#MyQuestionforScience #MeineFragefürdieWissenschaft











IDEENLAUF

Social impulses for science and research policy









Eine Initiative des Bundesministeriums für Bildung und Forschung



IDEENLAUF

Social impulses for science and research policy







DEAR READERS,

The report you are reading now is the outcome of IdeenLauf ('flow of ideas') in Science Year 2022 – Participate! It presents the results of the exchange of ideas between science and society, and between many different scientific disciplines.

Our work over the past months has made clear to us that these kind of participatory formats benefit both sides – science and citizens. This is because dialogue as equals promotes understanding of one another, creates transparency, strengthens trust in scientific methods and insights, and contributes new perspectives to science.

Citizens across Germany were invited through IdeenLauf to submit questions to the scientific community, with the slogan #MyQuestionfor-Science (#MeineFragefürdieWissenschaft). In response to our invitation, people submitted more than 14,000 questions. We, the Ideen-Lauf committees, would therefore like to thank everyone who has contributed their perspectives to IdeenLauf this year – whether by asking fascinating questions or getting involved in the digital citizens' dialogue, the online consultation.

The outcome is this report. The 59 clusters and 9 'future spaces' incorporate a large variety of questions, personal interests, and the day-to-day realities of a range of people. People who

are hoping for new insights, solutions and answers to fundamental questions from science. It is also the result of intensive discussions between researchers from various disciplines and citizens from all over Germany. Research questions and fields have been combined in conferences and workshops with social questions, and considered from new perspectives. Our debates were enriching, fruitful and multifaceted.

We present these jointly developed ideas to the Federal Ministry of Education and Research and to the scientific community. Consider the result of our work as a pool of inspiration and stimulus for future research projects and science and research policy.

We hope through this to have made a contribution to our society developing in a positive direction on the basis of scientific insights. This way, science can provide real social added value that impacts on the people's everyday lives. The many questions citizens submitted to IdeenLauf have highlighted how important it is to move from knowledge to action.

The editors Citizens Panel, Science Panel, Jury

SOCIAL IMPULSES FOR SCIENCE AND RESEARCH POLICY



BETTINA STARK-WATZINGER

Member of the German Bundestag,

German Minister of Education and Research

'14,439 questions for science brimming with curiosity, creative ideas and an interest in all kinds of research topics. I am greatly impressed and grateful for the multitude of suggestions that have arisen from this intensive interaction between citizens and science during this past year. Science thrives on diverse perspectives. Thanks to the "IdeenLauf" campaign, people had the chance to contribute ideas and questions reflecting the huge diversity of their experience, expertise and backgrounds. This citizen input provides valuable inspiration for research and research policy, for future innovations and new opportunities for our country.'





PROF. DR. KATJA BECKER
Speaker of the Alliance of Science
Organisations 2022
President of the German Research
Foundation (DFG)

'For researchers it is of great importance to relate their research to the questions that concern society. Scientists therefore actively communicate their insights to society while they are at the same time inspired by the ideas and experiences of citizens. We, as the Alliance of Science Organisations (Allianz der Wissenschaftsorganisationen), have therefore developed a variety of exciting formats in recent years in order to conduct research and research processes together with citizens. At the same time, it is and has always been essential to all of us that participation resonates with the preservation of academic freedom. During the Science Year 2022 and within the framework of IdeenLauf researchers and citizens had the opportunity for extensive exchange. The IdeenLauf in particular has provided valuable impetus and inspiration. Yet, it is also a pleasure to see that many of the important questions put forward by citizens are already the subject of in-depth research, often even in the context of large-scale multi-disciplinary projects. Therefore we look forward very much to furthering the dialogue!'

EDITORS

CITIZENS PANEL

Kristine August

not supplied

Thomas Autzen-Rahn

Winnert

Sina Bruder

Leipzig

Monika Buchenscheit

Erbach

Ulrike Dittmann

Dortmund

Jens Donner

Dortmund

Andreas Eberle

Gotha

Werner Groth

Marl

Doris Heleine

Essen

Steve Hoferick

Erndtebrück

Claudia Hohmann

Schweinfurt

Andreas Käsmayr

Dietmannsried

Sandra Klafky-Winter

Villingen-Schwenningen

Marek Langer

Remscheid

Benjamin Mahr

Hamburg

Andrea Matzke

Sprockhövel

Maris Moks

Berlin

Samuel Rehberger

Halle

Jutta Reichenbach

Heitersheim

Waltraud Riedl

Bad Füssing

Wolfgang Röhr

Aachen

Oliver Rost

Dortmund

Dr. Miriam Schwentker

Hamburg

Kathrin Seemiller

Diedorf

Dipl. Ing. Ronald Sommer

Bad Oeynhausen

Lucas Sostaric

Oberhausen

Dominic Straub

Nagold

Timo Wacke

Hamburg

Heinz Wenker

Sendenhorst-Albersloh

Prof. Dr. Antje Boetius

Alfred Wegener Institute, Helmholtz Centre for Polar and Oceanic Research, Max Planck Institute for Marine Microbiology, University of Bremen

Prof. Dr. Melanie M. Brinkmann

Helmholtz Centre for Infection Research GmbH (HZI), Technische Universität Braunschweig

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University of Southern Denmark

Prof. Dr. Friederike Fless

German Archaeological Institute (DAI)

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Universität Hamburg

Dr. Philip Häusser

TV host and author

Prof. Dr. Nina Langen

Technische Universität Berlin

Prof. Dr. Thorsten Logge

Universität Hamburg

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HTW Berlin University of Applied Sciences

Prof. Dr.-Ing. Dierk Raabe

RWTH Aachen University, Max-Planck-Institut für Eisenforschung GmbH

Prof. Dr. Martina Schraudner

Technische Universität Berlin, Fraunhofer IAO Center for Responsible Research and Innovation CeRRi

Prof. Dr. Metin Tolan

Georg-August-Universität Göttingen

Prof. Johannes Vogel, Ph.D.

Museum für Naturkunde Berlin, Humboldt-Universität zu Berlin

EDITORS



Dr. Thomas Bartoschek

University of Münster

Jacob Beautemps

University of Cologne

Dr.-Ing. Max Böhme

HTWK Leipzig University of Applied Sciences

Dr. Tanja Bratan

Fraunhofer Institute for Systems and Innovation Research ISI

Univ.-Prof. Dr. Ali Canbay

University medical center Knappschaftskrankenhaus Bochum

PD Dr. Tim Conrad

Zuse Institute Berlin (ZIB)

Prof. Dr. Patrick Donges

Leipzig University

Dr. Elisabeth Dütschke

Fraunhofer Institute for Systems and Innovation Research ISI

Dr. Denise Eckert

GSI Helmholtzzentrum für Schwerionenforschung GmbH

Prof. Dr. Angelika Eggert

Charité - Universitätsmedizin Berlin

Dr. Maha El Hissy

Deutsches Zentrum für Integrationsund Migrationsforschung DeZIM e.V.

Prof. Dr. Hannes Federrath

Universität Hamburg

Florian Genz

University of Cologne

Dr. Argang Ghadiri

Hochschule Bonn-Rhein-Sieg University of **Applied Sciences**

Dr. Heiko Giebler

WZB Berlin Social Science Center. Freie Universität Berlin

Prof. Dr. Dr. Sigrid Graumann

Protestant University of Applied Sciences Rheinland-Westfalen-Lippe

Dipl.-Psych. Martin Grund

Max Planck Institute for Human Cognitive and Brain Sciences

Dr. Ali Aslan Gümüsay

Alexander von Humboldt Institute for Internet and Society gGmbH

PD Dr. Eva Hackmann

Center of Applied Space Technology And Microgravity (ZARM)

Dr. Josephine Hofmann

Fraunhofer Institute for Systems and Innovation Research ISI

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Ostbayerische Technische Hochschule (OTH) Amberg-Weiden

Prof. Dr.-Ing. Lars Jänchen

University of Applied Sciences Emden/Leer

Dr. Ariane Kehlbacher

German Aerospace Center

PD Dr. Claudia Kemper

Landschaftsverband Westfalen-Lippe (LWL) für westfälische Regionalgeschichte Münster

Marlene Klemm

Pflegepraxiszentrum Nürnberg

Prof. Dr. Hanna Krasnova

University of Potsdam, Weizenbaum-Institut e. V.

Dipl.-Geogr. Simone Krause

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Hochschule Niederrhein University of Applied Sciences Prof. Dr. Sebastian Kurtenbach

FH Münster

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Max Planck Institute for Demographic Research (MPIDR)

Dr. Nicole Ludwig

University of Tübingen

Prof. Dr. Kai Maaz

Leibniz Institute for Research and Information in Education(DIPF)

Dr. Nadine Mengis

GEOMAR Helmholtz Centre for Ocean Research Kiel

Dr. Thorsten Merl

Philipps-Universität Marburg

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BioWissKomm Kassel

Dr. Christian Neuhaus

FUTURESAFFAIRS, Freie Universität Berlin

Prof. Dr. Lena Noack

Freie Universität Berlin

Prof. Dr. Thorsten Posselt

Fraunhofer Center for International Management and Knowledge Economy IMW

Prof. Wolfgang Prinz, Ph.D.

Fraunhofer Institute for Applied Information Technology FIT

Dr. Michaela Prothiwa

KU Leuven

Prof. Dr. Oliver Ruf

Hochschule Bonn-Rhein-Sieg University of Applied Sciences

Prof. Dr. Kerstin Schankweiler

Technische Universität Dresden

Dr. Étienne Serbe-Kamp

Backyard Brains, Max Planck Institute for Biological Intelligence, in foundation

Prof. Dr. Neșe Sevsay-Tegethoff

Esslingen University

Prof. Dr. Stephan Sommer

Bochum University of Applied Sciences

Benedikt Sonnleitner

Fraunhofer Institute for Integrated Circuits IIS

Dr. Tineke Steiger

Universität zu Lübeck

Matti Stöhr

TIB – Leibniz Information Centre for Science and Technology University Library

Prof. Dr. Simone Techert

Georg-August-Universität Göttingen, Deutsches Elektronen-Synchrotron DESY

Dr. Judith Terstriep

Westphalian University of Applied Sciences

Dr. Sabine Thater

University of Vienna

Prof. Dr.-Ing. Daniela Thrän

Helmholtz Centre for Environmental Research – UFZ

Dr. Nhat An Trinh

Humboldt-Universität zu Berlin

Thekla von Bismarck

Max Planck Institute of Molecular Plant Physiology

Dr. Matthias Wietz

Alfred-Wegener-Institut, Max Planck Institute for Marine Microbiology

Prof. Dr. Verina Wild

Augsburg University

Prof. Dr. Julian Wucherpfennig

Hertie School

Sabrina Zeaiter

Goethe University Frankfurt

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IDEENLAUF

#MyQuestionForScience #MeineFragefürdieWissenschaft

IDEENLAUF #MYQUESTIONFORSCIENCE

(#MEINEFRAGEFÜR DIE WISSENSCHAFT)

A year of questions, ideas and impulses: 14,439 questions, 59 clusters, 9 future spaces and many hours of intensive interaction between science and society. This is the result of IdeenLauf in Science Year 2022 - Participate!

We're living in a knowledge-based society. Whether it's health, mobility, information processing or the climate, in every area, the insights generated by researchers across the globe are being used to kindle innovations and actively shape our collective life as a society. From the development of new mobility concepts to preventing and overcoming illnesses and pandemics, as well as accelerating up the development of renewable energy sources, science uses its data and research findings to show

Precisely because research permeates so many areas of our society, it's important to further strengthen the dialogue between science, politics and society. All sides benefit from this: citizens participate actively involved, their everyday expertise, new ideas and questions are incorporated into the research process, the drafting of research questions and decisions about research policy. On the citizen side, this dialogue can strengthen trust in science and scientific literacy. These are critical requirements for a resilient democratic society.

us ways to overcome the challenges

of our times.



DR. JUDITH TERSTRIEP (Member of the Jury)

'IdeenLauf has initiated a fruitful dialogue between citizens and researchers. It has generated new perspectives for science. As an open participatory process, IdeenLauf has not only promoted the understanding of our work but it has also challenged us as scientists to communicate our research and knowledge to society in ways that are more comprehensible than before. We must continue this organised dialogue as an instrument of change in the context of mission-oriented innovation policies.'



Against this background, Science Year 2022 -Participate! has followed a new innovative approach with the IdeenLauf initiative. In contrast to previous years, it was not one single specialist topic at the forefront but the citizens themselves - and their questions for science. They had the chance to get involved, contribute their questions and express their ideas about the issues researchers should focus on.

Besides the many suggestions from society, it was the three IdeenLauf committees - the Citizens Panel, composed of around 30 individuals, the Science Panel and the Jury, composed of about 70 scientists - who particularly shaped this year.

The result was a great variety of ideas and impulses, which - grouped together and condensed in this report - offer impulses for future research and research policy.



PROF. JOHANNES VOGEL. PH.D. (Member of the Science Panel)

'Those who don't ask stay stupid. It's not only true when it comes to citizens putting their questions to science, though, but also for the scientific community when it fails to ask questions to society and citizens. IdeenLauf is a successful example of how you can find your bearings in this interaction, this new form of cooperation.'



'My question in the beginning was how we as representatives of the citizens could actually contribute during the Science Year. Could we do justice to citizens' questions sufficiently in clustering them? In my view, we managed together, as equals with our scientific colleagues, to give a frame for citizens' questions. I hope that the questions we worked on together will provide positive impulses for emerging research projects.'



THE COMMITTEES **OF IDEENLAUF**



SAMUEL REHBERGER (Member of the Citizens Panel)

'For me, IdeenLauf gave me a exciting insight into different scientific fields that used to seem rather remote. At the same time, the diversity of the questions submitted and the enthusiasm of citizens for science really impacted me. I think the citizens' questions give a good idea of the areas that people are particularly interested in. The many different people that I had the privilege of meeting in the process made the experience even more rewarding.'

The social perspective: the Citizens Panel

Citizens played a key role in IdeenLauf, part of Science Year 2022 - Participate! - and not just by submitting questions. They formed one of the three committees, the Citizens Panel, which was composed of about 30 randomly selected individuals. The Citizens Panel was invol-

> ved in the processes of gathering, grouping together and organising the questions.

The citizens committee worked with scientists from the Science Panel and the Jury over the course of the year. It provided comments on the clusters and future spaces from a social perspective, paid attention to the comprehensibility of the content produced and was given the task of selecting the cluster questions.

Male, female, non-binary; with domestic or foreign heritage; teenagers or pensioners; from villages or metropolises; from north and south, from east and west – the diverse composition of the Citizens Panel ensured that a variety of perspectives would be considered in IdeenLauf.



The scientific perspective: Science Panel and Jury

IdeenLauf was supported by a large number of scientists. About 70 lent their expertise to the process either as a member of the Science Panel or Jury. A wide array of disciplines was represented - from climate and technology to health and sociology. Doctoral and post-doctoral students contributed their knowledge alongside professors, university presidents and heads of research institutes.

The main tasks of the two committees were to group the submitted questions together by topic into clusters with the help of the Citizens Panel, to create cluster texts and future spaces, and to integrate feedback provided by the citizens in the course of the online consultation.



PROF. DR. STEFANIE MOLTHAGEN-SCHNÖRING (Member of the Science Panel)

'It is a central concern to me that society and science once again engage more in a dialogue with one other. So I believe it's very important that we look for social discourse. In my opinion, this has a lot to do with trust in science - and in the end even trust in democracy. After all, it's important that we speak with each other and learn from one another.'

MATTI STÖHR (Member of the Jury)

'IdeenLauf is an extremely thrilling campaign for a participatory, open interaction with science in our society. It is my honour to have been selected as a member of the jury and to be a part of it, because science communication is something I really care about. The process was on the one hand structured but also highly flexible, and I found both the depth and variety of questions as well as the cooperation between the panels to be characterised by a great deal of curiosity and respect.'



14,439 QUESTIONS -**SO MANY PERSPECTIVES**

Many different people from different backgrounds took part in IdeenLauf. Their varied questions introduced diverse perspectives. Some of their questions and motivations for participating in IdeenLauf are presented here.



INSA FEHR Age: 49

Home: Mönchengladbach

'Citizen involvement in IdeenLauf is a meeting of equals, meaning that it achieves more than just identifying relevant questions. There are so many people who can contribute to science moving forwards in individual areas, because they think differently or they simply go about asking something differently."



BENEDIKT KRIEGER

Age: 27 Home: Berlin

'Science can help us in nearly every individual and wider social situation in life. So it's all the more important that we're aware of the possibilities and diversity of science. If citizens can inspire others with their interest in science, I think it's a great idea that I want to be part of.'







SVEA WEIDEMANN

Age: 7

Home: Aschaffenburg

'When my teacher or my parents can't answer my questions, you need scientists - and I ask questions all day long. And perhaps I can help with the research or think of questions and ideas someone else might not think of."



MATTHIAS WEINERT

Age: 77

Home: Bremen

'Science can help people. So it mustn't "lose sight" of citizens but should always keep them in mind. Citizens in turn can help and provide new impulses for research by using their everyday knowledge and practical experiences,.'



CARMEN MARTINEZ VON BÜLOW

Age: 47

Home: Munich

'I believe that a reciprocal relationship between science and society can be very productive. There is a lot of potential in the citizens. Additionally, unusal perspectives may be a doorway to new ideas.'

FROM THE QUESTION TO THE REPORT

#MyQuestionforScience (#MeineFragefürdieWissenschaft) -The start to a year full of ideas

In January 2022, IdeenLauf started with an invitation to submit questions for science. Under the slogan #MyQuestionforScience (#Meine FragefürdieWissenschaft), all citizens were invited to contribute their ideas to research and research policy. The questions were gathered until April in many ways, including at zoos, museums and schools, as well as digitally via the website and social media channels.

More than 14,000 questions for science were submitted. The next step was to condense and group together the guestions submitted to filter out the ideas and potential for science and research policy innovation from the multitude of citizens' questions.



PROF. DR. MELANIE M. BRINKMANN (Member of the Science Panel)

'Working closely with the citizens is very enriching and motivating, because I can feel the sincere interest in science and the trust that is placed in it. Through IdeenLauf, I'm not only communicating with society, but also stepping right into the immediate, living interaction. It has given me valuable impulses for my research topics. For me, Ideen-Lauf is a real "win-win" (and I hope the citizens felt the same. I'

Questions on questions - review and selection

About 4,500 questions entered the further process of IdeenLauf. The deciding factors were the citizens' ratings on the Science Year website, along with random selection. These questions were once more reviewed by the editors to group together substantively similar questions. Moreover, the members of both panels as well as the Jury had the opportunity to nominate questions from those that had initially not been selected.

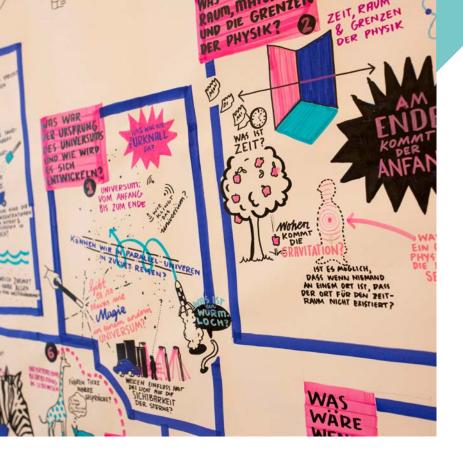
From question to cluster - a weekend full of questions

This selection was assessed at a conference in May 2022. The three committees composed of scientists and citizens discussed the selected questions at the conference, evaluated them and condensed them further. By this, thematic on topics with particular significance for science, politics and society were created.

The variety of participants and perspectives were taken time and again as impetus in the IdeenLauf to think and discuss beyond the boundaries among scientific disciplines. To highlight these intersections once again, first drafts for the so-called future spaces were furthermore developed at the conference. The future spaces emphasise thematic overlaps between the clusters from which new research questions and innovative research fields can be derived.

Feedback from society - the online consultation

The outcomes of the conference were once again presented for discussion: all those interested were able to comment on the clusters and identify additional future spaces via a digital citizens' dialogue, the online consultation, in June and July 2022. Substantive additions, change proposals, and general remarks were thus incorporated into the process. In the final





DR. ALI ASLAN GÜMÜSAY (Member of the Jury)

'IdeenLauf gives us as scientists new impulses to engage with and is a first step to not only passing on information but also to a fruitful exchange between citizens and science. To this end, Ideen-Lauf is not a one-way street but the opportunity to promote and even demand the interaction between science and society.'

phase of the online consultation, the committees reviewed the citizens' contributions so that they could be included in the report in a structured manner.

Editorial fine-tuning - the committees finalise the report

In September 2022, the three committees met once more. During two workshops they finalised the clusters as well as defined and sharpened the profiles of the future spaces. The IdeenLauf report 'Social impulses for science and research policy report' was presented to the scientific and political community in November.

HEINZ WENKER (Member of the Citizens Panel)

'The many questions for science let me realise how broadly based and deeply rooted interests and knowledge actually are in our country. In light of the ever more immanent questions about war, the climate emergency and pandemics, analysing the importance and direction of countless further questions was a challenge for all involved. All in all, however, the process was both extremely laborious, and stimulating.'



THE YEAR AT A GLANCE



Citizens participate with their questions

Under the slogan #MyQuestion forScience (#MeineFragefürdieWissenschaft), all of Germany's citizens were invited to submit their questions for science.





Cluster conference

Three committees of scientists and citizens grouped questions into clusters during a three-day conference. They further identified potential initial future spaces.











More than 14,000 questions were submitted

By 15 April, citizens had submitted 14,439 questions. They contributed many different perspectives on a wide variety of topics.







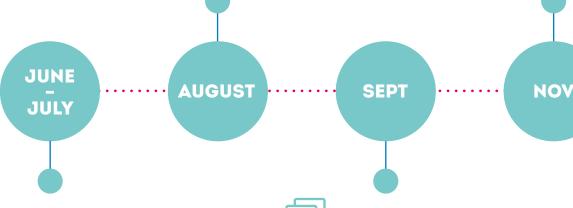
Integration of the feedback

The committees of IdeenLauf discussed the feedback received from citizens online, integrating it into the clusters.



Report . handover

At the final event of Science Year 2022 - Participate! the committees submitted the IdeenLauf report to the Federal Ministry of Education and Research and to the Alliance of Science Organisations as stimulus and inspiration for future research and research policy.





Online consultation

All citizens were able to comment on the results of the cluster conference via a digital citizens' dialogue. Participants were also able to build their own future spaces.



Finalising the texts

During two workshops, the committees determined the final selection and composition of the future spaces and finalised the report.



What's next?

FROM

2023

Until summer 2023, the results from IdeenLauf will be reviewed for potential implementation by the scientific community as well as research policymakers and initial funding measures will be introduced.

WHAT'S NEXT?

The more than 14,000 questions submitted by IdeenLauf participants form the basis for this report. Over the course of 2022, the three Ideen-Lauf committees - the Citizens Panel, Science Panel and Jury - condensed the questions and put them into their scientific context. This is how the 59 clusters and 9 future spaces came into being. As a social inspiration for future research and research policy, the IdeenLauf report was handed over to the Federal Ministry of Education and Research and to the Alliance of Science Organisations in November 2022.

Science and research policymakers will study the content produced in depth and review the report for potential areas of implementation by the summer of 2023. The results will be presented to the public.

The first concrete steps have already been worked out: the Federal Ministry of Education and Research is planning two funding initiatives.

One funding initiative is intended to address the citizens' questions via concrete research projects using innovative and participatory approaches. The other initiative will be a funding guideline influenced by the IdeenLauf results for the development of social innovations.

In addition, the questions and suggestions from citizens will be accessible digitally beyond the end of IdeenLauf and will therefore be available to science and research policy even after Science Year 2022 as an inspiration for further research.

