SFB-TRR 161

Quantitative Methods for Visual Computing

Transregional Collaborative Research Center

Annual Report 2021

FUNDED BY DFG

CONTENT

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 Constance, Ulm University, and LMU Munich.

In this interdisciplinary research center, around 40 scientists in the fields of visualization, computer vision, computer graphics, human-computer interaction, multimedia 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.

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

Dr. Heike Lehmann
SFB-TRR 161 Manager

Prof. Dr. Daniel Weiskopf
SFB-TRR 161 Spokesperson

In the run-up to the SFB-TRR 161 status seminar 2021, we are very pleased to present the 2021 Annual Report.

We have faced many challenges over the last year. The COVID-19 pandemic was suddenly dominating our lives, leaving no one unaffected. There have been so many in-person meetings that could not take place and so many stays abroad that have not been possible. Nevertheless, we make every effort to continue our successful work in the strong collaborative environment between the four SFB-TRR 161 sites Stuttgart, Constance, Ulm, and Munich—and, of course, with our numerous partners all over the world.

In the last months, the pandemic has once again underlined the importance of visual computing. There are significant applications and methods that were developed in the SFB-TRR 161 to address the pandemic challenges. They are highlighted in this report on page four. However, quantifying aspects in visual computing are still an unmet need in many fields of research and development, offering many more opportunities for us.

In general, in this report you will learn more about the progress of our work since summer 2020. And we would like to point to the newest publications, prizes, and awards of our members (see pages 14 and 18.) Elsewhere in this report: Conference highlights with the participation of SFB-TRR 161 members, reports of those doctoral students who could stay abroad in 2020, and summaries of the Lecture Series and Conversation Series in winter term 2020/2021. Presenters included luminaries in their fields, e.g., experts who co-founded the research areas of AR/VR in the 90s (see page 11).

We are very much looking forward to meeting you at the status seminar and we wish you inspiration and reading pleasure with the Annual Report 2021!

Heike Lehmann and Daniel Weiskopf

RESEARCH AND THE COVID-19 PANDEMIC

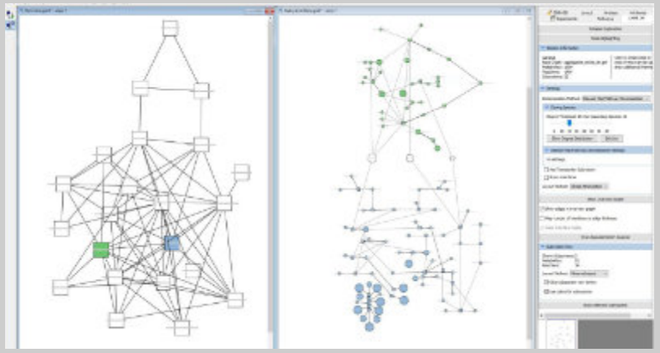
The COVID-19 pandemic affects not only everyday and social life, but also the research done within the SFB-TRR 161.

Around the world scientists collaborate, share their results, and communicate in new ways. We observe a new dynamic in many research infrastructures, which could in some sectors lead to lasting changes.

Our researchers participate in interdisciplinary projects and cooperations to help with their expertise. In teams they try to find answers to pressing questions related to the coronavirus pandemic.

COVID-19 DISEASE MAP

The COVID-19 Disease Map project [1] is a large community effort that aims at providing data, computable content and bioinformatics pipelines to facilitate the understanding of the detailed host virus interactions and the underlying disease mechanisms. It currently involves 275 researchers from 128 institutions around the world. The first community paper that is currently under peer review involved **Falk Schreiber** (D04, INF) and Tobias Czauderna (Monash University, Melbourne). It was focused on the involved tool stack and general pipelines. The second paper now describes several studies that were performed within this overall framework. **Michael Aichem** (D04), **Karsten Klein** (D04, INF) and **Falk Schreiber** (D04, INF) worked on the exploration and topological analysis of the involved networks. On the one hand, they performed a comprehensive centrality analysis and on the other hand, they provided a computational tool for the hierarchical exploration of the networks. This tool was built on top of LMME [2] (Large Metabolic Model Explorer), which has been developed in D04 as part of the SFB-TRR 161. The figure below shows its usage for the COVID-19 Disease Map.



The left part of the figure shows the relationships between the 22 pathways that are involved in the COVID-19 Disease Map, while the right part shows the detailed interaction mechanisms for the two pathways that have been highlighted with color.

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Participating researchers: Michael Aichem (D04), Karsten Klein (D04, INF), Falk Schreiber (D04, INF)

[1] Ostaszewski, M., Mazein, A., Gillespie, M.E. et al. COVID-19 Disease Map, building a computational repository of SARS-CoV-2 virus-host interaction mechanisms. Sci Data 7, 136 (2020). https://doi.org/10.1038/s41597-020-0477-8

[2] Michael Aichem, Tobias Czauderna, Yan Zhu, Jinxin Zhao, Matthias Klapperstück, Karsten Klein, Jian Li, Falk Schreiber. Visual Exploration of Large Metabolic Models. Bioinformatics, btab335 (2021). https://doi.org/10.1093/bioinformatics/btab335

TASK FORCES

TASK FORCE A: DATASETS, BENCHMARKS, AND REPLICATION

The data management plan, the foundation of which is the implementation of DaRUS as work package 1 under Project INF, is available to all members of the Collaborative Research Centre from the participating universities since the second half of 2020. Project INF is still in negotiations with ZENDAS on the GDPR aspects of the infrastructure for research data management.

