye tracking, machine learning, and uncertainty.

COMPLETED PROJECTS

With the upcoming retirement of project leader Thomas Ertl, project A02 "Quantifying Visual Computing Systems" was completed at the end of the second funding period. The project's successes in the area of performance quantification will continue to support future research. For instance, technical measurement strategies for GPU performance and energy consumption will be adopted by project INF in the third funding period, thereby improving technical evaluation in several projects.

Bastian Goldlücke completed project B05 "Efficient Large Scale Variational 3D Reconstruction". The research on 3D reconstruction will be partially adopted in the third funding period by project B04 "Adaptive Algorithms for Motion Estimation", since motion estimation also involves the estimation of the 3D scene structure.

Project leader Dietmar Saupe will retire soon and thus project A05 "Visual Quality Assessment" was completed at the end of the second funding period. The achievements of the project will continue to serve as the basis for future research, for example in the DFG project "JND-based perceptual video quality analysis and modeling" by former doctoral researcher Mohsen Jenadeleh. The topic of image saliency will still be covered within the SFB-TRR 161 by project A07 "Spatio-temporal Models of Human Attention for Optimization of Information Visualizations".

Falk

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NEW PROJECTS

Project A09 "Scalability and Complexity in Immersive Analytics" (led by Schreiber Klein) Karsten specifically supports our research on mixed reality. It will in-

vestigate quantification measures for the scaling of both data and task dimensions and will assess complexity in immersive environments.

Konstanz



tary look at MR from the perspective of computational human-computer interaction: How can we optimize graphical user interfaces presented in mid-air? Such optimization is important to reduce muscle strain as well as to improve the effectiveness of interaction.

► Konstanz

SPECIAL – THIRD FUNDING PERIOD

Project A04 "Quantitative Models for Visual Abstraction" was successfully completed at the end of the second funding period. Many of the project's findings as well as developed techniques will be instrumental in the planned research on stylistic rendering for uncertainty visualization as part of project A01 "Uncertainty Quantification and Analysis in Visualization", where A04's project leader Oliver Deussen will stay on as one of the two project leaders.

Project B07 "Computational Uncertainty Quantification", led by Andrea Barth, was completed at the end of the second funding period. The project's successful research on uncertainty quantification will influence work in project A01 "Uncertainty Quantification and Analysis in Visualization" in the third funding period.



SFB-TRR 161 project leaders in the third funding period.

Project C07 "Optimization for Dynamic Mixed **Reality User In**terfaces", led by Tiare Feuchtner, takes a complemen-



Stuttgart

PEOPLE

In 2022 and 2023, SFB-TRR 161 researchers were successful in several international rankings.

STANFORD/ELSEVIER CITATION DATABASE

The Stanford/Elsevier citation database has been updated in September 2022¹. The comprehensive dataset spans 22 disciplines with 174 subfields and shows which scientists are at the very top of their respective field, taking into account variations in citation density between individual disciplines.

For the citation year 2021, seven SFB-TRR 161 project leaders made it onto the list and are thus among the top 2% of researchers cited in their fields. For the subfield "Human Factors", **Andreas Bulling** (A07) ranks 43 out of a total of 14.025 most cited scientists worldwide, while **Albrecht Schmidt** (C06) reaches 52nd place. In the field "Software Engineering", **Oliver Deussen** (A01, A04) ranks 41 out of 21.494, while **Daniel Weiskopf** (A01, B01, Ö, MGK) occupies rank 42 and **Daniel Keim** (A03) rank 56. In the subfield "Artificial Intelligence & Image Processing", **Dietmar Saupe** (A05) ranks 27 out of 321.592 scientists. **Falk Schreiber** (D04, INF, Ö, MGK) ranks 39 out of 20.000 researchers in the subfield "Bioinformatics".