IdeenLauf has come to an end for now. But the discussion produced and the stimulus for science and research policy can now begin.

FUTURE SPACES AND CLUSTERS

The outcome of IdeenLauf

FUTURE SPACES AND CLUSTERS -THE OUTCOME OF IDEENLAUF

IdeenLauf has shown that citizens' interest in scientific topics and questions is significant, as is their desire to contribute their own suggestions and ideas to science and research policy.

The questions submitted dealt with topical issues such as climate change, the consequences of the pandemic and questions of security, war and peace. Questions on everyday issues from the areas of education, work or health were also posed, as were fundamental questions, for example concerning the origin of the universe or how values and norms emerge.

Through IdeenLauf, scientific topics were reassessed in the context of interaction and dialogue: interdisciplinary cooperation enabled issues to be discussed from a different angle. Citizens' ideas and everyday experiences brought fresh perspectives to bear on established questions, resulting in connections and interactions that are able to strengthen the innovative power of science, politics and society. It also became clear that a lot of subjects which occupy citizens' minds are already the subject of intensive research. Good scientific communication is kev here.

It was the outcome of the IdeenLauf - the clusters and the futures spaces - that enabled these aspects to be combined.

The Clusters were discussed and combined into thematic units based on their innovative content and relevance for future research and research policy. They were then set into their scientific context and their text was reviewed. Individual cluster questions indicate the range of themes within the clusters they relate to.

The order and numbering of the clusters in the report is random and does not represent neither a statement nor a rating.

:UTURE SPACES

The participants of IdeenLauf contributed diverse perspectives, conducting discussions that extended beyond the boundaries of individual scientific disciplines. The future spaces highlight these crossovers. They emphasise thematic overlap between the clusters from which new reserach questions and innovative research fields can be drawn.

Once again, the order of the future spaces was chosen at random.

FUTURE SPACES



#Justice #Gerechtigkeit

#DevisingDemocracy #DemokratieGestalten

#Communication

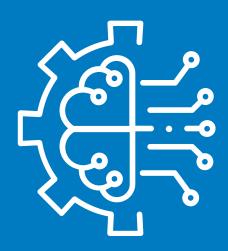
#Kommunikation

FUTURE SPACE 01

PATHWAYS TO A FAIR LIFE **TOGETHER**

Be it resources, opportunities or risks - social and global injustices and related conflicts are global dangers. Science can make a fundamental contribution towards researching the causes of and pathways towards a more just coexistence by working across disciplines and following social science methodologies. It is necessary to analyse existing systems and processes and outline new global, national and communal perspectives as well as creative opportunities.

- 02 How do we shape engagement with the past for a global future?
- 03 How can we shape cultures of harmonious coexistence?
- 10 How do we shape the educational institutions of the future?
- 13 How can the economic system be structured in an ecologically, socially and economically sustainable way?
- 15 How do we shape a social and climate-neutral transformation of energy systems, nutrition and mobility?
- 16 How can the inequalities in and between societies be overcome?
- 17 How can we shape digitisation for the common good?
- 18 How can peaceful life together be created and preserved?
- 22 How does international cooperation need to change for a better world?
- 24 What is 'right' and 'normal' now?
- 31 How can we ensure food security for people locally and globally?
- 50 How can gender-specific differences be better taken into account in medical research and care?



#AI #KI #DigitalFuture #DigitaleZukunft

#Shaping **Transformation** #TransformationGestalten **FUTURE SPACE 02**

DIGITISATION AND TECHNOLOGY FOR THE PEOPLE

Digitisation, artificial intelligence, and human-technology interactions are revolutionising our lives. Science can contribute to aligning this revolution with people's needs: quality of life, shared participation and common good. Research produces technology and must involve ethical considerations while doing so. It is important to shape the societal transformation responsibly and together - for example in data privacy, the use of AI and in biotechnology.

- 08 How is communication and language-learning changing in the global digitised world?
- 14 How are (digital) media changing discourse and the formation of opinions?
- 15 How do we shape a social and climate-neutral transformation of energy systems, nutrition and mobility?
- 17 How can we shape digitisation for the common good?
- **30** What can we learn from how humans, animals and plants process and exchange information?
- **33** How can we stop climate change?
- 37 How do we fashion a sensible symbiosis with technology?
- 38 Are groundbreaking changes for human life on the horizon in basic research?
- **40** How can we shape a sustainable energy system?
- 43 How might digitisation and artificial intelligence develop?
- 46 How do we combine technology with ethics?
- 55 How do we ensure psychological well-being in a changing world and promote social and environmentally-friendly behaviour?
- 58 How are the meaning and boundaries of human life changing through technological progress in medicine and do we want this?



#EnergyForClimate #EnergieFürsKlima

#FairSharing

#SustainableSociety #NachhaltigeGesellschaft

Sustainability is a central and global issue – both for future global development as well as within IdeenLauf. For this reason, we can see crossovers between this and all the other clusters. There is also crossover with future space 01: 'Pathways to a fair life together', future space 02: 'Digitisation and technology for the people', future space 04: 'Relationship of humans to nature', future space 05: 'Broader perspectives for thinking about and shaping health' and future space 09: 'Basic research for tomorrow's world.'

FUTURE SPACE 03

THE TRANSITION TO SUSTAINABILITY

Distributing resources justly between different continents and generations, and interacting with them fairly, is imperative for humanity to act responsibly. Science can develop solutions for this – as well as the responsible use of the biosphere and for a social transformation towards sustainability. Areas of focus are resources like water or energy, economic sectors such as agriculture or construction, and intangible assets such as knowledge and technical know-how.

- **07** How do we move from knowledge to action?
- 13 How can the economic system be structured in an ecologically, socially and economically sustainable way?
- 15 How do we shape a social and climate-neutral transformation of energy systems, nutrition and mobility?
- 16 How can the inequalities in and between societies be overcome?
- 18 How can peaceful life together be created and preserved?
- 19 How do we enable each individual to act sustainably?
- **31** How can we ensure food security for people locally and globally?
- **33** How can we stop climate change?
- **34** How should we adress the climate emergency as individuals and as a society?
- 35 How can we conserve resources and avoid waste?
- **39** How can energy be stored efficiently, at high density and for long periods?
- **40** How can we shape a sustainable energy system?
- 44 How can we better understand innovation processes and ensure they help us faster?
- 45 How will new technologies influence our homes and lives?
- 47 What resources and materials can we use sustainably?
- 48 What will our future mobility be like?
- 56 Which ways of life contribute to a high quality of life?



#BioDiversity #Biodiversität **#SustainableChange** #NachhaltigerWandel #ClimateChange #Klimawandel

FUTURE SPACE 04

RELATIONSHIP **OF HUMANS TO NATURE**

Preserving the foundations of our life on earth is the central task of the 21st century. Research can provide the knowledge base for preserving the global system of land, air and oceans, stopping climate change and ultimately ensuring an environment worth living in. This requires a new relationship between humans and nature. It must take into account quality of life and health, as well as how we sustainably use natural resources and preserve biodiversity.

- 03 How can we shape cultures of harmonious coexistence?
- 22 How does international cooperation need to change for a better world?
- 29 How can we understand and protect nature and its diversity better?
- 30 What can we learn from how humans, animals and plants process and exchange information?
- 31 How can we ensure food security for people locally and globally?
- 33 How can we stop climate change?
- 35 How can we conserve resources and avoid waste?
- 47 What resources and materials can we use sustainably?
- 48 What will our future mobility be like?
- 49 How can people stay as healthy as possible?
- 56 Which ways of life contribute to a high quality of life?



#OneHealth #PlanetaryHealth #HealthyFuture #GesundeZukunft

FUTURE SPACE 05

BROADER PERSPECTIVES FOR THINKING ABOUT AND SHAPING HEALTH

We generally think of health in terms of an organism or - at most - a group of people. Science contributes to us being able to understand and shape health more comprehensively. The healthcare system needs to become more holistic and take into account the natural foundations of our lives. This involves planetary health, the social environment, working conditions and the use of resources in the healthcare system. Individual and personalised medicine should be integrated into this systemic perspective.

- 50 How can gender-specific differences be better taken into account in medical research and care?
- 51 How can the provision of person-centred healthcare and nursing be organised in future?
- 52 What are future treatment strategies for incurable, severe, chronic or as yet little-researched diseases?
- 53 How do genetic factors and the interaction between environmental influences and genes shape people's characteristics and health?
- 54 How can we better understand and fight cancer?
- 55 How do we ensure psychological well-being in a changing world and promote social and environmentally-friendly behaviour?
- 57 What are the causes for post-viral illnesses such as long/post-Covid and how can we counteract them?
- 59 How can thinking, behaviour and experience be explained and influenced by brain functions?



#Science Communication

#Wissenschaftskommunikation

#FromKnowledge **ToAction**

#VomWissenZumHandeln

#CitizenScience

FUTURE SPACE 06

DIALOGUE BETWEEN SCIENCE **AND SOCIETY**

Science and society must be in dialogue long before new technologies or social innovations impact people's everyday lives. It's important to engage in scientific communication in such a way that the research process, its preliminary findings and uncertainties become more comprehensible. Dialogical communication and participation create added value: they strengthen trust in science bring diverse perspectives as well as expertise into research and bring something new into this world.

- 01 How do we develop culture and creativity?
- 05 How and what can we (truly) know?
- 06 How do we shape and communicate science?
- 07 How do we move from knowledge to action?
- **09** What influences lifelong learning and how can we promote it?
- 15 How do we shape a social and climate-neutral transformation of energy systems, nutrition and mobility?
- 17 How can we shape digitisation for the common good?
- 20 How can democratic participation be facilitated and protected?
- 21 How can the dialogue between science, society and politics be improved and made useful?
- 29 How can we understand and protect nature and its diversity better?
- **34** How should we address the climate emergency as individuals and as a society?
- 42 How can the interaction between science and society be improved?
- 43 How might digitisation and artificial intelligence develop?
- **46** How do we combine technology with ethics?
- 55 How do we ensure psychological well-being in a changing world and promote social and environmentally-friendly behaviour?



#NewEducation #NeueBildung

#NewWork #NeueArbeit

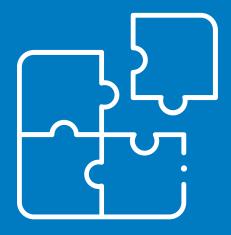
#FairEducationFairWork #FaireBildungFaireArbeit

FUTURE SPACE 07

EDUCATION AND WORK IN THE FUTURE

Education and work play a central role in our lives. It is important to shape them fairly. Our rapidly changing world needs an approach to education that gives people the skills for independent learning and comprehension. It has to strengthen critical thinking and provide skills. Our changing world needs a future for work just as much as it needs future work itself. With the help of science, society can establish contemporary values and norms for education and work.

- **01** How do we develop culture and creativity?
- 03 How can we shape cultures of harmonious coexistence?
- **04** What do arts and culture mean to us?
- 07 How do we move from knowledge to action?
- **09** What influences lifelong learning and how can it be fostered?
- 10 How do we shape the educational institutions of the future?
- 11 How can we foster vocational interests and support vocational choice in a sustainable way?
- 12 What influences the development of children and what role do media play in this?
- 16 How can the inequalities in and between societies be overcome?
- 23 Do we need a new understanding of work?
- 41 How will gainful employment change?
- 55 How do we ensure psychological well-being in a changing world and promote social and environmentally-friendly behaviour?



#Shaping TransformationFairly

#TransformationFairGestalten

#Strengthening Resilience

#WiderstandsfähigkeitStärken

#DevelopingSolutions Together

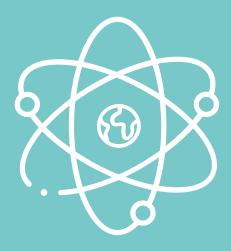
#GemeinsamLösungenEntwickeln

FUTURE SPACE 08

RESILIENCE **FOR FUTURE CRISES**

Our world is made up of complex systems. In light of an increasing number of crises, science is tasked with finding solutions to shape our systems in a way that is fit for the future. Research can contribute to being appropriately prepared for changes and to react in an evidence-based manner. It can develop potential actions we can take to transform key areas such as the environment, nutrition, health and education, culture and society.

- 03 How can we shape cultures of harmonious coexistence?
- 10 How do we shape the educational institutions of the future?
- 16 How can the inequalities in and between societies be overcome?
- 20 How can democratic participation be facilitated and protected?
- 22 How does international cooperation need to change for a better world?
- 31 How can we ensure food security for people locally and globally?
- 33 How can we stop climate change?
- **36** How is the climate changing and what are the effects?
- **40** How can we shape a sustainable energy system?
- 42 How can the interaction between science and society be improved?
- 46 How do we combine technology with ethics?
- 55 How do we ensure psychological well-being in a changing world and promote social and environmentally-friendly behaviour?
- 57 What are the causes for post-viral illnesses such as long/post-Covid and how can we counteract them?



#FutureHuman #ZukunftMensch

#CreatingKnowledge #WissenSchaffen

#BackToTheFuture

FUTURE SPACE 09

BASIC RESEARCH FOR TOMORROW'S WORLD

Science can help us overcome future challenges that are yet unknown. To do so, it need to be free and open-ended - basic research facilitates long-term progress. Science can investigate what options there are for developing our society and our living environment: should humans prepare for a life under completely different circumstances – in space or under water? Findings from basic research will continue to lead to unexpected and unforeseen applications.

- **01** How do we develop culture and creativity?
- 18 How can peaceful life together be created and preserved?
- 25 What is the origin of the universe and how will it develop?
- 26 What are time, space, mass and the limits of physics?
- 27 Why do planets develop differently, and is our planet earth unique?
- 28 (Extra)terrestrial life setting off into new worlds?
- 31 How can we ensure food security for people locally and globally?
- **32** What if?
- 37 How do we fashion a sensible symbiosis with technology?
- 38 Are groundbreaking changes for human life on the horizon in basic research?
- 44 How can we better understand innovation processes and ensure that they help us faster?
- 46 How do we combine technology with ethics?
- 47 What resources and materials can we use sustainably?
- 48 What will our future mobility be like?
- 58 How are the meaning and boundaries of human life changing through technological progress in medicine and do we want this?

CLUSTERS

1 HOW DO WE DEVELOP CULTURE AND CREATIVITY?







At the heart of this cluster is the question of what the bases of culture and creativity are. People want to know how and where culture and creativity operate and emerge – and how can both be fostered in the individual and society?

Context

Culture isn't static; it's a dynamic process.
Cultural creations emerge from an individual
and collective process of cooperation – a
negotiation process whose context is defined
by specific cultural techniques such as reading
and writing.

Cultural products are innovative creations inspired by ideas and influences and expressed in different media and designs. People create culture in distinct social contexts – from the



past and present. This process is often related to technological innovations.

To understand how culture and creativity develop and might even be learned, we have to explore how creativity and culture develop in practice. This requires examining the spaces of experience of these creative acts – both for the individual as well as for the cultural place they come from or live in. For example, the question why a person likes to read books so much relates to the fact that books were created in a context of considered content, good material and appealing form.

Outlook

One of the big challenges of the future concerns the insight that humans can essentially be taught to become creatively active. This does not, however, mean to renounce traditions, rules, accomplishments or knowledge. It is rather about regarding things as they currently are and the thought underlying them as being still in development. They are open-ended products that are as yet unfinished and might never be finished. They are, however, becoming ever more complete the more they are used, seen, perceived, broken down into their constituent parts and put back together again.

CLUSTER QUESTIONS

Where does creativity come from?

Do we invent or discover mathematics?

What sustainable technological and social innovations were invented in the ancient world?

How are cultures created?

Why do I enjoy reading books so much?

How do artists come up with new melodies time and again?

How does peace and quiet contribute to the creation of art?

Are suffering and good art connected?

This requires science to research processes which inspire creative work and ultimately shape art.

All of the processes, conditions of production and modes of action which allow us potential insights into the genesis of culture and creativity must be researched. Key questions are: what is needed in order to have the idea for a cultural work? Does one have to master a craft? What are the corresponding processes? What competences are needed? And why do the works created in this way have their own particular effect on the individual?

Author: Prof. Oliver Ruf

HOW DO WE SHAPE ENGAGEMENT WITH THE PAST FOR A GLOBAL FUTURE?

Constructive remembrance is the basis for successfully shaping the future. The question of how collective remembrance can be made to be both inclusive and pluralistic is central to this cluster. Citizens want to know how cultural heritage can be better protected. Which media can be used to communicate memory? What role do social media play in the work of remembrance? And what meaning do places of remembrance have?

Context

War, flight, anti-Semitism, racism and the history of colonialism are important issues in our society. We are faced with the task of reflecting on the presence of the past and defining cultures of remembrance in a new and above all global way. Dealing with the past is a collective process, which must be supported by the whole of society.



Key questions from this cluster are how we develop cultures of remembering in a pluralistic, participatory and inclusive manner while at the same time better protecting tangible and intangible cultural heritage from the effects of, for example, climate change, war and destruction. Citizens want to know how active remembering can be well organised and which media (for example, art and literature) and places of remembrance (for example, museums and memorials) society needs. They are interested in how these can be made fit for the future, and what role social media play.

Outlook

The research cluster shows how theories. policies, processes and media of remembrance should be rethought. The core idea here is the global and participatory shaping of remembrance for today's plural society. Remembrance should also be explored with respect to violence, traumas, and crises of climate and war. New science-based approaches for individual and collective biographical work can help to improve processing traumas from war and violence and stop them in a better way and stop them from being passed on over generati-

CLUSTER QUESTIONS

How can science and research policymakers help protect people and their cultural heritage in the event of a catastrophe?

How can we protect our cultural heritage from the effects of the climate emergency?

Why have Jews been discriminated against for so long?

How has the literature of black authors in the German colonies and in Germany developed up to now and what literary traditions is it linked to?

How can we better identify where objects in museum collections come from? That is, to see if they have not been illegally removed from their countries of origin.

How do we want to shape the culture of rememberance that we want as a society in the future?

How can German colonialism be addressed?

Is social media good or bad for the culture of rememberance?

Can traumatic events really be 'inherited' over several

Why can museums not be made more digital?

ons. This is a task that academics in the fields of history, the political and social sciences, art, media and literature studies and archaeology can be involved in.

Of interest in particular are the preservation and protection of tangible and intangible cultural heritage alongside questions of history and past cultures. Science could develop new concepts for protecting and preserving cultural heritage - but also approaches to how this heritage can be systematically used to strengthen cohesion in society and to teach skills. Research can make an important contribution towards strengthening the basis of our life together.

Author: Dr. Maha El Hissy



HOW DO WE SHAPE CULTURES OF COLLECTIVE LIFE?









Times have become unsettled, world peace is in peril. How we establish (new) cultures of collective life in peace and equality is a matter of concern to the citizens submitting questions. One of the key questions is how people act as social beings in society. What role do the interactions between different cultures and social inequality and inequity play? How do we ensure better participation, in particular in education? Citizens are asking themselves to what extent digitisation helps or harms collective life.

Context

The cluster's underlying question is how we shape (new) cultures of collective life in our society and how we can improve existing ones. It touches upon people as individuals as well as interpersonal relationships. But it also addresses the relationship between different social groups, different cultural concepts and ideas of collective life. The issues raised are equally diverse: how do people act as social beings and in the social sphere? How can interpersonal



relationships, mutual respect, sympathy, empathy and love be nurtured? How do people from different cultures, religions and generations live together?

It is about the development of traditions and customs, about different concepts of the family and traditional unequal gender relationships. The key questions here is how we can respond to social, cultural and (non-)religious diversity in society. What can we do to counter inequality and unequal opportunities for participation? What remains largely unsettled is the role of digital worlds for collective life - online as well as offline. One of the particular points of focus of the cluster is the educational system.

Critical questions are asked first and foremost regarding the functionality and fairness of the three-tier school system and how the participation of children and families from poorer families can be better supported. Universal values and the hope for peace, justice and equality, notwithstanding all our diversity and difference, are the guiding themes here.

Outlook

It is becoming clear that peaceful and just collective life is facing new challenges in view of

CLUSTER QUESTIONS

Why do prejudices still exist?

How can cultural diversity be made more appealing to society and thus be made more accessible to people?

How is sympathy developed?

Why are people intentionally antisocial?

Does patriarchy really have advantages for men?

What factors are required to ensure equal opportunities as

Why is pink seen as feminine and blue as masculine?

What was the concept of family like before it was shaped by religion?

What effects do digital worlds have on cultural life?

How can we make sure that children from poor backgrounds also get access to education?

current crises and increased polarisation. What we need is to build bridges between individuals. their relationships with others, and between social groups and society as a whole.

The scientific perspective on the influence and effect of digital worlds on social togetherness must at the same time encompass opportunities as well as risks. Central issues in all of this are the fight against inequalities and the support of vulnerable groups who have fewer opportunities for development, education and participation. Social, economic, cultural and political components all come into play here.

Analysing the relationship between values and modes of behaviour, as well as concepts of togetherness – in the family, in gender relations or between different groups in the population, for example - leads to new research questions. While these relate to ethics and democracy, they also have great practical relevance. What can we learn from this in terms of promoting more equality and in terms of specific actions toward a new culture of collective life?

Author: Prof. Dr. Beate Küpper

WHAT DO ART AND CULTURE **MEAN TO US?**

How do art and culture affect people as individuals and society? This question at the heart of this cluster touches on how art and science can each enrich one another. New technological developments have an impact on art and culture. What are the consequences of this? At what point does artistic freedom come under threat? What does a culture that is fit for the future look like?



Context

The cluster centres on the question of to what extent art, creativity and culture are important to our society. The meaning of art and culture (to us) is the subject of ongoing negotiation and contentious debates. Issues include what art and music do to us. What are their (positive) effects on us?

It is clear here, that art and culture also play a key role for us on a very personal and emotional level. Questions that are raised about art, music and fashion can also be related to other arts such as theatre and dance.

One issue occupying people's minds is the concrete interaction between art and science. Although they each have guite different approaches, they also have touchpoints and the potential for enriching each other.

Besides this, the effects of technological development on art and culture must also be considered. They depend on the political and economic context such as infrastructure and funding. This can put art under pressure, which may pose a threat to artistic freedom.

Outlook

In times of crises, when funds and resources are scarce (such as during pandemics or wars), the social value and benefit of art and culture seem to be guestioned or subordinated to other areas. This also applies to the academic disciplines and research fields related to art and culture. Art and culture must therefore not only be discussed in terms of utility, productivity and measurability.

Against this backdrop, key research questions arise from this cluster: how do we develop suitable formats to make the importance of art and culture visible in the future and shape their meaning for society? How can the potential of art and culture be anchored broadly in society -

CLUSTER QUESTIONS

What influence does music have on children?

Why is art not always appreciated?

What is the meaning of art?

To what extent can art and science interact with each other?

Is artistic freedom at risk?

How can the demise of humanities courses be prevented?

Will there ever be a time when fashion stays the same over a longer period (30 years) and is similar across the entire population?

How can artistic research enhance science?

What influence do artificially generated images have on art?

Is art a waste of resources in a world of finite natural resources?

for example, for critical reflection or provision of other approaches to the world. There is a desire for approaches that show how art and science can work together. Focus should be applied to how creativity and artistic methods can feed into scientific work and enrich it.

We need methodologies so we can better master the changes and challenges of our society: art and culture can serve as a laboratory for this, and our knowledge can be combined with artistic and creative experiences and reflections.

Author: Prof. Dr. Kerstin Schankweiler



HOW AND WHAT CAN WE (TRULY) KNOW?

In spite of increasing knowledge, there are questions that science still hasn't answered. One of the themes of this cluster is why this is. The people who submitted questions want to know what the meaning of knowledge is and what guidance it has to offer. Can we ever know everything? And how certain is our knowledge?



Context

The volume of available knowledge keeps on growing. At the same time, however, new questions and ambiguities arise. What can we truly know? And what do we not know? What causes fear and anxiety because it remains unknown to us and cannot yet be satisfactorily explained - such as the meaning of life, death, will or conscience? And how do we interact with our gaps in knowledge?