Nevertheless, the goal of Task Force A now turns into investigating how a consistent availability of data sets and established benchmarks, as well as sustainable replication of results, can be achieved. To this end, Task Force A has put forward a call to action to all projects to make suitable data sets and benchmarks available, either reported or new. While there may not always be a clear connection between a given data set and another project (other than the one producing the data), a strategy based on preemptive availability ought to be viewed as a successful path. Obviously, the current COVID-19 situation has had a negative influence on nearly all research, affecting study designs and running user study, data collection techniques, and thereby led to several delays, which also affected evaluating the procedures and guidelines developed so far.

With the overarching goal to set common guidelines for the replication of results, Task Force A and Project INF have surveyed how researchers approach replication to investigate what methods form a framework of guidelines toward FAIR, secure and GDPR-compliant practices. A direction to provide collaborative infrastructure across all three spatial dimensions in VR/AR/MR, and hybrid spaces, also presents a new vector to standardize replication and data collection, and ensure validity of user studies and experiments. With that, a native solution based on Unity 3D has and is being actively examined, designed, and implemented, first, as a library, consisting of a collection of building blocks, and then, serving as the foundation of a shared platform with a set of established study designs and data collection methods.

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TASK FORCE B: USER TESTING

Over the last year, the activities of Task Force B focused mainly on dealing with the disruption brought about by COVID-19 for user-based studies. Led by Task Force B, several groups within the SFB-TRR 161 collaborated on producing and circulating a survey, with the goal of understanding the impact and long-term implications of pandemic-related regulations for the work of researchers involved in user-based studies.

This collaboration resulted in a position article published in the 2020 IEEE Workshop on Evaluation and Beyond-Methodological Approaches to Visualization (BELIV). We presented and discussed this work at the BELIV workshop during the VIS 2020 conference, and it also formed the basis for a later workshop with students of the SFB-TRR 161 Graduate School during their Doctoral Student Retreat.

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CONFERENCES & WORKSHOPS

The COVID-19 pandemic has drastically changed the landscape of academic conferences and workshops. In 2020 and 2021, gatherings of the scientific community were almost exclusively moved to the virtual world. SFB-TRR 161 members seized the opportunity to participate and presented their work at numerous national and international conferences and workshops. Several workshops and conferences were also organized by members of the SFB-TRR 161 (cf. highlights).

- **Jul. 2020** ICME 2020
- **Sep. 2020** VISSOFT 2020
- **Sep. 2020** DAGM VMV 2020
- **Oct. 2020** ATAQM WORKSHOP
- **Oct. 2020** BELIV WORKSHOP 2020
- **Oct 2020** IEEE VIS 2020
- **Nov. 2020** ISMAR 2020
- **Mar. 2021** TEAP 2021
- **Mar. 2021** VIZBI 2021
- **May 2021** CHI 2021
- **May 2021** ETRA 2021
- **May 2021** SSVM 2021

SOME CONFERENCE HIGHLIGHTS FROM 2020 AND 2021

July 2020: Team A05, Dietmar Saupe and his cooperation partner Raouf Hamzaoui (De Montfort University, UK) organized the workshop "Data-driven Just Noticeable Difference for Multimedia Communication" as part of ICME 2020 +++ September 2020: Michael Sedlmair gave an invited talk at DAGM VMV 2020: Machine Learning meets Visualization +++ October 2020: Dietmar Saupe, Vlad Hosu (A05) and Bastian Goldlücke (B05) organized the ATQAM Workshop as part of the ACM Multimedia Conference +++ October 2020: Florian Frieß (INF), Valentin Bruder, Steffen Frey and Thomas Ertl (A02) received the LDAV Best Paper Award at IEEE VIS 2020 +++ October 2020: Together with a team of international colleagues, Michael Sedlmair (A08) organized the workshop BELIV - Evaluation and Beyond - Methodological Approaches for Visualization. It took place online in conjunction with the IEEE VIS 2020 conference under the topic "From a Distance: Research practices during the COVID-19 pandemic and beyond" +++ March 2021: Marc Ernst (C05) and colleagues organized the 63rd Conference of Experimental Psychologists (TeaP). The session on Motor Processes was chaired by Priscilla Balestrucci (C05) +++ March 2021: Daniel Weiskopf gave a keynote on "Uncertainty Visualization" at the 11th international meeting on Visualizing Biological Data (VIZBI) +++ May 2021: Andreas Bulling (A07) chaired ETRA 2021 and was co-organizer of the "1st International Workshop on Privacy and Ethics in Eyetracking" (PrEThics).