¹J. P. A. loannidis, September 2022 data-update for "Updated science-wide author databases of standardized citation indicators", Mendeley Data, 2021. doi: 10.17632/btchxktzyw.5

RESEARCH.COM BEST SCIENTISTS RANKING

For its 9th edition of the Best Scientists Ranking in the field of computer science, the academic platform *Research.com* investigated data from 14,402 scholars, taking into account publications and citation metrics from multiple bibliometric data sources. Four SFB-TRR 161 project leaders are among the ranking's top 15% of computer science researchers worldwide.

With 38,224 citations and 629 publications, **Daniel Keim** (A03) reaches position 486, placing him among the top 4 % of computer scientists worldwide. Of the 495 German researchers considered for the ranking, he occupies position 19. **Albrecht Schmidt** (C06) reaches position 900 in the international comparison with 22,774 citations and 606 publications and thus ranks among the top 7 % of computer scientists. Among German computer scientists, he reaches position 35. **Thomas Ertl** (A02) and **Daniel Weiskopf** (A01, B01, MGK, Ö) occupy positions 1239 and 2135 respectively, thereby placing them among the top 15 % of computer scientists worldwide. In the national ranking, Thomas Ertl reaches 45th place while Daniel Weiskopf is placed 92nd.

COOPERATION WITH EXTERNAL PARTNERS

Our researchers work together with both national and international colleagues on a regular basis. In 2022 and 2023 those collaborations included:

- Phillip Alday, Beacon BioSig (D05)
- Simon Danisch, Makie.jl (D05)
- Ksenia Keplinger & Andria Smith, Max Planck Institute for Intelligent Systems (A08)
- Demetria Labate, University of Houston (B04)
- Giuseppe Liotta, Emilio Di Giacomo, Fabrizio Montecchiani & Tommaso Piselli, University of Perugia (D04/INF)
- Frank Neumann, University of Adelaide (A05)

- Marius Pedersen, NTNU Gjøvik (A05)
- Felix Putze, University of Bremen (C06)
- Mirana Ramialison, Hieu Nim, Natalie Charitakis & Denis Bienroth, Murdoch Children's Research Institute (D04/INF)
- Fabio Sarto, University of Padua (C06)
- Phoenix Van Wagoner, Cal State Fullerton (A08)



Daniel Weiskopf (A01, B01, MGK, Ö) has recently joined the editorial board of IEEE Transactions on Visualization and Computer Graphics (TVCG) as an Associate Editor-in-Chief. As the top-tier journal in the field of visualization, TVCG publishes papers on subjects related to information and scientific visualization, visual analytics, virtual and augmented reality, and computer graphics, covering theory, algorithms, methodologies, human-computer interaction techniques, systems, software, hardware, and applications in these areas. The journal's editorial board strives to publish papers that present important research results and state-of-the-art seminal papers in computer graphics, visualization, and virtual and augmented reality.

Dieter Schmalstieg received one of the prestigious Alexander von Humboldt Professorships. After heading the Institute of Computer Graphics and Vision at the Graz University of Technology, he is to continue his internationally successful research on virtual and augmented reality at the Visualization Research Center of the University of Stuttgart. For the SFB-TRR 161, Dieter Schmalstieg has been an important cooperation partner for several years. Aside from co-authoring SFB-TRR 161 publications, he was keynote speaker at our workshop on Situated Analytics in November 2021. "Having Dieter Schmalstieg join our site in Stuttgart will further strengthen our expertise in immersive technologies and open the way for new and exciting collaborations," says SFB-TRR 161 spokesperson Daniel Weiskopf.



Andreas Bulling (A07) and his Perceptual User Interfaces Group at the University of Stuttgart were successful with their nomination for a Humboldt Research Award. As a result, award recipient Hans Gellersen from Lancaster University will be collaborating closely with Andreas Bulling and his research group. Known internationally for his research in the fields of Upiquitous Computing and Human-Computer Interaction, Hans Gellersen's particular interest lies in gaze and gestural interaction in HCI. With the award money, he plans to conduct research on advancing human-computer interfaces that better reflect the central role of gaze and eye movement for interaction and navigation in 3D. His first visit to Stuttgart took place in February 2023.