It's likely that the unanswered questions in our lives are increasing. Because of the more complex view of what's going on and going wrong in our world, the more pressing the questions

are that concern our basic way of life: what is normality; what's the point of boredom; what is success really; and what makes for a good and upright life? Our need for orientation knows no bounds and extends from the question of whether God exists to the measurability of happiness and doubt, and if we can ever in fact know everything. Many supposedly simple answers to these kinds of big questions float around in public debate.

In light of a growing need for orientation, questions about the fundamental meaning of knowledge and cognition must trigger equally fundamental reflection and discussion about what we (can) know, who this 'we' actually is, and how we can initiate and shape a confident conversation about knowledge.

Outlook

Given the size and complexity of the questions raised here, different disciplines must work together. What is needed is a scientific program that thinks outside of the box and is given the space and means to do so.

At the heart of this is the desire to identify the boundaries between knowledge and belief and to be given the tools to determine and describe something like normality, and a reality that is valid for all people (or at least as many people

CLUSTER QUESTIONS

Is knowledge the same as truth?

Will we ever be able to know everything?

Are there scientific arguments for reincarnation?

What happens after death?

How can happiness be measured?

Why are there conspiracy theories?

Is immortality worth pursuing?

Why do people believe in gods?

Why is there time?

Why is knowledge power?

as possible). Behind this, however, is also the desire to explore the meaning and nature of being human with all the attendant thoughts and feelings.

If 'people' are clearly so flawed that they generate problems of global dimensions, is it not necessary to ask what meaning human existence has on an individual as well as a global level and in relation to other forms of life? What constitutes being human and what are the basic orientations of human existence?

> Authors: PD Dr. Claudia Kemper, Prof. Dr. Thorsten Logge

HOW DO WE SHAPE AND COMMUNICATE SCIENCE?

Science has to reach people. But how must research findings be formulated and adapted so that they are well received by people? In light of the often clearly-formulated scepticism towards science, the people submitting questions to IdeenLauf want one thing most of all - to understand science and be able to trust in it (again).



Context

Science is a highly complex, constantly evolving and heterogeneous system with fluid boundaries. It is shaped by diverse specialities, topics and questions, people and communities, and in particular institutions and structures. And, last but not least, by events. The practices, paradigms and interests of science can be viewed as both unifying as well as competing elements. Depending on origin, position and perspective, the perception of science can differ very strongly.

Many of the questions allocated to this cluster show people's interest in being able to better understand this system and its interrelationships. Beside science's impact and responsibilities, the submitted questions are especially

concerned with the comprehensibility and trust in science. A certain amount of scepticism toward science is evident. The social and political context, as well as the reciprocal relationship between science, society and politics are relevant here.

In light of overall social and global challenges, sustainability within the organisation and the communication of science are key aspects. Extraordinary events such as crises influence the meaning, role and perception of science. They ideally have the effect of generating knowledge and accelerating the transfer of knowledge and/or science. All actors, but especially science policy makers are adressed here. Particularly significant are measures to encourage scientific culture(s) that are as open as possible, with free access to (publicly financed) scientific insights and the greatest possible transparency.

Outlook

Science should function freely and independently as much as possible. Interdisciplinary research questions and methodologies are more than ever gaining in importance in their contribution to science's success, influence and, in particular, communication. The focus should especially be on transparency, trust and comprehensibility. Questions on the design and

CLUSTER QUESTIONS

How can people with a sceptical view of science and research be reached?

What factors are key for people trusting in science

How do we make sure that scientific insights become established in society and politics?

How can science be made more tangible and visible to citizens?

How can science develop further so that it can become more effective as an adviser on policy and former of opinions for people with different levels of education?

How can discoveries be made accessible to a broader public?

How can people become more trusting in substantiated science again rather than in pseudo-science?

How can the humanities and natural sciences benefit even more from one another?

Why are citizens' opinions important to research?

Is science the new art?

impact of forms of communication also offer grounds for further research.

Science reporting in the media and promoting competent, appealing communication are front and centre here. Analysing and building on the audience-specific impacts of the many analoque, digital and hybrid formats in science communication already in existence would likely be both challenging and worthwhile. What can (future) technologies such as artificial intelligence and machine learning contribute to this?

Author: Matti Stöhr



HOW DO WE MOVE FROM KNOWLEDGE TO ACTION?







Science researches an incredible amount. But despite numerous research findings, it cannot deliver clear answers to all of society's questions. Why does it fail to do so? IdeenLauf participants are asking themselves what a path from science to societal implementation might look like, what role society's ability to communicate plays in this, and what concrete solutions to these problems might look like.



Context

What do knowledge and peoples actions have to do with one another? This question has preoccupied science and society for a long time.

More knowledge is being produced all the time. And more and more data and scientific insights on the big social, political and ecological guestions and challenges of humankind are becoming available. But the more knowledge is produced, the clearer it is that there are frequently no definitive answers to the big questions. With each new insight, it becomes

evident that knowledge is something preliminary and something that is constantly evolving. Searching, producing and presenting knowledge are all actions - but does knowledge always have to lead to action? Is knowledge definitive enough to begin with? Ambiguities account for a major part of our individual and collective lives. Some people respond to these with refusal, others with apathy, and some simply take refuge in simpler explanations of the world.

Carrying out scientific work and communicating knowledge is on its own not enough for individual or collective behaviour to be guided by the findings. Fundamental questions relating to our social and political collective life arise in order to be able to tackle problems together. Because most problems concerning our immediate living environment can be resolved neither by individuals in isolation nor with simple answers.

Outlook

How can communication in our society be improved in spite of - or precisely because of our different opinions, political convictions and experiences? This is a matter of the conditions and possibilities of human interaction and the question of how people can agree on a com-

CLUSTER QUESTIONS

Why is it difficult to move from knowledge to action?

Is it becoming increasingly difficult to convey knowledge (in terms of the recipients)?

How do we achieve solidarity of action rather than egocentric thinking and behaviour?

What skills do I need to develop to escape my 'filter

How can people around the world be immunised against fake news?

How come most people trust in science but nonetheless act against their better knowledge and against scientific recommendations?

How can we simplify complicated scientific correlations so that everyone finds them accessible and acts accordingly, for example regarding issues such as climate change, COVID-19 vaccination and so on?

mon denominator in knowledge, even if they are of fundamentally different opinions. Under what circumstances is it possible to accept differences and at the same time pursue a common goal?

What new means of generating and conveying knowledge are offered by art and culture or general forms and formats that rely specifically on emotions? In light of the challenges we face collectively (locally, nationally and internationally), developing theoretical answers and concrete solutions is a pressing issue for science.

> Authors: PD Dr. Claudia Kemper, Prof. Dr. Thorsten Logge

HOW IS COMMUNICATION AND LANGUAGE LEARNING CHANGING IN THE GLOBAL **DIGITISED WORLD?**

Communication is subject to constant change. How is digitisation changing language? What are the effects of globalisation on communication? These are important questions in this cluster. People would like to know what the consequences of such changes are for language learning. The effects on traditional and conventional forms of communication are also of interest. How communication under these conditions can be improved and how humans and machines communicate are further topics addressed in these questions.



Context

Language is a key component of human coexistence and is constantly changing. Besides the interest in the origin and development of language, other sign systems such as writing, gestures, symbols, pictures and mathematics also have a communicative function. Those submitting questions raise the issue of the influence of digital media on language development. They note not only the wealth of languages in

the world, but also guery the necessity of this diversity. The disappearance of dialects or entire language groups (as a result of globalisation, for example) is also a topic within this cluster.

Examining the languages of different subcultures (such as youth speak, slang and so on) is also adressed as well as – with particular emphasis - language learning, including of foreign and second languages. This is joined by questions on multilingualism and its benefits and drawbacks for child development. Concrete meanings of terms and their origin are likewise queried, together with questions on the current state of linguistic research.

Outlook

With the continuous emergence and dissemination of new media, new spaces for communication are also emerging. Speech is being supplemented as people's central tool of communication by new sign systems with their own rules that require investigation. The same applies to the influence of these new sign

CLUSTER QUESTIONS

How can all of the languages of origin of children and youths with a migration backgrounds be appreciated and supported?

Will dialects disappear?

What factors play a role in us suddenly dreaming in a language different from our own native language? At what point does the brain decide it will now dream in the other language?

Is there a grammar to gestures?

Do the language regions in the brain vary in size and complexity depending on whether you have learned a complex or simple language or multiple languages?

How is language evolving due to digital media?

If children in a class at school speak different languages, why is this not better utilized?

Do we now communicate more via images or via language?

What is the best way for immigrant children to learn German and what do effective and sustainable concepts for school integration look like?

How and in what 'language' does someone who has been deaf since birth think?

systems on the conventional familiar forms of communication. Here, besides aspects of communication between people, those between humans and machines should also be made the object of research.

In the globalised world, communication is of central importance. Scientific answers to questions about changes in and improvements to our communication are of significant importance and ought to be researched thoroughly.

> Authors: Prof. Dr. Oliver Ruf, Sabrina Zeaiter



WHAT INFLUENCES LIFELONG LEARNING AND HOW CAN WE **PROMOTE IT?**

Formal as well as non-formal and informal learning are important in our high-tech society. How lifelong learning can succeed sits at the heart of this cluster: what should learning environments, materials and media look like so that they are used by as many people as possible? What role do digital media and the increasing technologisation of society play? And how can the necessary space for lifelong learning be created in everyday life?

Context

The world we live in is characterised by significant technical changes and increasing complexity, as well as by insecurities and crises. It is important in such an environment that people learn successfully throughout their lives; this includes being willing and being able to learn. Not just so that they can meet the changing social and economic requirements but also so they can develop themselves independently.

Lifelong learning includes learning during childhood and youth, learning as an adult, as well as learning as an older person. Formal learning is institutionally organised in nurseries, schools, colleges and universities. This is mostly associated with examinations and qualifications. However, lifelong learning also includes all forms of non-formal and informal learning which take place in private and professional everyday life. The questions in this cluster discuss the attitudes of people towards lifelong learning, as well as their existing knowledge, their curiosity, and their motivation to learn and further their development.

Alongside this, an important role is also played by the characteristics of people's personal living situations where lifelong learning happens, such as place, time and space. These learning environments are characterised by available learning materials, their accessibility, the preparation of the content, their design and the potential to inspire people to intensively engage with the content.

Outlook

In this context, research questions should focus on the factors conducive to lifelong learning. In future, researchers could address questions on innovative concepts for the more vigorous promotion of lifelong learning integrated into people's activities. This may, for example, be regarding the conditions in professional working arrangements and workplaces, but it may also relate to other learning situations (such as [child's] play, computer games and so on).

However, it is not only the conducive conditions that should be considered. The limited daily time that people can spare besides their job

CLUSTER QUESTIONS

Can innovative thinking be learned?

Can one learn curiosity?

What approaches make sense for facilitating accessible and undemanding lifelong learning? How can educational offers complement day-to-day work?

Digitisation, sustainability, health: our society needs lifelong learning for individuals if it is to function well. How can we organise lifelong learning so that it does not only rely on the personal dedication of the individual?

Is it possible to practice an activity in either a laborious or super-easy manner, and what conditions make a

What conditions are required so children retain the joy of learning when they have to attend compulsory schooling?

What ways are there to acquire knowledge other than through school learning and learning by doing?

How can I motivate people towards more lifelong learning?

How could schooling be as individualised as possible, oriented around one's future career?

What are the criteria for 'discarding' knowledge?

and family lives must also be considered. Additional questions are about age- and targetgroup oriented measures to encourage and support lifelong learning to which researchers should find answers.

Author: Prof. Dr. Mandy Hommel



HOW DO WE SHAPE THE **EDUCATIONAL INSTITUTIONS** OF THE FUTURE?

How education can be made more practically useful is a topic that is on people's minds. Those submitting questions want to know which places of learning are required for this. They are asking the scientific community what digitisation means for educational institutions. What would contemporary media use and didactics look like? What new content needs to be communicated? And what content may be obsolete?

Context

The central question of this cluster is how schools and other educational institutions can be shaped in the future. Behind this lies the fact that people question our present educational system, especially early childhood education and the school system. German educational federalism, with its plural educational systems, is also challenged. Additionally, aspects of educational equity and the right to have a say in shaping things resonate here.

One clear objective is preparing young people in the best way possible for the challenges of the future while pursuing an individualised perspective in education – with a positive view of heterogeneity. This encompasses, in addition to different educational backgrounds, the topic of inclusion and the question of integration. Here, educational training should increase peoples sensitivity to diversity, with the aim of preventing and counteracting discrimination of any kind.

These considerations are supplemented by questions about the design of a discriminationfree learning environment and the institutional changes that are needed for this. How should

places of learning be designed, and what value do places of learning outside of school have, including for increased practical relevance? This consideration includes the buildings themselves (the room design, equipment, and so on), the structural components (such as classroom size, timings, breaks), as well as content-related aspects. What educational content should be taught in schools, and what content is perhaps superfluous or outdated?

One area of focus is digitisation and related questions of media didactics. However, 'knowledge for life' (for example, relating to taxes and pensions), soft skills and emotional intelligence are also raised as potential themes. In addition, the pressure to perform and adolescent stress caused by grades and tests are other factors which play an important role. IdeenLauf participants furthermore feel that the impact of the COVID-19 pandemic on education is important, as is what we can learn from this.

Outlook

The questions raised in this cluster touch upon a long research tradition. They reflect our society's educational challenges, focussing on what research needs to deliver in the future for

CLUSTER QUESTIONS

What digital literacy will we need in the future? How do we teach our children to read and write in view

What will school be like in the future?

Why are the really important things that we need later in life not taught at school? For example, taxes, dealing with stress, bureaucracy and so on.

Why don't we have more say in shaping our school?

Why do we not have a subject where you learn how to write

How can children be supported better during the pandemic?

What stops us from thinking of education independently of school so we can focus on the individual and all of their potential?

How can we share out education more justly?

How can an educational system be established in which all children have the same good opportunities for getting a good

How can you advance digitisation in German education?

us to achieve personalised and needsbased support for children and young people. Researchers should identify which learning and teaching methods are effective to this end and what role digitisation in all its facets can, should and must play. People hope to get answers from scientists about how the educational system can positively engage with the heterogeneity of our society and the resulting differing needs so we can achieve inclusion, integration and educational justice.

Increased focus should be placed on collaboration between research and politics so that research findings can serve as the basis for the future-oriented development of our education system.

Author: Sabrina Zeaiter







11

HOW CAN WE FOSTER VOCATIONAL INTERESTS AND SUPPORT VOCATIONAL CHOICE IN A SUSTAINABLE WAY?

What (new) approaches to vocational choice could look like is one of the themes of this cluster. IdeenLauf participants asked how people can develop more satisfaction with their career. How can vocational interests that are in particularly high demand in the labour market be fostered? What professional development and further training is needed? And are current job profiles still up to date?



Context

The focus of this cluster is on individual vocational interests, vocational orientation, vocational choice, and vocational education in general.

In the context of vocational choice, the citizens frequently identify an inconsistency between the vocational interests of young people and the vocational education and academic programmes offered, as well as the qualifications in demand by the labour market.

The challenges here include those related to the tension between promoting individual vocational interests on the one hand, and how these fit with potential future fields of work on the other. But consistency here is key to people being satisfied with their vocational choice and staying in the field for a longer period of time.

Additional questions concern the problem of the lack of young talent in the craft trade sector and the quality of vocational training in Germany. For companies, the urgency of these questions is particularly apparent in the shortage of skilled workers: the lack of qualifications and the associated time-consuming and cost-intensive search for applicants are pressing problems.

Outlook

This cluster presents questions for future research in the areas of vocational choice and vocational education. The research efforts required can be situated in four areas: promoting individual vocational interests (for example, in

CLUSTER QUESTIONS

What can and must be done so that more people seeking work pursue a trade, so that the trades are in a good position for the future?

Do more girls choose IT professions if they come into contact with IT topics at an early stage and have the opportunity to learn programming or at least try it out?

Why do apprenticeships in Germany have such a bad reputation or since when has this been the case? And how can this be changed?

How could schooling be as personalised as possible and oriented towards one's future career?

Why are there so few women in the natural sciences?

Why instead of grades do we not have any written evaluations, which say a lot more about a person (e.g. behaviour in groups) and would be more meaningful for future employers?

STEM or IT topics, trades and so on), developing better vocational orientation measures, in qualifications for professional development, and in the adaptation of vocational education and training profiles, study programmes and content to changing job profiles. The focus here should be not only on the effectiveness of measures to support individual and vocational oriented interests, it should also consider the needs of the labour market. Researchers should among other things develop approaches which aim to sustainably meet the demand for skilled workers.

As the professional world changes ever faster, more and more people will have to reorient themselves professionally in the course of their lives. Researchers should therefore also investigate how key skills that aid vocational flexibility and career satisfaction can be strengthened in young people.

Author: Prof. Dr. Mandy Hommel

WHAT INFLUENCES CHILD DEVELOPMENT AND WHAT **ROLE DO MEDIA PLAY IN THIS?**

The negative and positive effects of digital media on children are the subject of frequent public debate. It is a question that is also posed in this cluster, along with the question of how children can on the one hand be protected from harmful influences, while the potential benefits are simultaneously exploited. What competences children need for media use, how these can be taught and what (further) educational needs this creates for teachers are also aspects that interest citizens.

Context

The key question in this cluster is regarding the influence of different media on child development. It is clear from the questions submitted that digitisation and the media are of central importance for the future of our society. Alongside potential obstacles and negative side effects from which children should be protected, the positive use of innovative media for education is also a central theme of this cluster.



This is followed by a discussion of the use of media by children and young people. The focus here is on the effect of various media on adolescents. Another element of the conversation, alongside the protection of children and youth when using media, is the constructive application of media in education (for example, via virtual reality glasses, video games, music and social media). The key issue here is the necessary media competence of both learners and teachers, and potential methods and techniques of teaching.

Alongside this is the question of how interests, imagination, creativity, curiosity and other personality traits are formed in children. Emphasis is also placed on the question of the influence of nature and nurture on the development of intelligence and personality.

Outlook

Media use is generally accompanied by a fundamental uncertainty: new, unknown or unfamiliar media frequently trigger fears. Constant technological change means that their effect

CLUSTER QUESTIONS

Why do children love to hear the same stories over and over again?

What are the effects of social media on children?

Do video games have effects on child development?

What influences the intelligence of children more: nature or nurture?

Do we want social media content that educates us, too, or do we want entertainment?

How could the digital media stream be better regulated in the future to make scientifically verified sources more

Why do children ask so many questions?

on adolescents in particular and the sensible handling of them cannot be conclusively settled. Continuous social and scientific debate and reassessment are therefore not only unavoidable but also necessary. More often than not, this debate is controversial and interdisciplinary.

Future research should target insights for the constructive and evidence-based use of new media. It would be advisable for researchers. to work with established processes and media here. This may, for example, take the form of so-called action and intervention research. Here, pilot projects are drawn up in which innovations are tested in real classes, evaluated, and integrated into existing learning environments. This results in a focus on the promotion of individual (personality) development and on dealing with diversity in groups of learners. Personal competencies, too, and safe and secure (data) interaction with digital media and large volumes of information are possible goals whose implementation should be researched further.

Author: Sabrina Zeaiter



HOW CAN THE ECONOMIC SYSTEM BE STRUCTURED IN AN ECOLOGI-CALLY, SOCIALLY AND ECONOMI-**CALLY SUSTAINABLE WAY?**





Our way of doing business creates worldwide crises. Sustainability is the demand of the times. But what goals should a sustainable economy have? Which indicators and instruments can be used for a sustainable economy? And do these offer alternatives to growth?



Context

Many people do not regard the current economic system as being sustainable. They believe change is necessary. The topic of this cluster is what a future economic system which is simultaneously economical, ecological and socially sustainable might be like. There is a desire for alternative systems which can combine these three pillars of sustainability. What people are looking for is a system that takes into account and has at its core social consent as well as planetary limits.

It is important that we reduce our need for and use of finite raw materials. We need to replace current unsustainable economic processes with closed-loop and circular economic processes - so we use fewer raw materials repeatedly. Questions about the economic system's resilience to crises and its independence from hazardous external factors are likewiese considered as being significant in this cluster. Here, IdeenLauf participants see the challenges to the economic system's stability as being ecological, political and social crises, and also the climate emergency. All of these can have significant negative effects on the economy.

Outlook

The central research topic for the future should include a comprehensive critical analysis of the existing economic system. Indicators such as the inflation rate and economic instruments such as debt should be evaluated critically using a scientific approach. There is a need for research to resolve fundamental questions on the sustainability of the existing system and its alternatives. Answers to this should highlight possibilities that are in harmony with the economy, ecology and social affairs.

CLUSTER QUESTIONS

How does a society which is based not on growth but on a sustainable interaction with natural resources need to be organised?

In nearly all areas of social life, we are faced with the need to change things fundamentally. For example, in the areas of environmental and climate concern, food, energy and mobility. How can we do that?

What alternative economic model is best suited to counteract climate change and high consumption without neglecting social consent?

Is there a correlation between countries with vigorous capitalism and citizens with poor mental health?

Are our supply chains crisis-proof?

Is a world with prosperous people possible without capitalism, too? What would that look like?

How can our economy become more resilient to crises (climate change, Covid, wars)?

Does it make sense to subsidise or promote a high level of regional self-sufficiency?

Another meaningful fundamental question is how societies evaluate their relationship with economic systems (keywords here being cost internalisation or gross domestic product versus happiness) and how a transformation of the economic basis of societies would take place and what this would ultimately look like.

In summary then, the following questions preoccupy IdeenLauf participants: 1. the future viability of the current economic system and changes within this system; 2. the economic system of the future and the redesign of the existing one towards sustainable business, together with specific possible socio-political levers; and 3. a far-reaching systemic question as to how fundamental rethinking and reorientation can succeed.

Author: Dr. Ali Aslan Gümüsay

HOW ARE (DIGITAL) MEDIA CHANGING DISCOURSE AND THE FORMATION OF OPINIONS?

The internet and social media have a significant influence on society. This cluster focuses on how society is changed by them. People are asking whether social media has divisive or unifying effects on society, or both? Why do people radicalise via the internet and social media? Researchers should identify approaches to what can be done to counter this.

Context

In a democracy, individual and public formation of opinions are reliant on functional media. The importance of the internet and social media platforms here is the theme of this cluster. On the one hand, social media platforms have improved people's opportunities for participating in and actively contributing to public discourse. But this is also associated with fears of manipulated representations, a division of society, and threats of extremism.

The questions raised here relate primarily to the second, more negative aspect of the internet and social media. Thereby they pertain to both the current situation as well as potential



developments and counterstrategies. They address the formation of individual opinions, interaction with others, and the consequences for politics and society overall: how do our views of society change due to networking? Why do people become radicalised online, and what can be done to counter it? Is society really becoming divided as many people claim, and how can the extent of the division be measured or agreement be potentially reached?

Outlook

The questions in this cluster make it clear that the great expectations associated with the establishment of the internet as a medium of communication have not been fulfilled. A wider range of information and opinions as well as better opportunities to participate for many have, in the view of large parts of the population, not led to improved opinion formation and rational discourse.

This raises the following question for research: have the internet and social media platforms generated the phenomena described or merely made them more visible? For individuals as well as for society as a whole it seems increasingly difficult to assess the relevance of opinions. There is more information than

CLUSTER QUESTIONS

Under what circumstances do people become radicalised on the internet and what can be done to counter this?

Why is there so much hate on social media?

How do extremist attitudes arise and how can they be

Is society really becoming divided at the moment?

How are the living conditions of young people in rural regions different from those of their peers in the cities? Are there differences? Which ones exactly? Can they be measured? Do young people in rural regions need more support?