Albrecht Schmidt has been elected member of the Leopoldina where he participates in the Informatics Section.

Originating in 1952 as a classical scholarly society and appointed as the German National Academy of Sciences in 2008, the Leopoldina today counts 1,600 members from almost all branches of science in over 30 countries. Election to the academy is carried out in a multi-stage selection process and admission criteria are outstanding scientific achievements.

Thomas Ertl was appointed as a member of the selection committee for the Heinz Maier-Leibnitz Prize.

Each year, the DFG awards this prize to early career researchers as a distinction for outstanding achievement. The prize is funded by the German Ministry of Education and Research.

As of July 2020, **Steffen Frey** has accepted a tenure-track assistant professorship at the University of Groningen (RUG), Netherlands, where he joined the division Scientific Visualization and Computer Graphics of the Bernoulli Institute.

He maintains an advisory role within project A02, Quantifying Visual Computing Systems.

Leonel Merino has joined the Steering Committee of the IEEE Working Conference on Software Visualization (VISSOFT).

"The conference focuses on visualization techniques that target aspects of software maintenance and evolution, program comprehension, reverse engineering, and reengineering [...]. We aim to gather tool developers, experts, users, and researchers from software engineering, information visualization, computer graphics, and human-computer interaction to discuss theoretical foundations, algorithms, techniques, tools, and applications related to software visualization. We seek technical papers, empirical studies, applications, or case studies and provide a platform for presenting novel research ideas and tools." (From IEEE VISSOFT website: www.vissoft.info)

Miriam Butt was elected first chairwoman of the German linguistics society Deutsche Gesellschaft für Sprachwissenschaft (DGfS).

The DGfS is the leading professional association for individual academic linguists and linguistic institutions in Germany. Its scope includes all philologies and all branches of linguistics. Each year DGfS holds one 3-day conference which is the largest linguistic expert conference in Germany with more than 500 participants from Europe and overseas.

Since 1988, the DGfS includes a special interest group on Computational Linguistics (DGfS-CL) promoting the communication between computational and theoretical linguistics.

Michael Sedlmair was appointed to a permanent W3 professorship. The appointment follows after only 2.5 years on a tenure-track professorship, funded by the Carl Zeiss Foundation, and after a successful final evaluation, which was brought forward due to a call to another university.

Aside from his work within the SFB-TRR 161, Michael Sedlmair is involved in the two Clusters of Excellence of the University of Stuttgart: EXC SimTech "Data-integrated Simulation Science" and EXC IntCDC „Integrated Computational Design and Construction for Architecture". In addition, he is one of the Cyber Valley professors. He is also a member of the Stuttgart Center for Simulation Science (SC SimTech), where he has recently taken on the function as Gender & Equality officer.

PERSONNEL CHANGES

Since July 2020

New Arrivals:

- Katrin Angerbauer (Stuttgart, A08)
- Fiona Draxler (Munich, C06)
- Daniel Immanuel Fink (Constance, C01)
- Dimitar Garkov (Constance, INF)
- Heike Lehmann (Stuttgart, SFB Manager)
- Hui Men (Constance, A05)
- Yao Wang (Stuttgart, A07)
- Christina Warren (Stuttgart, Ö)

Alumni:

- Houssem Ben-Lahmar (Stuttgart, D03)
- Michael Blumenschein (Constance, A03)
- Steffen Frey (Stuttgart, A02)
- Franz Götz-Hahn (Constance, A05)
- Jesse Grootjen (Munich, C06)
- Melanie Herschel (Stuttgart, D03)
- Leon Kokkoliadis (Stuttgart, Ö)
- Cristina Morariu (Stuttgart, A08)

LECTURE SERIES GOES ONLINE

In winter term 2020/21, our Lecture Series took place online due to the pandemic restrictions. We had 11 renowned international speakers who shared their knowledge via WebEx:

Kede Ma (University of Hong Kong)
Image Quality Assessment: Unifying Structure and Texture Similarity

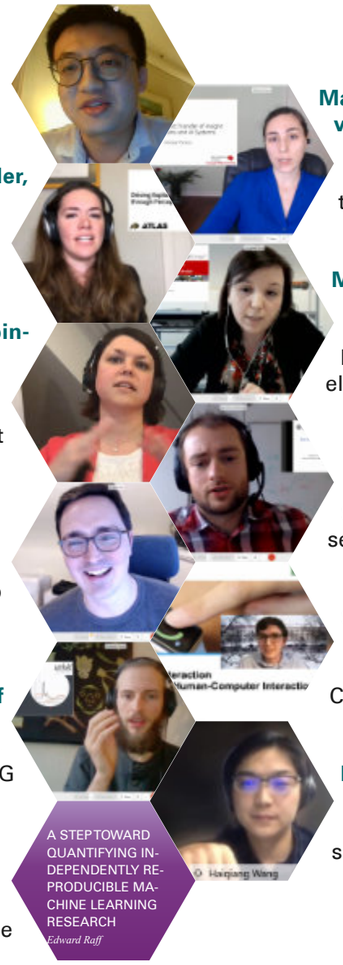
Danielle Szafir (University of Boulder, USA)
Driving Exploratory Visualization through Perception & Cognition