At the 99th Joint Photographic Experts Group (JPEG) meeting in April 2023, **Dietmar Saupe** (A05) was approved as co-chair of the Ad-hoc Group on Image Quality Assessment. JPEG AIC (Advanced Image Coding and Evaluation) aims to locate and evaluate new scientific developments and advancements in image coding research. Relevant topics include new compression methodologies and quality evaluation methodologies and procedures.

Project A05 recently delivered a contribution to the upcoming JPEG AIC-3 standard, and was accepted for the main part of the JPEG AIC Core Experiment that prepares the drafting of the standard.

VISITING SCHOLARS

With travel once again possible, a number of international scientists visited our research sites:

- Jian Li (Konstanz, D04/INF)
- Takayuki Itoh (Konstanz, D04/INF)
- Peter Eades (Konstanz, D04/INF)
- Jinxin Zhao (Konstanz, D04/INF)
- Raouf Hamzaoui (Konstanz, A05)







Hantao Liu (Konstanz, A05) Tamas Sziranyi (Konstanz, A05) Xingbo Wu & Zhengyan Dong (Doctoral Students, Konstanz, A05)

TALKS & WORKSHOPS

WORKSHOP "OUT WITH IT!"



In June 2022, the SFB-TRR 161 funded a training for voice, speech, and body language by coach Katharina Padleschat at the University of Stuttgart. The aim of the workshop was teaching the participants strategies how to successfully convey their message in front of professional audiences, students, staff, and colleagues. With a balanced mix of theoretical input and practical exercises, the workshop addressed topics such as how to speak in a lively, convincing manner or how to use both body language and voice consciously and professionally without appearing artificial. As a follow-up, all participants were able to book an individual online coaching session with Katharina Padleschat—an opportunity of which many of the attendees made use.

WORKSHOP "BIAS LITERACY 101"



In a workshop with Sabastian Tilman, Diversity Officer at the University of Konstanz, SFB-TRR 161 members learned a lot about bias and how it can influence our behavior. The workshop, which took place online on March 9, 2023, looked at different types of bias, for example perception, cognitive, and social biases. In addition, it discussed the distinction between bias, stereotype, and prejudice and how they are connected to discrimination. With exercises and opportunities for open exchange between the participants, the workshop aimed at creating mindfulness around the influence of bias on academic decisions and introduced strategies to mitigate those negative effects. Those strategies included perspective-taking, bias reduction through anonymization of papers, and stereotype modification through active countering.

THE UNSPOKEN TIPS FOR NAVIGATING YOUR CAREER

Passant El.Agroudy, Fiona Draxler (C06), Katrin Angerbauer (A08), Katrin Lichius, and Tiare Feuchtner (C07) organized the workshop "Women* in Computing: The unspoken tips for navigating your career" in Stuttgart on October 25, 2022. The half-day workshop highlighted the research opportunities and career paths for excellent researchers in the field of computing and was partly funded by the SFB-TRR 161 "Quantitative Methods for Visual Computing" and ERC Amplify.

The seven-hour workshop aimed to create a safe space for researchers to discuss career and family struggles and to exchange ideas and approaches on how to handle those struggles. The twentynine attendees came from eleven different universities and three companies.

In their presentations, six speakers proved different perspectives on careers in computing. For instance, Mai Sherif, senior IT manager at Procter and Gamble, spoke about her journey as a young engineer from the global south to leading a large department in one of the top fast-moving consumer goods enterprises. Among her slides were statistics supporting the high financial returns of hiring women in managerial roles.

Betty Mohler, principal research scientist at Amazon, talked about her journey as a tenured professor and her choice to move to the industry as a senior researcher. She also gave some insight into her research using virtual reality and avatars to understand the differences in the self-image of men and women regarding their weight.

As a senior lecturer at the University of Glasgow, Julie Williamson was able to provide participants of the workshop with some valuable insights into how "successful" CVs are made and inspired them by showing the actual number of rejects between all the accepted items. She highlighted the importance of balance and having internal validation from an activity besides a career in order to maintain mental health.