What influence do disinformation and fake news have on election outcomes?

How do people develop attitudes of hostility towards certain groups and what can we do as a society to counter this?

How can you change reporting in general to prevent bias?

Which factors influence the formation of political opinions?

What is the benefit to all of us if we can 'speak' with each other on the internet securely and in confidence?

can be processed by individuals, organisations or society. The increased visibility facilitated by the internet leads to greater uncertainty. Individual phenomena may be temporary occurrences in the transition from analogue to digital communication media, while others may be the expression of a deeper social change. Researchers should therefore investigate how network hubs can be created in global and open communication networks which identify misinformation without restricting the freedom of these networks that is required for democratic formation of opinion.

Author: Prof. Dr. Patrick Donges



HOW DO WE SHAPE A SOCIAL AND CLIMATE-NEUTRAL TRANS-FORMATION OF ENERGY SYSTEMS. **NUTRITION AND MOBILITY?**









What forms of energy generation and storage we need for the future is a central question in this cluster. This includes the question of sustainable mobility. IdeenLauf participants furthermore want to develop ideas as to which incentive and economic systems support a transformation in our interactions with energy, food and mobility.

Context

To overcome the global climate and energy crisis, science, politics and society need to work together closely. Joint action is also called for within science. The result of this cooperation must be on the one hand to increase energy efficiency. At the same time, we need new forms of energy generation and storage. One key technology of the future will for example be the generation of hydrogen from climate-neutral energy sources and its storage. Its mass application must be researched. In future, direct use of hydrogen could be the basis of a climateneutral propulsion technology, for example.

Besides advanced drive technologies, however, our mobility also requires new transport systems. We need to research and implement broader mobility concepts covering rural as well as urban areas. At the same time, climate-neutral mobility must be affordable and support inclusion: people with impairments in particular are frequently reliant upon wellfunctioning infrastructure.

We must understand the global changes in the climate not merely as abstract problems: in future, private action must be geared more strongly towards sustainability. The scientific questions for individual and sustainable action range from food and climate-neutral mobility to environmentally-friendly global tourism. The desire for independence from foreign energy supplies has recently been a growing concern for society and politics. In the search for solutions, the social and economic consequences of high fuel prices, climate change and altered habitats must be taken into account. Whether the return to unsafe and highly risky technologies such as nuclear energy is an option for overcoming the climate and energy crisis must be decided in dialogue between science, politics and society.

Outlook

In the long term, fossil fuels will not be sufficient to cover our energy needs. Combining many individual alternatives for energy generation is a complex task and requires researching new coordination and planning concepts. It has become clear in this cluster that researching requires new alternative economic models for the climate, energy and mobility. In research on the transformation from fossil to renewa-

CLUSTER QUESTIONS

How can we solve our energy problems sustainably so that we are independent and energy stays affordable?

How can politicians be convinced to act in accordance with the climate emergency?

In nearly all areas of social life, we are faced with the need to change things fundamentally. For example, in the areas of environmental and climate concern, food, energy and mobility. How can we do that?

What ways are there to implement important infrastructure measures more quickly (the energy transformation etc.) that citizens can simultaneously co-determine or shape?

How will mobility for people in rural regions be affordable in the future?

What happens when the oil runs out?

What could a mobility transformation in Germany look like?

How will the drive for climate protection affect aviation?

How can we provide our country with energy in the future?

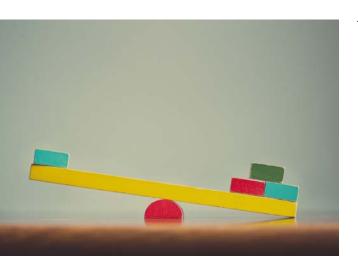
Why have nuclear power plants in Germany been shut down when we are now drawing nuclear energy from other countries?

ble energies, the aspect of time is playing an increasingly important role. The rapid advance of climate change urgently requires solutions to the energy problem. Research in the areas of climate, energy and mobility must therefore be oriented towards the usability of solutions in the near future. Increasing efficiency in a few energy-intensive industrial sectors should therefore be researched with the same intensity as the possibility of careful energy use by individual consumers. Researching and utilising network effects is a promising approach to creating sustainable climate, energy and mobility systems - for example via broad-based shared use of resources, and by establishing suitable incentive systems for responsible action based on scientific findings.

Author: Prof. Dr. Hannes Federrath

HOW CAN THE INEQUALITIES IN AND BETWEEN SOCIETIES **BE OVERCOME?**

Inequalities are increasing around the world. Citizens want to know what the reasons are for the unequal distribution of resources, rights and life chances. They are asking how these material and immaterial goods are distributed between countries, income groups, genders, ethnicities, religions and so on - and how a fair distribution can be achieved.



Context

This cluster adresses questions relating to the distribution of resources, rights and life chances in the broadest sense. Citizens are discussing which conditions and measures are necessary and feasible to make the distribution process more egalitarian and fairer. (In)equalities here are considered from three perspectives: the global perspective looks at economic differences between countries in terms of the distribution of income and assets on the one hand and in terms of the costs and consequences of global challenges such as climate change on the other hand.

The social perspective is characterised by a multidimensional understanding of inequality. It examines inequalities between people of unequal income and wealth. Discrimination of social groups based on their gender, ethnicity, sexual orientation or identity as well as their physical and mental condition also plays a role. An additional focus should be families and children as social groups, which have thus far received rather less attention in inequality research. They are, however, increasingly affected by structural disadvantages in light of new and persisting socio-demographic processes (such as rising divorce rates and more single parents).

The household perspective is ultimately concerned with the disadvantage of women, which arises from the distribution of household, care and paid work by gender.

Outlook

In addition to studying the causes, the focus here is on developing and evaluating effective measures for eliminating inequality in the three fields identified. Research should investigate to what extent changing individual elements of the existing welfare state (educational, healthcare,

CLUSTER QUESTIONS

What could politics effectively do to counter racism, anti-Semitism, sexism and other forms of discrimination? How can you dissuade people from right-wing beliefs?

How can the climate emergency be made more globally equitable? No shifting of the problem to third countries.

How can worldwide wealth be distributed more equitably?

What would the effects of an unconditional basic income be on our society?

How can social and structural changes contribute to women not falling into old-age poverty, especially due to parental leave and part-time work?

Are social scoring systems conceivable in Europe in the near future?

How can global justice be achieved? Less exploitation, collective cooperation, etc.

What can we do to counter the gender pay gap?

Why do there still have to be homeless people in Germany when we have a social welfare system?

What do we need to do or what can we do to create more affordable housing?

pension and tax systems) is sufficient to reduce inequalities: the alternative would be fundamental reform. In this context, an unconditional basic income as a possible replacement for existing social security benefits should be at the centre of attention in particular. Furthermore, research should be conducted into what effects the law and the labour market have on social inequality, discrimination and the exclusion of various social groups.

Author: Dr. Nhat An Trinh









HOW CAN WE SHAPE **DIGITISATION FOR** THE COMMON GOOD?







Digitisation is changing our society and increasingly determining our lives. IdeenLauf participants are interested in the role it plays in personal and professional life. They are asking what opportunities and risks digitisation offers for democracy and the economy. And they want to know what needs to be considered in the use of artificial intelligence (AI).



Context

Digitisation has become a part of day-to-day living and is now firmly anchored in many areas of human life. Democratic processes, international relations, the economy, the healthcare system and education are impacted by digital technologies. In the future, this influence will increase even futher.

Businesses, too, are experiencing the effects of the digital transformation: business processes, cooperation between people and ways of working are being questioned and evolving. The increasing use of digital tools has an influence at a personal level on human communication, self-perception, social attitudes and patterns of health and consumption. In spite of the increasing importance of digital technologies

in nearly every aspect of human life, these developments are not assessed entirely positively. On the one hand, increasing digitisation is associated with greater economic efficiency, easier access to information and better social networking. On the other hand, we are seeing a growing number of negative consequences from digitisation, which extend from the threat to democracy, social polarisation, bullying and hate speech on social media, to the blurring of lines between personal and professional life, and even the loss of autonomy and privacy.

Outlook

The consequences of digitisation pose a number of questions that require sociological, technical and legal perspectives. One finding of the work on this cluster is that, on the one hand, the opportunities and risks of advancing digitisation for our society, especially for democracy and the financial system (for example, digital currencies), should be researched further. On the other hand, the questions as to the risks for individuals must be examined. Particularly important here are issues of data protection and data security, the role of artificial intelligence in relation to human dignity, and the protection of citizens' rights and freedoms.

CLUSTER QUESTIONS

How dangerous is artificial intelligence? Can Al become autonomous?

How will social media change democratic processes?

What would be the effects if people could control their brains like their computers?

How will the digital society of the future function?

How does data protection need to be structured to achieve a balance between the rights of the individual and economic

What influence does digitisation have on our intrinsic reward system?

How does social media work without advertising?

How does social media affect our perception of reality?

What happens to human dignity and a fulfilled life if automation makes many jobs permanently redundant?

What influence does digitisation have on the reach of political initiatives?

Science and politics should also address how far the digital society can satisfy people's needs for a healthier and more sustainable life. We need a better understanding of the extent to which social media influence our attitudes and perception of reality and what consequences this has for the individual and society.

One goal here should be to assess the status quo scientifically, understand undesirable developments, and identify solutions to the emerging challenges so that digitisation can be used for the benefit of individuals and society as a whole.

Author: Prof. Dr. Hanna Krasnova

HOW CAN PEACEFUL LIFE TOGETHER BE CREATED **AND PRESERVED?**

Russia's war of aggression against Ukraine is another important topic in IdeenLauf. It raises the fundamental guestion of how Germany, the EU, NATO and the UN should respond to wars and conflicts. People would like researchers to tell them how peace and security can be assured in the future. And what role deterrence and military technology play in this?

Context

Against the backdrop of Russia's war against Ukraine, questions about war and peace take on a new relevance. IdeenLauf participants want to know how and under what conditions wars occur and why the actors do not manage to settle their differences peacefully. People are concerned about what developments can be expected in the war in Ukraine and how the conflict can be resolved as quickly as possible. Many of the questions suggest a concrete perception of danger or a fear that Germany or other NATO States could be drawn into the war. Nuclear weapons are ascribed a central role here: how realistic is a nuclear escalation or even World War III? The Russian president, Vladimir Putin, is seen as a key figure in this context: what are his goals, and what is his war and information strategy with regard to both his own population as well as in relation to other countries? Does the current war exemplify a new world order, a contest of systems?

In light of the potential dangers, citizens are asking questions about specific recommended courses of action in the short as well as long term: what should be the response to further conflicts? And how should actors such as Germany, the EU, NATO and the world community

act to end the war soon or avoid a further escalation? What role does military technology play? And how should Germany and its allies position themselves to ensure security in the future?

Outlook

Two concrete recommendations arise for research in the area of security policy in Germany. Both result from the fundamental difficulty that the current situation can only be assessed on a sure footing when the complex relations between already existing research findings from various topical fields are considered - for example, actor-specific, action-oriented approaches in the area of conflict research. When people talk about Germany, the EU, NATO or other institutions, a scientific analysis as to which institutions or persons are the real actors in this war makes sense.

Likewise, insights on the role of ethnonationalism and more recent research findings on authoritarian regimes should flow into the discussion – as should insights on the role of nuclear weapons or military deterrence (nuclear as well as conventional/inside of alliances such as NATO). The first recommendation resulting from this cluster is to strengthen research on these topics. Secondly, there is a concrete need

CLUSTER QUESTIONS

What should you do when 'someone' isn't following the rules, ignoring all the laws and ruthlessly enforcing their own interests in opposition to the common good? In the family, in countries, in cities, in international relations?

How can peaceful coexistence be achieved among all people on earth?

Why are tanks being built if their only purpose is to destroy human life?

What are necessary conditions for preserving or achieving peace?

Why can laws for the preservation of human rights in the global economy and for fair, balanced trade relations not be enforced and if so, why do they show no effect?

How can misinformation, the misrepresentation of history, and propaganda be combatted effectively or prevented?

Will there be a contest of systems with China?

How can the UN be reformed in such a way that it can actually adopt binding decisions and resolutions without exclusively nuclear powers or the G7 being able to veto them?

What does a theoretical world look like where peace reigns?

How can military conflicts be resolved without using deadly weapons or without simply giving in?

to combine these fields in a meaningful way in the future in order to be able to analyse for example questions of nuclear escalation in the context of authoritarian regimes.

Author: Prof. Dr. Julian Wucherpfennig







HOW DO WE ENABLE EACH INDIVIDUAL TO ACT SUSTAINABLY?



Which measures and incentives for individuals, industry and politics can be used to achieve more sustainability? One question in this is how a sustainable lifestyle can become affordable for all people. In this context, citizens are asking which short- and long-term steps must be taken by industry, politics and civil society.



Context

Why do many of us (still) not act sustainably? Research on this question explores how norms, habits, opinions, good intentions, messages and incentives influence our behaviour. These incentives do not have to be material. Positive feedback and interpersonal recognition are incentives, too. At the same time, we are strongly defined by the norms and values that are conveyed to us by society.

This includes norms on consumption. They influence how many new products and new purchases we consider to be normal. Sustainability, however, requires more than just individual decisions. It remains important to examine individual behaviour in the context of other actors and structures. Research in this area

therefore also looks at how individual people can influence politics and businesses through democratic processes and collective action and how sustainable living can be simplified at a structural level.

This ranges from small changes or 'nudges' (e.g., highlighting the most climate-friendly option on a menu, for example) to creating the conditions that make sustainable action possible in the first place. Such measures include establishing or expanding public transport. Structures need to change so that sustainable options become economically viable and available to everyone regardless of income. In this respect, the role of social discourse between individuals, industry, politics and science must also be discussed.

Outlook

On the one hand, this cluster shows the demand for science to on the one hand research specific strategies for action in the present, for example to facilitate and implement climate-friendly nutrition. On the other hand, we need longer-term and multi-issue strategies in order to cope with even radical changes together.

Researchers must therefore look at future scenarios such as what world our children will live in or what a world without cars might

CLUSTER QUESTIONS

In nearly all areas of social life, we are faced with the need to change things fundamentally. For example in the areas of environmental and climate concern, food, energy and mobility. How can we do that?

What can be done to convince more citizens, more politicians, and more businesses to act in such a way that limits global warming to 1.5 degrees?

What influence does advertising have on our well-being? Can advertising be banned?

Why do we think that we always need new clothes, a new mobile phone or a new car?

What would the earth look like without humans?

What would happen if we stopped driving cars as of tomorrow?

look like. For example, it is important to understand how and why social values toward sustainability and consumption change, how individuals can contribute to this, and how their behaviour can be scaled up into collective action.

We additionally require research that establishes links between various dimensions of sustainability such as ecological, economic and, social sustainability. Only by achieving this will sustainable action become feasible for everyone, regardless of income, instead of being a moral luxury. Last but not least, it is important to not only develop solutions on a theoretical level such as incentive structures theoretically. Instead, science must also engage in a dialogue with politics, industry and civil society so that new approaches can be implemented.

Author: Dr. Sophie Lohmann

HOW CAN DEMOCRATIC PARTICIPATION BE ENABLED AND PROTECTED?

Democracy must be protected from improper influence by lobbying or non-democratic political forces. Citizens asked in this cluster how this can be done effectively. They also want to know how democratic processes can be modernised and optimised. And how democracy can be defended permanently against attacks from the outside and inside.

Context

Every person should be given the opportunity of leading a self-determined life. The question arises of how the limits of the freedom of the individual should be defined within a community. From ancient times until today, the most frequent answer has been: democracy. It exists in a great variety of forms. What they generally have in common is that decision makers are to be elected by the people who, after the election, must adhere to the decisions made (by the government). The question thus arises as to who is allowed to participate in the election as part of the eligible community of voters (for

example with regard to age or citizenship). This question must be answered to ensure that all of the relevant interests in society are included in the democratic process. The election process is also of central importance, and it must be not only organised but also optimised.

The emergence and continuation of democracy is tied to conditions in the social sphere (e.g. level of prosperity, development of bureaucracy or the need for democracy), legal sphere (e.g. rights of freedom and participation), and within the individual sphere (e.g. information/participation resources and opportunities to vote).

Influence on this process must be based on the principle of equality, which must not be imperilled by excessively close ties between politics and the economy ('lobbying') or manipulation. This is because democracy is also threatened from the inside by the openness and tolerance that are essential to it - unlike in the case of other, authoritarian regimes. Democracies face the challenge of integrating an increasingly pluralistic society into the democratic process in a new media environment and using innovations to modernise themselves beyond democracy defined by party politics.



CLUSTER QUESTIONS

What basic conditions does democracy require?

In connection with media and politics, how will democracy change in the coming year?

Does science change our democracy?

How important are rights for children and why?

What effect do protest movements have on politics?

How can we ensure that all people have sufficient capacity (financial, mental, intellectual, physical...) to contribute?

How can you ensure that inventions and discoveries around new technologies are not only used commercially or even fall into the wrong hands (despots) are used the good of

How can the increasing contradiction between the desire for more participation and the decline of existing participatory elements in democracy be resolved?

Outlook

In order for democracy to stand up to undemocratic challenges from the outside and in, we need to understand democracy even better in the future. Various research topics arise from the question of what conditions are particularly relevant and how these can be protected. Researchers' scientific findings should contribute towards successfully arranging participation such that people who have to live with the political decisions can participate in the democratic process with equal influence. Furthermore, democracy needs an answer from science to the question of how (representative) processes must be modernised and supported to (again) generate a greater commitment of people to democratic values.

Author: Dr. Heiko Giebler





21

HOW CAN THE DIALOGUE BETWEEN SCIENCE, SOCIETY AND POLITICS BE IMPROVED AND MADE USEFUL?

The importance of scientific knowledge for society and politics is rising all the time. The coronavirus pandemic is not the only thing that shows this. One theme of this cluster is how research findings can attract more attention. How can transparency and communication assist in this process? Furthermore, citizens want to know what the limits of science's influence are in society.

Context

Across the globe, we are facing major societal challenges. How do we want to run our economy in the future; how can sustainable ways of life be adopted by broader society, and how do we combat climate change? Solutions to these challenges lie in a combination of basic and applied research, expert knowledge, practical experience, and the knowledge from the reality of citizens' lives.

Innovative, socially acceptable solutions that have the potential to have a broad impact require the cooperation of different scientific disciplines, active participation of citizens in the research process, and recommendations for politicians that enable evidence-based political action.

We're operating here in a fine balance of dependencies between science and politics on the one hand and objectivity/independence on the other. Questions are: how can science influence political and social actions, and where are the limits? What role does transparency play here? These and many more questions regarding the relationship between science, politics and society require new answers.

Outlook

New insights into the science-policy-society relationship, processes of exerting influence and the possibilities as well as limitations of participation can contribute significantly to the translation of scientific knowledge into political and social action. Developing these insights or deepening existing ones is a research field that requires attention.

It is key here to find a common language for communicating as equals and giving a voice to those who have had little say so far while also enabling all sides to engage in this dialogue. To understand these interdependencies, we need new research approaches. These should review the scientific system critically with regard to whether and how it creates social added value and if the established scientific reputational systems are helpful for this process. Incentives for a stronger consideration of social aspects and active involvement of social actors should be created on this basis.

A particular priority here is the initiation and moderation of socio- ecological transformation processes. These harbour both tremendous innovative potential as well as (expected) high so-

CLUSTER QUESTIONS

How does science intend to ensure that everyone can participate in it, regardless of their social environment?

Why is so little attention paid in science to fundamentally and critically questioning our social and economic systems? Shouldn't we be doing that much more at the moment?

What does science need to change and improve so that scientific evidence and findings regarding protecting humans and their environment are recognised and implemented in politics.

Is it better to finance scientific research from public taxation or from private investors or free-market funds?

How does science succeed in getting people (gatekeepers, politicians, society in general) to act?

How can research be made more appealing?

cial value added. For a successful transformation, it is key to establish new social practices, restructure industry and rethink value creation without losing sight of economic aspects. More thinking should be given in future to the interplay between social, ecological, technological and other forms of innovation, and citizens should be involved as experts contributing their real life experiences.

Author: Dr. Judith Terstriep

HOW DOES INTERNATIONAL **COOPERATION NEED TO CHANGE** FOR A BETTER WORLD?

Global inequality is on the rise. In this cluster, citizens are asking what kind of international cooperation we need to counteract this better. They are asking what the causes of global inequalities are and which concepts science is developing to create a world that is more just.

Context

Many people perceive the global order as unjust. On the one hand there are grievances such as hunger and poverty and even child and forced labour, while on the other the lives of some people are characterised by prosperity. The consequences of climate change are borne foremost by countries who are themselves only minor contributors to the issue. What are the causes of such inequalities and why is no global justice achieved? How can such grievances be counteracted with concrete proposals for action from science?



A system of global dependencies is often presumed to be the cause: some, mostly Western states cement or even enhance their privileged positions at the cost of other states. How should international cooperation be arranged so that these global guestions can be resolved as effectively and justly as possible? Do we need new international organisations or should the existing means of cooperation be reformed? Should Germany detach itself from international dependencies (for example, in the area of natural resources)?

IdeenLauf participants note that political action across countries is often inconsistent, especially within the European Union. Would greater harmonisation be sensible and desirable? Why is there no consistent or common coronavirus, financial, tax or security policy? These questions may also decide the future of the EU. Closely linked to such questions is the role of the nation state and its borders. Do national borders make sense? Do the EU's external borders need to be protected?

Outlook

Overall, this points to a certain tension: on the one hand, states are seen as having their own

CLUSTER QUESTIONS

What would happen if every person could freely choose the place they live in?

Is a world without demarcated national states possible and/ or meaningful?

In light of global challenges, do we not need new global systems of government? In particular, those that regulate and protect public goods?

How can a global world community without poverty be created?

Why can laws for the preservation of human rights in the global economy and for fair, balanced trade relations not be enforced and if so, why do they show no effect?

Will China, by means of heavy financial investments in African states, 'colonise' them financially? What long-term effects will there be as a result?

What role will the EU play in the future in terms of common financial or foreign policy?

Why are there still so many child labourers used without this being sanctioned? For example in cocoa cultivation, rare earths, etc.?

How can the suffering on the EU's external borders be resolved?

Why is it accepted and legitimated daily by our society that our imperial economic system exploits other countries?

interests, while on the other hand, these are often seen as an obstacle to solving global problems. This leads to the potential for research investigating how better cooperation between states can succeed – so that global challenges such as climate change can be approached collectively and a better, more just world is achieved. Such approaches are of central importance, especially in light of the growing isolation of states. Deeper analysis and investigation of the (future) role of borders and their meaning for the nation state as well as of transnational cooperation should also be carried out.

Author: Prof. Dr. Julian Wucherpfennig







DO WE NEED A NEW UNDERSTANDING OF WORK?



What work will be like in the future is a central question of interest to those asking the questions. How can equal opportunities and equal pay be reached for the various genders? The people hope for ideas from science for new incentives to alleviate the shortage of qualified workers as well as information on what effects an unconditional basic income would have in the working world.

Context

This cluster addresses the social effects of the transformation of work and the interface between society and the world of work. The questions reveal participants' desire to find out from science what effects this transformation will have on industries and national economies. Value creation is shifting geographically and entire industries are changing their value chains. Citizens are particularly interested here in how, for example, the pharmaceutical industry is changing and if all of Germany can be supplied exclusively with nationally produced food. But we also see change at the individual

worker level. Example questions in this context are: 'Is it possible to work less?' and 'How can we ensure equal opportunities for all, regardless of gender, origin, and marital status?' An appropriate distribution of wages is central to work performed, for example, by parents.

Science is being called upon to investigate where differences in this area come from and how these can potentially be reduced. In this way, it is hoped that the shortage of workers in trades and healthcare can be counteracted. There should also be investigations into which non-monetary incentives help in finding applicants for these jobs.