Maria Wirzberger (University of Tübingen)
Designing intelligent educational technologies: Perspectives related to learner characteristics and context factors

Mario Fritz (Saarland University)
Trustworthy Visual Computing: Towards Sustainable Detection of Deep Fakes

Benedikt Ehinger (University of Stuttgart)
Challenges for Analysis and Visualization using encoding models of EEG brain activity

Edward Raff (Booz Allen Hamilton, Columbia, USA)
Quantifying Reproducible Machine Learning



Mariya Toneva (Carnegie Mellon University, Pittsburgh, USA)
Data-Driven Direct Transfer of Insight between Brains and AI Systems

Marcella Cornia (University of Modena and Reggio Emilia, Italy)
Predicting Human Eye Fixations via Deep Learning-based Saliency Models

Dominik Schlechtweg (University of Stuttgart)
State-of-the-art models in lexical semantic change detection

Sven Mayer (LMU Munich)
Hand- and Body-Aware Interaction for the Next Generation of Human-Computer Interaction

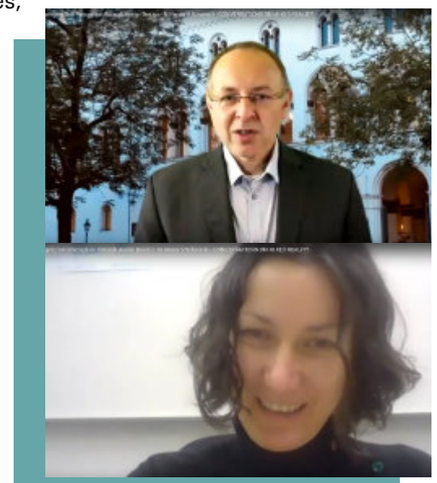
Haiqiang Wang (Tencent Media Lab, Shenzhen, China)
JND-based Perceptual Quality Measurement and Prediction

Online events as the format of the future?

Presenting the lectures online had its pros and cons. Compared to physical lectures that allow only visits of doctoral researchers, interested students and PLs who are at the specific location, the number of attendants increased by roughly 50% for online lectures to an average of about 50 participants. The drawback of online lectures is of course that the speakers vanish as quickly as they appear. There is no time to meet within the research groups and sit together for scientific exchange, which is usually the case if the speaker is a local guest. Perhaps a combination of both online and physical lectures is the step into the future.

CONVERSATION SERIES ON VIRTUAL/AUGMENTED/MIXED REALITY

In winter term 20/21 Katrin Wolf, professor for Human-Computer Interaction at the Beuth University of Applied Sciences Berlin, and **Albrecht Schmidt**, chair in Human Centered Ubiquitous Media in the Computer Science Department of the LMU Munich (C06) introduced a conversation series that brought together experts about virtual reality (VR), augmented reality (AR), and mixed reality (MR) and an interested audience. Together they looked at research challenges, technologies, and applications and investigated how such technologies can be used to create a positive impact on our health and well-being.



Albrecht Schmidt and Katrin Wolf, organizers of the series

For the audience it was a unique opportunity to engage in discussions with experts like Mark Billinghurst, who was one of the key people in defining augmented reality (AR) at the end of the 1990ies, or Mel Slater, one of the fathers of virtual reality (VR) and its applications to different domains.

The opportunity to get to know views from completely different areas was another incentive to partake in the series. Eva Wolfangel, a top science journalist from Stuttgart who received the European Science Writer of the Year Award in 2018, shared her views and own experiences with virtual reality. Insights into medical aspects of mixed reality were introduced by Igor Sauer, who heads the Experimental Surgery at the Charité in Berlin and coordinates the research activities of the Surgical Clinic of the Charité.

With Niels Henze and Valentin Schwindt, two former members of the SFB-TRR 161's project C04 also joined the series. Niels Henze, now professor for Media Informatics at the University of Regensburg, and Valentin Schwindt, meanwhile professor for Human-Computer Interaction at the Frankfurt University for Applied Sciences, shared their knowledge on how self-perception might change through avatar design.

The conversation series is paused during summer term 2021, but will hopefully be continued during the 21/22 term.