Katrin Kreidel, CEO at Hydrop Water Systems, shared her experiences with starting a company and pointed out available funds for research startups. Katrin Angerbauer (A08) and Kathrin Lichius, both PhD candidates at the University of Stuttgart, discussed challenges such as navigating



a career with a disability and reconciling family life and career.

The second part of the workshop was organized as a group activity where challenges facing the attendees were anonymously collected and discussed in groups. Among the discussion topics were collaboration and networking, imposter syndrome, identifying your research topic, and microaggressions in the workplace. The workshop concluded with a tour of the Arena 2036 building, a futuristic complex with several companies and research institutions collaborating on the spot.

The event went by in a flash and was informative and fun for everyone involved. Sharing and discussing struggles helped the attendees to feel more connected even beyond the workshop. The talks were inspiring and encouraging to find one's own way and to give back to the community as well. A second edition of the workshop will take place on June

Image: Passant El.Agroudy

^{22, 2023} in Konstanz.

CONFERENCES

In 2022 and 2023, members of the SFB-TRR 161 presented their research at a large number of national and international conferences and workshops, their contributions ranging from presentations to keynote speeches and invited talks. For their outstanding work, they won several conference awards (cf. Awards, pp. 12-13).

SFB-TRR 161 CONFERENCE: QiVC 2023

Organized by the SFB-TRR 161, the 2nd International Conference on Quantification in Visual Computing (QiVC) takes place in Leipzig, Germany on June 11, 2023 as a co-located event of EuroVis 2023. The program includes keynote speakers Gudrun Klinker (TUM), Zhi Li (Netflix), and Melanie Tory (Northeastern University). We look forward to reporting on the conference in our next Annual Report!

CONFERENCE HIGHLIGHTS IN 2022 AND 2023

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April 2022: Keynote by Daniel Weiskopf (A01, B01, MGK, Ö) on "Multidimensional Visualization" at PacificVis 2022 +++ September 2022: Daniel Klötzl, Tim Krake (B01), Youjia Zhou, Ingrid Hotz, Bei Wang and Daniel Weiskopf (A01, B01, MGK, Ö) received a Visual Computer Second Best Paper Award at CGI2022 (cf. p. 13) +++ September 2022: Bastian Goldlücke (B05) and Oliver Deussen (A01, A04) served as general chairs of GCPR 2022 and VMV 2022 +++ October 2022: TopoInVis2022 Honorable Mention Award for "Reduced Connectivity for Local Bilinear Jacobi Sets" (cf. p. 13) +++ October 2022: Michael SedImair (A08) and colleagues received the IEEE VIS Conference 2022 Ten Year Test of Time Award (cf. p. 12) +++ October 2022: IEEE VIS 2022 Best Paper Award for "Uncertainty-Aware Multidimensional Scaling" (cf. p. 12) +++ October 2022: Jenny Schmalfuß (B04) presented the paper "A Perturbation-Constrained Adversarial Attack for Evaluating the Robustness of Optical Flow" at ECCV 2022, a conference with an acceptance rate of only 2.7% for oral presentations +++ December 2022: VRST 2022 Best Paper Award for "Walk This Beam: Impact of Different Balance Assistance Strategies and Height Exposure on Performance and Physiological Arousal in VR" (cf. p. 12) +++ January 2023: Karsten Klein (D04, INF) was co-organizer of the Dagstuhl-Seminar 23051 "Perception in Network Visualization" +++ April 2023: Benedikt Ehinger (D05) was an invited speaker at MakieCon 2023 +++ June 2023: Yao Wang and Andreas Bulling organized the 8th International Workshop on Pervasive Eye Tracking and Mobile Eye-based Interaction (PETMEI) in conjunction with ETRA 2022).

