FUTURE TOPIC
TU Graz research
2026-1/#35

“Digital Systems are Not a Force of Nature”

When people interact with digital systems, the user and the system influence each other. On the one hand, this means that we can learn a lot about our society, its opinions and group dynamics by analysing digital systems. At the same time, however, it also means that we as individuals, but also as a society, are influenced by the design of these systems – be they social networks or artificial intelligence. How can we enable fair interaction here? How can bias be minimised? What does digital support mean for the way we deal with knowledge and the value we attach to it? Scientists at TU Graz are carrying out research on this.

Birgit Baustädter

“We are currently in an incredibly exciting phase of change,”


Lunghammer – TU Graz

says Viktoria Pammer-Schindler. She is deputy head of the Institute of Human-Centred Computing at TU Graz and deals with precisely these questions. The work of her institute revolves around technology in the human environment on an individual and societal level, examining the influence these systems have and how we can design them in such a way that they are socially acceptable, fair and healthy to use.

“A classic environment is social media, but also all other systems in which large numbers of people interact digitally with each other – for example, travel booking systems.” In a further step, this knowledge is moulded into the design of modern, adaptive, data-supported and AI-driven systems that meet the requirements of fairness, accessibility and healthy use.

INTERACTION DESIGN

Viktoria Pammer-Schindler’s research aspect is interaction design with a focus on user-Centred interaction. Her aim is to develop interactive technologies together with the respective target group and on the basis of scientific theory. “I particularly take a look at technologies that accompany us in our private and professional lives and examine how they change our relationship to knowledge and learning.” This includes, for example, what knowledge we consider to be “worth knowing”, which skills we consider to be essential and how this view changes. With the rapid developments and easy availability of powerful AI models, a lot has happened. Today, these models can generate simple texts, create images or write computer code very well. But: “As soon as it has to go deeper, where we expect higher quality and need to be more precise, the results of the AI models reach their limits. I suspect that our working world will move a little further away from generating and closer to evaluating.” The researcher also believes that the value of high-level knowledge and trustworthy sources will actually increase rather than decrease.

“Of course, even before there was artificial intelligence, there were publications full of nonsense.”

“But today, much less effort is required to generate false publications.” Especially when training young people, it is important to her not to demotivate them with the possibilities of AI. It is wrong to believe that knowledge is no longer necessary today because AI can already take over all our tasks. Precisely this misjudgement would lead to frustration in the education system. “Knowing something and being able to do something is satisfying in itself. Research has shown us this. However, some effort is first required to acquire knowledge and skills. This should be taught and experienced in schools and universities.”


Otmar Winterleitner – TU Graz

Viktoria Pammer-Schindler

BEHAVIOURAL ADDICTIONS

The social debate on these and similar topics has changed in recent years, says Viktoria Pammer-Schindler, just as the media landscape on the internet has changed: “YouTube can no longer be compared with TikTok. There are completely different mechanisms in TikTok that can be addictive.” She addresses so-called behavioural addictions. The platforms are designed in such a way that users find it difficult to detach themselves from them and stop continuously scrolling. It takes enormous willpower to build a healthy relationship. “I like to compare it to sugar or fat. In the past, we didn’t have so much of it available and had to eat it in large quantities as soon as it was available. Today, these substances are available in abundance, but our human programming has not changed. That’s why we overeat. This is exactly how these platforms are designed. They address fundamentally meaningful human needs and behaviours, but they overstimulate us.” She hopes for regulation:

“I don’t know how long it will take, but it will come.

Just a few years ago, smoking was ubiquitous.”

ACCESSIBILITY

Alexander Lex works at the Institute on the visualisation of data and how this visualisation can support the recording of information. “For example, we find it very difficult to recognise patterns in a spreadsheet table. But if, for example, we have a picture with blue and red dots in front of us, we very quickly get a feeling for the amount of red dots.” Researchers utilise these visual phenomena to make data more easily accessible. However, visualisation is also a key issue when it comes to disinformation. Here, too, visualisations ensure attention and supposed credibility. “Graphics make information appear more serious and factual.” Unfortunately, this is often exploited by actors who want to spread disinformation or distort narratives. It is particularly perfidious when graphics from reputable sources are used and then completely misinterpreted or placed in the wrong context. Counter-arguments become difficult and fact-checking very time-consuming. One of Alexander Lex’s main areas of research is therefore how graphics published by reputable sources can be made more resilient to misuse.

He would now like to devote himself to a topic that has had little research done on it: the preparation of complex, scientific visualisations for blind or visually impaired people. The challenge: “A pure text description often does not show all the information and is therefore not sufficient for actual understanding.” The approach that Alexander Lex and his team are working on involves 3D-printed models that can be used in teaching and convey an understanding of visualisation methods. This makes digital methods, such as textual descriptions of other visualisations, more easily accessible.

INCLUSION

Researcher Elisabeth Lex is working on the question of how recommendation systems and AI-supported personalisation can work reliably for the widest possible variety of users. The focus is not on the “average” user, but on those people whose needs, preferences or usage patterns deviate from the mainstream.