All guests in the conversation series:

- Regan Mandryk, University of Saskatchewan, Canada: *Designing Digital Tools for Managing Mental Health*
- Andy Wilson, Partner Research Manager at Microsoft, USA: *What does it take to make AR and VR usable and useful?*
- Michael Nebeling, University of Michigan, USA: *XR for Everybody: Empowering new design participants*
- Mark Billinghurst, University of South Australia: *Empathic Computing – Novel Concepts for Collaborative Interfaces*
- Eva Wolfangel, Science Journalist from Stuttgart: *Can social VR make us happy?*
- m.c. schraefel, University of Southampton, UK: *Inbodied Interaction*
- Daniela Petrelli, Sheffield Hallam University, UK: *X-Mas Special: Digital Gifts – Ideas and Discussion*
- Mel Slater, University of Barcelona, Spain: *The transformative power of virtual reality*
- Susanne Boll, Carl von Ossietzky University of Oldenburg: *Mixed reality for care*
- Niels Henze, University of Regensburg and Valentin Schwindt, Frankfurt University for Applied Sciences: *Changing Self-Perception through Avatar Design*
- Igor Sauer, head of Experimental Surgery at the Charité, Berlin: *Extended Reality in Surgery*
- Marilyn Lennon, University of Strathclyde, UK: *Digital Health and Wellness*
- Yvonne Rogers, University College London Interaction Centre, UK: *When does AR get creepy: Helping or hindering healthcare?*

Research Stays

The SFB-TRR 161 strongly encourages PhD students to do research stays abroad in order to broaden their horizon and gain experience in intercultural communication. Sadly, the restrictions imposed by the COVID-19 pandemic have made international travel increasingly difficult. Still, two PhD students were able to complete a research stay in the period between July 2020 and June 2020, one of them on-site while the other was converted to a remote internship.

Jochen Görtler (A01)

INTERNSHIP AT APPLE

From June to September 2020, **Jochen Görtler** (A01) had the opportunity to intern at Apple, where he joined a group of visualization researchers focusing on human-computer interaction and machine learning. Originally, the internship was supposed to be in Seattle, WA, but due to the COVID-19 pandemic, the internship took place remotely.

During his time at Apple, he developed a visualization system that helps better understand the performance of machine learning models. A paper that summarizes the research results is currently undergoing the peer-review process.

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Nils Rodrigues (B01)

GRAZ, AUSTRIA

From June to September 2021, **Nils Rodrigues** (B01) visited the Institute of Computer Graphics and Knowledge Visualisation at TU Graz. He worked with Prof. Tobias Schreck and Lin Shao on the identification of four (unique) tasks of people working with scatter plots and the recording of eye-tracking data while users execute these four tasks. They developed a first deep learning model to identify the tasks based on gaze and image data which already yields promising results. Back in Stuttgart, Nils continued his work on the model by including additional gaze data. His collaboration with the researchers from Graz is continued in a shared supervision of a Master's thesis at the TU Graz.

The Uhrturm, a famous landmark of Graz (Photo: Wikimedia Commons)

Despite the restrictions due to the pandemic, the research stay could take place in its full lenght, it merely had to be moved by two weeks due to travel warnings.

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NEW DOCTORAL SPEAKERS

Oliver Wiedemann (A05) and **Florian Friess** (INF) are the current doctoral speakers. As such, they represent the interests of the PhD students and organize events such as doctoral retreats and workshops.

Left: Oliver Wiedemann, Right: Florian Friess.

DISSERTATIONS

Since July 2020, two candidates completed and successfully defended their dissertations:

- **Michael Blumenschein** (A03): Pattern-Driven Design of Visualizations for High-Dimensional Data
- **Houssem Ben-Lahmar** (D03): Provenance-Based Visual Data Exploration

Congratulations!

MACHINE LEARNING WORKSHOP

On April 20, 2021, members of the SFB-TRR 161 graduate school had the pleasure to attend the work shop Machine Learning: Dimension Reduction Techniques by Dr. Michaël Aupetit, Senior Scientist at QCRI, Qatar.

In the workshop, Michaël Aupetit presented both older and newer dimension reduction techniques, ranging from Principal Component Analysis (PCA), over K-Means and Self-Organizing Maps (SOM), to a comparison between t-distributed Stochastic Neighbor Embedding (t-SNE) and Uniform Manifold Approximation and Projection (UMAP). He introduced Multi-Dimensional Projections as a means to visualize high-dimensional visual data while preserving similarity based patterns. The workshop concluded with a demonstration of VisCoDeR, a tool to interactively explore different dimension reduction techniques and their characteristics.

A full report on the workshop is available on our Visual Computing Blog.

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FORMER DOCTORAL CANDIDATES

Cristina Morariu left the SFB-TRR 161 and is now working as a Machine Learning Scientist at Amazon in London, UK.

Franz Götz-Hahn has accepted a position as team leader at the chair of Intelligent Embedded Systems at the University of Kassel.