2022

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PacificVis 2022

15th IEEE Pacific Visualization Symposium, virtual



ACM CHI Conference on Human Factors in Computing Systems, New Orleans, LA, USA

VVS 2022



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22nd Annual Meeting of the Vision Sciences Society Meeting, St. Pete Beach, Florida, USA

2022 CVR/VISTA

Centre for Vision Research Conference, York University, Toronto, Canada

ETRA 2022

ACM Symposium of Eye Tracking Research & Applications, Seattle, WA, USA & virtual

ETVIS

Workshop on Eye Tracking an Visualization, in conjunction with ETRA 2022

1st Image Quality Assessment Workshop online

IMRF 2022

20th International Multisensory Research Forum, Ulm, Germany

SVCP

Summer School on Video Coding and Processing, Ilmenau, Germany

VINCI '22

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15th International Symposium on Visual Information Communication and Interaction, Chur, Switzerland

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QoMEX 2022

14th International Conference on Quality of Multimedia Experience, Lippstadt, Germany

CGI2022

Computer Graphics International, virtual

IB 2022

16th International Symposium on Integrative Bioinformatics, Konstanz, Germany.

ECCV 2022

17th European Conference on Computer Vision, Tel-Aviv, Israel

ECCV-AROW 2022

European Conference on Computer Vision Workshop on Adversarial Robustness in the Real World, virtual

ECCV-RVC 2022

European Conference on Computer Vision Robust Vision Challenge Workshop, virtual

Dagstuhl-Seminar 23051

Transparent Quantitative Research as a User Interface Problem, Schloss Dagstuhl, Germany

GCPR-VMV 2022

German Conference on Pattern Recognition 2022 & Vision, Modeling and Visualization 2022, Konstanz, Germany

IEEE VIS 2022

IEEE Visualization Conference, Oklahoma City, USA & virtual

BELIV 2022

evaluation and BEyond - methodoLoglcal approaches for Visualization, in conjunction with VIS 2022

ICIP 2022

IEEE International Conference on Image Processing, Bordeaux, France

ASSETS 2022

The 24th International ACM SIGAC-CESS Conference on Computers and Accessibility, Athens, Greece & virtual

CONFERENCES



VQEG Meeting

Video Quality Experts Group, virtual

Online Workshop on Large-Scale Subjective Image Quality Assessment MTNU Gjøvik, Norway

VRST 2022

28th ACM Symposium on Virtual Reality Software and Technology, Tsukuba, Japan & virtual

2023



WACV 2023 IEEE/CVF Winter Conference on Applications of Computer Vision, Waikalua, Hawaii, USA



Dagstuhl-Seminar 23051

Perception in Network Visualization, Schloss Dagstuhl, Germany

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DMCM23

7th Disease Map Community Meeting, Maastricht, the Netherlands

CHI 2023 ACM CHI Conference on Human Factors in Computing Systems, Hamburg, Germany

MakieCon 2023 Makie Conference for Julia Visualization, Jena Germany



ETRA 2023

ACM Symposium of Eye Tracking Research & Applications, Tübingen, Germany

PETMEI

8th International Workshop on Pervasive Eye Tracking and Mobile Eyebased Interaction, in conjunction with ETRA 2022

VRST 2022 BEST PAPER AWARD

At the 28th ACM Symposium on Virtual Reality Software and Technology (VRST 2022), the SFB-TRR 161 publication "Walk This Beam: Impact of Different Balance Assistance Strategies and Height Exposure on Performance and Physiological Arousal in VR"



mance and Physiological Arousal in VR" won the Best Paper Award. Authors of the paper are Dennis Dietz, Carl Oechsner, Changkun Ou, **Francesco Chiossi** (C06), Fabio Sarto, **Sven Mayer** (C06), and Andreas Butz.

- ▶ Project C06
- Munich

ROBUST VISION CHALLENGE

Azin Jahedi, Maximilian Luz, Lukas Mehl (B04), Marc Rivinius, and Andrés Bruhn (B04) won the ECCV 2022 Robust Vision Challenge (RVC 2022) in the category "Optical Flow." Of all the submissions in the flow category, their submitted method "MS_RAFT+", an extension of the "MS-RAFT" approach presented

early this year at the IEEE International Conference on Image Processing (ICIP), performed best across the different datasets considered for the challenge (KITTI, Middlebury, MPI Sintel, and VIPER).