The central research topic, which emerges, is how the world of work is changing and how it can be shaped. Workers find themselves facing a dynamic world and must therefore strengthen their personal resilience towards the negative consequences of changes.

Changing value-creation chains are reflected at all levels in the experience of individual workers. Science should provide answers as to

perceptions of fairness. This also includes work that thus far has not been paid such as the care

CLUSTER QUESTIONS

Is Germany heavily affected by corruption/lobbying?

How can we better reconcile family and work? Should there perhaps be mandatory parental leave for fathers?

How can we succeed in assuring good pay for nursing staff and doctors to make this work attractive again?

Which professions are slowly dying out?

Why are some occupations better paid than others?

How can greenwashing be tackled?

How could changing from a 40-hour work week to a 30-hour work week be possible in (nearly) all fields of work?

Why is it made so difficult for immigrants and refugees to take on paid employment in Germany?

What are the social consequences of the transformation of work in the 20th and 21st centuries?

Could Germany feed itself using only its own arable land?

what the effects of a basic income or reduced weekly working hours would be. At the same time, the demand from thus far disadvantaged groups for participation and equal treatment in work life is increasing. Researchers should assess and measure discrimination and demonstrate ways to ensure equal opportunities.

Author: Benedikt Sonnleitner



WHAT IS STILL 'RIGHT' AND **'NORMAL' TODAY?**

How norms and values are created and how they change is in the focus of this cluster. The participants in IdeenLauf want to know whether there are fundamental values that apply to all people. What do religions, norms and values have to do with each other? And how do we set norms and values?

Context

Alongside the material foundations, shared life together requires values and norms to avoid (recurring) conflicts and develop a collective identity. How these are created and how they change is what IdeenLauf participants want to know. They are furthermore interested in whether there are values and norms that apply worldwide and universally to all people.

Changes often come about slowly, through social change, but sometimes quickly, too, through crises or (technological) innovation. They may be intentional (such as political decisions) or unexpected by-products. The interactions between (changes in) values and norms and society are one issue for IdeenLauf participants.



Conflicts about values and norms in and between societies characterise the history of humankind. Most religions claim immanent truth, which render processes of negotiation impossible beyond a certain point, meaning faith has both a uniting as well as a divisive role. Citizens are interested in the relationship between values, norms and religion.

Values and norms provide a specific picture of humankind (for example, regarding rational action, roles or the ability for reintegration in society) and social conceptualisations (for example, an open and diverse society), although these idealised concepts frequently fall down when it comes to reality or workability. Nonetheless, they contribute to reducing uncertainty, providing reliable expectation in place of the unknown. These reductions in complexity and explanations of phenomena may, for example, be provided by religion, but they are also supplied by conspiracy theories. Citizens are asking if humans can really think without 'right' and 'wrong', 'normal' and 'abnormal'.

Outlook

It is necessary, in the globalised world and as a basic condition of human life together, to understand values and norms even better, especially with regard to religion. Researchers should investigate even more closely how values and

CLUSTER QUESTIONS

Is the welfare of society more important than the welfare of the individual?

How are people able to ignore the suffering they do to others (exploitation/violence)?

Why do we have prejudices?

How can helpfulness in society be promoted?

Are prisons sensible or are there better alternatives?

Does one's own health also fall under ,governmental affairs' or is it a private matter in a democracy? (e.g. vaccination, abortion, assisted suicide...)

What influence do faith and religion have on economic and social matters?

Why are there conspiracy theories?

How can people of all religions or without religions live together peacefully? Is that possible?

How are trends created? (Examples: Why are there beauty ideals? Why is football so popular?)

norms are created and how they develop. The process by which they change is a research topic that scientists should address. The role of religion in society, too, and the reasons for its existence in a modern society should receive more attention from science.

These studies should then be used to deduce which values and norms or resulting conceptions are practicable for modern societies and their cohesion, and should be protected and strengthened. In a society shaped by social media, intensive investigations should also be carried out into how (collective) identities, common preferences and trends are formed.

Author: Dr. Heiko Giebler



WHAT IS THE ORIGIN OF THE **UNIVERSE AND HOW WILL IT DEVELOP?**

This cluster contains general questions about the universe. People want to know how viable our current understanding of the universe is. Do the laws of nature apply universally or could there be universes with their own laws of nature? Practical questions are also raised: how much does light pollution restrict research? And what can be done about it?

Context

The beginning of the universe (all mass, space and time) is seen in the Big Bang. Based on the cosmological Standard Model, the Big Bang occurred about 13.8 billion years ago and caused the expansion and cooling of the universe. Within fractions of a second, the first elementary particles were created. A little later, protons, neutrons, hydrogen and helium were formed, and ultimately the first galaxies.

While we are finding out more and more about the development of our universe through observations, theories and numerical simulations, we are quickly reaching our limits: what happened before the Big Bang? Where does the universe end? What is the universe made of if we can't see all matter?



Our understanding of the universe is based on the assumption that the laws of nature that we observe near Earth are valid universally. But what if this assumption cannot be sustained? Another fascinating question is whether there are parallel universes and whether we might someday be able to travel to other universes. What might these universes look like if they followed completely different laws of physics? Might the world there be upside down?

Lastly, there is also the question of how we can preserve the view of our night sky in the future. How much is exploration of the depths of the universe complicated by artificial light and thousands of satellites near earth? How severe is light pollution and what can we do about it in the future?

Outlook

In order to be able to answer questions about the universe, astrophysical observations are combined with theories and numerical simulations. Observational astrophysics needs better instruments to look deep into outer space, observe its origins and understand them. Measures to combat increasing light pollution are also required. Further intensive research is needed to better understand the effects of

CLUSTER QUESTIONS

Is something like magic conceivable in a different universe?

How probable is it that our universe is an invention of a higher being?

What does the universe sound like?

What influence does light have on the visibility of the stars?

Do wormholes exist? Are there two or even more universes?

What is the universe made of?

What was there before the Big Bang?

Will we be able to travel to parallel universes?

How was the galaxy created?

light pollution on humans and the environment (including the night sky) and to identify alternatives to preserve the night sky. To this end, an intensive interaction with politics and the economy is recommended.

In highly complex, simulated universes, scientists investigate the creation and development of galaxies. The simulated universes here match the observable universe as closely as possible. So far, little research has been conducted on what would happen if we suspended the laws of physics in simulations. Research questions could be: is it possible to construct parallel universes that follow different laws of physics and are still stable? What might these universes look like? By simulating parallel worlds, we could learn more about our universe and identify the limits of the cosmic principle.

Author: Dr. Sabine Thater

26 WHAT ARE SPACE, TIME, MATTER AND THE LIMITS OF **PHYSICS?**

Physics at the frontiers of knowledge interests many of the IdeenLauf participants. What kinds of black holes are there? Are these phenomena adequately described by the theory of relativity? What does it look like inside black holes? Time travel, too, occupies people's imaginations: will it be possible in the future, or do the principles of thermodynamics prohibit it?



Context

Einstein's general theory of relativity unifies space and time and explains gravity as a curvature of space-time caused by energy and mass. It predicts the existence of extreme objects such as neutron stars, forms the basis of modern technologies such as satellite navigation and facilitates observations that used to appear impossible previously - such as, for example, the first image of the black hole at the centre of the Milky Way.

But this is not the end of the research. Although extremely successful in their areas of application, the general theory of relativity and quantum mechanics have so far eluded unification. The research areas of quantum gravity and particle physics are extremely important for a unified description of the universe and its beginnings. Knowing the true nature of black holes, time, space, light and matter inspires IdeenLauf participants as much as researchers in this field.

Outlook

Curiosity and the urge to understand our world drive research in fundamental physics. At the same time, research is a key to new technologies that could preserve and improve our life. One of the most important longterm research objectives, emphasised in this cluster, is the development and verification of a quantum theory of gravity. The theoretical and observational investigation of black holes contributes decisively to this. In the context of IdeenLauf, further research into them is of particular interest.

Here, there is also overlap with other research

CLUSTER QUESTIONS

What is infinity?

What does a quantum physicist say about the soul?

Is there a point where we reach the limit of what humans can express about our universe using mathematical

When space stays unchanged, does time stand still?

Where does gravity come from?

Is it possible that if no one is in a place, the place does not exist for that period of time?

Can you find/invent an infinite source of light?

Are there energy sources in the universe that we can use for the Earth?

What happens in a black hole?

What is time?

What is dark matter?

objectives such as the further development of the Standard Model of particle physics or answers to the question as to the nature of space and time, and their special role in physical theories. Connected with this is the consideration, too, of whether time travel is possible.

All of these fundamental research questions have very high innovative potential and contribute to a comprehensive understanding of the universe. The purely scientific questions must be complemented by philosophical aspects such as, for example, the correct interpretation of quantum mechanics and the possibility of a final answer to all questions of physics.

Author: PD Dr. Eva Hackmann



WHY DO PLANETS DEVELOP **DIFFERENTLY AND IS OUR PLANET EARTH UNIQUE?**



For hundreds of years, Earth was at the centre of human conception of the universe. Today we know that it is just one planet among countless others. But what is it that makes Earth so special? Those submitting questions want to know if there is a possibility that other planets are also undergoing a development similar to that of Earth. Could life also, then, be possible on these planets? IdeenLauf participants are asking how long Earth will continue to exist and for how long we will be able to live on the blue planet.

Context

Compared to other planets, Earth stands out. It is the only planet in our solar system where water exists on the surface today. The radiation of our Sun and the climate on Earth provide the temperatures that are needed for this. The atmospheres of other planets - the giant gas planets like Jupiter and Saturn, for example have entirely different characteristics and dynamics.

IdeenLauf participants want to know why that is. How do planets actually form, and how different can planets look from one another? How many planets are there in the universe, and do they all circle around stars like our Sun? What influences the orbital motion and rotation of a planet and its composition and later development? And what influences the occurrence of valuable resources like water, nutrients and gold and diamonds on the surface?

The discovery of thousands of planets outside of our solar system allows us to get ever closer to some of the answers. But many sometimes fundamental questions remain open. The Earth itself has changed massively from its formation

to the present day. The surface used to keep undergoing constant renovation; asteroids and meteorites frequently impacted the Earth. Nonetheless, oceans formed and life emerged from the smallest organisms to huge dinosaurs. How do we know what happened when? How has life influenced the Earth's development? And what will the future of Earth be like depending on the development of the Sun? Does our planet have an expiry date?

Outlook

To understand the general development of Earth and other planets better, we need to combine different perspectives. Observing stars and exoplanets gives us numerous data points of high statistical value. Combining exploration of our solar system with rock samples from the Earth, from planets and from meteorites provides us with a lot of detailed data. This helps us to better understand the Earth's history and past catastrophes such as the extinction of the dinosaurs. Putting this manifold data together with theories, simulations and experiments can help us better research the formation, composition and potential development of stars and planets (and their climate systems).

CLUSTER QUESTIONS

How many planets are there?

How can we protect ourselves from the dangers of outer space, e.g. from meteorites or space debris heading towards Earth?

Why does the world turn at exactly the speed it does and not faster?

When will the Sun go out?

What colour were dinos?

When did the world have its lowest temperatures?

Is it possible to live without the Sun?

How much water is there on Earth?

Where do colourful rocks get their colour from?

Is there gravity at the centre of the Earth?

The discussion around this cluster gives rise to the challenge to science to pursue this research field further. An answer should be provided as to why Earth has developed in such a way that life could develop here. With the help of this knowledge, other planets should be searched for that may possibly undergo or have undergone a similar evolution to Earth. We could find out which geological or astronomical processes (that is, not just those caused by humans) might make Earth or other planets uninhabitable or even potentially destroy them. What makes Earth so special, and is there a plan(et) B?

Author: Prof. Dr. Lena Noack

(EXTRA-)TERRESTRIAL LIFE -**SETTING OFF INTO NEW WORLDS?**

Where humanity comes from is a topic that occupies the minds of scientists and citizens - including in this cluster. But people also want to know what the future of humanity will be like. Solutions to global problems such as climate change play a central role here. Can space technology satisfy the demand for energy? Whether humanity can move to a planet B if the Earth becomes uninhabitable is another topic in this cluster. And what would making contact with extraterrestrial forms of life mean?

Context

Since the beginning of human thought, existential questions have preoccupied us: where do we come from? Where are we going? How and why did life on Earth come into being? Are we alone in the universe? And will future technology allow us to travel to distant worlds and extraterrestrial civilisations?

This cluster covers central questions regarding the limits of life, the future of humanity, and conceivable journeys to distant planets. Will we meet aliens there, and what would contact be like with them? Are extraterrestrial life forms intellectually superior to us or even similar to humans?

Another key question in this cluster concerns the future of our home planet. Are climate change, environmental disasters, and the shortage of resources forcing us to search for



a 'new Earth'? Many questions revolve around the necessary technologies for overcoming unimaginable distances in time and space. Will we travel faster than the speed of light like on the Starship Enterprise? Or will people freeze themselves for space travel? Are there any celestial bodies that could be considered as destinations? What food would we need, and would the long stay in space affect human biology? What would it be like to move around on other celestial bodies and work on an Earth 2.0 there?

Questions are also asked about the potential use of space (for example, commercial trips to the Moon or raw material extraction on celestial bodies). Finally, people ask if space technology might be able to help combat terrestrial crises, in particular climate change.

Outlook

At first, some of the approaches may sound utopian, but they are nonetheless interesting to research: the prerequisite for humans being able to permanently occupy other planets would be the development of new propulsion technologies. Only with these would it be possible to travel to distant galaxies and planets. Additional basic research in physics - for example,

CLUSTER QUESTIONS

Why did life evolve on Earth?

Could it be that we will at some point find a different planet we could live on?

When and how will it be possible to live on Mars?

How do bacteria survive if they are frozen?

How can we produce food in outer space?

Will anyone ever be able to build satellites that burn up in the atmosphere without causing any waste? If so, how? And how can this be done without putting a lot of CO, and toxic gases into the atmosphere?

How can raw materials from asteroids be used?

Will we one day be able to fly through space at the speed

Which part of Earth is uninhabitable?

How long would a journey to the next habitable planet take?

with regard to Einstein's theory of relativity - is also very important.

It would be exciting to see whether space technology can contribute to solving terrestrial problems. New sources of energy and propulsion concepts could satisfy the growing hunger for energy. Collaboration between different research disciplines could contribute to holistic insights. Understanding the limits of life on Earth might be a first step towards understanding the future of humanity and the existence of extraterrestrial life forms. It would also form a bridge to universal questions of our origins and future.

Scientific reflections would also be interesting regarding the question of whether contact with aliens (or a generally better understanding of 'extreme' living conditions) could soften our primarily human-centric perspective and provide impetus for the transformation towards an open community.

Author: Dr. Matthias Wietz



HOW CAN WE UNDERSTAND AND PROTECT NATURE AND ITS **DIVERSITY BETTER?**



The global environment is in danger. How the balance of Earth's ecosystem can be rescued is a question of prime interest to many people. To this end, it is necessary to clarify the characteristics of a healthy ecosystem and how such an ecosystem develops. In this context, those submitting questions want to learn from science what kind of biodiversity is required for the ecosystem and how it can be protected. They would like researchers to clarify whether genetic engineering is a potential way out and if it can be used to revive extinct species. This also raises the question of how these technologies can be assessed from an ethical perspective.



Context

Life on earth has evolved over the past 3.8 billion years into an incredible diversity of microorganisms, fungi, animals and plants. The variety of abilities that has been developed by these living creatures is fascinating. The Earth's system is a dynamic network between species and their environment as well as the different habitats and ecosystems. For the functioning of this network, the interaction between species is crucial. Thus the loss of key species can upset the equilibrium of existing ecosystems.

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of complex habitats (e.g. by invasive species) disrupt the fine balance of these networks. This presents us with the challenge of understanding the causes and effects on the entire ecosystem of the Earth.

Outlook

Two major complexes of questions for the future arise in this cluster: First, whether nature and the environment can inspire us to new research. How can the different abilities and characteristics of species be used to answer important questions for our own life? Of interest are new applications that may result from this knowledge. For example, can differences in the lifespan and regeneration of tissues be used for improving the understanding of our own aging and possibly for new medical applications?

The second complex of this cluster concerns the question of how we can maintan a functioning Earth ecosystem. What biodiversity is essential for this? What impact does the loss of species and entire ecosystems have on the overall ecosystem of the Earth? Research should investigate how we can give existing ecosys-

CLUSTER QUESTIONS

Why are bees threatened with extinction?

How much and to what extent does chemical pollution harm the world's oceans?

Are people continuing to evolve today, too, and if so in what direction?

How do animal and plant cells differ in the ageing process?

Why is biodiversity important for us humans?

What purpose do viruses have in the course of evolution?

Can we revive extinct animal and plant species? And what effects would this have?

What makes us human?

When will it be possible to put a person into hibernation?

tems the protection they need. This requires an interdisciplinary approach that facilitates both a macro as well as a micro view and that includes the development of genetic engineering tools as possible countermeasures. Whether the revival of extinct species with the help of genetic engineering is a sensible approach should be investigated by the scientific community, while keeping the challenges at the biotechnological and ethical levels in mind. The dynamic development of ecosystems must also be taken into account. Preserving undisturbed developing ecosystems while at the same time investigating them is a valuable approach.

This requires a local as well as global view of ecosystems and habitats, and joint action by politics, society and science.

Author: Thekla von Bismarck

30 WHAT CAN WE LEARN FROM HOW **HUMANS, ANIMALS AND PLANTS** PROCESS AND EXCHANGE **INFORMATION?**

What differences there are between human and animal capacities is of interest to many Ideen-Lauf participants. They want to know what kind of communication is possible between humans and animals and what plants or fungi can perceive. The participants want us to learn from the answers to these questions and develop applications.

Context

Evolution has created an enormous diversity of life. It has also ensured that living creatures are able to process a broad spectrum of information. Flies can see particularly quickly; dogs can smell Alzheimer's; tomatoes detect damage done by pests; octopuses hide in the most incredible places – and some birds use the earth's magnetic field for orientation.



We do not know the limits of the abilities of living things on our planet. Which senses are still undiscovered and what are the interactions of the different senses need to be yet explored. Questions in this cluster thus include the extent to which animals differ in their abilities from humans. Can plants perceive more than we think? And what can we learn from the incredible abilities of animals? Of great interest also are questions regarding how humans and animals communicate and how this communication can be improved.

Outlook

The questions about the cognitive abilities of living things, their emotions and their possible sensory perceptions show the interest in basic research. Citizens want to know from research how plants and animals interact with each other in their communication. The resulting research questions are directed at the disciplines of plant physiology, neuroscience and ecology. It will be necessary here to create interdisciplinary approaches in order to be able to examine the processing and transmission of information in natural environments.

CLUSTER QUESTIONS

Do plants have a memory?

Why can animals sense and detect danger better than measuring devices can?

Why do females rank higher in the animal world and not among humans?

Is it possible to learn animal language in the same way as other languages?

Do mosquitos give us anything (medicinally) or do we not need them?

Why do we not use our whole brain to think?

Do animals have consciousness, and how does it differ from

Do animals have an internal dialogue?

How do trees communicate with each other?

Can plants feel pain?

New insights could in future put us in a position to benefit from the extreme diversity of information processing: from generating electricity from plants to animal disaster warning systems.

Author: Dr. Étienne Serbe-Kamp





HOW CAN WE ENSURE FOOD SECURITY FOR PEOPLE LOCALLY **AND GLOBALLY?**











What sustainable food production might look like is one central aspect of this cluster. What does this mean for land use, the use of drinking water and the keeping of animals? People are just as interested in the question of whether alternative foods such as algae, insects or lab-produced meat present an alternative as is the question of how food production can again be increased within one's own country or locally. Communication plays a central role: science must contribute to ensure the term 'sustainability' is used in accordance with its precise meaning for a good understanding of the complex interrelationships.

CLUSTER QUESTIONS

Why are the concentrations of nitrate and nitrogen still too high in the Baltic and North Seas?

What can be done to counter the increasing drought in eastern German federal states?

What are the arguments for or against genetic modification?

Is marine sand and gravel extraction still defensible?

Why does commercial agriculture give so little consideration to humus formation and soil diversity? Does this fact contribute to species extinction?

What future do algae have in the global food supply?

How will we organise sustainable global trade?

How can we ensure the basic needs of every human being worldwide are satisfied?

What should a future global drinking water supply look like?

What is artificial photosynthesis used for?

Context

While the security of the food and drinking water supply in Germany long played only a subordinate role - unlike in the countries of the Global South - concern about adequate resources is growing here, too, in the face of the climate and economic crisis and the threat of war. In this cluster, questions about quality, sustainability and health, as well as environmental friendliness, land use and the type of food production play a central role.

One focus is the controversy surrounding intensive and extensive agriculture. Those submitting questions want scientists to clarify the effects, for example, reducing livestock farming has - or keeping it to areas that are not suitable for the cultivation of food crops like wheat. People are also concerned about food waste - food loss. from a global perspective.

Even though pesticides are one solution to prevent food crises, IdeenLauf participants meanwhile place the focus on doing without food measures that are only applicable in the Global North. Another topic in this cluster is bioenergy production at the expense of food. Likewise the

growing world population is viewed by people as a global and key factor in supply problems that should be solved with the help of science.

People would like clarified whether the expansion of extensive agriculture and switching to a vegan lifestyle are steps in the right direction. They observe that the present data on the benefits and drawbacks of various agricultural production methods are often the subject of heated debate.

Outlook

Key questions for research arising from this cluster are what the scientific definition of the term 'sustainable' is. There is great potential in investigating better communication methods so that research efforts and findings in this area can be successfully disseminated to the population. This will enable transparency on which methods or proposed solutions for food supply, land use and ensuring water resources actually meet scientific sustainability criteria. Fears and hopes regarding switching to a vegan diet and to alternative agriculture must be examined. Researchers should place the focus here on investigating in greater depth the benefits and

drawbacks of extensive and intensive agriculture - and, above all, on communicating the findings clearly.

Science must lay the basis for rational discourse without ideological camps being formed. Only through rational discourse does change become possible, and this is the only way to effectively prevent food shortages.

Author: Prof. Dr. Wolfgang Nellen

WHAT IF?

What benefit do 'What if...' guestions have? This guestion is concerned with how science can work with scenarios and simulations. Citizens want to find out what methods and tools scientists need for this. And which branches of research could benefit from it.

Context

In order to study reality, researchers often ask questions about alternative scenarios and their probability. They investigate in theory what a different reality might be like - by significantly modifying the conditions and circumstances in models, for example. These kinds of changes generate a range of consequences and scenarios, which in turn help us to better understand reality. This scientific approach is based on entirely open-ended, even naïve questions. Children also use this approach because they don't have to accept anything the way it is since their thinking is not yet limited by things they have learned.

'What if' questions like these are important for research and society because they help us understand things. Of course, it is facts that determine what our world is like and how it



works. But all of these facts can be understood better and in more depth if questions are asked about them. For example, the question 'What if the earth was flat?' is helpful for understanding why it is and must be a sphere. The question 'What would the climate be like if there were no mountains on Earth?' helps in understanding how geophysical processes in the Earth's history generate climate zones – such as by the folding of mountain ranges.

Outlook

In this cluster, citizens want an answer to the question of how the world could be different in the universe, on Earth or as relates to life on Earth. But the probability of particular utopias or dystopias also offers research potential. Some questions are particularly pressing, such as those on the loss of species or opportunities to interact differently with nature.

Research about alternative realities, often also referred to as scenario studies, is not only essential to understand the past and the present, but also to form a picture of potential futures. This helps us humans to think systemically, identify solutions and make decisions. Research of this kind is frequently based on elaborate models and simulations, and requires good visualisations so the results can be shared with society.

It is becoming increasingly important, for science as well as for the economy and society as

CLUSTER QUESTIONS

What if the Earth were flat?