NEW DOCTORAL CANDIDATES

Yao Wang, A07
Katrin Angerbauer, A08

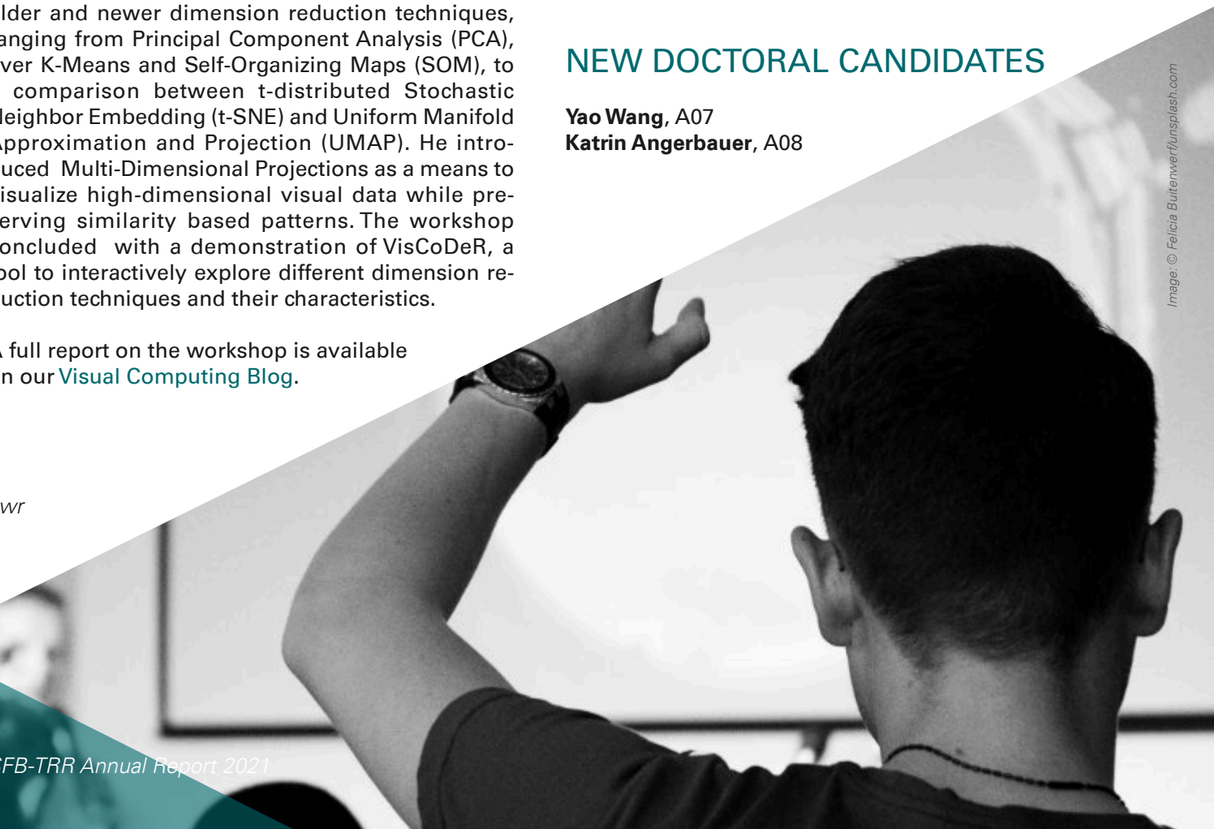
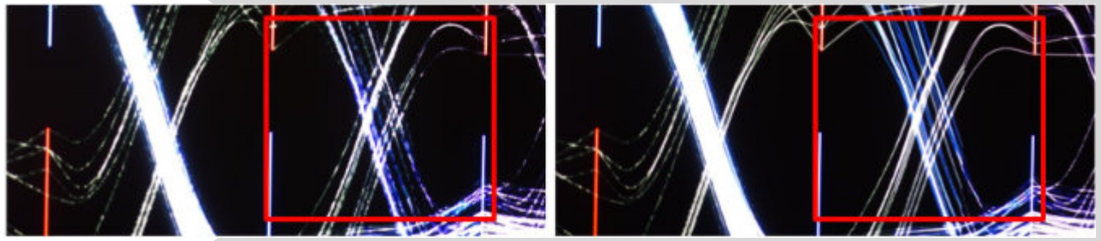


Image: © Felicia Buitenwerf/unsplash.com

LDAV BEST PAPER AWARD

- Projects INF, A02
- Stuttgart

In November 2020, **Florian Frieß** (INF), **Valentin Bruder** (A02), **Steffen Frey** (alumni), and **Thomas Ertl** (A02) received the Best Paper Award at the 10th IEEE Symposium on Large Data Analysis and Visualization (LDAV). In their paper "Foveated Encoding for Large High-Resolution Displays", they present a system that dynamically adapts the encoding quality in a way that reduces the required bandwidth without impacting the details perceived by one or more observers on large displays. This system can be useful for collaborative exploration of scientific data sets across large high-resolution display.