- Project B04
- Stuttgart

TOPOINVIS2022 HONORABLE MENTION AWARD

At the IEEE Workshop on Topological Data Analysis and Visualization (TopolnVis) 2022, Daniel Klötzl, **Tim Krake** (B01), Youjia Zhou, Jonathan Stober, Kathrin Schulte, Ingrid Hotz, Bei Wang, and **Daniel Weiskopf** (A01,

B01, MGK, Ö) received the Honorable Mention Award for their publication "Reduced Connectivity for Local Bilinear Jacobi Sets". The TopolnVis Workshop was held in conjunction with IEEE VIS 2022 in Oklahoma City, USA.

- ▶ Projects A01, B01
- Stuttgart





The exhibition "Stayin' Alive – mit Seuchen leben", which was on display in Konstanz between July and October 2021, won both the 2022 Red Dot Design Award in the category *Exhibition Design* and a Golden Nail Award in the category *Spatial Experience*. The Red Dot is an internationally recognized award for high design quality. The Golden Nail is awarded for outstanding communication and design achievements by the Art Directors Club für Deutschland e.V., Germany's most significant association of the German-speaking elite of the creative industry. "Stayin' Alive – mit Seuchen leben" was the final project of students who participated the teaching module "Modia Exhibition Design" in which SEP. TPP. 161 project leaders

"Stayin' Alive – mit Seuchen leben" was the final project of students who participated in the teaching module "Media Exhibition Design", in which SFB-TRR 161 project leaders **Harald Reiterer** (C01) and **Falk Schreiber** (D04, INF, Ö) are involved and for which they and their colleagues received the Landeslehrpreis of the State of Baden-Württemberg in 2021.

Projects C01, D04

Konstanz

IEEE VIS TEST OF TIME AWARD

Michael SedImair (A08), and his co-authors Miriah Meyer (Linköping University, Sweden) and Tamara Munzner (University of British Columbia, USA) recived the IEEE VIS Conference 2022 Ten Year Test of Time Award for their joint publication "Design Study Methodology: Reflections from the Trenches and the Stacks" (IEEE InfoVis 2012). The award recognizes publications that have been published at previous conferences, but whose content is still highly relevant and which have had a major impact and influence within and beyond the visualization community. In their paper, Michael SedImair and his colleagues dedicated themselves to the question of how

interdisciplinary design studies ought to be implemented from a methodological point of view. Based on their combined experience from 21 design studies, they developed a practical guide for conducting problem-oriented design studies and defined a list of 32 "pitfalls" that frequently occur in design studies. The paper received the InfoVis Best Paper Honorable Mention Award in 2012.

- Project A08
- **Stuttgart**

AWARD

IEEE VIS BEST PAPER AWARD

At the ECCV 2022 Workshop on Adversarial Robustness In the Real World (AROW), held virtually on October 23rd 2022, **Jenny Schmalfuss** (B04), **Lukas Mehl** (B04), and **Andrés Bruhn** (B04) received a Best Paper Award for their publication "Attacking Motion Esti-

mation with Adversarial Snow". Their work found that adding "unfortunately placed" snowflakes to video sequences can cause neural networks for motion estimation to detect no motion where motion is actually taking place.

AROW WORKSHOP BEST PAPER

- Project B04
- Stuttgart

Tim Krak (A01, B01 Paper Av tainty-Av ing". IEEE advances



(A01, B01, MGK, Ö) received the Best Paper Award for their paper "Uncertainty-Aware Multidimensional Scaling". IEEE VIS is the premier forum for advances in theory, methods, and applications of visualization and visual analytics and was held in 2022 as a hybrid event in Oklahoma City, USA, and online.