What would be the impact if suddenly only 1 billion people lived on Farth?

Would it have been better for the environment if there had been no globalisation?

What will our future be like if we continue living the way we

Would the world be better without people?

What if there was no Earth?

Could humans and herbivorous dinosaurs have lived together peacefully?

What would Europe's climate be like without the Alps?

What would happen to the ecosystems if there were no more fish left in the seas and all the coral reefs had died off?

Should we do away (entirely) with the keeping of animals in Germany? What are the arguments for and against?

Could the human body adapt to climate change by evolution?

a whole, to make futures tangible, whether by scenario building or simulation methods. There are experimental methods such as real-world laboratories, for example in sociology and technical sciences, for simply trying out 'what if...'.

Complex interdisciplinary models present a particular challenge. How can climate research and economics be brought together - with the aim of finding out how expensive different paths in climate change or climate protection will be for municipalities and industry. Simulation and scenario building as techniques must therefore now increasingly be communicated and used more as part of training.

Author: Prof. Dr. Antje Boetius



HOW CAN WE STOP CLIMATE CHANGE?









Climate change is the most pressing global challenge. The role played by greenhouse gas emissions is one question that interests IdeenLauf participants. They want research to tell them whether reducing emissions of these gases is enough or whether we need additional measures. Do we need to adapt our behaviour to climate change? And what are the technical possibilities for making climate change manageable?

Context

Global greenhouse gas emissions are constantly rising despite international climate agreements: this has dramatic consequences for ecosystems and for humanity. To counteract the negative consequences of climate change (such as increasing heat and loss of biodiversity), three central strategies have proven to be effective: 1. adapting to climate change by taking measures to mitigate its consequences (such as unsealing the soil); 2. avoiding greenhouse gas emissions via technological solutions (such as zero-emission energy

generation) and behavioural adaptations (such as not driving); 3. intervening in the climate system with the aim of removing CO, from the atmosphere (such as by reforestation of the rainforest) or measures that reduce solar radiation.

What is certain is that if we want a safe and sustainable future, we need to mitigate the effects of climate change as much and as quickly as possible, based on scientific insights. The window of opportunity for successful action will close soon.



A combination of the three strategies is probably indispensable to stop the progress of climate change and minimise its effects. The central question is how the concentration of greenhouse gasses in the atmosphere can at least be stabilised in the face of a growing global population, and what role technologies play in this. How can a rapid transformation of energy generation be successful, and how can we store energy in the future? Researchers should study how and to what extent we can remove carbon from the atmosphere and what the consequences will be.

Before such technologies can be applied on a large scale, however, adaptation measures

CLUSTER QUESTIONS

How can an independent and emission-free energy supply be ensured in Germany and at what price?

Why are all natural gas plant operators not obliged to also supply heat as well as electricity? How can we store energy better so we can use renewable energies more efficiently?

Do wind turbines influence the weather?

What impact could grass or algae that were genetically modified to be white, reflect more light and become dominant after their introduction have on the climate and the environment?

Would it be possible to capture the methane emitted by cattle and use it for something else?

How can we store CO2 effectively in the wake of deforestation?

What are the effects of geoengineering on the environment, airborne species (e.g. insects), water-based species and on us as humans?

How can we store energy better so we can use renewable energies more efficiently?

How can climate protection and the protection of biodiversity complement each other, or do they always need to be weighed against one another (for example, in the construction of wind farms)?

must first and foremost be taken in the short term. In the medium to long term, the focus is on technological developments, some of which still need to be researched.

Another major obstacle is the lack of funding. Often, political leadership is lacking the ear for science. The latter must therefore find ways to make itself better heard. Also significant is how new technologies could be advertised to individuals and society, as well as the implementation of necessary measures or how the relevant knowledge can be strengthend in advance.

Author: Prof. Dr. Stephan Sommer



HOW SHOULD WE ADRESS THE CLIMATE EMERGENCY AS INDI-VIDUALS AND AS A SOCIETY?

In this cluster, the focus is on questions of why existing knowlegde on combating climate change has not been implemented for a long time already. IdeenLauf participants also want to know from researchers what the most effective measures against climate change would be. Do we need more changes of personal behaviour, or is this only a challenge for politics and society? And how can joint climate protection measures be taken?

Context

The climate emergency has reached society's attention and with it questions about solutions. In spite of unambiguous scientific findings regarding climate change and its causes, action is not being taken quickly enough to limit global warming to the agreed tempertaure targets. It is therefore understandable and appropriate for the guestion to arise in IdeenLauf as to how we can stop climate change and why we fail to act as a society. Questions about the most effective measures that need to be taken in the coming years, and about possible actions for each individual, are important to clarify and to communicate.

If all people – especially in the rich industrialised nations - substantially reduced their contribution to climate change via climate-friendly diets, consumption and mobility, we could make a meaningful contribution to reducing emissions right now. This would not, however, eliminate all emissions – far from it: electricity, heating and hot water - things that not everyone has a direct influence over – today contribute to a large part of our emissions in Germany. Changes in systemic structures (such as the educational system, political action and economic incentives) are therefore required. The highly complex task of

identifying and implementing these kinds of strategies to prevent climate change requires, among other things, incorporating both the context as well as our values.

Outlook

The fundamental question is whether we can counteract climate change appropriately with the existing systems and power structures as well as with our social norms. What new, innovative and creative solutions do we need? To what extent can social crises become catalysts for change? Could our society function without economic growth?

A transformation towards climate neutrality requires social acceptance, economic incentives and political will and action. Science must point out ways this could be achieved The heterogeneity of society and the context of global politics must both equally be considered here. How can we get people on board with necessary political decisions? To find social solutions for climate change, we need a discourse between different scientific disciplines, politics and society. Successful and visible climate protection measures can help to move this discourse forward towards the question of how climate protection measures can be implemented more quickly. In

CLUSTER QUESTIONS

To what extent can society prepare for emergencies (natural disasters, pandemics, wars)?

Why is it so difficult to modify your (consumption) behaviour, even when you know that it's harmful to us and our planet?

If social norms are so deterministic of our actions, how can they be used to reduce food waste and promote sustainable diets?

How can we ensure that scientific findings, for example regarding species extinction and climate change, have more influence on legislation and policy implementation?

Why do we prioritise economic progress over the preservation of species including our own?

Is the root cause of climate change that there are too many people?

Is it possible to solve the current climate and environmental crisis within the existing system?

How can creative, artistic competencies (problem solving, change, shifting perspectives, empathy) be effectively used to fulfil the 17 UN Sustainable Development Goals?

Will we still be able to travel in the future without harming the Earth?

Can fashion be produced sustainably?

addition, we need a better understanding of the effectiveness of new measures for mitigating climate change. In this context, individual and societal modes of action should be evaluated holistically - meaning beyond techno-economic considerations - and in the actual context of their application.

Author: Dr. Nadine Mengis







HOW CAN WE CONSERVE RESOURCES AND AVOID WASTE?





Using resources sustainably is more important than ever. How this can be achieved lies at the heart of this cluster. Besides avoiding waste and recycling, are there any other measures? The question of what politics, the economy and each individual can do is also a concern to citizens. They want science to tell them what framework conditions we need for this.



Context

Because resources are becoming scarce, their conservation and the avoidance of waste are tremendously important. Pollution has many sources and can be found in all kinds of places. According to the German Federal Statistical Office, there were 417 million tonnes of waste in Germany in 2019. Half of this was construction and demolition waste. However, in citizens' questions it was in particular household and plastic waste (macro- and microplastic) which came into play. Questions included: how much waste is there, and how can it be avoided? How can production become more sustainable? How can the oceans and space be freed from waste, and what effect does waste have on the environment, especially organisms and living creatures?

Resource conservation goes hand-in-hand with sustainability. Use of natural resources such as soil, raw materials, water, and air is increasing globally. This is caused by an economic system and lifestyle patterns that are not based on sustainability. Sensible and sustainable use of and thus conservation of resources was also a topic in the questions from citizens.

Other questions related to the measurability of sustainability and the climate neutrality of products and industries. There were questions, too, about a change in the potential framework conditions, about alternative products, and about possible technological measures in the fields of digitisation and biotechnology that support a sustainable lifestyle.

Outlook

The excessive use of natural resources deprives humans of their livelihoods, and climate crises, water shortages and wars are the results. The tension here is between knowledge, understanding, recognition and ultimately action by politics, business and individuals. The aspects of sensible resource conservation and waste avoidance - be they of a technical, political or organisational nature - are future issues in every sector. But the effects of alternative technologies on the environment, technologies for cleaning the seas and soils, and the trans-

CLUSTER QUESTIONS

How environmentally friendly is an electric car really?

How can microplastics be reduced?

What is being done about space junk? What is being done to produce plastics in an environmentally friendly way and so that they are biodegradable?

Why does plastic take so long to decompose?

How much and to what extent does chemical pollution harm the world's oceans?

How can glyphosate be replaced?

How can digitisation be reconciled with ecological sustainability?

How can we assess which products or services are truly climate-friendly?

What are the alternatives to concrete?

What effects does the construction of wind farms have on the surrounding forest? What happens to the microclimate, biodiversity, soil and neighbouring trees when a large wind turbine is built in the forest?

formation of the economic system including the concept of circularity are equally all topics of research.

To measure sustainability, there are approaches such as ecological accounting. This allows the environmental effects of products and processes to be measured. One important (research) approach is the evaluation of a product's entire life cycle including its societal and social effects. What is needed are clearer and more comprehensible evaluation frameworks that also relate to the overall system and incorporate and assess the concept of circularity. Every evaluation and action is based on actual values. so efforts must be made in the area of data capture and related methodologies.

Author: Dipl.-Geogr. Simone Krause

HOW IS THE CLIMATE CHANGING AND WHAT ARE THE EFFECTS?

The climate crisis is the central concern in this cluster. Those submitting questions want to know what the consequences of the greenhouse effect are. They ask how fast the Earth is warming and at what point there is no turning back. Can science use models to predict the consequences of climate change for certain regions? And do these models help in adapting to the consequences of climate change?

Context

When we describe the state of our atmosphere over longer periods and across a larger area, we are referring to the climate. Climate as part of the Earth's system is influenced by other sub-systems (such as oceans, seas, lakes, rivers, bodies of ice, habitats and soils) and is changing constantly. The present warming of the Earth, however, is clearly due to humans.

IdeenLauf participants want to know when climate change began and how much the Earth will warm up over the coming years. They are asking fundamental questions about particular phenomena associated with global warming: why is the temperature rise in the Arctic and Antarctic especially high - meaning higher than in most other regions on Earth? How long will it take for the ice sheets at the North and South Poles to melt? But citizens are also interested in the concrete consequences of climate change - for example, the consequences due to climate-related changes in the Gulf Stream.

Other questions hint at the fear that the climate catastrophe may no longer be able to be stopped. Accordingly, citizens are demanding solutions from the scientific community as to what can be done when the internationally agreed climate targets are not reached. They want to

know which of the consequences of the Earth's warming are irreparable and whether positive changes could arise from it, too.

Outlook

This cluster tasks research with finding out how guickly and to what extent the warming of the Earth is progressing and what effects it will have on our lives.

The role of various tipping points in the climate system and when they will be reached should be clarified. Exceeding these critical thresholds could trigger self-reinforcing and irreversible processes. The increasing frequency of extreme weather events such as storms, extreme rains and flooding, long periods of heat and droughts are having an increasingly direct effect on life in many regions. Thus a further research option from the context discussed here may be the precise clarification of predictions regarding regional and short-term influences of climate change.

In order to better understand and predict the effects of climate change, science uses models supplied with large amounts of data. Data about past cold and warm periods, however, are not available in sufficient quality, so the proportion of climate fluctuations that

CLUSTER QUESTIONS

By how many degrees will the Earth warm up over the next 10 years?

Is it even possible to stop climate change?

What does science recommend doing when the internationally recognised and agreed climate targets are not reached?

How long will it take for the ice sheets at the North and South Poles to melt?

What can we conclude from changes to the Gulf Stream with regard to climate change?

Which of the consequences of climate change are irreparable?

When did climate change start?

Why is the temperature rise in the Arctic and Antarctic particularly high - meaning higher than in most other regions on Earth?

Are there good things, too, that are caused by climate change?

How high will the sea level be in 200 years?

are natural must be studied further. Climate models become more and more precise with new discoveries; for example, ice sheet models are used to predict the retreat of polar ice, and research into land-ocean interactions contributes to their improvement. Regional impact models are used to try to predict warming over the next 5-10 years. To further optimise them is a conclusion for questions for science.

Author: Dr. Thomas Bartoschek



HOW DO WE FASHION A SENSIBLE SYMBIOSIS WITH TECHNOLOGY?

This cluster concentrates on the future development of technology in interaction with humans. The boundary between human and machine in the future is an important question here. How much technology is sensible and good for humans is just as interesting as the answer to the question of how life together in human communities is changing due to the increasing use of technology.



Context

By making use of technology, human existence has become closely intertwined with it. On the one hand, humans work together with robots in factories. On the other hand, technology is also being used in and on the human body itself (for example, as implants, prostheses, orthoses - that is, externally applied devices to support muscles or bones - or exoskeletal systems - outer support structures for the body). Medical technology implants now help people with health impairments hear and see better. A future guestion is whether the performance of the human brain could also be improved using an implanted computer chip.

If we understand human beings as technical systems comprising biochemical reactions and electrical potentials, then interfaces between humans and technology will increasingly be developed. Whether a connection between brain and smartphone will thereby be possible at some point is one of the participants' questions. Another question is whether human consciousness can thereby be copied into a robot's memory. This close interaction between humans and technology makes clear that the boundaries between the two are fluid.

Outlook

The ever closer interaction between humans and technology gives rise to new questions that must also be discussed in the fields of medicine, ethics, sociology, biology, information technology and materials and natural sciences. What technologies will we be able to use as humans in the future? How will they make our lives easier?

CLUSTER QUESTIONS

Can your consciousness be transferred to a robot, and if so, are you then the robot?

Will it be possible to program dreams in the future?

Why is there not yet a device that can taste or smell?

Is it possible that we will be able to transfer our consciousness into a virtual world in the future?

Will there at some point be a helmet that can be connected to a computer so that, for example, all of geometry can be uploaded to your brain?

When will you be able to connect your brain to a smartphone?

Can a brain technically be reproduced?

Can you connect a computer chip to a human brain so you become smarter?

Where is a human being's consciousness located? What exactly is consciousness? Will it be possible at some point to upload someone's consciousness to a robot, for example?

How far developed are displays that can deliver images on the retina?

In this cluster, the question for science is what boundary there is between man and machine. One research question is seen as how much technology humans really need and what skills are lost through increased human-technology interaction. What symbioses between humans and technology are healthy for humans and the environment and how humans' life together will change with increasing use of technology are also aspects indicating new research perspectives.

Author: Dr.-Ing. Max Böhme

ARE GROUNDBREAKING CHANGES FOR HUMAN LIFE ON THE HORIZON IN BASIC RESEARCH?

Reflections on the scientific basis of innovation and technology, such as those in this cluster, include questions that are also discussed in science fiction: when will propulsion systems be available that make travel to distant planets possible? How realistic is travel by being 'beamed up'? And can human life be extended so that we can also experience the remote future?

Context

The theme of this cluster is the scientific foundation of innovation and technology. One question here is whether we will ever succeed in travelling from Earth to distant planets. Holidays to and colonisation of the Moon and Mars are achievable goals before the end of this century. Whether the colonisation of planets outside of our solar system is possible seems utopian by contrast. This complex of issues could be summarised in the fundamental guestion, surely inspired by science fiction: 'How are we ever going to get out of here?'.

Another complex of issues in this cluster is the development of life beyond Earth. 'Are we alone in the universe?' is the fundamental question underlying this. Another question inspired by science fiction is whether the future of travel by being 'beamed up' - dissolving from one place and re-materialising in another - will soon be possible. This topic is closely linked to quantum computing. Citizens were furthermore interested in the nature of light as well as in technical applications and innovations that could be derived from this.

An additional focus of this cluster are questions about life inspired by biology: these have in common the underlying consideration of whether, and if so using what technology, the human lifespan can be substantially prolonged or if people could at least be preserved so that they can experience the distant future. Accordingly, people are also interested in whether it is scientifically possible to revive extinct animals such as dinosaurs - or create artificial life. In this context, a summarising question could be: 'Can life be taken out of its temporal context?'.

Outlook

The possibility of travelling to remote planets requires technical development and research on novel types of propulsion - while travel to other solar systems is of a different quality altogether. Scientists are currently intensively engaged in research to find out if we are alone in the universe. This is an additional aspect for further research. The research being carried out with the new James Webb Space Telescope is part of this. The desire for 'beaming up' to be made possible concerns the most

CLUSTER QUESTIONS

How can we manage to reach planets outside of our solar system?

How can we make other planets inhabitable?

Would it be possible for humanity to begin life on a new planet - and why would this be possible?

How is research about life on Mars progressing?

Is there a possibility of life outside of our solar system?

Could you create antigravity on Earth?

Can you use quantum computers as a normal end user, too? What is light?

Can people be frozen and unfrozen alive?

Why do we not use rotating spaceships/space stations where centrifugal forces generate a kind of 'gravity'? Why should we not do this?

Will we in future be able to revive extinct animals? Mammoths, for example?

Is it possible to produce life artificially?

fundamental laws of quantum physics. Researchers are working on this, for example in the development of quantum computers. The question of eternal life is currently only rarely a topic in science and should be addressed of increased focus in the future. Furthermore, it is also suggested to develop future scenarios or desirable futures that inspire researchers to technological innovations and open up new avenues for science to pursue.

Author: Prof. Dr. Metin Tolan





HOW CAN ENERGY BE STORED EFFICIENTLY, AT HIGH DENSITY AND FOR LONG PERIODS?



In the coming years, we need to replace fossil fuels with renewable energies. One question that interests IdeenLauf participants is what energy storage we need for this. They want to know what requirements need to be met for novel energy storage systems and energy sources on the large, medium and small scales. How portable do they need to be? And can one single energy source fulfil the various requirements or are multiple ones requires?

Context

The fossil energy sources coal, gas and oil have excellent functionality: high energy density, relatively simple storage as well as transport capacity and worldwide availability. If they are now to be replaced because of their negative CO₂ footprint, we need new energy storage technologies and new energy storage methods. These must have the aforementioned properties while largely avoiding net CO₂ emissions. This is all the more true from a global perspec-

CAUTION Lithium ion batteries C 2008058816 A. P.Z., HICH tive if we focus not only on the energy transformation in western Europe, but take a worldwide view of energy generation, transport and use.

Specifically, the following properties or requirements are called for: high energy density relative to volume/weight; storage options that are as simple and loss free as possible; transport options that are as simple and flexible as possible (preferably using existing transport infrastructure); low energy losses due to conversion (energy-efficiency); and low material costs (cost-efficiency).

Outlook

The properties that make fossil sources of energy economically useful cannot all be realised by one single alternative storage medium. This cluster has made it clear that new science and technology discoveries are required for specific areas of application. There are at least three fields of application or investigation here: 1. Energy storage on a large scale as compensation for the lack of base load capacity provided by some renewable energy sources - wind energy, for example, is not available when the air is still. This also includes flexible transport of energy sources independent of pipelines

CLUSTER QUESTIONS

How do we want to store energy in the future in view of fluctuating supplies of wind and solar energy?

How advanced is energy storage technology?

What possibilities are there for storing energy that are better than the current ones, for example for e-mobility?

Could there be batteries that get better and not worse by

How can the heat from the summer be stored for the winter?

What will win out in the automotive industry in the future? Hydrogen, electric motors ... and which solution is sustainable and globally feasible?

How can we develop sustainable batteries that can be recycled without polluting the environmental?

What is the current state of research on high-density batteries?

both on land and especially by sea.

- 2. Energy storage for applications where there is high, stationary energy demand, such as for process heat generation in industry, building heating and hot water.
- 3. Small- and medium-scale energy storage for mobile, off-grid use. Important areas of application are motor vehicles, mobile machines, planes and ships.

Especially with regard to the energy efficiency of storage methods, this cluster highlights the need for research but also the great potential for innovation. This results in the question of how efficiency in the production of mobile storage devices can be significantly increased. The aim should be to compensate for the current inefficiency in the production of storage devices or in the conversion of energy sources (for example, only one litre of e-fuel would be needed per 100 km instead of three litres). Increased energy efficiency is just as necessary for new energy sources for cars as it is for trucks, planes and shipping, as well as in energy-intensive stationary applications.

Author: Dr. Christian Neuhaus

HOW DO WE SHAPE A SUSTAINABLE ENERGY SYSTEM?

In this cluster, citizens asked what a socially-just, ecological and sustainable energy system might look like. What sources of energy could be used and what energy storage we need are central questions in the development of an energy system of this kind. Science must also develop solutions for how it can be intelligently controlled. And what does all of this mean for consumers?



Those submitting questions worry about the security of supply provided by weather-dependent (and thus fluctuating) energy resources such as wind power, solar energy or hydropower. The current state of research outlines solutions here via smart electricity systems and electricity management at a pan-European level. These are also able to cover the increasing energy demand of the future without excessive reductions in energy efficiency due to multiple conversion processes (as is necessary in the case of storage). Furthermore, consumers can participate economically in an energy system like this, for example, via their solar panels, electric cars or batteries.

Context

The theme of this cluster is the energy system of the future. Technologies are discussed, from core fusion to wave power, that could play a role in a future energy system. The challenges inherent in renewable energies are also discussed: what needs to happen so our electricity supply can cover increasing energy demand? The cluster focuses on social and ecological aspects, and on the sustainability of the energy supply. It is essential here to consider both existing technologies as well as new energy sources (from photosynthesis to Earth's magnetic field).

Outlook

Many of the questions on new and sustainable energy systems show that consumers want to participate more actively in the energy system of the future. This provides new research options. For example, researchers could engage in the question of how energy can be made usable for the energy system from the human body (kinetic energy during physical exercise) or through everyday items (energy storage via clothing). In addition, in the near future more attention should be paid to increased communication of the current state of research. It will

CLUSTER QUESTIONS

What energy source is the most promising in terms of sustainability?

Are there approaches to and possibilities for using nuclear

How many times can energy be converted until it is no longer usable?

What has to happen so we can use solar energy globally?

What are the benefits of a wind turbine?

How could photosynthesis be emulated mechanically?

How can nuclear waste be disposed of?

Why do we not yet have hydrogen-based heating systems for private use? What are future alternatives for gas, crude oil and coal as basic components of energy, medications, plastics, tyres and so on?

How can we filter CO₂ out of our atmosphere? When will there be wireless electricity?

How can electricity be transported over long distances?

then be possible to better explain the possibilities already in existence and reduce prejudice towards certain solutions.

Author: Dr. Nicole Ludwig







HOW WILL GAINFUL EMPLOYMENT **CHANGE?**



What the future of work will be like lies at the heart of this cluster. IdeenLauf participants ask what social significance work will have in the future. They are interested in what role robots will play. And those submitting questions want to know what competencies will be required in the labour market of the future.

Context

The theme of this cluster is the propects for development and the value of gainful employment: how will we work in the future and in what industries? Are we running out of work? What is work actually, and what value does work with people have for society? The effects of technological developments and the necessary competencies in the future working world are of interest, as are working schedules and the likelihood or effects of job losses.

On people's minds are both a concern about upheavals in the world of work caused by the digital transformation as well as the quest to find meaning through work (for example,



through new forms of work). They're also asking about the structure of collectively agreed wages, the integration of robots into the working world - as a solution to the shortage of qualified workers - and the possibility of taxing the work performed by robots.

Outlook

The question of what possible working worlds might look like after the phase of industrialisation offers potential for research. This leads to future questions about perspectives on work. Particular challenges arise here for a society that defines itself by gainful employment - challenges which are also waiting for potential solutions from science: the trend towards an increasingly academic approach is leading to a shortage of qualified workers not only in the trades but also in nursing and social occupations. How this shortage of qualified workers can be resolved should be researched scientifically just as much as means of providing these occupations with greater appreciation and acceptance.