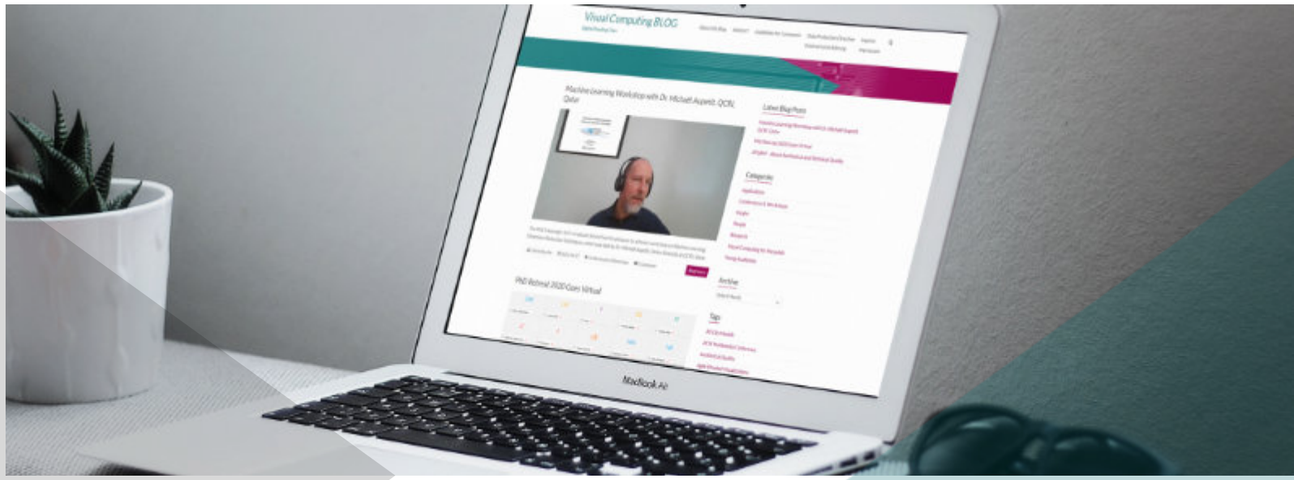


Two photos that show the difference between no foveated region (left) and the foveated region (right) at the example of parallel coordinates. The lines on the left photo are not clearly visible. The same is true outside of the foveated region, but the lines inside it are clearly visible. Source: F. Frieß, M. et al., "Foveated Encoding for Large High-Resolution Displays," IEEE Transactions on Visualization and Computer Graphics, p. 9, 2020.

TEACHING AWARD FOR SABINE STORANDT

- Project B06
- Constance

Sabine Storandt (B06) was awarded the Lehrpreis der Universität Konstanz von Studierenden (LUKS). LUKS is a teaching award with which students at the University of Constance honor lecturers from each university department for their outstanding teaching practices. One aim of the award is to make excellent teachers more visible and to allow other lecturers to draw inspiration from their teaching methods.



WHAT'S NEW ON OUR BLOG?

In 2020 and 2021, the Visual Computing Blog (www.visual-computing.org) has continued to reflect the activities of the SFB-TRR 161. The blog posts cover different science events, research stays, and new results. In the last year the blog had over 48,000 visitors and more than 220,000 page views.

The most read article was the second issue of our feature story format INSIGHT in July 2020, in which **Valentin Bruder** (A02) discusses his research on the performance of visual computing algorithms. He provides an overview of the challenges involved in processing large amounts of complex data for scientific visualizations and sketches several application scenarios that can benefit from performance modeling and prediction.

INSIGHT No. 2 by Valentin Bruder was the most read blog post of the last year.

On the side of events organized within the framework of the SFB-TRR 161, **Vlad Hosu** contributed a post about a workshop on Aesthetics and Technical Quality Assessment of Multimedia (ATQAM) as part of the ACM Multimedia extended conference program. The workshop was organized by SFB-TRR 161 members Vlad Hosu, Dietmar Saupe, and Bastian Goldlücke as well as colleagues from Taiwan, Singapore and Malaysia and featured keynotes from Prof. Al Bovik (University of Texas at Austin), and Prof. James Z. Wang, (Pennsylvania State University).

Other posts included a summary of the PhD Retreat as well as impressions from the Girls' Day, a workshop on Machine Learning organized by the graduate school and several research stays abroad, which we address in other sections of this report.

MEDIA COVERAGE

In February 2021, **Michael Sedlmair** gave an interview for the blog on fintechcube.com. In the interview, he discussed developments in the field of Immersive Analytics.

Link to the interview:
https://www.fintechcube.com/de/blog/post/interview-michael-sedlmair-uni-stuttgart

CANCELED EVENTS

- Tag der Wissenschaft (Stuttgart)
- Lange Nacht der Wissenschaften (Constance)
- Programming courses for girls (Stuttgart and Constance)
- The e-David exhibit by cross disciplinary painter and media artist Liat Grayver, which is supported by the SFB-TRR 161, has been postponed to fall 2021 (Constance)

EDUCATIONAL CARD GAME

Project Ö is developing an educational card game which will provide a playful access to automata theory. The aim of the game is to build a deterministic finite automaton in order to read cards which players found in the ruins of the laboratory of a once famous computational scientist and which are written in a mysterious language consisting only of T's and R's.

The game familiarizes players with terms such as states, transition functions or input alphabet and is designed as a supplementary hands-on activity for high school students who are taught automata theory in school. Furthermore, the game could also be used at events such as the Girls' Day, Tag der Wissenschaft or Informatiktag.

A prototype of the game has already been printed and is currently being tested with regard to teaching methodology and age-appropriate instructions.