- Projects A01, B01
- Stuttgart



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VISUAL COMPUTER SECOND BEST PAPER AWARD

Daniel Klötzl, **Tim Krake** (B01), Youjia Zhou, Ingrid Hotz, Bei Wang, and **Daniel Weiskopf** (A01, B01, MGK, Ö) were awarded the Visual Computer Second Best Paper Award for their research paper "Local Bilinear Computation of Jacobi Sets". The award was presented at the Computer Graphics International (CGI2022) conference, held online September 12-16, 2022.

- Projects A01, B01
- Stuttgart

RED DOT DESIGN AWARD AND GOLDEN NAIL FOR "STAYIN' ALIVE"



OUTREACH

GIRLS' DAY 2023

In 2023, the Girls' Day took place on April 27. Together with the SFB 1313, we invited girls from the age of fourteen to the Visualization Research Center at the University of Stuttgart for a programming course. Using Java, the girls were allowed to give free rein to their creativity when programming their own artwork. Eleven girls from different schools in the Stuttgart region participated in our workshop, which was complemented by information about studying computer science as well as a knowledge quiz. A special thanks to our tutors, who provided the girls with a lot of helpful information and answered all their questions!



Girls' Day. Image: Alexander Straub

BOGY INTERNSHIPS

Our BOGY internships continue to draw a lot of interest. Not only do they provide a chance to gain a deeper insight into visualization research. They are also a unique opportunity to experience what working at a university looks like. Since spring 2022, we received over 50 applications from 9th and 10th grade students. In April 2022, we welcomed one intern to the University of Konstanz and three to the University of Stuttgart. In October 2022 and February 2023, groups of three and four students respectively spent a week at the Visualization Research Center in Stuttgart. Aside from their own programming projects, they attended lectures, talked to PhD students about their work, and tried out some of the technology. Again, feedback on the internships was very positive. With five female interns out of a total of eleven, we were able to work toward our goal of making computer science more attractive for girls and debunking stereotypes about working in tech.

SFB-TRR 161 AT UNIVERSITY EVENTS

After a two-year break, projects within the SFB-TRR 161 were finally able to present their work at public events organized by our partner universities once again. Such open house days are not only a chance to showcase our research to the public, but also a great way to spark children's enthusiasm for computer science and to get in touch with both alumni and prospective students.



On May 14th, 2022, the University of Konstanz participated in the Lange Nacht der Wissenschaft. At the booth of scientists from project A05, visitors learned about different methods for the assessment of image quality. Together with the Centre for the Advanced Study of Collective Behavior (EXC 2117), members of project D04 introduced visitors to the behavior and neurobiology of zebrafish decision-making by scaling up a zebrafish laboratory experiment to human size.



Demonstrations at the Science Day in Stuttgart, Images: cwr

At the Science Day of the University of Stuttgart, held on June 25, 2022 and May 13, 2023, project Ö offered several programming projects with LEGO educational solutions for children from the age of six. With a drawing robot, they were able to create their own artwork. An obstacle course for our robots, which had to be navigated by using a color sensor, was also very popular with all our visitors. At the booths from scientists at the Visualization Research Center, visitors had the opportunity to dive deeper into the world of visualization and experience technologies such as augmented reality and eye tracking. CWI

COLLABORATION IN AUGMENTED REALITY: THE SFB-TRR 161 ABOARD THE MS WISSENSCHAFT 2022

Between May 3 and October 9, 2022, the SFB-TRR 161 participated in the exhibition aboard the MS Wissenschaft. The exhibition ship toured through Germany and Austria and dropped anchor in 35 cities. 65.000 people visited the exhibition, among them many school classes. The SFB-TRR 161 contributed the exhibit "Collaboration in Augmented Reality", a joint project of projects C01 and Ö.

In 2022, the exhibition on the MS Wissenschaft took place under the motto "Participate!" (in German: "Nachgefragt!"), which was also the motto of the Science Year 2022. The aim behind the exhibition was to give visitors an insight into the workings of science, into the processes and questions that go into a research project.

