



Contents



18 LEARNING

18 Speaking out

For us, it appears natural that children should start to speak at some point. Yet learning language is a major feat, which is still not fully understood even today. At the Max Planck Institutes for Psycholinguistics and Human Cognitive and Brain Sciences, scientists are studying how children learn this complex system of communication, apparently without effort.

26 Singing lessons for finches

No zebra finch emerges from the egg as an accomplished singer: each young bird first has to take singing lessons. Songbirds are, therefore, excellent model organisms for the study of learning processes in vertebrates. A team at the Max Planck Institute for Ornithology in Seewiesen is conducting research into how various songbird species learn their songs and what happens in their brains during the process.

32 Eye to eye with computers

Our eyes are our window on the world, but they also reveal a lot about us. Researchers at the Max Planck Institute for Informatics in Saarbruecken and at the University of Stuttgart exploit this by teaching computers to interpret our gaze. Ultimately, their aim is to enable robots or avatars to communicate with us eye to eye.

ON THE COVER Learning, or the acquisition of skills, follows complex rules and basic principles that apply to humans, animals and computers alike. In all cases, learning in living organisms demands a high level of intellectual ability, whether by infants acquiring language skills or birds learning to sing. When it comes to machines, learning requires highly sophisticated algorithms and large quantities of data, so that a computer can interpret human eye movements, for example.

10 In conversation: Federal President Steinmeier says that science should engage in dialog with society.

PERSPECTIVES

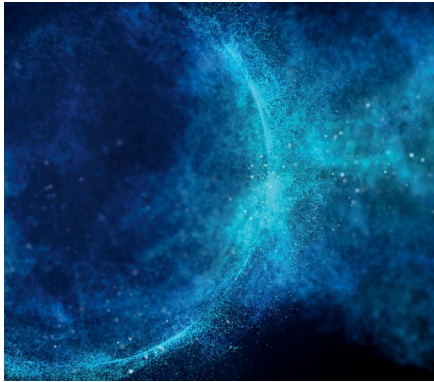
- 06 Prestigious award for two U.S. social scientists
- 06 "Oscars of Science" for Max Planck researchers
- 07 "There is no reason for germline therapy"
- 08 Quantum tricks at the push of a button
- 08 On the net
- 09 License for new drugs to treat Parkinson's disease

VIEWPOINT

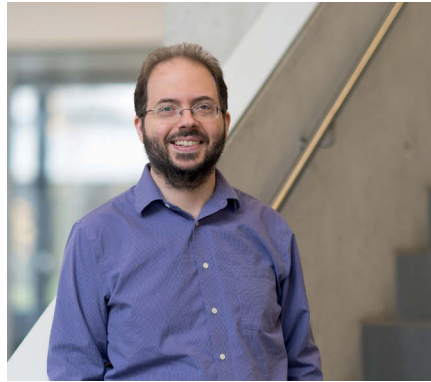
- 10 **Democracy needs science**
In times when different groups in society are increasingly isolating themselves from each other, science is also threatening to become just another opinion bubble. The Federal President Frank-Walter Steinmeier therefore demanded that scientists engage in dialog with politicians and society.

FOCUS

- 18 Speaking out
- 26 Singing lessons for finches
- 32 Eye to eye with computers



46 In the dark: to date, particle physicists have searched in vain for new ideas for explaining the world.



52 At the virtual level: Derek Dreyer uses computer science and mathematics to research programming languages.



58 On fire: the rainforest is afflicted by fires, which ultimately have an impact on the regional and global climate.

SPECTRUM

- 40** The alchemy of neutron stars
- 40** Dual-class society in the Bronze Age
- 41** In good company
- 41** Staying healthy in old age is a lifelong task
- 41** Heavyweight at the heart of Abell 85
- 42** Children increase life expectancy
- 42** Imagined movements can alter the brain
- 42** Less is more
- 43** Every mouse is different
- 43** Nuclear clocks get to the core
- 44** Nanoceramics from the ball mill
- 44** Magnetars – simply irresistible
- 45** Deadly networks
- 45** A fortress for sensitive data

PHYSICS & ASTRONOMY

- 46 Particle hunters on the trail**
The detection of the Higgs boson represented a huge success. But other expected or unexpected discoveries, which physicists hoped would explain the appearance of the world we live in, have failed to materialize. Researchers at the Max Planck Institutes for Gravitational Physics and Physics are looking for new perspectives.

MATERIALS & TECHNOLOGY

- 52 The digital language artist**
Personal portrait: Derek Dreyer

ENVIRONMENT & CLIMATE

- 58 Burn damage in the rainforest**
In the summer of 2019, there were more forest fires in Brazil than virtually any previous recorded. Scientists at the Max Planck Institute for Biogeochemistry are looking at the consequences that the immense loss of rainforest has on local, as well as global, climate.

CULTURE & SOCIETY

- 66 Patterns of terror**
Terrorism awakens fear and anxiety. We feel particularly helpless because the perpetrators' actions seem so incomprehensible. But there is actually a certain logic behind the actions of terrorist groups. A group at the Max Planck Institute for Social Anthropology discover the rules by which terrorists act.

REGULAR FEATURES

- 03 On location**
- 16 Post from the Mississippi**
Experiencing history in a canoe
- 38 Infographic**
Ups and downs in the bird world
- 74 Flashback**
The observer
- 76 Max Planck Community**
- 76 Next generation Max Planck Center opened
- 77 Commitment to greater climate protection
- 78 New Phdnet steering group ready to start
- 78 Welcome to the Planck Academy
- 79 Research Establishments**
- 79 Publisher's Information**