The transformation of the working world must in general be accompanied by training and further educational measures which will require the development of new learning con-

CLUSTER QUESTIONS

How can the technologisation of work and the loss of jobs/ livelihoods be reconciled?

Will robots replace humans as workers?

How can artificial intelligence assume the work of humans?

What is work and what is not work?

What is the optimal weekly working time (in terms of efficiency, satisfaction, effects on the climate/society/...]?

What model of work provides people the greatest satisfaction?

Labour market development - how can employees' development be adapted to their professional activity and not vice versa?

How can artists/creatives and their valuable skills (capacity for innovation, creativity, alternate perspectives, courage) be more effectively involved in our society's transformation plans?

What new jobs will there be in the future?

For many people, work has long been so much more than an economic necessity. Are we not overestimating the meaning of work? Aren't there good reasons to work less?

How can bureaucracy be reduced? Can public sector workers who no longer have jobs serve as scouts for applicants and help them?

cepts. Should human labour increasingly diminish in importance, for example because of robots and artificial intelligence, the cultural change and possible loss of purpose for many people must be studied by the social sciences.

Author: Prof. Dr. Nese Sevsay-Tegethoff

HOW CAN THE INTERACTION BETWEEN SCIENCE AND SOCIETY BE IMPROVED?

How relevant research findings can enter into the public consciousness via appropriate formats is the core question in this cluster. As many people as possible should be able to recognise reasonable and correct sources of knowledge reliably. This is tied to the question of what science must change so that research findings can be absorbed quickly and reliably by society. What methods and formats are needed so that science and society can enter into a fruitful dialogue?



Lauf participants as the answer to the question of what social responsibility science has for involving society in the shaping of the future.

This cluster calls for the dialogue between science and society to be strengthened, and for new formats to be found for conducting it. Citizens are asking how the interactive dialoque can be made sustainable as a recurring (iterative) process. They want to know what roles are required for fruitful interaction. Who can fill these roles in science and society? What function social media can have in this is also of interest.

Context

Key questions in this cluster are what significance knowledge will have in the future and how the quality of knowledge can be assured and rooted in society. New methods are required to make 'neutral' overviews of future issues available. What target-group specific communication formats are effective in the age of short attention spans is as much of interest to Ideen-

Outlook

This cluster makes clear that science communication and research into new formats must be strengthened. A greater penetration and dissemination of complex subject matter in society is only possible via good-quality, well-founded science communication: freely accessible scientific knowledge does not necessarily result in more knowledge in society. Instead,

CLUSTER QUESTIONS

What does science do to reduce the complexity of answers regarding scientific issues?

Who invented technology?

Where do scientists find their inspiration?

How can science be accessible in old age, too?

How advanced is Germany technologically compared with China?

How does Instagram know what I want to see?

How did people come to invent wireless networks?

Is it possible for all people in the world to have enough drinking water and food available, or what would need to happen to make this possible?

Where does Germany stand in terms of digitisation?

Why does the WiFi connection sometimes break up?

How does a battery work?

new hurdles are becoming apparent in the identification of high-quality scientific sources.

There is a need therefore to research and develop new communication forms for valid knowledge. Researchers should find ways to further develop science's understanding of itself as a communicator of knowledge to society. For society's ability to act, information on current issues of the future has to be provided promptly and continously discussed and supplemented.

Author: Prof. Dr. Nese Sevsay-Tegethoff





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HOW MIGHT DIGITISATION AND ARTIFICIAL INTELLIGENCE DEVELOP?

The consequences of digitisation and the use of artificial intelligence for individuals and society are the core topic of this cluster. People are interested in what opportunities and risks come from this and what areas are particularly affected by the potential consequences.



Context

Digitisation and artificial intelligence (AI) are two important topics of the future: although they mostly operate in the virtual world, they do have concrete effects on people's everyday lives.

In the area of artificial intelligence, IdeenLauf participants are interested in the scientific dimension. They are asking about the state of research, predictable and as yet unpredictable further development, or possible assessments of the consequences and effects of AI on our society. It is also clear that there are fears, such as we see in the question of whether AI could destroy humankind.

But many aspects of the existing opportunities of AI in the present are also addressed. The central guiding question was: 'Where and how can AI change our everyday routine or lives (e.g. by the use of AI in robots, for example in nursing care)?'

On the topic of digitisation, those submitting questions are also interested in the current state of research and the next possible and logical steps. Yet questions about the concrete aspects of application were also asked ('How far along are we actually with digitisation?'). Furthermore, people are hoping for information about basic technology ('How can all of this actually be stored?'). The third big group of questions relates to concrete aspects of the application of digitisation – such as digital money or the possible digitisation of all knowledge and how these topics may influence our future.

Outlook

From the many questions allocated to this cluster, it becomes clear that there is frequently a lack of fundamental understanding of technology. We see this, for example, in the fear of presumed AI capabilities that neither exist currently nor are to be expected in the foreseeable future. Many questions meanwhile also demonstrate people's interest in the concrete and direct consequences of AI and digitisation

CLUSTER QUESTIONS

Is the internet a good method for preserving knowledge?

Can a brain technically be reproduced?

How much (hard drive) storage is needed to store the knowledge of an 80-year old human?

Will it be possible at some point to recreate the feelings of others so as not to judge their feelings?

In what domains of human action, thought and feeling will humans be able to hold their own in the face of the increasing perfection of artificial intelligence?

If artificial intelligence develops consciousness, will we have the right to restrict it?

Could more robotics be used in the nursing sector?

Will AI become smarter than humans at some point?

Can artificial intelligence replace creativity?

Does digitisation have consequences for our careers?

What is the next digital step that we need to take?

What will money look like in the future? Does it make sense to invest in NFTs?

Do cryptocurrencies or cryptomining need to be prohibited because they consume too much energy (electricity) and resources (chips)?

Can Al compensate for our shortage of skilled workers in the future?

for their lives and everyday routines. Information is therefore required from science in order to give citizens the opportunity of making conscious and informed decisions about their interactions with Al and digitisation.

At the same time, the questions also present research options for the future: the application of Al or digitisation should be developed further as a matter of priority – for example, in the nursing field. In the process, scientists put the focus on ethical questions about digitisation, Al and their applications, including by carrying out 'risk impact assessments'. Furthermore, IdeenLauf participants would like future research to not only develop scenarios where new technologies are technically possible, but also make sense from society's point of view.

Author: PD Dr. Tim Conrad

HOW CAN WE BETTER UNDERSTAND INNOVATION PROCESSES AND ENSURE THAT THEY HELP US FASTER?

Our high-tech world is changing through innovations. Citizens are asking themselves how these come about and if their creation can be guided or strengthened. At the core are reflections on what the benefical framework conditions are, and what the obstacles in the innovation process are. Those asking questions are also interested in the opportunities and risks presented by the lasting and increasing storage of data.

Context

Innovations and new technologies develop and proliferate in processes. These processes are based on interactions between technical scientific insights on the one hand and the applications on the user side as well as user needs for solutions on the other hand. The direction and speed of these processes - including their coming to a halt or discontinuation – are open in advance.

This uncertainty and lack of resolution are inevitable key characteristics of innovation processes: the new is unknown before it emerges. Against this background, citizens participating in IdeenLauf are wondering about the course of innovation in general as well as about particular areas of innovation more specifically: how can the process behind the spread of innovations and technologies be better understood and potentially influenced in such a way that it leads to solutions to problems more quickly? How can good framework conditions be created for innovations? How can the results of innovations considered as positive (and negative) be more quickly achieved, recorded and analysed

within a broader perspective so that up-to-theminute stimulus for innovation is thus provided? Here, opportunities for adjustments and revision must be provided for in advance.

Outlook

It becomes clear from this cluster that we must better understand what individual, collective, discursive, political and regulatory restraints stand in the way of a more rapid use of innovation, but one which nevertheless allows for the ongoing adaptation of it. Scientists should develop methods through which real-world experiences can be gained of innovations after their introduction, instead of presumed effects, hopes and fears.

Additional research topics could be the potential and risks that result from robotics, automation and the all-pervading availability of information. The influence of innovations on working life should also be intensively studied here.

Alongside the direct effects of innovation, the effects in the broader context (for example, on social relationships and forms of communica-

CLUSTER QUESTIONS

How can an assessment of people's needs play a greater part in the development of technology?

Will technology and digitisation reduce or increase

They say the internet doesn't forget, but won't there at some point be no more room for servers? Storing unnecessary information is expensive and energy-consuming, after all.

Why are many people afraid of genetic engineering? Compared to conventional breeding, which may use mutated genes for example, genetic engineering is actually far more targeted.

Why can humans not communicate with animals using existing technology?

Will digital media replace paper books?

What added value does knowledge have when technology increasingly pervades everyday life?

Which household areas could be taken over by technology?

Why does it take so long for people to change?

Will technical progress come to an end at some point or will development continue indefinitely?

What innovations can give us more time for recreation/ friends/family?

How does innovation come about? People say it's market mechanisms - is that true?

tion) should also be considered by researchers. At the same time, scientific examination should not limit itself to theoretical assessments but also particularly observe and analyse the consequences actually realised.

Author: Dr. Christian Neuhaus





HOW WILL NEW TECHNOLOGIES INFLUENCE OUR HOMES AND LIVES?

What will the world look like in the near and far future? This is a question many people have on their minds - including IdeenLauf participants. They want answers from science about the consequences of advancing technology on health, housing, food and the economy. And which scenarios are desirable.



Context

The overarching topic of this cluster is what the world will look like in the near or far future. Citizens asked general questions about this field, such as what the world will look like in 30 to 50 years. Other questions adress the future of quite specific areas of life, such as health, food, the economy or housing - for example, if houses could also be built on water or underwater. Or, how can play areas be better integrated into future cities so that these can be used in a variety of ways?

On the other hand, IdeenLauf participants are also interested in detailed answers about the future - for example, concerning in vitro meat. In some cases, people are also preoccupied with very broad questions: how can the world be fed in the future?

CLUSTER QUESTIONS

What does the future of health look like?

How can artists/creatives and their valuable skills (capacity for innovation, creativity, alternate perspectives, courage) be more effectively involved in our society's transformation

Does in vitro meat have a future?

How can we feed the world in the future?

What will the future of architecture be like?

How could more household activities be outsourced to external/communal places? Who would support this?

Outlook

The questions on health, housing, food and the economy in this cluster crystallise overarching research topics with significant potential. Researchers could develop potential scenarios, for example in workshops or studies in which citizens, experts and futurologists are represented and surveyed, with the aim of finding out what kind of future people want to live in: what do they judge positively or indeed negatively? This would provide new ideas about which technologies or approaches will be needed or should be rethought.

Author: PD Dr. Tim Conrad

HOW DO WE COMBINE TECHNOLOGY WITH ETHICS?

How far technological development may go lies at the heart of this cluster. IdeenLauf participants want researchers to determine what ethical questions need to be considered in the development of new technologies. What norms and values apply? And who is responsible for ensuring that they are respected?

Context

Innovations and new technologies shape our everyday lives. We must therefore engage with the consequences of each respective technology for society. The central question is whether or not we want to use certain technologies. Should machines have consciousness in the future, and is it okay to clone humans? How can technology be useful without harming the individual human being, society or the environment?

The question also arises here as to the values and norms that the technologies used and promoted should be aligned with. Considerations of profit and sustainability play just as large a part here as the question of why technologies



that are harmful for our fellow human beings or the environment should be used at all. In many cases it is also unclear who is responsible for these decisions and who remains answerable for complaints. Citizens are furthermore asking themselves how we can ensure from the outset that the undesirable results and consequences of new technologies which occur despite the best of intentions can be prevented. As a minimum, it should be possible to determine the uncertainties when a technology is introduced.

Questions relating to ethics arise regarding the interaction between humans and technology for example, concerning abuse of technology to manipulate or harm other people. This also involves questions concerning data storage and its utilisation. The latter may also have consequences for society and the environment - both positive as well as negative.

Outlook

This cluster highlights research potential regarding the question as to how the development of new technologies can be structured so that there will be clear responsibilities for all of the resulting consequences. How can it be ensured that it is always clear who is answerable for problems, questions or discrepancies and will contribute to finding a solution? Existing

CLUSTER QUESTIONS

Is there a point where we become overdigitised?

Can a person's mind be cloned or downloaded?

Is it possible for all people in the world to have enough drinking water and food available, or what would need to happen to make this possible?

What automotive drive technology is the most viable one for the future?

How can digital technology be made useful for humans without harming them?

How can data protection and digitisation be reconciled?

Why do we always build worse objects instead of durable

Who cleans up the internet?

If artificial intelligence develops consciousness, will we have the right to restrict it?

How can algorithms be designed to prevent radicalisation on the internet?

How can we ensure that video recordings are genuine and not manipulated?

political and consumer protection institutions could play a role in this alongside new institutions yet to be formed. Interdisciplinary approaches are essential if science is to be able to answer these questions.

Author: Dr. Nicole Ludwig













WHAT RESOURCES AND **MATERIALS CAN WE USE** SUSTAINABLY?

Resource scarcity is a topic of growing public awareness. It is also therefore an issue on the minds of IdeenLauf participants. Furthermore, they want to know what materials will be available in the future. How does recycling and upcycling help us? How can we make material and substance cycles more effective? And how do we make nuclear waste less hazardous?

Context

The resources on our planet are finite. In order to accommodate the growing population and the complexity of lives and (personal and social) lifestyles, it is important to use finite resources in the most sustainable way possible. A high recycling rate is important here. Nonetheless, many questions relating to the reuse of materials remain unanswered - questions of both basic research as well as application.

The topic of this cluster is not just recycling, meaning the reuse of materials, but also upcycling. This term covers, for example, processes that use CO₂ from the air to manufacture plastic. An additional focus in this cluster is membrane research (such as for filtering sea water or cleaning groundwater), as well as resource-saving and environmentally compatible manufacturing processes (such as for medicines, energy materials, high-performance catalysts and nanotechnology).

People are also interested here in novel types of process technologies (such as building houses from concrete using 3D printing or producing meat substitutes). Citizens furthermore want to know if it is possible to make nuclear

waste less hazardous. They want answers from science to the question of whether highly radioactive elements can be made into less radioactive ones.

Outlook

In spite of comprehensive research, we have not yet sufficiently understood substances (their manufacturing and properties). Materials must be optimised, and manufacturing and reprocessing methods must become more efficient. Resource scarcity demands answers to the following research questions: where is it worthwhile to manufacture materials on a carbon basis (e.g. computers made of genetic material and batteries made of protein)? What materials could replace plastic? Science can explore the question of how we will handle water in the future: efficient approaches to drinking water production play an important role here. What are the building materials of the future? What new material properties that increase or enhance the sustainability and durability of products of daily use must be developed?

The aspect of environmental protection plays a key role in the question of how we can produce new and proven materials in the most environ-

CLUSTER QUESTIONS

When will there be a substitute for plastic?

Could plastic products become degradable?

How do we get the plastic waste back out of the seas?

How can we manage to establish a global circular economy?

How can the extraction of raw materials and the manufacturing, use and disposal of them associated with batteries for mobility needs take place in a way that is socially responsible, environmentally friendly and sustainable?

Is a total recycling process technically feasible and can it be expanded to cover all areas of life?

Are there new, more affordable and sustainable building materials/methods that can be utilised in the near term?

How can concrete become sustainable?

What needs to be done so that we can produce value-added metal components on demand in a decentralised manner using 3D printing?

Is it possible for enough food and drinking water to be made available to everyone in the world, and what needs to happen to make this possible?

How can gas and oil be restored naturally?

They say the internet doesn't forget, but won't there be no more room for servers at some point? Storing unnecessary information is expensive and energy-consuming, after all.

mentally friendly way and with the low energy consumption. The problem of nuclear waste and its final destination is likewise a question for science. How can this waste be 'packaged' in terms of material science and chemistry in such a manner that it causes the least damage to the environment? To answer these questions, we not only need to develop new procedures in materials and chemical science, but also physical analysis methods (such as photon analysis) in order to be able to measure and assess research progress as precisely as possible.

Author: Prof. Dr. Simone Techert

WHAT WILL OUR FUTURE **MOBILITY BE LIKE?**

What the mobility of the future will be like is a concern to many people. They're wondering which means for transport we will use in the future. Can energy even be recovered from the transport system? The needs of the users and how they should be taken into account is a central topic in this cluster - as is the question of how to end the preference for the car in the transport system.

Context

The focus of this cluster is on mobility - on land, at sea, by air, and even in space. Many questions in this area concern passenger transport: how can it be made more sustainable - both regarding energy usage as well as in the choice of energy storage media?

The fear that e-mobility's contribution to sustainability might rather be negative plays an important role in these questions. The current preferential treatment afforded to cars is questioned critically by many citizens. They regard the car as problematic – not only as a means of transport but also in terms of traffic being arranged around it (such as relating to when traffic lights change).



Mobility is not only viewed as an energy consumer but also as a potential energy supplier. Innovative road surfaces may be a topic worth exploring here. Another aspect that occupies people's minds is the arrangement of good conditions for active mobility (such as bicycle traffic). They are also concerned how public transport can be made more appealing. Prioritising space for buses and bicycles is an important factor here. Another concern of citizen's relates to the transport options for groups with limited mobility or disabilities, such as elderly or sick individuals.

Further topics relating to future mobility which are relevant for research are the safety and sustainability of flying and the development of new and faster aircrafts. Concerning freight transport, IdeenLauf participants ask how it can be made more efficient and how delivery services can be improved – for example, by means of drones.

Outlook

A series of questions and demands for science arise: how can mobility be made more sustainable and efficient, including, for example, by eliminating journeys - such as by digitising services or shifting activities into the virtual space? In the furture, how can we better take into account different needs such as physical

CLUSTER QUESTIONS

What will optimal mobility in the future look like with regard to the various requirements?

How do we achieve climate-neutral mobility?

What means of transport could enhance our infrastructure?

How can we make it possible to travel faster in outer space?

How can cars drive autonomously?

In what year will drones start delivering the majority of parcel shipments?

How can research be done on, for example, road surfaces that charge electric cars while driving?

Autonomous driving: how can algorithms decide what to sacrifice in the event of an impending incident?

How can transport and warehousing be reduced?

Why do I have to wait for traffic lights? Why can the cars not wait for me?

limitations or shift work, especially when it comes to the use of public transport? Innovative use of thoroughfares for energy generation or recreation, for example, seems equally as desirable as restructuring the traffic system in favour of non-car users.

How can science make a contribution to the present socially accepted expectations and norms being changed regarding journeys travelled and the compatibility of activities? How can we succeed in reducing the demand for mobility to save resources?

Author: Dr. Ariane Kehlbacher







HOW CAN PEOPLE STAY AS HEALTHY AS POSSIBLE?

The present healthcare system is primarily concerned with curing diseases. One of the central questions of this cluster is how to promote people's health. This would require clarifying what the basis of good health is. What influence do sport, exercise and a healthy diet have? Is adopting a healthy lifestyle enough? And how can the early detection of diseases be improved?

Context

One important impetus provided by the citizens taking part in IdeenLauf was the call for health support measures to be increasingly explored and promoted in the healthcare system. Preventative measures should replace the present centrepiece of the healthcare system, which is the (late) treatment of illnesses. This desire for health promotion is the fundamental topic of this cluster. The core questions are: what health preservation options are there? How can diseases be detected earlier? What earlier treatment alternatives and intervention options are there today for diseases and which ones will be available in the future?

The concrete individual questions can be grouped under the following topical fields: 1. How does our lifestyle influence our health? Potential factors may be diet, sport and exercise, stress, information overload, smoking or memory exercises. 2. What environmental factors (for example, air pollution, plastics, pathogens, bacteria, radiation) influence our health and in what way? 3. What role do endogenous causes play in the development of diseases (for example, the immune system, gut flora, genetic factors, predictive biomarkers, cell functions, epigenetics)? 4. What possibilities for the

early detection of diseases are there today and which ones will be available in the future based on research on the first three questions (for example, imaging, biomarkers)? 5. What early intervention options can be developed from this knowledge? Controlling epigenetics, lifestyle changes and vaccinations would be conceivable, for example. One question here is also whether vaccinations can be developed for a broader spectrum of illnesses in the future - such as cancer, fungal and other infections.

Outlook

From a scientific perspective, these questions indicate the desire for information about appropriate health preservation measures (primary prevention); but above all they also highlight the need for a scientific advancement of preventative and early detection strategies (secondary and tertiary prevention). The use of innovative technological possibilities for the identification of new molecular biomarkers (such as liquid biopsies, single-cell technologies, new high-resolution imaging methods) should also be considered here.

Citizens additionally want to better understand the effects of lifestyle and environmental factors on the human body. One approach could be

CLUSTER QUESTIONS

How do you identify a weak immune system?

How can we create a healthcare system which truly fosters health rather than illness?

What scientific methods could be used in future to identify as yet unknown pathogens and develop therapies that truly cure the causes?

Why do people actually get ill?

Could genetic transformation be used to prevent genetic diseases in a person? Is there an ethical limit to this?

To what extent does genetically altered food affect our health?

How much knowledge is healthy? What are the health effects of the acceleration and overflow of information in our recreation and working lives?

What effects do microplastics have on the human hormone system?

What influences progress towards a healthy body more: genes, diet, sports or lifestyle? Can genetic disadvantages be fully compensated for by a healthy lifestyle?

To what extent could targeted trophallaxis, inspired by and carried over from the animal kingdom, contribute to strengthening the immune systems of older, very young or immunocompromised people based on healthy individuals?

'exposome' research in which the interaction of external environmental, lifestyle and internal exogenous factors is investigated. At the same time, the influence of climate change or sociodemographic factors (such as social status) should also be included. Improved health and science communication is essential for all of the areas in this cluster. To this end, new formats of interaction and dialogue with citizens should be developed and tested.

> Authors: Dr. Denise Eckert, Prof. Dr. Angelika Eggert

HOW CAN GENDER-SPECIFIC DIFFERENCES BE BETTER TAKEN INTO ACCOUNT IN MEDICAL RESEARCH AND CARE?

Drugs are primarily developed for men. Why this is so is one of the questions in this cluster. Citizens want to know why the health of women is given so little attention. Why women live longer than men on average is also a question that people want to have answered. They also wonder whether taking sex hormones has effects on health.



Context

Gender-specific differences have been given little attention so far in the research on prevention and treatment of illnesses. Women's health, in particular, currently receives little attention. This cluster also touches on the shorter life expectancy of men compared to women, as well as the question of whether

taking sex hormones has effects on the treatment of illnesses.

In order to do justice to people in all of their diversity, gender-specific and diversity-aware approaches are needed in medicine and care. This requires basic research which concentrates more, for example, on the immune system as gender-specific and personalised medicine. In this cluster, IdeenLauf participants very explicitly raise the topic of gender equality in diagnostic and treatment methods, and in the development of drugs.

Outlook

It becomes clear in this cluster that people want more consideration to be given to the individuality of the genders. The cluster opens up new avenues for research by making science expand its focus and develop equal opportunities for all genders to improve medical and nursing care. Gender-specific research findings,

CLUSTER QUESTIONS

How do heart attacks differ in men and women as well as in people taking hormones for gender reassignment?

Why is female health promoted less in science than men's

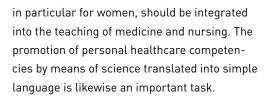
Why are women being neglected in medicine? Why do women live longer than men do?

Why is there no contraceptive pill for men?

How does medical research change when more attention is paid to gender differences?

When will more money be invested in gender-specific research? Many studies need to be repeated with women primarily, as many diseases and medications have a much different effect in them than in men.

Why are drugs in medicine often not adapted for and tested on the female body?