"Collaboration in Augmented Reality" allowed visitors of the exhibition to experience an interaction in AR. Once they pointed the cameras of two tablets at the surface of the exhibit, a virtual landscape appeared. After collaboratively build-



Some feedback on the exhibition aboard the MS Wissenschaft (Source: Wissenschaft im Dialog):

"Nach drei Jahren durften wir an Bord zurückkehren. Die Nachgefragt Idee finden wir sehr gut umgesetzt. Genau das ist Kern der Wissenschaft. Die richtigen Fragen zu stellen und dann nach der Antwort suchen."

OUTREACH

ing a wind turbine, a city in the virtual landscape was supplied with electricity and the lights went on again. Following the simulation, the use of such technology for industry and science was explained on a few animated screens. On an infographic on the exhibit's surface, visitors learned more about how research on modern interaction methods is conducted: from the initial design, over user studies, their evaluation, and the optimization of interaction methods to best meet the demands of the situation and the needs of the users.

Participating in the MS Wissenschaft was a great opportunity to bring research conducted within the SFB-TRR 161 closer to the public. Due to the uniqueness of the floating exhibition and the fact that it traveled to so many cities we were able to reach a much larger audience than we could have with a smaller, local exhibition. We look forward to participating in similar formats in the years to come!



"Eine beeindruckende Auswahl an Forschungsgebieten – das macht deutlich, wie viel wir noch zu erforschen haben. Vielen Dank!"

"Die Ausstellung ist vielseitig, anregend, toll gestaltet und interessant. Eine ganz tolle Anregung hinter der viel Können, Mühe und Initiative steckt!"

cwr

YOUNG ACADEMICS

DOCTORAL SPEAKERS

Sita Vriend (B01) and Patrick Paetzold (A01) are the current doctoral speakers. As such, they represent the interests of the doctoral students and organize events such as doctoral retreats and workshops.



Left: Sita Vriend Right: Patrick Paetzold.

DISSERTATIONS

Since May 2022, three candidates completed and successfully defended their dissertations:

- Florian Frieß (INF), Interactive Remote Visualization on Large Displays
- Franz Götz-Hahn (A05), Video Quality Assessment In-the-wild
- Ole Johannsen (B05), Variational 3D Reconstruction of Non-Lambertian Scenes Using Light Fields •

Congratulations!

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DOCTORAL RETREAT



From June 30 to July 1, 2022, our doctoral candidates met for their annual doctoral retreat. With the Villa Prym near Lake Constance, they chose a particularly nice venue to get together and talk about the current status of their projects as well as their plans for the third funding period. One part of the retreat was constituted by a workshop on career planning. Held by career coach Matthias Merkelbach, the workshop offered the doctoral candidates a lot of helpful information such as how to professionally prepare their personal profiles. Of course, a trip to Lake Constance would not be complete without a boat trip across the lake and the opportunity to enjoy some spectacular views! A full report on the retreat is available on our Visual Computing Blog. VW

NEW DOCTORAL CANDIDATES

David Hägele, A01 Moritz Heinemann, A02 Sabrina Jaeger-Honz, D04 Tafseer Ahmed Khan, D02

YAO WANG AT AALTO UNIVERSITY

In early 2023, Yao Wang (A07) spent eleven weeks at Aalto University, Finland as part of an exchange program. At Aalto University, he closely collaborated with the user Interface group led by Antti Oulasvirta. Their collaboration mainly centered around attention-driven optimization of information visualizations.



While he was in Finland, Yao also attended the HelsinCHI 2023 symposium, where he presented a poster about his dissertation topic as well as the paper "Scanpath Prediction on Information Visualisations". About his research stay, Yao particularly enjoyed meeting so many smart and friendly people as well as the great outdoors and the authentic Chinese food in Helsinki.

VW

Vladimir Mikheev, D05 Patrick Paetzold, A01 Abdelrahman Zaky, C07 Ying Zhang, D04

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A warm welcome to all new doctoral candidates!

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