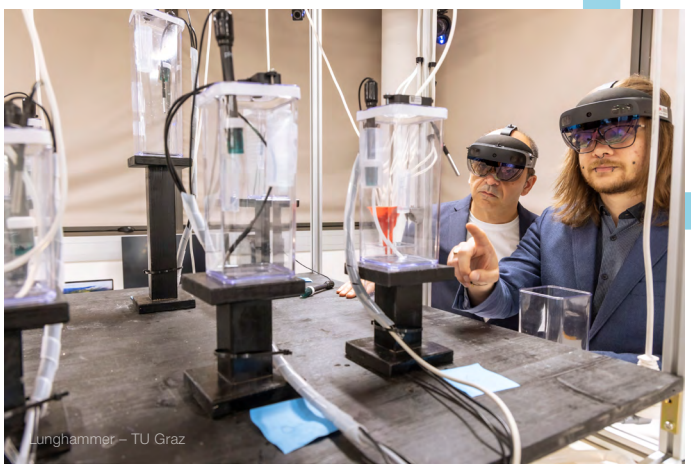
“Many systems deliver good results – but not equally good for everyone,” she explains. One reason for this lies in the underlying data. Certain groups are underrepresented or are not recorded with enough differentiation, which means that their preferences are barely visible in the system. However, distortions arise not only in data sets, but also in the models themselves – for example through optimisation goals or ranking mechanisms that favour dominant usage patterns.

Alexander Lex

TU Graz

Lunghammer – TU Graz

Elisabeth Lex


Lunghammer – TU Graz

These effects can be seen in different areas: from inaccurate recommendations for certain age groups or genders to poorer performance for individual, non-mainstream interests. In the context of accessibility, it is also clear that existing information is often too coarse to actually enable personalised and helpful suggestions.

Talk Science to Me
Elisabeth Lex

HUMAN CENTRED COMPUTING LABS

Human-Centred computing is a rapidly growing field of research in which the needs and behaviour of people are moving to the centre of the development of technologies and computer applications. The constant increase in available data and the growing complexity of IT systems calls for adequate visualisation of information and extended interaction possibilities between man and machine, for example via the virtual reality interface.

The Human-Centred Computing Labs in the Data House on TU Graz's Campus Inffeldgasse are one of Europe's most modern research facilities in the field of human-computer interaction. Due to the wide variety of technical infrastructure, they clearly stand out from other laboratories of the same designation. Numerous technologies are housed here in a research laboratory that can be combined for interlinked research in a wide range of disciplines, for example to move autonomous driving forward, improve brain-computer interfaces or combine virtual worlds of the highest quality with artificial intelligence and robotics. For example, VR-controlled telepresence using robots will be possible in real time to carry out work remotely or explore dangerous areas.

Lunghammer – TU Graz

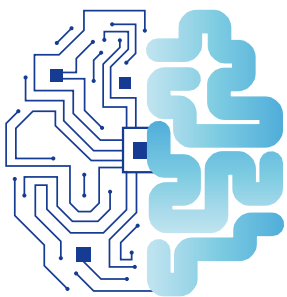
A key research step is therefore to make such systematic biases measurable and transparent – at both the data and model level. Building on this, Lex is developing approaches to make recommendation systems more robust in the face of diversity, for example through the targeted expansion of data sets, adapted modelling strategies or alternative evaluation criteria.

"In the long term, the aim is to develop systems that can adapt to different people – and not just to those who correspond to the statistical average."

The Chair in Human-Computer Interfaces and Inclusive Technologies receives financial support from the "Erzherzog-Johann-Gesellschaft Initiativ für Kinder und Jugendliche mit Behinderungen" association.

FAIRNESS

Scientist Fariba Karimi is investigating how different people can be better visualised in data sets. She focuses primarily on minorities and small groups that are socially and technologically disadvantaged. For example, there is a clear gender bias when it comes to suggestion algorithms in the area of career selection. However, she also examines how this lack of fairness and social bias can be read from data from social networks. Using network analyses, she investigated why (male) researchers still dominate the scientific system. Two factors are decisive here: homophily – the tendency to prefer to work with people who are similar to oneself – and the already established networks that give people who are part of them better access to cooperation and financial resources. "Complex systems like science are partly path-dependent, which means that small initial differences can have significant long-term consequences," says Karimi. "Feedback loops across generations, where certain groups have more resources, contribute to structural inequalities that create barriers for others."



Fariba Karimi is currently doing research on a similar topic as part of her ERC-funded project "NetFair – Network Fairness", in which she is investigating tendencies in social networks such as Google Scholar or LinkedIn that promote discrimination and social injustice. She focuses on intersectionality – the interplay of factors such as gender, origin or income in the area of marginalisation. As a result, she wants to develop methods that can reduce this discrimination. The aim is to achieve so-called network fairness and thus ensure that the systems function equally reliably for everyone.

MANY OPPORTUNITIES TO EXERT INFLUENCE

Viktoria Pammer-Schindler is very positive about the broad social discussions that are opening up around the use of digital systems and AI. However, there are still many unsolved problems in the design of the platforms. And the positive message in her point of view? "Technology is not a force of nature – we can play an active role in shaping it. And our students in particular, who will find themselves in positions of responsibility in the future, have a great deal of influence here."