Authors: Dr. Tanja Bratan, Prof. Dr.-Ing. Lars Jänchen, Marlene Klemm





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HOW CAN THE PROVISION OF PERSON-CENTRED HEALTHCARE AND NURSING BE ORGANISED IN THE FUTURE?

The issue of nursing plays an ever more important role in our ageing society. Many of those submitting questions are wondering what nursing and our healthcare system in general will look like in the future. The effects of digitisation on both and which work can be taken over by robots in the future are important aspects here. How can we organise humane nursing and affordable healthcare? And what status will nursing professions have in the future? These are the central questions in this cluster.

Context

There are many ways to improve our health-care system – both in the provision of medical care as well as in nursing. The subject of many questions within this cluster are related to the financing of the healthcare system, the economic constraints, the shortage of trained personnel, insufficient digitisation, poor working conditions and the pay that many people believe is unfair.

A ,care crisis' is identified and possible solutions are discussed. It is important to meet the needs of the people to be cared for. Care workers should be offered an attractive job and its financing should be ensured. Demographic developments will make the existing problems significantly worse in the future.

The core question in this cluster was what good, humane and thus desirable health care and nursing look like and how these can be implemented in a modern healthcare system in the future.

Outlook

New technological developments (such as digitisation and robotics) deliver potential approaches for future reforms. The task now is to explore what these new technologies can actually deliver. What tasks can be completed in what form, which of these solutions are reasonable, and how can they be implemented?

Just because something is technologically possible, does not mean we can or should implement it: future nursing and healthcare provision should always be arranged in a humane way. This also means that those reliant on nursing care should have contact with people and not merely be surrounded by machines. New technological developments and their planned use must thus be discussed comprehensively, taking into account the different user groups and stakeholders. Opportunities and risks must be transparently weighed up in order to counter scepticism and potential anxieties.

It is important, together with nursing recipients, to use treatment pathways to take a look at the

CLUSTER QUESTIONS

What will the future of digital nursing be like?

Why have nursing staff for years been paid so poorly?

Does the commercialisation of healthcare services make the shortage of trained personnel worse?

Will robots be able to relieve or partially replace nursing staff in care facilities in the near future?

In times of demographic change, where is nursing care heading – care in old age, care for people with disabilities?

How can the commercialisation of hospitals be successfully counteracted? What might alternative financing models look like?

Why is nothing done about pension poverty?

What could a funding system in medicine look like that prioritises the common good over profitability so that patents are shared and the treatment of rare diseases becomes more important?

How can the internal communication structure in hospitals be improved in spite of economic pressure and corona-

Attentiveness helps healing, they say. How can this be better integrated in nursing and patient care?

transitions between, for example, hospitals, therapy, care at home, and in-patient or short-term nursing care. Last but not least, research and reflection must take place around how this kind of nursing can be integrated into a future, affordable and simultaneously flexible health-care system.

Authors: Dr. Tanja Bratan, Prof. Dr.-Ing. Lars Jänchen, Marlene Klemm



WHAT ARE FUTURE TREATMENT STRATEGIES AGAINST INCU-RABLE, SEVERE, CHRONIC OR AS YET LITTLE-RESEARCHED **DISEASES?**

In this cluster, citizens asked the question why the development of medicines for serious diseases is so difficult. They want to know where the limits of drug development are and if animal testing can be replaced. Another important aspect is how alternative medicine and treatment methods can help.

Context

The theme of this cluster is the efficacy and development of drugs, as well as the investigation and discovery of processes that cause diseases. Research on this topic can serve as the basis for effective treatment methods and better drug development.

The central question was how yet unknown diesease relevant processes can be investigated and how new drug targets can be found on this basis. People also asked why the development of medicines for incurable diseases or those that are difficult to treat is so complex. One example of this was the chronic fatigue syndrome ME/CFS, a complex and as yet incurable disease. People also wanted to know where the limits of drug development are and how animal testing could be replaced.

Of special interest were the causes of specific diseases (such as dementia, diabetes, hair loss, tinnitus, and paraplegia) and the development of new drugs and treatment options for these. Many citizens asked about medication to counter alcohol dependency or the aftereffects from excessive alcohol consumption ('hangovers').

Another important point related to antibiotic resistance. According to the World Health Organisation, resistant bacteria are one of the biggest threats to humanity. Antibiotic resistance is spreading extremely rapidly. The core question was about the treatment of multi-resistant pathogens and alternatives to traditional antibiotics. Many IdeenLauf participants were further interested in the scenario of a post-antibiotic age in which antibiotics are no longer effective due to the spread of resistant germs, and bacterial infections must again be treated as in the Middle Ages.

A further focus was alternative treatment strategies and natural healing methods. Of interest here was when and how herbal medicines, naturopathy or relaxation methods can help against diseases. Many citizens also asked if technology and biotechnology (such as mechanical replacements for body parts or artificial organs) would make a longer and better life possible.

CLUSTER QUESTIONS

Will technology at some point make us immortal?

Where do antibiotic-resistant pathogens come from and how can they be treated?

Why can we not cure type 1 diabetes?

How can we successfully combine ancient effective naturopathy with modern orthodox medicine?

Why is there no cure for some diseases?

What is a good remedy for hangovers?

How far along is the development of medicines to heal

Will it be possible to chemically alter feelings in the future? How can dementia be healed?



One important challenge of this cluster is that we urgently require better networking of different scientific disciplines such as biology, medicine, physics, chemistry and engineering. This is the only way to discover the causes of diseases and processes figuring into them, and thus that alternative treatment strategies and drugs can be developed. Furthermore, the topics of antibiotic resistance and chronic fatigue syndrome ME/CFS must be researched more intensively and communicated better to politicians and public because of their immense relevance.

Author: Dr. Michaela Prothiwa



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HOW DO GENETIC FACTORS AND THE INTERACTION BETWEEN ENVIRONMENTAL INFLUENCES AND GENES SHAPE PEOPLE'S CHARACTERISTICS AND HEALTH?

What influence do genes and the environment have on human health? And how can therapeutic approaches be developed from this? What are the resulting insights for humans beyond diseases? IdeenLauf participants are asking whether we will be able to genetically program desirable attributes such as looks and behaviour in the future.



Context

The theme of this cluster encompasses very different research topics in the context of genes, environmental factors (epigenetics) and their interaction in humans. This also includes questions about the molecular bases of hereditary transmission and gene regulation, about natural and genetically-engineered changes of

genetic make-up and the interaction of genes and the environment in the expression of traits.

Citizens are interested in aspects of evolution, genetic and non-genetic causes of diseases and the possibilities for the development of synthetic organs and new therapies (such as gene therapy and stem-cell therapy). They are asking about the genetic foundations of traits with no direct link to disease, such as appearance, eye and hair colour, physical size, musicality, intelligence, sexual orientation and behaviour. In connection with this, questions were asked about genetic engineering processes which could slow down the ageing process and change human traits. At the same time, besides opportunities and risks, questions were asked about the ethical limits of genetic engineering interventions.

Complex gene-environment interactions (epigenetics) are apparently receiving increasing attention. This also ties into the question of the

CLUSTER QUESTIONS

Why are there autoimmune diseases where the immune system attacks the body's own cells?

Is it possible to manufacture organs synthetically and transplant them? If so, how?

How do you manage epigenetics?

Are we slowing down evolution through medicine?

How is modern medicine changing evolution?

Will it at some point be possible to regrow lost extremities through DNA modification or other technologies?

Can genetic engineering write epigenetic codes, too, and if so, how does this work?

How dangerous are mRNA vaccinations to humans?

Can genetic engineering lead to unwanted mutations in the modified organisms?

What effect do microplastics in the blood have on genetic make-up?

possibilities for intervening in or managing epigenetic processes. Regarding human evolution, those submitting questions want to know to what extent medical progress or indeed environmentally-induced mutations have an effect.

Outlook

There is a need for research regarding the communication of new procedures and research fields (e.g. such as relating to mRNA vaccines) and regarding the dialogue between researchers and citizens. In particular, questions relating to epigenetics promise new innovative research approaches.

Author: Prof. Dr. Dr. Sigrid Graumann

HOW CAN WE UNDERSTAND AND FIGHT CANCER BETTER?

Cancer is a widespread disease. The question of the inheritability of cancer is one topic that is of interest to IdeenLauf participants. What influence does digitisation have on the development of cancer? What therapies are available and what late effects cancer can have also occupy people's minds. They also want to know when a cancer vaccination will be available.



Outlook

CLUSTER QUESTIONS

Why do cells turn into cancer cells?

Is there early detection for cancer?

Many of the questions raised in the areas within this cluster have already been addressed by the National Decade against Cancer. One key aspect is the dialogue between science and citizens. The population can only be informed better about the current state of knowledge if low-threshold science communication is used.

Is there a commonality between viral diseases and cancer? Why are large mammals less susceptible to cancer?

What happens in chemotherapy? Why are you so exhausted

To what extent is cancer inheritable over generations?

One interesting question is why cancer occurs with different frequency and based on different causes, particularly in certain species. Larger mammals, for example, are less frequently affected by cancer than small ones. The cause of such phenomena could be increasingly addressed in transdisciplinary programs in the future in order to possibly provide new starting points for treatment methods.

Long-term and side effects as well as early detection and prevention strategies should continue and increasingly be the focus of future research.

> Authors: Dr. Denise Eckert, Prof. Dr. Angelika Eggert



Context

One topic in this cluster is the inheritability of cancer. Citizens want to know if the probability of getting cancer is higher if cancer has occurred previously in the family. They want the causes of cancer to be investigated - how normal cells can develop into cancer cells and what environmental effects influence the development of cancer. The development of potential forms of therapy (such as chemotherapy, radiotherapy, surgery, new and alternative therapy methods and vaccinations) is another important topic.

People want researchers to explore the longterm consequences of cancer and medical professionals to introduce possible preventative measures for cancer. Of interest is also the connection between cancer and viral diseases. and the difference in the forms of cancer between different creatures.



HOW DO WE ENSURE PSYCHO-LOGICAL WELL-BEING IN A CHANGING WORLD AND PROMOTE SOCIAL AND ENVIRONMENTALLY-FRIENDLY BEHAVIOUR?











What are the causes of psychological diseases? What role do stress, individual disposition and environmental changes play? These kinds of fundamental questions are asked by citizens in this cluster. They want research to tell them what modern therapies could look like. Citizens participating in IdeenLauf also consider it important to explore approaches on how society can be prepared better for mental stress.



How do we change humanity's entitlement and ownership behaviour to make our future socially and environmentally sustainable?

How can pressure on young people be reduced to minimise psychological damage and diseases in the long term and make life more worth living?

How do feelings originate? And what is the point of them?

Will it ever be possible to use artificial intelligence for the treatment of psychological problems? How far has research come?

What counts as a drug and from what point is someone

Does the use of the media have lasting negative effects on people's health?

Why are children sometimes hyperactive?

What could basic training for thoughtful parents look like?

How important is psychosomatics in orthodox medicine?

Why has rest become such a rare commodity?



Context

Citizens' questions are directed at factors that have a negative influence on behaviour and experience (such as stress, media and society) or a positive one (such as education on environmentally friendly actions or behaviour oriented towards the common good or artistic and creative activities). They asked in general about the interaction of body and mind (for example, gut and feelings), personality development (intelligence) and psychological change in the various

phases of life. Citizens want to understand the underlying causes and mechanisms.

A large proportion of the questions pertains to psychological disorders (such as depression, anxiety and problems sleeping) and their biological bases. Questions were asked as to the triggers of such disorders - for example, individual disposition but also resilience, epigenetics and pathogens - and about chances of being cured, and new approaches for psychotherapy such as artificial intelligence. Some of the questions demonstrate the desire to preventatively strengthen society against susceptibility to psychological disorders, reduce social pressure on young people, and prepare them better for the challenges in life (such as parenthood).

Outlook

The general focus when looking at health is increasingly on the psychological aspects. Not only society, but our environment, too, is changing more and more rapidly. There are new media, artificial intelligence, climate change and much more. This brings with it new sources

of stress that we want to counteract preventatively. The challenges here differ in the course of the individual lifespan. This is where new fields of research could come in, with the aim of promoting psychological well-being and social and environmentally friendly behaviour. The development of new methodological and technological approaches of psychotherapy could also strengthen our society for change. Accessible knowledge for all plays a central role in psychological health. This offers an approach for new research that should be taken up and promoted via open science formats, for example, and an improvement of science communication.

Author: Dipl.-Psych. Martin Grund

56 WHICH WAYS OF LIFE **CONTRIBUTE TO A HIGH**

QUALITY OF LIFE?

Our lifestyle has a significant influence on our health. Sleep and nutrition are important aspects of this. How much sleep is healthy is one of the questions in this cluster. People want to know why so many people sleep badly and what diet is healthy and sustainable. Citizens are interested in conjunction with this how the supply of healthy food from regional production can be promoted.

Context

The themes of this cluster - our lifestyles - are the foundations of a good life with high quality of life. The guestions in this area relate first and foremost to our basic needs for sleep and nutrition. Both are considered to be important parts of a sustainable lifestyle and the basis for quality of life.

Citizens have two areas of focus when it comes to the topic of sleep: on the one hand, they want to know why and how much you need to sleep. Where personal differences come from and what the perfect sleep cycle looks like are also of great interest. On the other hand, those submitting questions want to find out how sleep (deprivation) affects the brain, lifespan and quality of life.

Citizens' questions in the area of food relate to particular foods ('Are chocolate, eggs, carbohydrates, cow's milk, and sweets unhealthy?'), ingredients ('How do sweeteners work?') and particular diets ('What is the best diet for good gut bacteria?'). But there are also more general questions regarding nutrition in the context of health and well-being ('What are the benefits of fasting?', 'How much should you eat and what foods do you need as a minimum to survive?',

'What are the effects of genetically modified foods on health?'). Finally, there are also broader questions about correct and beneficial forms of nutrition ('What can be done about food intolerances? What form of nutrition is the best one for society - including for different age groups?').

It is noticeable that only isolated questions are posed regarding the responsibility of politics for the shaping of dietary environments – that is, the regulation of the food market - and availability of sustainable food options (for example, 'Why is the Nutri-Score not mandatory?').

Outlook

One major topical field in this cluster can be situated under the keywords 'planetary health diet' and 'well-being'. This includes in particular the large number of questions on meat consumption (quantity and kind) and on how animal-based foods are produced. But people would also like answers from science on questions about how nutritional habits and food environments are changing or how they can be changed. This makes clear the significance of external and internal influences on dietary decisions. The significance of the topic of global food safety to citizens is notable. They want answers

CLUSTER OUESTIONS

Why are there so many different opinions on the subject of a healthy diet? The recommendations often change quite quickly, particularly in sports.

What will we eat in the future?

Which diet is best for health?

Can sustainable/ecological agriculture supply the whole world with food in the medium and long term?

Will there ever be the perfect diet for everyone?

What meat is the most sustainable?

Is a vegan diet healthier?

How can we change people's habits? Unfortunately, exercise and a healthy diet are habits and hard to establish.

Will there be personalised dietary recommendations in the

What happens in the body if you have a sleep disorder and what treatment options are there?

from researchers on the question of whether genetic engineering and/or the expansion of sustainable ecological agriculture can secure the food supply for the world population. Additionally, people are wondering whether the German population could be supplied with food produced exclusively domestically.

The questions about taste ('What determines whether we perceive a food as tasty?') lead on to the topic of how dietary habits can be changed towards a future sustainable, planetary diet.

Author: Prof. Dr. Nina Langen







WHAT ARE THE CAUSES OF POST-VIRAL ILLNESSES SUCH AS LONG/ POST-COVID AND HOW CAN WE **COUNTERACT THEM?**

The COVID-19 pandemic has led to significant strain on all areas of our society - health, social and economic. This cluster is concerned specifically with a long-term consequence of a coronavirus infection which not only affects the individual, but indirectly affects our society, too: long/post-Covid. What exactly causes long/post-Covid after SARS-CoV-2 infection is not precisely known. This is also the reason why the current treatment options are significantly limited. This cluster makes it clear how little we still understand about the virus and the illnesses associated with it, how much need there is for research, and how important it is to establish care structures for patients suffering from long/post-Covid as well as for people suffering from the long-term effects of other viral diseases. Explanations regarding these issues are absolutely essential.

Context

The topics of this cluster are the direct longterm health consequences of the pandemic and the handling of a new infectious disease and its consequences. Citizens are interested in the causes of prolonged diseases associated with viral infections such as multiple sclerosis, ME/CF and long/post-Covid. They want to know what treatment and therapy options are feasible and if these are already available or if they are still being developed. Furthermore, they inquire about the structures for the treatment of those affected. IdeenLauf participants further asked questions about 1. the effects of the pandemic on children and young people, 2. the development of new vaccines which are even better and safer, 3. how we can learn to live with the respiratory pathogen SARS-CoV-2, and 4. how we can prepare for and react better to further pandemics.

Outlook

The causes of long/post-Covid as well as of other long-term illnesses associated with viral infections are currently poorly understood. Some of these diseases have been known to us for a long time, such as myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS), but still hold great research potential. Viral infections, autoimmune responses, persistent infections, genetic factors, risk factors and previous diseases are all discussed in this context. In order to successfully develop better diagnostics and therapy methods or to prevent these diseases, the causes must be identified. Expanding research on long/post-Covid is an important topic for the future. Comprehensive and interdisciplinary care structures for those afflicted in all age groups must be established, and a close network of outpatient and clinical care structures with common quality criteria must be ensu-

CLUSTER QUESTIONS

Is there a connection between the Epstein-Barr virus and the development of autoimmune diseases such as multiple sclerosis, ME/CFS or long Covid?

Why do some people with COVID-19 develop long Covid and

When will there be a treatment for chronic fatigue syndrome?

Which biomarkers are useful for diagnosing chronic post-viral diseases such as long Covid and ME/CFS?

How can long Covid patients be supported financially and medically long term?

How can outpatient care for ME/CFS and long Covid patients be improved in practice?

What impact is the coronavirus pandemic having on the mental state of children?

Will there soon be a 'super vaccine' for coronavirus?

How can a new pandemic be prevented?

When will the COVID-19 pandemic end?

red. Social acceptance is also essential, which includes better information. Since vaccinationsubstantially reduces the risk of getting long/ post-Covid, it is equally important to organise professional vaccination information.

The development of new vaccines – for example, nasal vaccines - is a pressing research topic both for the present as well as for future pandemics. The rapid evolution of SARS-CoV-2 necessitates new vaccines that offer good protection against infections with new variants of the virus. Besides this, scientists must continue the development of antiviral medications - including virostatics and monoclonal antibodies. These are required to provide highrisk patients with a good chance of treatment. Researchers should also make contributions to improved pandemic management, including the speedy development of therapies and vaccines, health communication, information and care, especially for children and young people.

Author: Prof. Dr. Melanie M. Brinkmann

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HOW ARE THE MEANING AND THE **BOUNDARIES OF HUMAN LIFE** CHANGING THROUGH TECHNO-LOGICAL PROGRESS IN MEDICINE AND DO WE WANT THIS?

Biomedical research is increasingly helping us to cure diseases which were still incurable just a few decades ago. Will medical progress soon enable us to live longer - may even - to live forever? In this cluster, citizens want to know what the limits of these kinds of interventions in human life are. They are asking if it is okay to also use medical technology products and applications for self-optimisation. What risks are associated with this?



Context

The topic of this cluster is the technological medical progress that enables far-reaching interventions in human life. Modern genetic medicine can prevent and heal incurable diseases. Interventions for self-optimisation that are not medically necessary have become possible. This results in fundamental questions relating to human self-conception and the understanding of health, justice and a good life.

In this context, IdeenLauf participants are asking questions about prolonging human life: to what extent is eternal life possible? And is it desirable in the first place? They are further asking critical questions about the long-term effects on human evolution and social justice caused by technological medical interventions.

They are likewise concerned with the value of animal life: to what extent will medical research be possible in future without animal testing? People also want to know how science can pick up on new things - and thus stay 'in motion'.

CLUSTER QUESTIONS

Will we continue to evolve into a different human species?

To what extent will it be possible for humans to continue their evolutionary development?

For how long will humankind continue to exist?

How does science keep moving?

How is modern medicine changing evolution?

Will it be possible at some point to stop ageing?

What methods do we need to promote or advance in order to be able to do without animal testing entirely in the future?

Could genetic transformation be used to prevent genetic diseases in a person? Is there an ethical limit to this?

How far has research come in terms of digitising the mind?

Will we ever be able to live forever? If yes, when?

Outlook

Technology impact assessments and interdisciplinary applied ethical research are already well established as research fields and should be consistently continued and developed methodically. Research projects could furthermore concentrate on a more vigorous social discourse on fundamental ethical and social questions in order to contribute towards finding a consensus. Investigating longer-term effects of technological medical progress on human evolution is also an important aspect for future research.

Author: Dr. Tanja Bratan





HOW CAN THINKING, BEHAVIOUR AND EXPERIENCE BE EXPLAINED AND INFLUENCED BY BRAIN **FUNCTIONS?**

IdeenLauf participants are interested in the human brain and want to know how it works. They're asking what happens in the brain when we feel love, hatred and envy. What organic differences are there in people's brains? Where in the brain are the different character traits located, and can these be influenced?



Context

The central starting point for this cluster is the brain as the basis for human behaviour and experience. The question of how exactly the brain works can be seen as the foundation here: to what extent, for example, electrical signals become images, words and - more abstractly thoughts. Is it possible to make thoughts visible? This is followed at an intermediate level by considerations as to how these thoughts enter the consciousness and whether all perceptions and feelings can really be located in the brain.

An additional component of this cluster is the question of cognitive processes - remembering and forgetting in particular receive a lot of attention here. Psychological experience is also a central issue. In various ways, people pose the question of the neurobiological bases of different emotions such as love and envy. In keeping with this, they broach the differences in people's behaviour and experience: what different talents or character traits are there? And how can neuroscience map them?

It should also be noted that another frequently posed question was how cognition and the psyche can be influenced. This takes place, on the one hand, in terms of more subconscious or unwanted changes (such as through addictions or effects of the pandemic but also by the use of media such as smartphones or navigation systems), as well as in terms of targeted influence, for example through certain forms of nutrition or special training methods after illnesses.

CLUSTER QUESTIONS

What possibilities are there for improving the cognitive abilities of people with traumatic brain injury?

With memories, is it only a matter of time before you forget them, or can it be proven that they'll always remain deep inside, even though you think you've forgotten them?

How does our brain change when we become addicted? Is it reversible?

Where does creativity come from in the brain, and why do some people have it and others don't?

What biological genetic elements shape character?

How could nightly dreams be made visible?

Is consciousness integrated in the structure of the brain or is it something else?

Why does our brain know that we have forgotten something, but not what we have forgotten?

How does a healthy diet affect the brain?

What influence does the change in media behaviour have on people (learning behaviour, brain, etc.)?

Outlook

The questions asked in this theme are mostly already part of existing research programmes, which, however, obviously need to be intensified. Central research directions that should be strengthened in the future are basic research on the general biochemical functioning of the brain and investigation of the neurobiological foundations of cognition and psyche. Research is urged to investigate the changeability of cognition and the psyche. It is also clear that there is an urgent need for more efficient communication of existing research findings to society. This self-awareness should therefore form part of all three of the identified research directions.

Author: Dr. Tineke Steiger



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www.wissenschaftsjahr.de

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www.wissenschaft-im-dialog.de

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Before publication, an editorial team checked and approved the questions submitted by citizens providing they complied with the Ideen-Lauf terms of participation. The content of the questions was not changed, but they were checked and adapted with regard to spelling and grammar. Before the report was published, the cluster questions were again subjected to a critical review with regard to the terms of participation, for example for insulting or offensive terminology. In the course of this, individual questions underwent minor adaptation but were not changed in content. Since this report uses gender-neutral language, the relevant cluster questions were likewise adapted.

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