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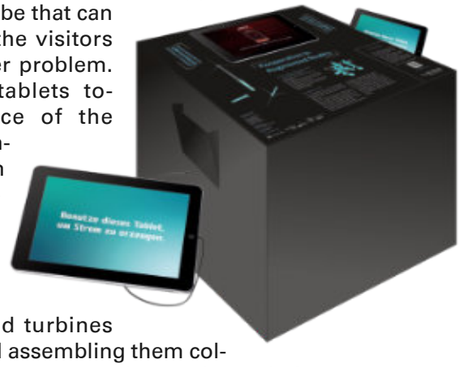
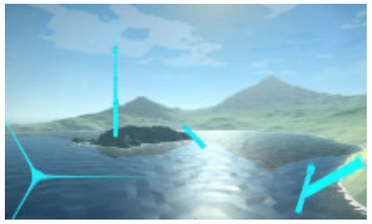
EXHIBIT "COLLABORATION IN AUGMENTED REALITY"

The interactive exhibit "Collaboration in Augmented Reality" introduces the concept of Augmented Reality and shows visitors how this technology can support collaborative practices in a playful way: The experience of interacting with this exhibit is built around a fictional story of a small town that runs out of electricity – visitors are asked to collaboratively assemble wind turbines, which then provide enough power supply for the town.

The exhibit consists of a wooden cube that serves as a mount for the involved devices: An information display first attracts visitors with an animation of a draining battery. It also explains the overall purpose and use of the exhibit. Two tablets are placed on opposite sides of the cube that can then be used by the visitors to solve the power problem. By holding the tablets towards the surface of the cube, the story unfolds: A small town appears in Augmented Reality and visitors are tasked with removing different pieces of the wind turbines from of a truck and assembling them collaboratively by using common interaction techniques (e.g., comparable to well-known drag and drop operations). After finishing this task, the wind turbines generate electricity – little by little, the lights turn on in different houses and buildings.



The application itself is based on a study prototype that allowed us to investigate collaborative 3D object manipulation techniques in a previous experiment. With this exhibit, we want to build on the knowledge we gained from this first experiment and try to gather anonymous data on the usage of the implemented interaction and manipulation techniques as a field experiment. This exhibit was originally planned to ride along the InnoTruck exhibition, which had to be postponed due to the COVID-19 pandemic. Currently, we are in the phase of implementing the different techniques while searching for suitable alternative venues.



Building the wind turbines in AR.

jz

Projects: C01, Ö

A few impressions from our virtual Girls' Day workshop, including some glimpses of the screensavers built by the girls.

GIRLS' DAY 2021

On April 22, 2021, nine girls from all over Germany participated in an online coding workshop organized by the SFB-TRR 161 in collaboration with our colleagues from the SFB 1313 "Interface-Driven Multi-Field Processes in Porous Media – Flow, Transport and Deformation" at the University of Stuttgart.

After a general introduction to computer science, the girls were divided into small groups and received a step-by-step tutorial in which they learned how to code their own screensaver using C#. To test their knowledge, the girls were invited to participate in a quiz on computer science. The two girls who scored the highest won an attractive price: a book on programming by Oliver Deussen.

cwr

> *» Es hat sehr viel Spaß gemacht und die Zeit ist wie im Flug vergangen. Mit dem neuen Bildschirmschoner habe ich jetzt ein tolles Andenken an den wundervollen Tag. Ich hätte nicht gedacht, dass der Tag so spannend und schön wird!«* (Feedback on the Girls' Day Workshop)

BOGY INTERNSHIPS CANCELED

Due to the measurements against the spread of the coronavirus, all BOGY internships planned for fall 2020 and spring 2021 had to be canceled. We hope to be able to offer those high school students who did not have a chance to visit our sites and get an impression of what working in academia looks like an opportunity to do so at a later point in time. Despite the uncertain situation, new applications are already incoming and our waiting list for internships is steadily growing.

BOGY internships are a great way for young people to get a first impression of a possible career and are conducted during 9th or 10th grade. For the SFB-TRR 161, they are an important part of our outreach to young people.

SFB-TRR 161 on Twitter

Facts & Numbers

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1.756 profile visits in the last 12 months

#mixedreality #virtualgermanchi #coronavis #girlsday #unikonstanz #etra2021 #chi202 #simtech #situated #dataviz #machinelearning #vielfat #unistuttgart #coding #eyetracking

PUBLICATIONS

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1. R. Bian et al., "Implicit Multidimensional Projection of Local Subspaces," *IEEE Transactions on Visualization and Computer Graphics*, vol. 27, no. 2, Art. no. 2, 2021, doi: 10.1109/TVCG.2020.3030368.

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12. M. Borowski, J. Zagermann, C. N. Klokmose, H. Reiterer, and R. Rädle, "Exploring the Benefits and Barriers of Using Computational Notebooks for Collaborative Programming Assignments," in *Proceedings of the ACM Technical Symposium on Computer Science Education (SIGCSE)*, 2020, pp. 468–474, doi: 10.1145/3328778.3366887.

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